DOE/OR/01-1826&D3

Record of Decision for Interim Actions for the Melton Valley Watershed at the Oak Ridge National Laboratory, Oak Ridge, Tennessee

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Date Issued—September 2000

Prepared for the
U.S. Department of Energy
Office of Environmental Management

PREFACE

This *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) was prepared in accordance with requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) to present the public with the selected remedy for environmental cleanup of the Melton Valley watershed. This record of decision (ROD) documents the selected remedy agreed on by the U.S. Department of Energy, the Tennessee Department of Environment and Conservation, and the U.S. Environmental Protection Agency. This remedy addresses the majority of the units located in Melton Valley as detailed in the ROD. This decision is based on the Administrative Record for this project. Following are principal documents relevant to this ROD:

- *Remedial Investigation Report on the Melton Valley Watershed at Oak Ridge National Laboratory, Oak Ridge, Tennessee* (DOE 1997);

- *Feasibility Study for Melton Valley Watershed at Oak Ridge National Laboratory, Oak Ridge, Tennessee* (DOE 1998);

- *Proposed Plan for the Melton Valley Watershed at Oak Ridge National Laboratory, Oak Ridge, Tennessee* (DOE 1999); and

- *Memorandum of Understanding for Implementation of a Land Use Control Assurance Plan (LUCAP) for the United States Department of Energy Oak Ridge Reservation* (DOE, EPA, and TDEC 1999).

These documents and other information supporting the selected remedial action can be found at the Information Resource Center, 105 Broadway Avenue, Oak Ridge, TN 37830 (865) 241-4582.

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TABLES

FIGURES

ACRONYMS

ARAR	applicable or relevant and appropriate requirement
AWQC	ambient water quality criteria
BERA	baseline ecological risk assessment
CAP	Citizens' Advisory Panel
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	*Code of Federal Regulations*
COC	contaminant of concern
D&D	decontamination and decommissioning
DOE	U.S. Department of Energy
ELCR	excess lifetime cancer risk
EMWMF	Environmental Management Waste Management Facility
EPA	U.S. Environmental Protection Agency
ETTP	East Tennessee Technology Park
EWB	Emergency Waste Basin
FFA	Federal Facility Agreement
FR	*Federal Register*
FS	feasibility study
HFIR	High Flux Isotope Reactor
HI	hazard index
HQ	hazard quotient
HRE	Homogeneous Reactor Experiment
ICMA	Interim Corrective Measure Area
ID	identification
IHP	Intermediate Holding Pond
ISV	in situ vitrification
IWQP	Integrated Water Quality Program
KEMA	Keuring van Electrotechnische Materialen
LLLW	liquid low-level (radioactive) waste
LLW	low-level (radioactive) waste
LOC	Local Oversight Committee
LUC	land use controls
LUCAP	land use controls assurance plan
LUCIP	land use controls implementation plan
MCL	maximum contaminant level

MOU	Memorandum of Understanding
MSRE	Molten Salt Reactor Experiment
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Policy Act of 1969
NHF	New Hydrofracture Facility
NRC	Nuclear Regulatory Commission
NTS	Nevada Test Site
O&M	operations and maintenance
OHF	Old Hydrofracture Facility
ORNL	Oak Ridge National Laboratory
ORR	Oak Ridge Reservation
OU	operable unit
P&A	plugging and abandonment
PWSB	Process Waste Sludge Basin
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act of 1976
RDR	remedial design report
RfD	reference dose
RI	remedial investigation
ROD	record of decision
SARA	Superfund Amendments and Reauthorization Act of 1986
SDWA	Safe Drinking Water Act of 1974
SSAB	Site Specific Advisory Board
SWSA	solid waste storage area
TDEC	Tennessee Department of Environment and Conservation
TRU	transuranic
TWTF	TRU Waste Treatment Facility
VOC	volatile organic compound
WAC	Waste Acceptance Criteria
WIPP	Waste Isolation Pilot Plant

PART 1. DECLARATION

1.1 SITE NAME AND LOCATION

U.S. Department of Energy
Oak Ridge Reservation
Melton Valley watershed at the Oak Ridge National Laboratory
Oak Ridge, Tennessee
CERCLIS # 0404152

1.2 STATEMENT OF BASIS AND PURPOSE

This record of decision (ROD) for interim actions presents the selected remedy for waste sites and other contaminated areas in Melton Valley on the U.S. Department of Energy (DOE) Oak Ridge Reservation (ORR) in Oak Ridge, Tennessee. The selected remedy is interim until a final ROD is completed for Melton Valley. This suite of remedial actions for Melton Valley is chosen to satisfy the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (42 *United States Code* Sect. 9601 et seq.), and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) [40 *Code of Federal Regulations* (CFR) 300]. The Federal Facility Agreement (FFA) for ORR was developed to coordinate CERCLA and the Resource Conservation and Recovery Act of 1976 (RCRA) and to provide a legal framework for remediation activities at ORR. The FFA integrated approach extends to preparation of decision documents under CERCLA and RCRA. In addition, National Environmental Policy Act of 1969 (NEPA) values are incorporated in the documents prepared for this project in accordance with the *Secretarial Policy Statement on the National Environmental Policy Act of 1969* (DOE 1994). This policy states that DOE will rely on the CERCLA process for review of actions taken under CERCLA and will address and incorporate NEPA values to the extent practicable in CERCLA evaluations. This process includes evaluating remedial alternatives against the criteria established in NEPA. Opportunities for public involvement under CERCLA also apply to NEPA because of this integration.

This ROD addresses current contaminant releases and potential risk or hazard through a combination of remedial activities such as containment, stabilization, removal, treatment, monitoring, and land use controls. The selected remedial activities are expected to significantly reduce the release of contaminants from Melton Valley source areas into White Oak Creek, Melton Branch, their tributaries, and the Clinch River. These activities will mitigate ecological and human health hazards from contaminated media within the Melton Valley watershed. Remedy selections for sediment, groundwater, and floodplain soils exhibiting <2500 μR/hour radiation are deferred until the effectiveness of source actions is evaluated. The selected remedy leaves hazardous substances in place which pose a future potential risk and which would require land use restrictions for hundreds of years or longer. Interim land use controls (LUCs) and monitoring as appropriate are included as part of this selected remedy to ensure protectiveness until a future remedial decision is made for the Melton Valley watershed. This future remedial decision will also specify the selected remedy for those units or areas being deferred from this ROD. As appropriate, the future decision will also address units remediated under this ROD that require modifications to their implemented action.

The selected remedy presented in this ROD is designed to ensure that human receptors are protected from exposure to hazardous substances from the Melton Valley watershed. These receptors include maintenance workers near the major waste management areas and industrial workers in the eastern portion of the watershed. The selected remedy enhances overall protection of valleywide ecological populations and subbasin-level populations over a majority of the valley. Portions of the valley not addressed by the selected remedy (such as various sediment and floodplain areas) may pose unacceptable risks to ecological receptors. Additional data collection and evaluation will be conducted as part of this remedy to further assess the status of ecological receptors in these areas. The schedule and technical approach for the ecological monitoring will be addressed in the remedial design work plan. The results of this ecological monitoring and any additional actions, as necessary, will be included in a future remedial decision.

The selected remedy also will ensure that surface water remediation levels [ambient water quality criteria (AWQC) and risk-based limits] will be met to protect surface water in the Melton Valley watershed in approximately 10 years after the full remedy becomes operational and functional. Actions included in the selected remedy achieve progress toward meeting the Safe Drinking Water Act of 1974 (SDWA) maximum contaminant levels (MCLs) for radionuclides in the Clinch River, which the state of Tennessee has designated for domestic water supply. The need for additional actions to meet MCLs will be decided and documented in a future decision. The ability to meet MCLs is dependent on the effectiveness of the actions included in this ROD as well as actions being developed for the Bethel Valley watershed.

This decision leaves hazardous substances in place that will require land use restrictions. DOE has developed a land use controls assurance plan (LUCAP) for ORR to help ensure that land use restrictions are maintained and periodically verified. As part of the remedial design process for Melton Valley, DOE will also develop a specific land use controls implementation plan (LUCIP) that will further detail the specific measures required for land use restrictions as part of this action. The selected remedy will be reviewed no less often than every 5 years because hazardous substances are being left in place at levels that do not allow for unrestricted access and unlimited exposure.

This decision is based on documents contained in the Administrative Record File for Melton Valley, including the remedial investigation (RI) (DOE 1997), the feasibility study (FS) (DOE 1998), and the proposed plan (DOE 1999). In addition, DOE has considered all comments received on the proposed plan in preparing this ROD. DOE, the U.S. Environmental Protection Agency (EPA), and the Tennessee Department of Environment and Conservation (TDEC) (parties to the FFA) concur with the selected remedy.

During implementation and on completion of the selected remedy, the effectiveness of the selected remedial actions will be evaluated. After completion of the selected remedy, the effectiveness of the selected remedy and an evaluation of the remaining risks to human health and the environment in Melton Valley will be used in selecting appropriate remedial actions under one or more additional CERCLA decisions. Future decision documents will address any additional remedial actions that may be required, including long-term institutional controls for Melton Valley.

1.3 ASSESSMENT OF THE SITE

The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

1.4 DESCRIPTION OF THE SELECTED REMEDY

The major problems identified in Melton Valley are the presence of high inventories of short half-life radiological waste and lesser quantities of long half-life radiological wastes, contaminant releases to surface water, and widespread contamination in secondary media. Table 1.1 shows the remedial action objective (RAO) developed to focus remedial planning to address the environmental problems.

Melton Valley is currently a restricted area under DOE control. Remediation levels have been established to achieve the reasonably anticipated future use of each remediation area within the ROD and are consistent with recommendations from stakeholders [including the Site Specific Advisory Board (SSAB)]. The selected remedy meets surface water quality objectives and protects workers in the area. As a result of public comment from the SSAB End Use Working Group and discussions with regulatory agencies, DOE intends to accomplish the following conditions in Melton Valley:

1. The eastern portion of Melton Valley, which contains the reactor sites, will be remediated to a condition that allows industrial use with limited restrictions.

Table 1.1. RAO for the Melton Valley watershed selected remedy, ORNL, Oak Ridge, Tennessee

Area/receptor	Goal
Waste management area (includes SWSA 4, 5, and 6 and Seepage Pits and Trenches)	• Manage waste disposal sites as a restricted waste management area • Protect maintenance workers • Meet AWQC in surface water in a reasonable amount of time • Mitigate further impact to groundwater
Industrial use area (generally the area east of SWSA 5)	• Manage areas generally east of SWSA 5 as an industrial area • Protect industrial workers • Meet AWQC in surface water in a reasonable amount of time • Mitigate further impact to groundwater
Surface water and floodplain area	• Achieve numeric and narrative AWQC for waters of the state in a reasonable amount of time • Remediate contaminated floodplain soils to 2500 μR/hour[a] • Protect an off-site resident user of surface water at the confluence of White Oak Creek with the Clinch River from contaminant sources in Melton Valley • Make progress toward meeting Clinch River's stream use classification as a drinking water source at confluence of White Oak Creek with the Clinch River
Human receptors	• Protect maintenance workers, industrial workers, and off-site resident users of surface water (at the confluence of White Oak Creek with the Clinch River) to a 10^{-4} to 10^{-6} excess lifetime cancer risk and an HI of 1 • Protect hypothetical recreational users of waters of the state[b]
Ecological receptors	• Protect ecological populations[c]

[a]A future CERCLA decision will be prepared to determine whether additional actions are required for floodplain soil <2500 μR/hour.

[b]This remedy addresses water quality but does not fully address fish consumption or sediment/floodplain soil contact or exposure under the recreational scenario. This remedy protects the hypothetical recreational user through a combination of remedial actions including land use controls. A future CERCLA decision will be prepared to assess whether any additional actions are required.

[c]The selected remedy enhances overall protection of valleywide ecological populations and subbasin-level populations over a majority of the valley. However, portions of the valley that are not addressed by the selected remedy may pose potential unacceptable risks to ecological receptors. Additional data collection and evaluation will be conducted as part of this remedy to further assess the status of ecological receptors in these areas. Results of this ecological monitoring and any additional actions as necessary will be included in a future remedial decision.

AWQC = ambient water quality criteria
HI = hazard index
ORNL = Oak Ridge National Laboratory
RAO = remedial action objective
SWSA = solid waste storage area

2. Much of the western portion of Melton Valley, occupied by the waste disposal sites, will continue to be a waste management area with wastes contained in place.

3. Surface water, designated as waters of the state, will be remediated consistent with the state's stream use classification (e.g., recreation and fish and aquatic life). The floodplain soils will be remediated to 2500 μR/hour. The hypothetical recreational user

is protected under the remedy through a combination of remedial actions including LUCs. The selected remedy addresses water quality but does not fully address fish consumption or sediment/floodplain soil contact or exposure under the recreational scenario. Fish consumption, sediment and floodplain soil contact, and exposure under the recreational scenario will be evaluated at a later date to determine whether additional action will be required.

The LUC objectives necessary to ensure the protectiveness of the selected remedy are:

- *Industrial area*: prevent unauthorized access to or use of groundwater, control excavations, or penetrations below prescribed contamination cleanup depths; prevent unauthorized access; and preclude uses of the area that are inconsistent with LUCs.
- *Waste* management *area*: prevent unauthorized access to or use of groundwater; prevent unauthorized contact, removal, or excavation of source material; prevent unauthorized access; and preclude alternate uses of the area (e.g., additional waste disposal or development).
- *Surface water and floodplain area:* prevent unauthorized access to surface water, sediment, floodplain soils, or underlying groundwater; prevent fish consumption; and preclude uses of the media that are inconsistent with planned LUCs.

Through a variety of source actions, the selected remedy addresses principal threats to human health and the environment posed by contaminated media in the Melton Valley watershed. Principal threat wastes are those source materials considered highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. A variety of wastes and contaminated media present in Melton Valley are considered to be principal threat wastes, particularly those that contain radionuclides (both short- and long-lived). These wastes are located throughout the valley, primarily the burial grounds [Solid Waste Storage Areas (SWSAs) 4, 5, and 6]. Hydraulic isolation is DOE's primary mechanism to address these principal threat wastes. Hydraulic isolation is preferred for most of Melton Valley because of the magnitude of the principal threat wastes, and the worker risks and excessive cost entailed if treatment or removal were the primary mechanism for addressing these wastes. DOE does, however, include treatment and removal in selected areas to enhance the overall protectiveness of the selected remedy. This treatment and removal is selected where it will provide significant cost-effective benefits, minimize the need for LUCs in areas outside the waste disposal areas, and allow for industrial use in the eastern portion of Melton Valley.

While the remedy is based upon Alternative 5 of the FS, it is not identical to any of the five action alternatives presented in the FS. The selected remedy was composed using the nine

CERCLA criteria. Assembly of the selected remedy was accomplished by first satisfying the threshold criteria [protection of human health and the environment and compliance with applicable or relevant and appropriate requirements (ARARs)]. The additional five balancing criteria were then used to modify the assemblage of remedial actions. This strategy allows DOE, in consultation with EPA and TDEC, to select a remedy that achieves the best mix of actions possible given the large number of units being addressed. This remedy addresses goal-driven, regulatory, and programmatic considerations as effectively as possible. A major factor in devising this strategy is the desire to maximize containment of buried wastes and to use treatment as an enhancing component where it would provide significant, cost-effective benefits. This strategy also incorporates minimization of land surface use restrictions outside the waste disposal areas and allows for industrial use in the east end of Melton Valley.

Following are the major components of the selected remedy:

- hydraulic isolation (including various combinations of multilayer caps, upgradient diversion trenches, and downgradient collection trenches) for the major contaminant source areas in Melton Valley (SWSAs 4, 5, and 6, and the Seepage Pits and Trenches Area);
- disposal of contaminated soils from the lower 23 trenches in SWSA 5 North at the Nevada Test Site or the planned Environmental Management Waste Management Facility (EMWMF), or management at another suitable facility;
- in situ vitrification (ISV) of two trenches in the Seepage Pits and Trenches Area;
- the majority of structures will be demolished. Contaminated debris meeting the Waste Acceptance Criteria (WAC) will be disposed of in the planned EMWMF. Subsurface structures not demolished will be stabilized in place;
- removal of the High Flux Isotope Reactor (HFIR) Waste Collection Basins, and the Homogeneous Reactor Experiment (HRE) Pond and surrounding contaminated soils (soils will be disposed at the planned EMWMF or managed at another suitable facility);
- maintenance of cryogenics for the HRE pond until removal;
- plugging and abandonment (P&A) of all wells that have no future use, including the hydrofracture injection and monitoring wells;
- removal or hydraulic isolation of various contaminated surface soils above remediation levels throughout Melton Valley (excavated contaminated surface soil will be disposed at the planned EMWMF or managed at another facility, or used as contour fill under one of the various multilayer caps included in the selected remedy);

- removal of floodplain soil radiologically contaminated at levels > 2500 μR/hour (soil will be disposed at the planned EMWMF, managed at another suitable facility, or used as contour fill under one of the various multilayer caps included in the selected remedy);
- removal, stabilization, or isolation of inactive waste pipelines as necessary to address contamination;
- in situ grouting of the HRE fuel wells in the Seepage Pits and Trenches Area;
- monitoring to verify the effectiveness of remedial actions and the protection of ecological receptors, and to support a future decision for deferred portions of Melton Valley; and
- interim LUCs to restrict access to contaminated areas and groundwater.

DOE will develop a specific LUCIP as part of the remedial design process for Melton Valley that will detail the specific measures required for land use restrictions as part of this action. DOE acknowledges that numerous community comments have been received, which express an interest in a final decision being made regarding permanent LUCs. While information is currently insufficient to make such a final decision, interim controls are being imposed and will remain until permanent controls are established in future remedial decisions for this area. DOE is committed to maintaining LUCs, including institutional controls, for as long as they are necessary to ensure protection of public health and the environment.

The scope of the selected remedy does not include active facilities in Melton Valley. The two inactive experimental nuclear reactors [i.e., HRE and Molten Salt Reactor Experiment (MSRE)] are also not in the scope of the selected remedy; their decontamination and decommissioning (D&D) will be planned in separate CERCLA documents. Five low-level waste (LLW) tanks in Melton Valley [identification number (ID) 5.16, 8.5, 8.6, 8.7A, and 8.7B in Appendix A] are being remediated as an early action in the FFA Tanks program, and those actions will be incorporated in the selected remedy to be documented in the Bethel Valley ROD. The Bethel Valley portion of the White Oak Creek watershed is the subject of separate CERCLA documentation.

Remedy selection for the following items is not included in this ROD:

- streambed and lakebed sediments (White Oak Lake, embayment, creeks);
- floodplain soil exhibiting radiation < 2500 μR/hour;
- groundwater;
- HRE and MSRE reactor buildings and associated media up to 2 ft from reactor buildings;
- active units;

- transuranic (TRU)-waste containers located in 23 trenches in SWSA 5 North and Keuring van Electrotechnische Materialen (KEMA) fuel located in SWSA 6;
- five Melton Valley tanks included in the Bethel Valley scope; and
- units located in Melton Valley but outside the Melton Valley watershed ROD area.

Table A.1 includes a detailed listing of units in Melton Valley watershed ROD. Table A.2 includes a listing of FFA units that are out of scope.

Pursuant to DOE's authority under the Atomic Energy Act (AEA), DOE is undertaking the retrieval, processing, and disposal of retrievable TRU waste stored on the ORR as documented in *Final Environmental Impact Statement for Treating Transuranic (TRU)/Alpha Low-Level Waste at the Oak Ridge National Laboratory, Oak Ridge, Tennessee* (DOE 2000) and follow on ROD. As part of this undertaking, DOE will be retrieving the containerized TRU waste contained in the lower 23 SWSA 5 North trenches. These activities are being taken in support of the national approach for TRU waste management, which basically calls for the consolidation and geologic disposal of transuranic waste materials, which DOE has stored in anticipation of retrieval. Although retrieval of this TRU waste is not being done under CERCLA authority, EPA and TDEC support DOE's commitment to retrieve, process, and dispose of the TRU waste in the 23 trenches of SWSA 5 North. These efforts are consistent with the overall remedy being selected through this ROD and removal of this TRU waste will enhance the overall protectiveness and permanence of the actions being taken in Melton Valley. Remediation of contaminated soils associated with the SWSA 5 North area, including soils surrounding the waste containers DOE will retrieve under AEA authority from the 23 trenches, will be done under CERCLA authority as part of the remedy being selected in this ROD.

1.5 STATUTORY DETERMINATIONS

The selected remedy protects human health and the environment, complies with federal and state requirements that are ARAR to the remedial action, is cost-effective, and uses permanent solutions and alternative treatment technologies to the maximum extent practicable for this interim remedy. The selected remedy consists of interim actions and will be reevaluated in the future. No ARAR waivers are required for this remedy. This remedy also satisfies the statutory preference for treatment. As required by CERCLA, a review will be conducted no less often than every 5 years after initiation of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Hazardous substances above health-based levels will remain in the Melton Valley watershed after implementation of this remedy. Because hazardous substances are to remain, DOE, TDEC, and EPA recognize that Natural Resource Damage claims, in accordance with CERCLA, may be applicable. This document does not address restoration or rehabilitation of any natural resource injuries that may have occurred or whether such injuries have occurred. DOE has agreed to fund a pilot study of the Watts Bar Operable Unit that will examine natural resource issues and may provide a model for addressing such issues for the Melton Valley area; however, this study is not completed. In the interim, neither DOE nor TDEC waives any rights or defenses each may have under CERCLA, Sect. 107(a)4(c).

1.6 ROD CERTIFICATION CHECKLIST

The following information is included in Part 2, "Decision Summary," of this ROD:

- contaminants of concern (COCs) and their respective concentrations;
- baseline risk represented by the COCs;
- remediation levels established for COCs and the basis for the levels;
- current and future land and groundwater use assumptions used in the baseline risk assessment and ROD;
- decisive factor(s) that led to selecting the remedy;
- land and groundwater use that will be available at the site as a result of the selected remedy;
- estimated capital, operation and maintenance, and total present worth costs; discount rate; and the number of years over which the remedy cost estimates are projected; and
- how source materials constituting principal threats are addressed.

Additional information regarding the Melton Valley watershed can be found in the Administrative Record for this site.

APPROVALS

**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

September 2000

	9-21-00
Rodney R. Nelson, Assistant Manager Oak Ridge Operations U.S. Department of Energy	Date
	9-21-00
Earl C. Leming, Director U.S. Department of Energy Oversight Division Tennessee Department of Environment and Conservation	Date
	9/21/00
Richard D. Green, Director Waste Management Division U.S. Environmental Protection Agency – Region 4	Date

PART 2. DECISION SUMMARY

2.1 SITE NAME, LOCATION, AND DESCRIPTION

The 34,516-acre ORR is located within and adjacent to the corporate city limits of Oak Ridge, Tennessee, in Roane and Anderson counties (Fig. 2.1). Oak Ridge is located approximately 12.5 miles west-northwest of Knoxville, 12 miles southwest of Clinton, and 10 miles northeast of Kingston. ORR is bounded to the east, south, and west by Clinch River (Melton Hill and Watts Bar) and on the north by the developed portion of the city of Oak Ridge. ORR hosts three major industrial research and production facilities originally constructed as part of the World War II-era Manhattan Project: East Tennessee Technology Park (ETTP) (formerly the K-25 Site), Oak Ridge National Laboratory (ORNL) (formerly X-10), and the Oak Ridge Y-12 Plant.

The Melton Valley watershed, situated just south of ORNL, encompasses approximately 1062 acres. ORNL historic missions—plutonium production during World War II and nuclear technology development during the postwar era—produced a diverse legacy of contaminated inactive facilities, research areas, and waste disposal areas in Melton Valley. From 1955 to 1963, ORNL's solid waste areas were designated by the Atomic Energy Commission as the Southern Regional Burial Ground. During this period, ORNL served as a major disposal site for wastes from over 50 off-site government-sponsored installations, research institutions, and other isotope users. Figure 2.2 shows the locations of principal contaminated areas in the Melton Valley watershed, which include the following:

- buried wastes,
- landfills,
- tanks,
- impoundments,
- seepage pits and trenches,
- hydrofracture wells and associated grout sheets,
- buried liquid waste transfer pipelines,
- leak and spill sites,
- surface structures, and
- contaminated soil and sediment.

Table A.1 in Appendix A of this document lists each contaminated area included within the scope of this decision and the corresponding selected remedy. Contaminants present in Melton Valley include radionuclides (short- and long-lived), metals, and volatile organic

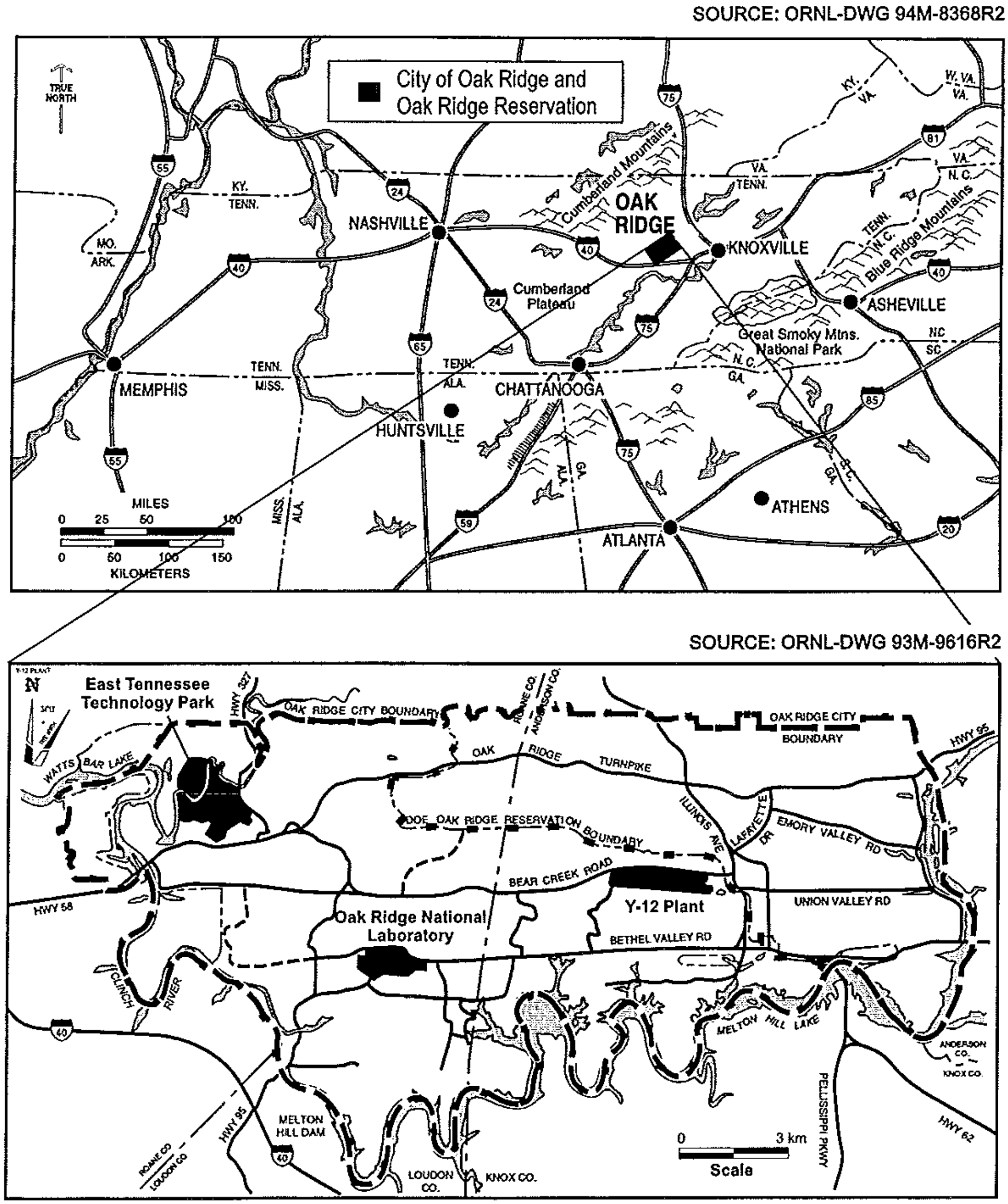

Fig. 2.1

Location of Oak Ridge Reservation

DOE - ORNL Melton Valley watershed - Oak Ridge, Tennessee

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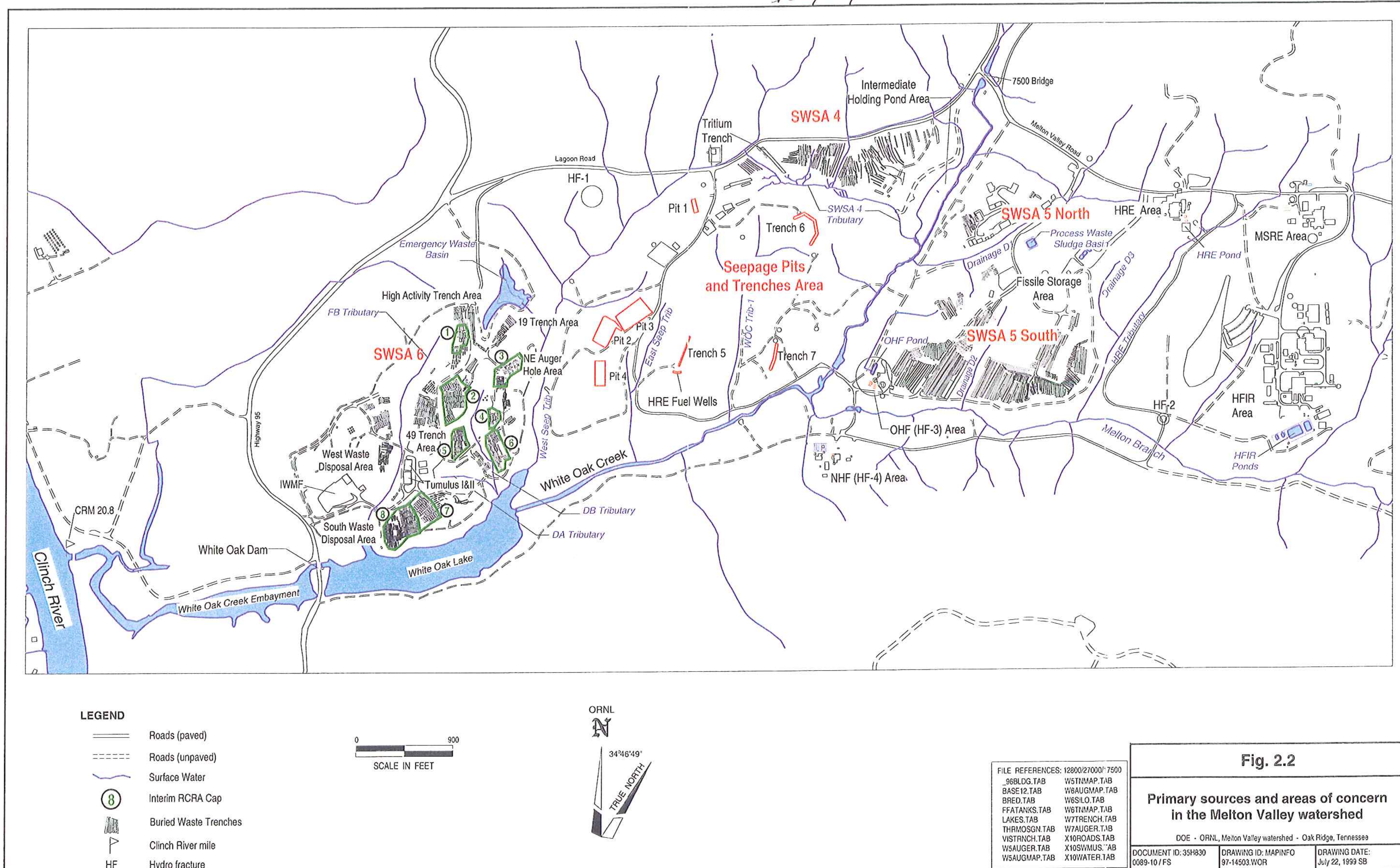


Fig. 2.2

Primary sources and areas of concern in the Melton Valley watershed

compounds (VOCs) in waste, soil, groundwater, surface water, sediment, and biota. Migration from shallow groundwater to surface water is the principal exit pathway from contaminant source areas in Melton Valley.

In accordance with CERCLA Sect. 120 and 40 CFR 300.430(f)(4) and the FFA, DOE is acting as lead agency for this action. TDEC and EPA provide oversight and approval of the remedy selection and the related cleanup decisions.

2.2 SITE HISTORY AND ENFORCEMENT ACTIVITIES

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, as well as activities at the Y-12 Plant and ETTP, have resulted in the release of contaminants to the environment. Because of these contaminant releases, ORR was placed on the EPA National Priorities List established under CERCLA [54 *Federal Register* (FR) 48184, November 21, 1989].

2.2.1 Solid Low-Level Waste

2.2.1.1 Disposed wastes

Shallow land burial was used routinely at ORNL for disposal of solid LLW from 1943 to 1986, when improved disposal technologies were implemented. The principal waste burial sites in Melton Valley are SWSAs 4, 5, and 6. Early burial procedures used unlined trenches and auger holes covered by either soil from the trench excavation or a combination of concrete caps and soil. The concrete caps were used for disposal of high activity wastes (> 200 mrem/hour at the container surface) or wastes with transuranic constituents. Burial of LLW in unlined trenches and auger holes ceased in 1986 when ORNL began placing solid LLW in below-grade concrete-lined silos in SWSA 6. CERCLA wastes generated from previous actions at Waste Area Grouping (WAG) 13 and WAG 11 were disposed in silos or underground vaults in SWSA 6. These wastes will remain in place and will be further contained by actions in the selected remedy.

DOE Order 5820.2A was issued in September of 1988. It required that all LLW disposed after the issuance date meet performance objectives for LLW disposal. Since 1988, DOE has used wells, silos, trenches, and the highly engineered aboveground tumuli technology for disposal. Specific to above-grade disposal, Tumulus I operated from 1988 to 1990. Tumulus II operated from 1990 to 1992. Both Tumuli are in interim closure status awaiting a final cap consistent with the SWSA 6 cap, which will be developed during remedial action design after the Melton Valley ROD is signed. The Interim Waste Management Facility (IWMF) has operated since 1992 and has approximately 1500 m^3 of capacity remaining. Full capacity of IWMF is approximately 5400 m^3. In accordance with an October 1993 letter to TDEC, DOE committed to retroactively cease waste disposals, except for IWMF, as of December 1993.

In the fall of 1999, DOE-Oak Ridge Operations (ORO) requested and received an approval to exempt all post-1988 disposals, except for Tumulus I and II and the IWMF, from the requirements of DOE Order 435.1 (successor to DOE Order 5820.2A). This request was justified since the post-1988 wells and silos are collocated with pre-1988 wells and silos; the post-1988 wells and silos were evaluated as part of the ongoing CERCLA analysis of Melton Valley; and the radiological inventory of the post-1988 wells and silos is less than two percent of the total inventory of SWSA 6 and much less than the total inventory analyzed in the Melton Valley CERCLA assessment. Further, the condition of the post-1988 wells and silos, which are lined with concrete and steel, suggests that they present an even smaller dose/risk hazard than pre-1988 sources due to the relative immobility of the source term.

In accordance with DOE Order 435.1, a Disposal Authorization Statement (DAS) is required for both the Tumuli and IWMF facilities. With a DAS, DOE-ORO will be able to complete loading and closure under its Atomic Energy Act authority. The performance assessment, the primary document required for the DAS, will be consistent with design, land use, and institutional control assumptions set forth in the Melton Valley ROD.

2.2.1.2 Stored waste

DOE has eliminated below-grade storage of waste in SWSA 6 with the removal of high activity low-level waste from six storage wells (WH604, WH609, WH623, WH673, WH674, and WH675 used 1993–1999). Additionally, DOE will remove KEMA fuel from SWSA 6, which is currently scheduled for removal in fiscal year (FY) 2001. Removal of the high-activity waste and KEMA fuel is being implemented under DOE's Atomic Energy Act of 1954 authority and is not a specific component of the CERCLA remedy. The KEMA fuel is under the national spent nuclear fuel program and will be repackaged and sent with other spent fuel at ORNL to the Idaho National Environmental Engineering Laboratory. The following are active waste management LLW and TRU waste above-grade storage units in SWSA 6: 7822J (LLW Staging/Storage Pad), 7842 (contact handled-TRU Storage Bldg.), 7842A (Solid Waste Storage Pad), 7842B

(Temporary Storage Tent), 7842C (Temporary Storage Tent), and 7878A (Temporary Storage Tent). DOE plans to remove these facilities prior to SWSA 6 cap installation.

The principal operation of SWSA 5 North has involved storage and disposal of alpha-contaminated waste, including TRU waste. TRU wastes are currently defined as those containing alpha-emitting transuranium radionuclides with half-lives > 20 years and concentrations > 100 nCi/g. In 1970, the Atomic Energy Commission established a TRU waste classification that required solid waste to be segregated and stored pending final determination of long-term disposal. SWSA 5 North was designated as the TRU storage area in 1970 to abide by this mandate. Twenty-three trenches in SWSA 5 North are considered retrievable storage for TRU waste and will be removed as a separate non-CERCLA action under authority of the Atomic Energy Act, in support of the National TRU Waste Program.

2.2.2 Landfills

On-site landfills were used for disposal of bulky solid waste that was not considered LLW. Landfills usually contain construction debris and used equipment that was placed in large excavations or ravines. These excavations were then backfilled with the excavated soil. Sites considered landfills in Melton Valley include the SWSA 5 NW Landfill, SWSA 5 NE Landfill, SWSA 5 Dump Area, and the Contractors Spoil Area.

2.2.3 Tanks

During the early years of ORNL operation, liquid low-level (radioactive) waste (LLLW) produced by ORNL was concentrated and stored in underground storage tanks constructed of concrete (Gunite) or steel. As programs were terminated, some tanks were abandoned in place with liquid waste and sludge left in them. All of the Melton Valley tanks are made of steel. Some of these tanks have neither cathodic protection to prevent corrosion nor secondary containment to capture possible leaks. Melton Valley tanks include five at Old Hydrofracture Facility (OHF) (closed under an Action Memorandum), two at HRE (closed under a previous action), three near MSRE (T-1, T-2, WC-20), one at HFIR, and one at NHF (T-14). Five LLW tanks (T-1, T-2, WC-20, HFIR, and T-14) in Melton Valley are being remediated as an early action in the FFA Tanks program, and those actions will be incorporated in the selected remedy to be documented in the Bethel Valley ROD.

2.2.4 Impoundments

Several impoundments were created in Melton Valley to store wastewater and provide additional settling and storage capacity for LLLW. Impoundments in the Melton Valley watershed include OHF Pond, HRE Pond, Process Waste Sludge Basin (PWSB), the Emergency

Waste Basin (EWB), HFIR Waste Collection Basins (ID numbers 8.1A–8.1D), and the HFIR Cooling Tower Surface Impoundment. These impoundments were made of natural clays with no liner, except the PWSB, which has a polyvinyl chloride liner. The HRE Pond has been filled and capped with asphalt and has been cryogenically isolated in a technology demonstration. EWB was built for use as a process liquid wastewater holding pond in an emergency but never received wastewaters. The HFIR Cooling Tower Surface Impoundment was used for study of chromate removal from cooling tower blowdown. The impoundment was filled with soil after use. The OHF Pond and PWSB are being remediated as part of a CERCLA removal action, and that action is being incorporated in the selected remedy in this ROD.

2.2.5 Seepage Pits And Trenches

In Melton Valley during the early 1950s, chemically treated LLLW was disposed of in large seepage pits and trenches excavated in low-permeability soil. As intended, LLLW seeped into the surrounding clay soil. This clay soil acted as a sorption agent for some radionuclides contained within the waste. Seven seepage pits and trenches were used from 1951 to 1966 until the hydrofracture method of liquid waste disposal became operational.

2.2.6 Hydrofracture Wells

Four hydrofracture well injection sites are located in Melton Valley. Two were used for experimental purposes. The OHF and the New Hydrofracture Facility (NHF) were used for waste disposal. In the hydrofracture waste disposal process, a waste/grout slurry was pumped into the hydraulically fractured bedrock 800–1000 ft below ground and allowed to harden. As intended, the waste and cement mixture spread in thin layers between the nearly horizontal bedrock strata for distances of several hundred feet. Most of the approximately 1.5 million curies of radioactive waste consisted of fission products such as ^{137}Cs and ^{90}Sr, although approximately 2000 curies of long-lived radionuclides in TRU waste sludges were disposed in the NHF grout sheets. The cement in the grout mixture hardened to contain waste sludges and most of the liquid in a solid form. A small fraction (much less than 1 percent) of radiological contaminants in the waste liquids separated from the slurry during the grout injection process. This contaminated liquid remains in the fractures in the Pumpkin Valley Shale and is detectable in deep monitoring wells 1000 ft from the hydrofracture waste injection sites. The hydrofracture waste disposal zone is located in a formation that contains natural highly saline groundwater. During operations, dozens of wells ranging in depth from approximately 600 to 1000 ft deep were installed to monitor performance of the hydrofracture process. Unless properly plugged and abandoned, these wells are potential pathways for contaminated fluids to migrate from deep groundwater to shallower groundwater zones.

2.2.7 Buried Pipelines

The LLLW system includes a complex series of buried waste pipelines used to transport radioactive liquid waste from generator facilities to storage tanks and seepage pits/trenches or hydrofracture injection sites for disposal. These buried waste pipelines are constructed of various materials, including carbon steel, black iron, and stainless steel.

2.2.8 Surface Structures

Surface structures were required to support research, waste management, or other operations at ORNL. Facilities that are inactive and have no future use include OHF and NHF surface structures, MSRE support facilities, and HRE support facilities. In some cases, environmental media (including soil, sediment, groundwater, and surface water) surrounding these surface structures have been impacted by contaminant release.

2.2.9 Contaminated Soil And Sediment

Radiological and hazardous chemical contamination of soil and sediment occurs in many areas of the Melton Valley watershed. Causes of soil contamination include the following:

- material spills on the ground surface,
- LLLW pipeline leaks that cause surface contamination,
- surface breakouts of contaminated liquids during operation of seepage pits and trenches,
- surface breakouts of contaminated groundwater in areas such as waste burial trenches,
- contaminated floodplain soil and sediment in Melton Valley, and
- contaminated biological material including leaves and animal droppings.

The area of White Oak Creek containing the most highly contaminated floodplain soil is the former Intermediate Holding Pond (IHP) area east of SWSA 4.

2.2.10 Land Use Controls

By separate Memorandum of Understanding (MOU), EPA, TDEC, and DOE have agreed to implement facility-wide certain periodic site inspection, certification, and notification procedures set forth in a LUCAP. These procedures are designed to ensure DOE maintenance of any waste-unit-specific LUCs set forth in this ROD and deemed necessary for future protection of human health and the environment. A fundamental premise underlying execution of the MOU is that, through DOE's substantial good-faith compliance with the procedures called for in the LUCAP, reasonable assurances would be provided to EPA and TDEC as to the permanency of those remedies, which includes the use of waste-unit-specific LUCs at ORR.

The terms and conditions of the LUCAP or MOU are not specifically incorporated or made enforceable herein by reference. However, DOE, EPA, and TDEC understand and agree that the contemplated permanence of the remedy reflected herein is dependent in part on DOE's substantial good-faith compliance with the specific LUC maintenance commitments reflected therein. Should such compliance not occur or should the MOU be terminated, it is understood that the protectiveness of the remedy may be reconsidered; consequently, additional measures may need to be taken to ensure adequate and necessary future protection of human health and the environment.

The ORR LUCAP mandates that when a remedial action that includes LUCs has been selected, a LUCIP will be developed as a component of the post-ROD documentation. DOE will develop a LUCIP for the Melton Valley watershed that addresses the same units covered under the ROD and submit it to EPA and TDEC for approval. The Melton Valley watershed LUCIP will be submitted and reviewed with the Melton Valley watershed remedial design work plan (see Sect. 2.11.3). The LUCIP will specify how DOE will implement, maintain, and monitor the land use control elements of the remedy identified in this ROD to ensure that the remedy remains protective of human health and the environment. Upon regulatory approval, the Melton Valley watershed LUCIP will be added to Appendix B of the ORR LUCAP.

2.3 HIGHLIGHTS OF COMMUNITY PARTICIPATION

DOE published a public notice of availability for the proposed plan in *The Oak Ridger*, *The Knoxville News-Sentinel*, *The Roane County News*, the *Clinton Courier-News*, and other regional newspapers. The public notice established a public comment period from June 1, 1999, to July 30, 1999. A public meeting was held June 22, 1999, to present the preferred alternative described in the proposed plan and solicit public input. All comments on the proposed plan are identified and addressed in Part 3, "Responsiveness Summary," of this ROD.

DOE has sought public input on the Melton Valley watershed project at multiple public meetings. Additionally, DOE has held regular public briefings with the SSAB, a citizen's panel that provides advice and recommendations to the DOE Environmental Management Program. The ORR End Use Working Group, a subcommittee of SSAB, is a community-based advisory organization established in 1996 to provide recommendations to DOE on postremediation ORR land use, cleanup assumptions and goals, and beneficial reuse of portions of ORR. DOE, TDEC, and EPA consider the End Use Working Group input for planning future CERCLA watershed evaluations, and implementing remedial actions. Further, DOE, EPA, and TDEC use, and will continue to use, input from organizations such as the SSAB, the End Use Working Group, the Local Oversight Committee (LOC), the Oak Ridge Environmental Peace Alliance, the U.S. Fish and Wildlife Service, and the city of Oak Ridge, as well as the public, to assist in selecting and implementing remediation programs that reflect local community values. Comments received throughout the evaluation process have influenced the approach, content, and conclusions of this CERCLA decision document.

The goals and the selected remedy presented in this ROD are consistent with publicly recommended end uses. For example, the End Use Working Group recommended "restricted end use for the disposal areas in Melton Valley." The End Use Working Group also recommended that "DOE must, at a minimum, ensure worker safety and control further migration of contamination in Melton Valley. Levels of contaminants released to the Clinch River via White Oak Dam must not exceed standards protective of human health and the environment."

This ROD presents the selected remedy for a major portion of Melton Valley. It is anticipated that actions taken as part of this remedy will be consistent with final actions selected in a future final ROD for Melton Valley. This action was chosen in accordance with CERCLA as amended by SARA, and to the extent practicable, the NCP. This decision is based on the Administrative Record for this project. Following are principal documents relevant to this ROD:

- *Remedial Investigation Report on the Melton Valley Watershed at Oak Ridge National Laboratory, Oak Ridge, Tennessee* (DOE 1997);

- *Feasibility Study for Melton Valley Watershed at Oak Ridge National Laboratory, Oak Ridge, Tennessee* (DOE 1998);

- *Proposed Plan for the Melton Valley Watershed, Oak Ridge, Tennessee* (DOE 1999); and

- *Memorandum of Understanding for Implementation of a Land Use Control Assurance Plan (LUCAP) for the United States Department of Energy Oak Ridge Reservation* (DOE, EPA, and TDEC 1999).

These documents and other information supporting the selected remedial action can be found at the Information Resource Center, 105 Broadway Avenue, Oak Ridge, TN, 37830, (423) 241-4582.

2.4 SCOPE AND ROLE OF THE ACTION

The objective of remedial action in Melton Valley is to address present and potential future threats to human health and the environment posed by disposed waste and contaminated media in the watershed. This decision is made from the watershed perspective to ensure that actions within this geographic area are consistent with the remediation strategy.

The scope of this ROD does not include active facilities in Melton Valley. The two inactive experimental nuclear reactors (i.e., HRE and MSRE) are also not in the scope of the selected remedy; their D&D will be planned in separate CERCLA documents. Five LLW tanks in Melton Valley (ID number 5.16, 8.5, 8.6, 8.7A, and 8.7B in Appendix A) are not included in the scope of this ROD and will be addressed as part of the Bethel Valley decision process. The Bethel Valley portion of the White Oak Creek watershed is the subject of separate CERCLA documentation.

Remedy selection for the following items is not included in this ROD:

- streambed and lakebed sediments (White Oak Lake, embayment, creeks),
- floodplain soil exhibiting radiation < 2500 μR/hour,
- groundwater,
- reactor buildings and associated media up to 2 ft from reactor buildings,
- active units,
- TRU-waste containers located in 23 trenches in SWSA 5 North and KEMA Fuel located in SWSA 6,
- five Melton Valley tanks included in Bethel Valley scope, and
- units located in Melton Valley but outside the Melton Valley watershed area.

Table A.1 in Appendix A includes a detailed listing of units in the Melton Valley watershed ROD area, including those that are deferred. Table A.2 includes a listing of FFA units that are out of scope.

Deferred units will be addressed in a future CERCLA decision document; however, land use controls as appropriate are included as part of this selected remedy until a final decision is made.

DOE has undertaken cleanup actions in Melton Valley under Removal Action authority pursuant to CERCLA. Removal actions previously completed in Melton Valley include White Oak Creek Embayment (Sediment Retention Structure), WAG 5 Seep C (groundwater treatment), WAG 5 Seep D (groundwater treatment), SWSA 4 Seep Control (waste trench grouting), and OHF Tanks (sludge removal). OHF Pond remediation, OHF tank shell stabilization, PWSB removal, and T-4 waste cell grouting are progressing under Removal Action Authority at the time of this ROD preparation. Appendix A documents how each prior removal action is replaced, incorporated, or amended by the selected remedy.

Many waste areas (e.g., SWSA 4, SWSA 5, and SWSA 6) being addressed in this ROD are solid waste management units (SWMUs) as defined in the RCRA Hazardous and Solid Waste Amendment of 1984 (HSWA) Permit for ORR (#TN 001). In accordance with FFA Section IV (RCRA/CERCLA Coordination), the parties have agreed that, for the inactive SWMUs listed in Appendix A-1(a) of the HSWA Permit, RCRA corrective action that would otherwise be required under that permit will be deferred to the CERCLA response action process as implemented under the FFA. Upon completion of the Melton Valley actions selected by this ROD at the SWMUs, the parties expect that no further corrective action would be required under the HSWA permit or the RCRA program.

In addition some of the SWMUs addressed in this ROD are RCRA-regulated hazardous waste management units under the state of Tennessee's authorized RCRA program. These RCRA-regulated units include the eight Interim Corrective Measure Areas (ICMAs) (including the Detonation Trench under ICMA 6) and Hillcut Test Facility located within the SWSA 6 area. The TDEC Division of Solid Waste Management has agreed that implementation of the proposed remedies for these RCRA units will constitute closure and will satisfy the applicable RCRA closure requirements including TDEC Rules 1200-1-11-.05(7)b and 1200-1-05 (14)(k). Following signature of this ROD, the Division of Solid Waste Management plans to begin the necessary post-closure permitting process. Post-closure care activities, such as maintaining capped areas, preventing run-on/run-off, and performing a groundwater compliance-monitoring program, are required by the ROD and will be further detailed in post ROD documents. The post-closure permit will specify requirements for post-closure care by cross-referencing the relevant provisions of the ROD and post ROD documentation. DOE will submit cap construction plans, as prepared for the RDR, to TDEC for review and approval.

The 23 SWSA 5 North trenches constitute a SWMU under DOE's HSWA permits. Trench 27 in SWSA 5 North is a RCRA-regulated unit under Tennessee's RCRA program. With respect to the 23 trenches, the parties agree that any corrective action decisions will be deferred until after DOE completes retrieval of the casks in the trenches pursuant to DOE's AEA authority and the follow on actions selected under this ROD for the excavation of SWSA 5 North contaminated soils. At the conclusion of these activities, the parties expect that no further corrective action would be required under the HSWA permit or the RCRA program for the 23 trenches. With respect to Trench 27, the parties agree that the closure plan will be revised to defer closure of Trench 27 to DOE's retrieval of TRU waste from the trench pursuant to DOE's AEA authority and the follow on actions selected under this ROD will constitute closure and will satisfy the applicable RCRA closure requirements. The parties anticipate that these activities will affect the "clean" closure of Trench 27 and that no post-closure permit will be necessary.

The selected remedy is not the final remedial decision for Melton Valley but is expected to be consistent with any future remedial decisions for Melton Valley.

2.5 CURRENT AND POTENTIAL FUTURE LAND AND RESOURCE USES

In order to focus on remedial planning, DOE evaluated and determined current and anticipated future land and resource uses. This allowed DOE to propose and select remedial actions protective of receptors consistent with exposure under these land and resource use scenarios.

2.5.1 Current Land Uses

Melton Valley is currently a restricted area under DOE control. Much of the area (primarily the western and central portions of the valley) consists of waste burial grounds, and a large portion of the surrounding area is contaminated as a result of past DOE activities. The eastern portion of the valley contains three reactor sites (one of which, the HFIR, is currently operational).

2.5.2 Current Groundwater And Surface Water Uses

Because surface water is the primary exit pathway medium for contamination from the burial grounds and other contaminated areas, the surface water and floodplain areas (White Oak Lake, White Oak Creek Embayment, White Oak Creek, and Melton Branch, and their associated floodplains) are contaminated. Since the area has access restrictions, surface waters and their environment are not available for uses such as recreation and livestock watering. However, White Oak Creek and Melton Branch are currently classified by the state of Tennessee for Fish and Aquatic Life, Recreation, and Livestock Watering and Wildlife uses, and, as such, must meet the standards suitable for those uses. All other named and unnamed surface waters in the watershed are also classified for Irrigation by default under the Rules of the TDEC Chap. 1200-4-4. Groundwater, which is contaminated in many areas, is not currently used as a resource.

2.5.3 Anticipated Future Use

Reasonably anticipated future uses of land in Melton Valley are an important consideration in determining the types and frequencies of exposures to residual contamination, and the appropriate extent of remediation. Consistent with EPA guidance, *Land Use in the CERCLA*

Remedy Selection Process (EPA 1995), DOE solicited input on anticipated future land use from the other FFA parties (EPA and TDEC), local land use planning authorities, local community, and other members of the public as early as the scoping phase of the RI/FS. The future land uses are based in part on this input and in particular on the land use recommendations of the SSAB End Use Working Group.

One important factor in determining future land use was that the Melton Valley watershed is located on a government facility (ORR) providing extensive site access restrictions. The valley, nestled between two ridges, is geographically isolated from other areas of ORR and is relatively remote from neighboring communities. No plans are under way or anticipated for releasing portions of Melton Valley or neighboring land areas for unrestricted development. Although Melton Valley is technically located within the city limits of Oak Ridge, it is not subject now or in the foreseeable future to any zoning authority. Encroachment on or inappropriate use of the watershed by the public would not be permitted due to land use controls. Hunting or fishing is permitted seasonally or periodically in some neighboring areas of ORR under state-monitored wildlife resource management programs, but it is not allowed in Melton Valley.

Remedial actions under this ROD are expected to result in the following conditions in Melton Valley:

- The eastern portion of the Melton Valley watershed will be remediated to a condition that allows industrial use with limited restrictions. Industrial use was selected as the reasonably anticipated future land use because it is a logical extension of the past and current use of the area. The eastern portion of the watershed has been used for the operation of three DOE reactors, two of which are now inactive. Roads, utilities, and other infrastructure support ongoing reactor operations at the HFIR.

- Much of the western portion of Melton Valley, occupied by the waste disposal sites, will continue to be a waste management area with wastes managed in place. Consistent with the EPA expectation in the NCP, continued waste management was selected as the reasonably anticipated future land use for the western portion of the watershed because the large quantities of radioactive and hazardous waste would be impractical to remove and treat (55 *Federal Register* 8704; March 8, 1990). With the waste managed in place, no other land uses would be appropriate for this area.

- Surface water designated as waters of the state will be remediated consistent with the state's stream use classification (e.g., recreation and fish and aquatic life). The floodplain soil will be remediated to 2,500 μR/hr under this ROD. The sediment and floodplain soil will be evaluated at a later date to determine whether additional remedial action will be required to meet a condition consistent with recreational use.

- The source control actions, which are included in the selected remedy, will have a beneficial impact on the level of groundwater contamination. Final groundwater remediation is not in the scope of this ROD.

2.6 SUMMARY OF SITE CHARACTERISTICS AND RISKS

Waste disposal areas within the Melton Valley watershed contain large quantities of contaminated soil, injected waste, and buried waste. Contaminants in this waste are primarily radioisotopes, although VOCs, semivolatile organic compounds, and metals are also present in some areas. Significant contamination, particularly in soil and in groundwater, occurs near the boundaries of the waste disposal areas. The shallow groundwater within the Melton Valley watershed discharges to surface water at seeps, tributaries, Melton Branch, and White Oak Creek. Surface water is the principal exit pathway that carries contamination from the source areas to the Clinch River. Figure 2.3 shows a conceptualized version of this release mechanism.

2.6.1 Human Health Risk

Potential risk to human health is estimated through knowledge of the types and concentrations of contaminants present in an area (their toxicity or carcinogenicity) and assumptions of the modes of human exposure to the contaminants.

2.6.1.1 Human health exposure scenarios

Three human health exposure scenarios were evaluated for the Melton Valley area in the baseline human health risk assessment presented in the RI: the industrial worker exposure scenario, the recreational exposure scenario, and the residential exposure scenario.

The industrial scenario assumed the worker is exposed 2000 hours/year for 25 years. The exposure pathway assumptions for soils in the industrial area include incidental ingestion (0.05 g/day), dermal contact (hands and forearms), inhalation of wind-generated dirt particulates (8 hours/day), and external exposure to radionuclides in soil (8 hours/day). The recreational

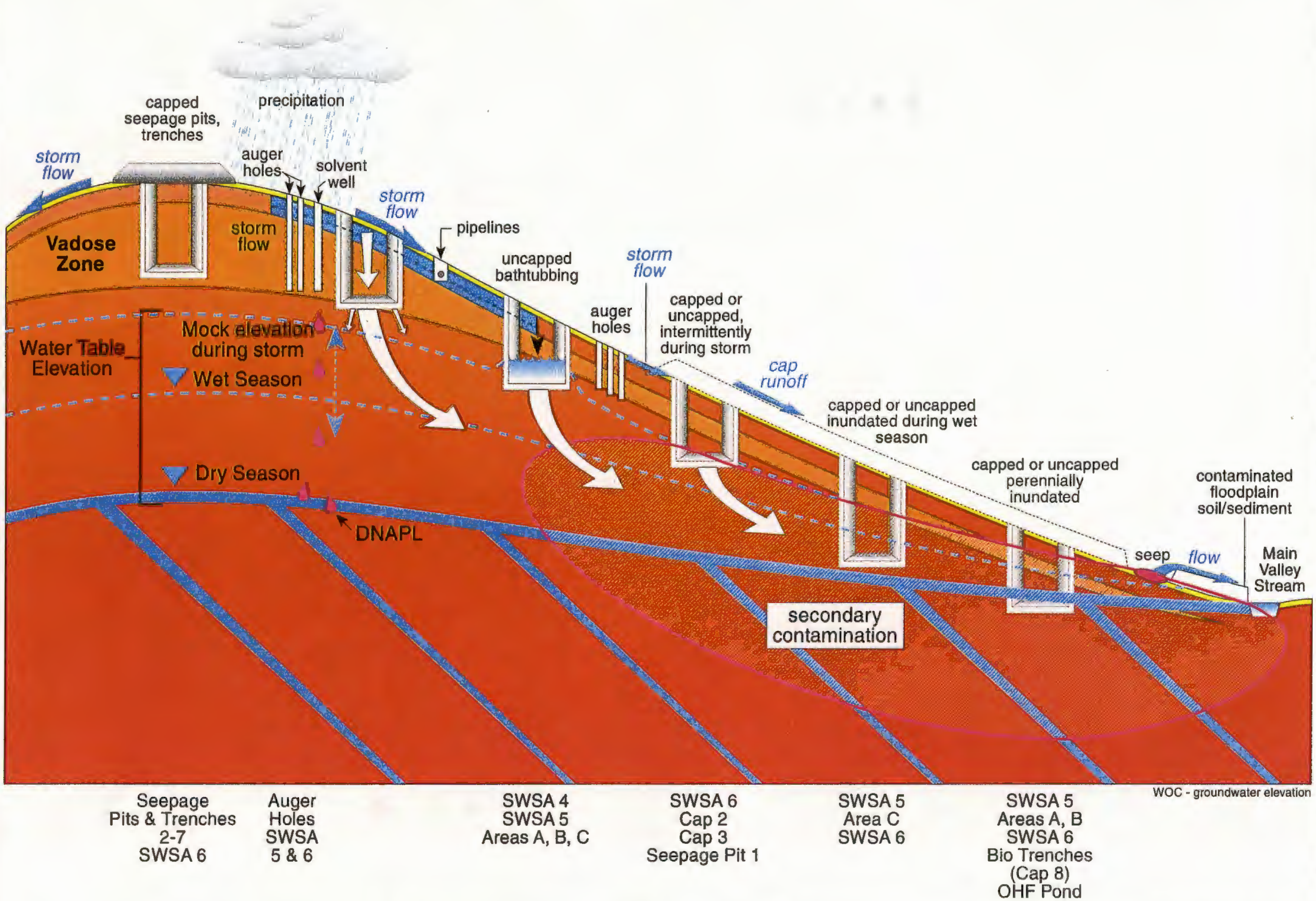


Fig. 2.3	**Conceptual model of typical hydrological processes/release mechanisms in the Melton Valley watershed, ORNL, Oak Ridge, Tennessee** DOE - ORNL, Melton Valley watershed - Oak Ridge, Tennessee	**DOCUMENT ID:** **0089-20 / ROD**	**DRAWING ID:** **99-18321.FH8**	**DRAWING DATE:** **February 24, 2000 SB**

scenario used in the Baseline Risk Assessment assumed a person might visit the area for 1 hour/ day on 75 days each year for 30 years, would be exposed to site contamination through direct exposure, and dermal contact, and ingestion/inhalation of soil or sediment, would consume 0.05 L/day of surface water, and would consume 54 g of fish/day on 48 days each year. The residential scenario assumed that a person would be exposed to site contamination for 350 days/year for 30 years (6 years as a child and 24 years as an adult) and consume 2 L/day of groundwater. The other routes of exposure for a residential receptor include incidental ingestion, dermal contact, inhalation, external exposure, ingestion of homegrown produce, and exposure to surface and groundwater. The residential exposure scenario for surface water assumes ingestion (2 L/day), whole body dermal contact with water during household use, inhalation of volatiles and radionuclides (^3H) in water during household use, and ingestion of homegrown produce irrigated with water.

Uncertainties in the human health risk assessment are related to several factors. Sample availability varies across the site, and most of the sampled locations were biased samples collected at known radiological contamination sites. COCs were selected from the suite of contaminants for which analytical data were available. Contaminants not identified as COCs in the RI could exist on-site. However, given the large number of samples taken within the watershed, it is unlikely a dominant COC was not identified. Uncertainty in the health effects from the toxicity values and risk characterizations used to evaluate the risk from contaminants on-site contributes to uncertainty in the final risk estimates. Elements of human health exposure are estimated scenarios only and may or may not be representative of actual exposures that individuals could receive on-site.

The Melton Valley baseline human health risk assessment evaluated risks to human receptors from contaminants in the waste as well as contaminants that have migrated from waste disposal areas into nearby soil, groundwater, surface water, sediment, and biota. Because the Melton Valley area is large, contains many contaminant source units, and is topographically and hydrologically complex, the area was subdivided into subbasins for risk assessment. The concept underlying the use of subbasins is that transport mechanisms from contaminant sources to contaminated media, such as soil, groundwater, surface water, and sediment, operate through hydrologic principles. The subbasin structure used for the baseline human health risk in Melton Valley is shown in Fig. 2.4. A schematic diagram of potential human health exposures is shown in Fig. 2.5.

2.6.1.2. Risk analysis

For carcinogenic contaminants, risks are expressed as the incremental probability that a human will develop cancer through the appropriate exposure scenario (e.g., industrial, recreational, or residential). Excess lifetime cancer risk (ELCR) is calculated using the following equation:

$$Risk = CDI \times SF$$

where

Risk	=	unitless probability (e.g., 2×10^{-5}) that a human will develop cancer
CDI	=	chronic daily intake averaged over the appropriate time span of the exposure scenario
SF	=	slope factor based on degree of carcinogenicity of the contaminant, expressed as l/(mg/kg/day)

These risks are probabilities usually expressed in scientific notation. For example, an ELCR of 1×10^{-6} indicates that an individual experiencing the maximum exposure of the applicable exposure scenario has a 1 in 1 million chance of developing cancer as a result of the site-related exposure. This value is referred to as the "ELCR" because it would be in addition to the probability that an individual will develop cancer from other factors such as smoking or exposure to background radiation. The probability that an individual would develop cancer from normal "background" causes has been estimated to be as high as 1 in 3 (0.33 or 3.3×10^{-1}). EPA's acceptable range for ECLR from contaminated sites is 10^{-6} to 10^{-4}, or risk levels of 1 in 1 million to 1 in 10,000.

For hazardous chemicals that have a direct toxicity but are not carcinogenic, a hazard quotient (HQ) is estimated rather than a risk probability. The HQ for toxic chemicals is based on the reference dose (RfD) for each substance divided by the amount of exposure that would be received through the applicable exposure scenario. The RfD is the amount of a toxic substance that an individual may be exposed to without causing toxic effects. The HQ is calculated as follows:

$$Noncancer\ HQ = CDI/RfD$$

where

CDI	=	chronic daily intake
RfD	=	reference dose

Chronic daily intake and RfD are expressed in the same units of mass and time and represent the same exposure period (i.e., short-term, subchronic, or chronic).

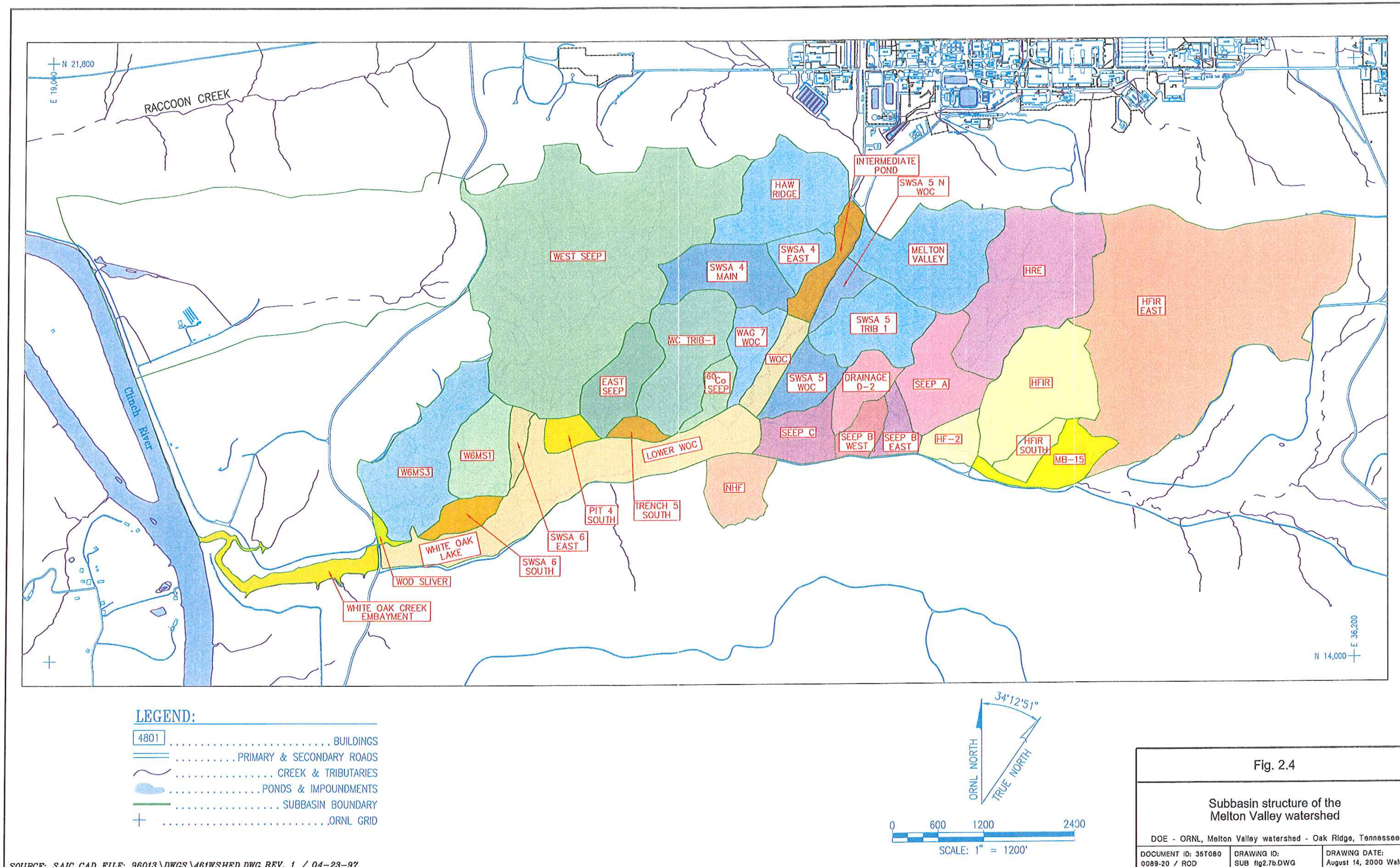


Fig. 2.4

Subbasin structure of the Melton Valley watershed

DOE - ORNL, Melton Valley watershed - Oak Ridge, Tennessee

DOCUMENT ID: 35T080 0089-20 / ROD	DRAWING ID: SUB fig2.7b.DWG	DRAWING DATE: August 14, 2000 WaM

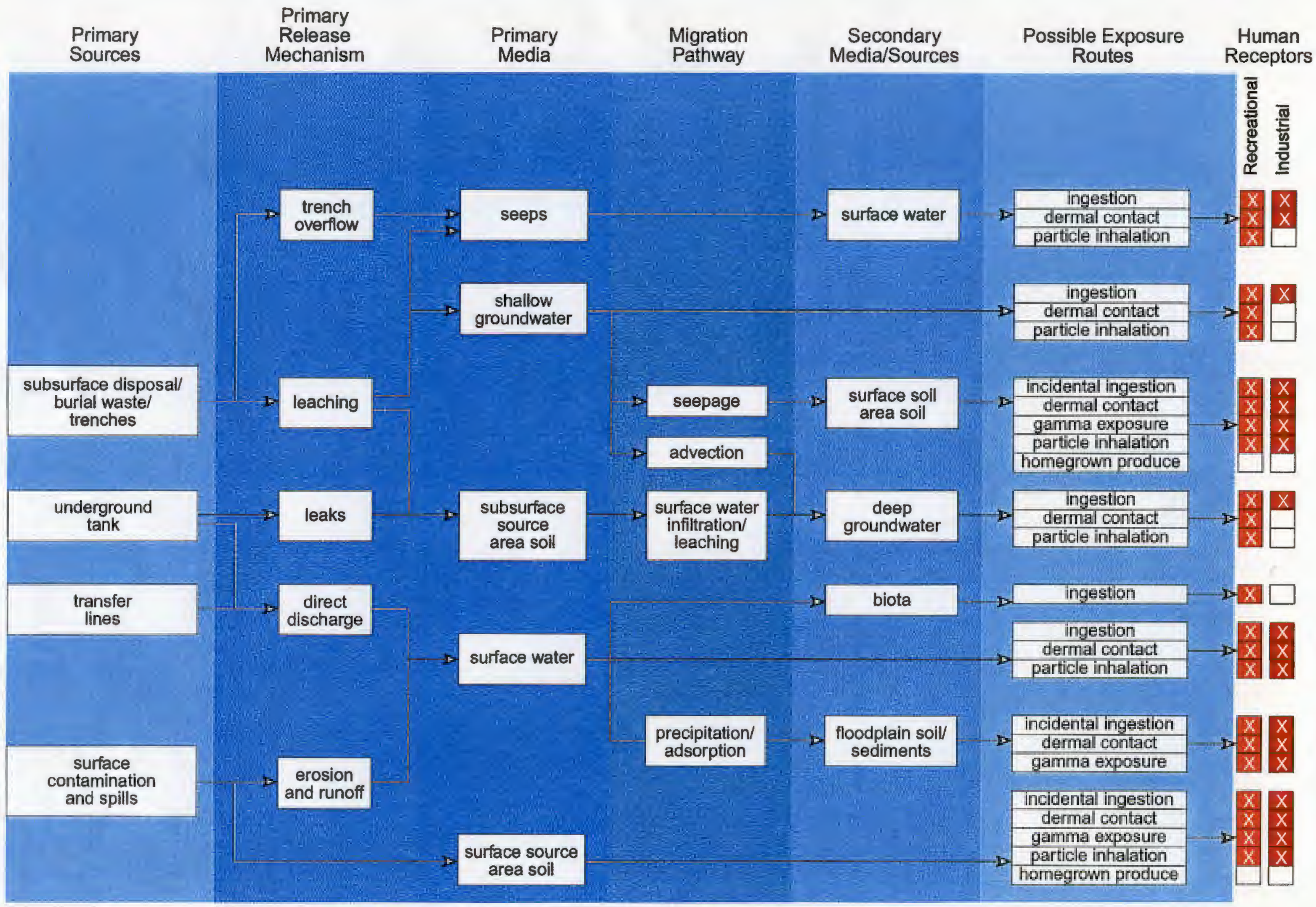


Fig. 2.5	Conceptual model of potential human health exposure scenarios, Melton Valley watershed, ORNL, Oak Ridge, Tennessee DOE - ORNL, Melton Valley watershed - Oak Ridge, Tennessee	DOCUMENT ID: 35T080 0089-20 / ROD	DRAWING ID: 99-18322.CDR	DRAWING DATE: AUGUST 30, 1999 TG

The hazard index (HI) for a site is computed by adding all the HQs for all chemicals of concern that affect the same target organ (e.g., liver) within a medium (e.g., soil or water) or including all media to which a person may be exposed in the applicable exposure scenario. An HI < 1 indicates that, based on the sum of all HQs from different contaminants that may be encountered in the exposure scenario, toxic noncarcinogenic effects are not likely to occur. HIs $>$ 1 indicate that site-related exposures may present a risk of toxicity to humans.

2.6.1.3 Human health risk summary

The baseline human health risk assessment for the Melton Valley area found that unacceptable risk levels exist in the area for industrial, recreational, and residential exposure scenarios. The estimated human health risks are caused almost entirely by the presence of radioactive materials that could cause cancer risk unless remedial actions are taken. Table 2.1 summarizes the risks estimated for the exposure to all media and exposure scenarios for each subbasin in Melton Valley. Radionuclides are the contaminants that drive the risks in each subbasin. The pathway through which the greatest risk is produced is external exposure to gamma radiation, and two radionuclides, ^{137}Cs and ^{60}Co, account for the majority of the external exposure at the site.

Table 2.2 shows summary concentrations of ^{137}Cs and ^{60}Co found in Melton Valley soils. Figure 2.6 shows surface gamma radiation exposure rates measured in various parts of the Melton Valley area.

The potential health effects associated with exposure to radionuclides are caused by ionizing alpha, beta, and gamma radiation. Primary effects of this exposure include an increase in the occurrence of cancer in irradiated individuals and possible genetic effects that may occur in future generations. The risk of serious genetic effects is much lower than the risk of cancer. Therefore, genetic effects are not the focus of this toxicity assessment, and radiological risks are evaluated only with respect to incremental cancer probabilities, according to EPA guidance.

Table 2.1. Human health risk summary for all media, Melton Valley watershed, ORNL, Oak Ridge, Tennessee

Subbasin	Exposure scenario		
	Industrial	Residential	Recreational
	Surface water		
IHP	5.2 E-03	2.4 E-02	8.9 E-05
WOC	7.0 E-04	3.0 E-03	3.9 E-05
LWOC	2.3 E-02	1.1 E-01	2.5 E-04
SWSA 5 Seep B East	2.4 E-03	1.0 E-02	3.3 E-05
SWSA 5 Seep B West	3.6 E-01	9.1 E-01	4.9 E-03
SWSA 5 Seep C	3.0 E-02	1.6 E-01	3.3 E-04
HF-2	1.2 E-03	6.9 E-03	2.1 E-05
Cobalt-60 Seep	ND	ND	ND
East Seep	1.4 E-03	7.2 E-03	1.8 E-05
Haw Ridge	ND	ND	ND
Melton Valley Drive	2.8 E-05	1.6 E-04	<1.0 E-06
NHF	<1.0 E-06	<1.0 E-06	<1.0 E-06
Pit 4 South	1.6 E-04	8.0 E-04	<1.0 E-06
SWSA 4 East	ND	ND	ND
SWSA 4 Main	9.6 E-03	4.4 E-02	1.1 E-04
SWSA 5 D-2	7.2 E-03	3.3 E-02	<1.0 E-06
SWSA 5 N WOC	5.7 E-05	1.1 E-03	<1.0 E-06
SWSA 5 Seep A	9.3 E-03	3.8 E-02	1.1 E-04
SWSA 5 Tributary 1	1.1 E-03	5.9 E-03	<1.0 E-06
SWSA 5 WOC	3.9 E-02	1.9 E-01	4.3 E-04
SWSA 6 East	1.8 E-04	7.4 E-04	<1.0 E-06
SWSA 6 South	ND	ND	ND
W6MS1	2.4 E-03	1.3 E-02	<1.0 E-06
W6MS3	3.8 E-03	1.5 E-02	<1.0 E-06
WAG 7 WOC	8.9 E-06	ND	3.2 E-06
WOC Tributary 1	4.7 E-04	2.5 E-03	6.4 E-06
West Seep	1.6 E-03	8.1 E-03	2.4 E-05
HFIR	ND	ND	ND
HFIR South	8.5 E-06	<1.0 E-06	<1.0E-06
HRE	7.5 E-04	4.7 E-03	6.9 E-06
MB15	2.0 E-04	1.8 E-03	1.1 E-05
	Sediment		
IHP	3.3 E-02	1.8 E-01	1.5 E-03
WOC	1.0 E-02	5.8 E-02	4.6 E-04
LWOC	5.5 E-02	2.8 E-01	2.6 E-03
SWSA 5 Seep B East	LD	LD	LD
SWSA 5 Seep B West	LD	LD	LD
SWSA 5 Seep C	3.5 E-03	1.9 E-02	1.6 E-04
HF-2	LD	LD	LD
Cobalt-60 Seep	LD	LD	LD
East Seep	ND	ND	ND
Haw Ridge	ND	ND	ND
Melton Valley Drive	ND	ND	ND
NHF	ND	ND	ND
Pit 4 South	8.4 E-03	4.2 E-02	3.8 E-04

Table 2.1 (continued)

Subbasin	Exposure scenario		
	Industrial	Residential	Recreational
SWSA 4 East	ND	ND	ND
SWSA 4 Main	1.7 E-03	9.9 E-03	1.6 E-04
SWSA 5 D-2	3.2 E-03	4.3 E-02	6.3 E-05
SWSA 5 N WOC	ND	ND	ND
SWSA 5 Seep A	1.5 E-04	1.5 E-03	6.7 E-05
SWSA 5 Tributary 1	3.2 E-01	9.9 E-01	1.7 E-02
SWSA 5 WOC	1.0 E+00	1.0 E+00	1.0 E+00
SWSA 6 East	ND	ND	ND
SWSA 6 South	ND	ND	ND
W6MS1	LD	LD	LD
W6MS3	LD	LD	LD
WAG 7 WOC	ND	ND	ND
WOC Tributary 1	LD	LD	LD
West Seep	LD	LD	LD
HFIR	ND	ND	ND
HFIR South	ND	ND	ND
HRE	LD	LD	LD
MB15	LD	LD	LD
Soil			
IHP	5.9 E-02	3.1 E-01	2.8 E-03
WOC	3.6 E-03	2.3 E-02	1.7 E-04
LWOC	9.3 E-03	5.6 E-02	4.2 E-04
SWSA 5 Seep B East	9.2 E-02	4.3 E-01	4.3 E-03
SWSA 5 Seep B West	1.1 E-02	2.4 E-01	4.8 E-04
SWSA 5 Seep C	5.5 E-03	6.6 E-02	2.5 E-04
HF-2	8.6 E-03	4.3 E-02	3.9 E-04
Cobalt-60 Seep	ND	ND	ND
East Seep	1.0 E+00	1.00 E+00	2.6 E-01
Haw Ridge	1.9 E-02	1.0 E-01	8.7 E-04
Melton Valley Drive	3.1 E-03	1.8 E-02	1.4 E-04
NHF	1.1 E-04	9.6 E-04	<1.0 E-06
Pit 4 South	1.1 E-02	5.4 E-02	4.8 E-04
SWSA 4 East	ND	ND	ND
SWSA 4 Main	5.7 E-01	9.9 E-01	3.7 E-02
SWSA 5 D-2	6.9 E-04	9.8 E-03	3.6 E-05
SWSA 5 N WOC	3.1 E-04	2.2 E-03	1.4 E-05
SWSA 5 Seep A	2.7 E-04	4.8 E-03	1.3 E-05
SWSA 5 Tributary 1	1.0 E-02	5.4 E-02	4.6 E-04
SWSA 5 WOC	8.8 E-04	1.1 E-02	3.9 E-05
SWSA 6 East	2.5 E-03	1.3 E-02	1.1 E-04
SWSA 6 South	<1.0 E-06	4.4 E-03	<1.0 E-06
W6MS1	1.2 E-04	4.1 E-03	<1.0 E-06
W6MS3	<1.0 E-06	2.2 E-03	<1.0 E-06
WAG 7 WOC	5.3 E-02	2.7 E-01	2.4 E-03
WOC Tributary 1	7.9 E-02	3.9 E-01	3.7 E-03
West Seep	9.6 E-01	1.00 E+00	1.3 E-01
HFIR	1.2 E-03	4.3 E-01	5.1 E-05
HFIR South	ND	ND	ND
HRE	3.6 E-02	2.0 E-01	1.7 E-03

Table 2.1 (continued)

Subbasin	Exposure scenario		
	Industrial	Residential	Recreational
MB15	8.5 E-01	1.00 E+00	8.1 E-02
Groundwater			
IHP	6.0 E-04	3.2 E-03	<1.0 E-06
WOC	<1.0 E-06	7.5 E-06	<1.0 E-06
LWOC	8.1 E-03	4.1 E-02	<1.0 E-06
SWSA 5 Seep B East	8.1 E-03	3.3 E-02	7.9 E-05
SWSA 5 Seep B West	3.2 E-01	8.5 E-01	4.1 E-03
SWSA 5 Seep C	5.1 E-01	9.8 E-01	7.7 E-03
HF-2	<1.0E-06	<1.0 E-06	<1.0E-06
Cobalt-60 Seep	1.0 E-04	1.0 E-03	1.7 E-06
East Seep	1.4 E-04	6.0 E-04	1.5 E-06
Haw Ridge	<1.0 E-06	8.0 E-06	<1.0 E-06
Melton Valley Drive	1.2 E-04	1.5 E-03	<1.0 E-06
NHF	<1.0 E-06	1.0 E-03	<1.0 E-06
Pit 4 South	<1.0 E-06	<1.0 E-06	<1.0 E-06
SWSA 4 East	5.5 E-03	2.9 E-02	<1.0 E-06
SWSA 4 Main	2.2 E-02	1.1 E-01	2.4 E-04
SWSA 5 D-2	2.1 E-01	6.7 E-01	2.6 E-03
SWSA 5 N WOC	1.8 E-04	2.1 E-03	<1.0 E-06
SWSA 5 Seep A	2.6 E-01	6.7 E-01	3.3 E-03
SWSA 5 Tributary 1	1.2 E-04	1.5 E-03	<1.0 E-06
SWSA 5 WOC	3.2 E-03	2.7 E-02	<1.0 E-06
SWSA 6 East	3.8 E-04	2.1 E-03	<1.0 E-06
SWSA 6 South	1.3 E-04	7.6 E-04	<1.0 E-06
W6MS1	7.6 E-04	3.2 E-03	1.4 E-05
W6MS3	5.9 E-04	4.4 E-03	1.1 E-04
WAG 7 WOC	<1.0 E-06	<1.0 E-06	<1.0 E-06
WOC Tributary 1	3.5 E-04	1.7 E-03	2.8 E-06
West Seep	4.7 E-04	9.5 E-02	1.2 E-05
HFIR	<1.0 E-06	<1.0 E-06	<1.0 E-06
HFIR South	ND	ND	ND
HRE	1.5 E-03	8.4 E-03	<1.0 E-06
MB15	2.0 E-04	8.4 E-04	2.5 E-06

HFIR = High Flux Isotope Reactor
HRE = Homogeneous Reactor Experiment
IHP = Intermediate Holding Pond
LD = limited data
LWOC = Lower White Oak Creek
MB = Melton Branch
ND = no data
NHF = New Hydrofracture Facility
ORNL = Oak Ridge National Laboratory
SWSA = solid waste storage area
WAG = waste area grouping
WOC = White Oak Creek

Table 2.2. Summary of primary COCs in soil samples, Melton Valley watershed, ORNL, Oak Ridge, Tennessee

Contaminant of concern	Concentration detected		Unit of measure	Frequency of detection
	Median	Maximum		
Cesium-137	162	700,000	pCi/g	562/692
Cobalt-60	15	500,000	pCi/g	186/517

COC = contaminant of concern
g = gram
ORNL = Oak Ridge National Laboratory
pCi = picocurie

2.6.2 Ecological Risk

The baseline ecological risk assessment (BERA) evaluated risks to ecological receptors associated with contaminants in the waste areas as well as contaminants that have migrated from waste areas to nearby surface water, sediment, and soil. Ecological receptors include fish, fish-eating birds, small mammals, sediment-dwelling organisms, soil invertebrates (e.g., earthworms), and wide-ranging species (e.g., fox, deer). The conceptual model for pathways of exposure to plants and animals in the floodplains and streams is shown in Fig. 2.7, and the conceptual model for risk applicable to wide-ranging species in shown in Fig. 2.8. Chemicals of potential ecological concern for ecological risk were identified by screening media data against background concentrations for inorganic analytes (organic analytes were not screened against background since these contaminants are man-made). All analytes that exceeded background concentrations within each subbasin in the Melton Valley watershed were carried through the ecological risk assessment.

Demonstration that an ecological risk is present normally requires multiple lines of evidence that corroborate the cause and effect relationship between environmental quality and ecological impact. One line of evidence that is used is comparison of media contaminant concentrations with benchmark concentrations to indicate that a potential may exist for risk to one or more ecological receptors. Other lines of evidence include biological surveys of the area to determine the numbers and types of plants and animals and assess the health of such populations. A third line of evidence that can be used is media toxicity testing in which species of interest are subjected to exposure to appropriate media from the site, and resulting effects on the health of the species are measured. Existing information and studies in the Melton Valley area that were available for the ecological risk assessment included single chemical analytical data for surface water, soil, and sediment. Additionally, other studies conducted as part of the Biological Monitoring and Abatement Program (BMAP) and the WAG 2 remedial investigation provided some biological survey data for aquatic species and soil invertebrates. No media toxicity data were available to assess risk to benthic invertebrates, piscivorous species, and terrestrial plants and animals.

2.6.2.1 Soil-related ecological risk

Ecological risk was assessed for plants, soil invertebrates, and terrestrial wildlife exposed to radionuclide and nonradionuclide contaminants in surface soil within each subbasin of the Melton Valley watershed where soil data were available. Nonradionuclide data were available from 22 subbasins.

Potential risks from nonradionuclide soil-related exposures were identified for 21 subbasins for plants, 11 for soil invertebrates, 21 for short-tailed shrews, 11 for white-footed mice, 11 for red fox, 3 for white-tailed deer, 8 for red-tailed hawks, 5 for wild turkeys, and 6 for mink. IHP resulted in the highest risks for all receptors due to high soil mercury concentrations. Radionuclide exposures resulted in potential risks to terrestrial biota at 16 subbasins. Radionuclide risks were highest in the East Seep subbasin with ^{137}Cs driving risks for all receptors. Ecological risks are documented in further detail in the RI report (DOE 1997).

Terrestrial ecological risk of most concern in Melton Valley is the potential risk to mammals from contaminants in soil. The shrew, a small burrowing animal that eats earthworms, is the most sensitive mammal evaluated in the RI; therefore, results of risk to the shrew will be discussed in more detail. The BERA identified 12 metals (As, Ba, Be, Cd, Cr, Cu, Hg, Mo, Ni, Se, Tl, and Zn), 5 radionuclides (^{137}Cs, ^{60}Co, $^{239/240}Pu$, ^{241}Am, and ^{244}Cm), and polychlorinated biphenyls (PCBs) as ecological COCs to the shrew. These COCs are identified as presenting potential risk to individual shrews; Hg, Cr, Ni, PCBs, Mo, Se, and radionuclides were shown to present risk to populations of shrews. Risk from radionuclides is evaluated by the total dose a receptor could receive. The threshold dose for mammals is 0.1 rad/day. The data summary for these constituents is shown in Table 2.3.

The major uncertainty associated with ecological risk for Melton Valley is having only a single line of evidence (i.e., comparing chemical data against ecological benchmarks). In addition, several uncertainties are associated with the estimated risk to small mammals in Melton Valley. Risk from mercury may be overstated because it is calculated based on methyl mercury, a species of mercury more hazardous than elemental mercury or mercuric sulfide (considered the most likely form of mercury present in Melton Valley soil). Risks attributable to chromium may also be overstated because they are based on the assumption that all detected chromium was hexavalent chromium (Cr^{+6}), a variety more toxic and bioavailable than trivalent chromium (Cr^{+3}). Analytical data did not specify the form of chromium present, but studies have shown that in most soils Cr^{+6} is likely to be reduced to Cr^{+3}. Risk attributed to nickel is predominated by one sample location in SWSA 4, and risk attributable to PCBs is predominated primarily by

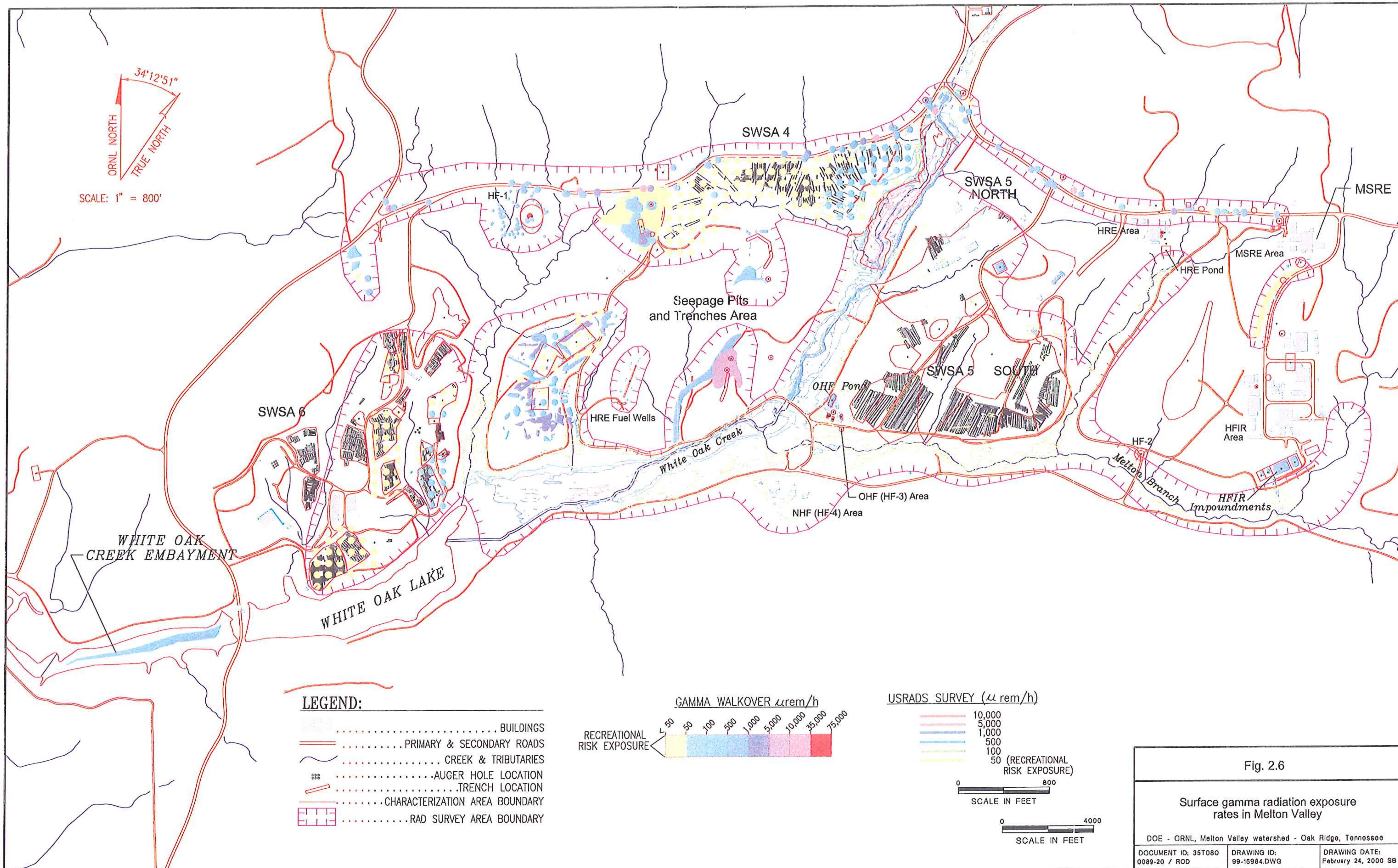


Fig. 2.6

Surface gamma radiation exposure rates in Melton Valley

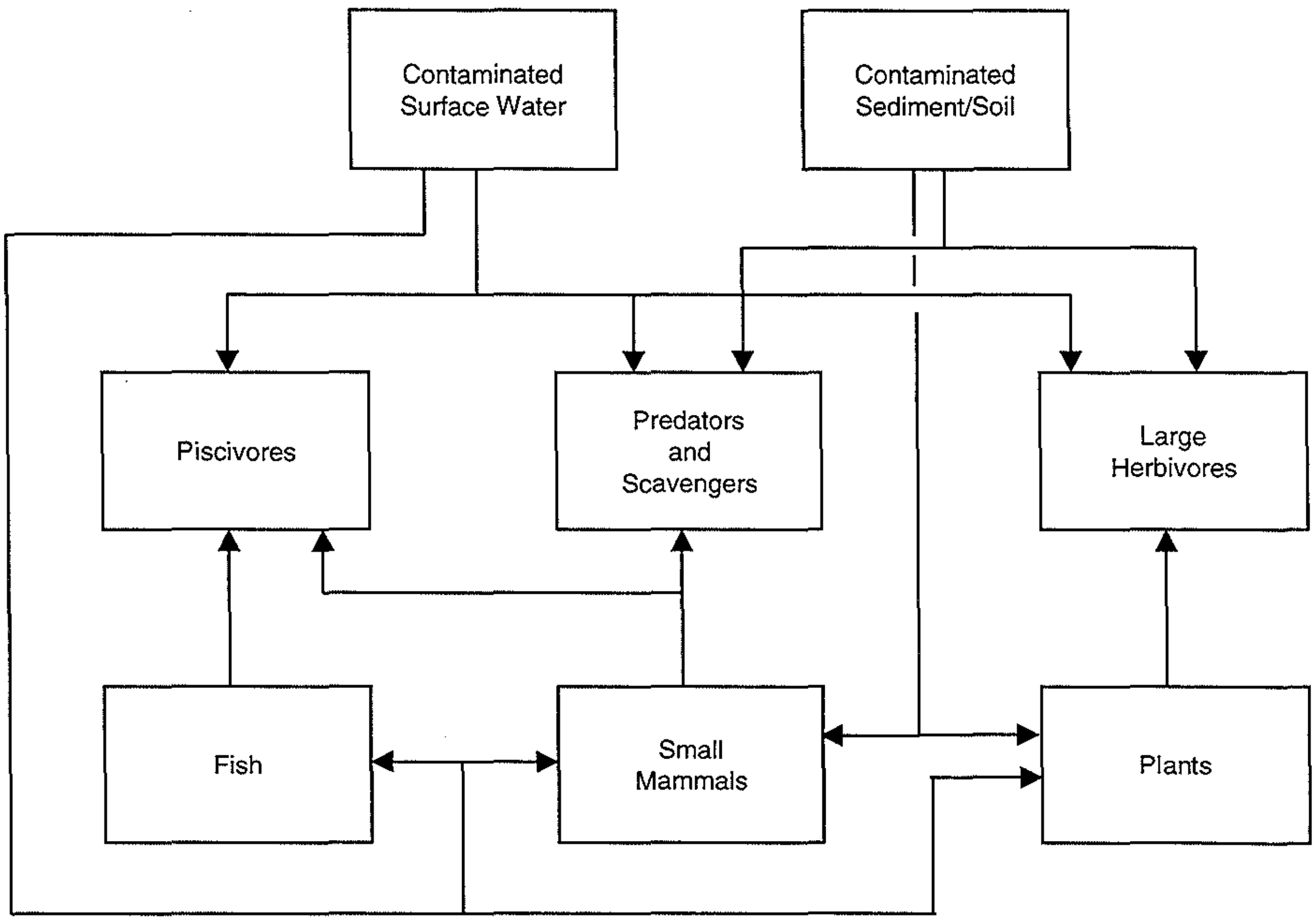


Fig. 2.7	Conceptual model of ecological risk applicable to Melton Valley streams and floodplains DOE - Melton Valley watershed - Oak Ridge,Tennessee	DOCUMENT ID: 35T080 0089-20 / ROD	DRAWING ID: NFA-RODA.PPT-3	DRAWING DATE: February 24, 2000 SB

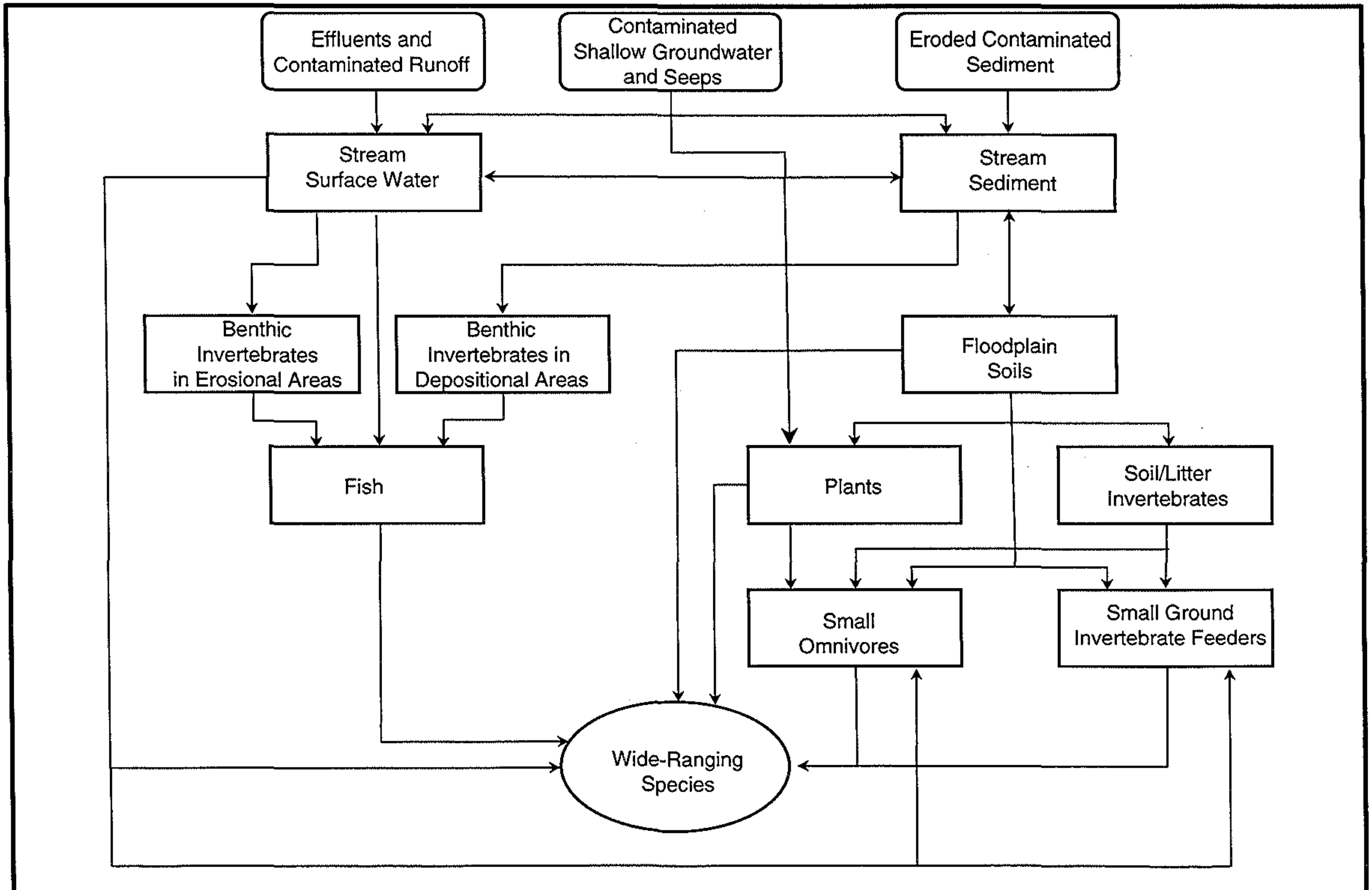


Fig. 2.8	Conceptual model of ecological risk applicable to wide-ranging wildlife DOE - Melton Valley watershed - Oak Ridge, Tennessee	DOCUMENT ID: 35T080 0089-20 / ROD	DRAWING ID: NFA-ROD.PPT-4	DRAWING DATE: February 24, 2000 SB

Table 2.3. Data summary for ecological COCs in soil, Melton Valley watershed, ORNL, Oak Ridge, Tennessee

Contaminant of concern	Maximum concentration detected	Reference concentration[a]	Units of measure	Frequency of detection
Arsenic	21.6	12.5	mg/kg	167/182
Barium	961	212	mg/kg	184/184
Beryllium	3.3	2.2	mg/kg	169/182
Cadmium	5.5	NA	mg/kg	82/115
Chromium	104	78.4	mg/kg	142/142
Copper	163	125	mg/kg	6/6
Mercury	76.4	0.53	mg/kg	66/122
Molybdenum	7.3	NA	mg/kg	42/42
Nickel	7,860	56.7	mg/kg	181/184
Selenium	5.1	NA	mg/kg	50/101
Thallium	2.5	0.79	mg/kg	40/51
Zinc	908	108	mg/kg	184/184
PCB-1260	2.3	NA	mg/kg	51/90
Cesium-137	700,000	1.53	pCi/g	562/692
Plutonium-239/240	163	NA	pCi/g	55/87
Americium-241	122	NA	pCi/g	75/98
Curium-244	35.6	NA	pCi/g	35/57
Cobalt-60	500,000	NA	pCi/g	186/517

[a] The reference concentration used for soil analyte screening in the Melton Valley watershed risk assessment was the upper 95th tolerance limit of the background data.

COC = contaminant of concern
g = gram
kg = kilogram
mg = milligram
NA = not available
ORNL = Oak Ridge National Laboratory
pCi = picocurie
PCB = polychlorinated biphenyl

one sample in SWSA 5 (mid-drain); all other PCB contaminated surface soils had HQs < 5. Only the shrew was shown to be at risk from molybdenum and selenium; the risk was fairly widespread. All HQs for molybdenum and selenium were low (< 5), and no background value was available for screening. Table 2.4 and Fig. 2.9 present the risk and uncertainties for the shrew.

Table 2.4. Ecological risk to subbasin-level terrestrial populations, Melton Valley watershed, ORNL, Oak Ridge, Tennessee

Subbasin	Preaction risk
IHP	Potential dose of 4.0 rad/day (HQ=40) to shrew primarily from Pu; potential risk to shrew and mice from Hg, based on methyl mercury; potential risk to shrew from Cr, based on Cr^{+6}; potential risk to shrew from Mo (HQ < 2) and PCB (HQ < 5)
SWSA 4 Main	Potential dose of 1.8 rad/day (HQ = 18) to shrew from Cs; potential risk to shrew from Be, Ni, and Se
WOC	Potential dose of 0.4 rad/day (HQ = 4) to shrew primarily from Pu; potential risk to shrew and mice from Hg, based on methyl mercury; potential risk to shrew from Mo (HQ < 2), Se (HQ < 2), Zn (HQ = 5; one location), and PCB (HQ = 7; one location)
Lower WOC/WOL	Potential dose of 1.7 rad/day (HQ = 17) to shrew and mice primarily from Pu; potential risk to shrew from Hg, based on methyl mercury and Cr based on Cr^{+6}; potential risk to shrew from Mo and Se (HQ < 2)
SWSA 5 TRIB 1	Potential dose of 0.18 rad/day (HQ = 1.8) to shrew from Pu, potential risk to shrew from Hg, based on methyl mercury, at one location and potential risk to shrew from Se based on two locations
SWSA 5 Drainage D2	Potential risk to shrew from PCBs based on one location
Seep B West	Potential dose of 0.8 rad/day (HQ = 8) to shrew from Am and Cm; potential risk to shrew from Hg, Mo, and Se based on one location
HF-2	Potential risk to shrew from Cr based on Cr^{+6}; potential risk to shrew from Ba, Mo, and Zn driven by one location (HQ < 4)
MB15	Potential dose of 3 rad/day (HQ = 30) to shrew from Co
West Seep	Potential dose of 5 rad/day (HQ = 50) to shrew from Co based on one location
East Seep	Potential dose of 14 rad/day (HQ = 140) to shrew from Cs based on one location; potential risk to shrew from Se (HQ = 2) in one location
HRE	Potential risk to shrew from Cr (HQ = 18) based on Cr^{+6} in one location
Seep A	Potential risk to shrew from Se based on two locations (HQ = 2 and 6)
Seep B East	Potential dose of 0.2 rad/day (HQ = 2) to shrew from Cs; potential risk to shrew from PCBs (HQ = 2) at one location
Seep C	Potential risk to shrew from Se and Mo based on two locations (HQ < 3); potential dose of 0.18 rad/day to shrew (HQ = 1.8) driven by one location
SWSA 5 WOC	Potential risk to shrew from Hg (HQ < 7) based on methyl mercury in two locations
SWSA 5N WOC	Potential risk to shrew from Se (HQ = 2) based on one location
WAG 7 WOC	Potential dose of 0.15 rad/day (HQ = 1.5) to shrew from Cs based on one location
WCTRIB 1	Potential dose of 0.18 (HQ = 1.8) to shrew from Cs based on one location
Pit 4 South	No rad risk; potential risk to shrew from Mo (HQ = 2) and Se (HQ = 2) driven by one location
SWSA 6 South	Potential risk to shrew from Mo (HQ = 2) and Se (HQ = 2) driven by one location
WAG 6 MS1	Potential risk to shrew from As (HQ = 5) based on one location

Am = americium
As = arsenic
Ba = barium
Be = beryllium
Cm = curium
Co = cobalt
Cr = chromium
Cs = cesium
Hg = mercury
HQ = hazard quotient
HRE = Homogeneous Reactor Experiment
IHP = Intermediate Holding Pond
Mo = molybdenum
Ni = nickel
ORNL = Oak Ridge National Laboratory
PCB = polychlorinated biphenyl
Pu = plutonium
rad = radioactive
Se = selenium
SWSA = solid waste storage area
TRIB = tributary
WAG = waste area grouping
WOC = White Oak Creek
WOL = White Oak Lake
Zn = zinc

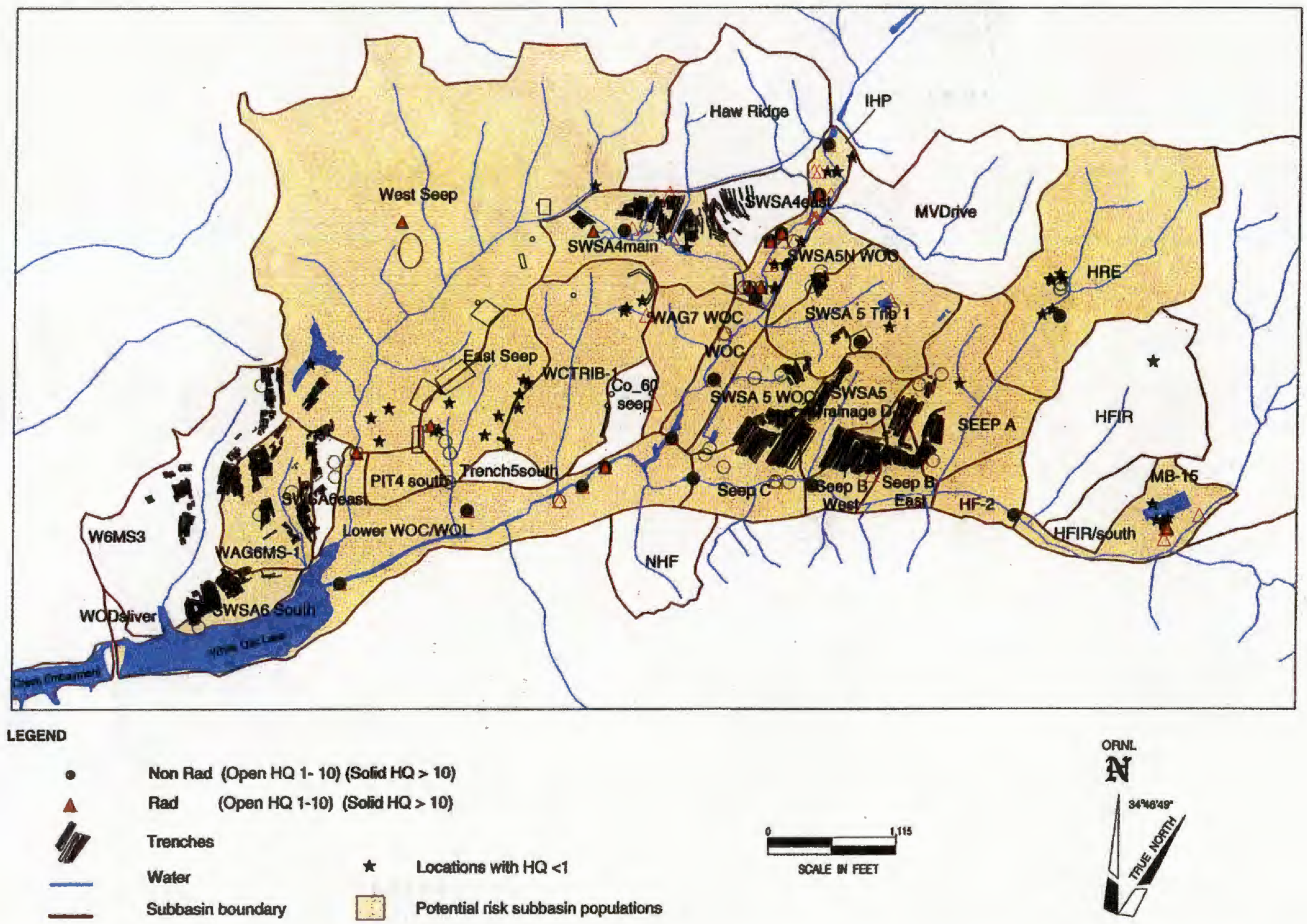


Fig. 2.9	Potential risk to shrew in Melton Valley DOE - ORNL, Melton Valley watershed - Oak Ridge, Tennessee	DOCUMENT ID: 35T080 0089-20 / ROD	DRAWING ID: 99-18235.CDR	DRAWING DATE: AUGUST 24, 1999 TG

2.6.2.2 Surface water-related ecological risk

Ecological risks were evaluated for aquatic organisms and piscivorous wildlife exposed to nonradiological contaminants in unfiltered surface water in Melton Valley. Evaluations were restricted to unfiltered surface water from main stem streams and large tributaries potentially providing suitable habitat for fish. Risks were estimated by comparing the distribution of observed concentrations to different types of aquatic benchmarks. Chemicals were considered to present significant risk if at least 20 percent of the concentrations exceeded probable effects benchmarks. Nonradiological data were available from 20 subbasins for the fish evaluation. Potential risks from exposure to radionuclides were evaluated for aquatic organisms across all 25 subbasins for which surface water and sediment radionuclide data were available. Based on a single line of evidence of comparison of unfiltered water analyses to chemical benchmarks, 16 subbasins appear to present potential risk to aquatic receptors. However, significant risk from surface water chemical concentrations were corroborated by biological data for only 5 of those 16 subbasins: Intermediate Holding Pond, White Oak Creek, MB-15, Lower White Oak Creek/White Oak Lake, and the White Oak Creek Embayment. The weight of evidence is strongest that there is an adverse aquatic impact in the subbasins that contain White Oak Creek upstream of White Oak Dam.

Potential risks to aquatic organisms exposed to radionuclides in surface water within the watershed were identified for only two subbasins: SWSA 5 White Oak Creek (^{137}Cs in OHF Pond) and Seep C (^{90}Sr).

Potential risks were evaluated for five species of piscivorous wildlife: mink, river otter, belted kingfisher, great blue heron, and osprey. Evaluation of available single chemical toxicity data, toxicity test data, and field surveys suggest that the Melton Valley watershed populations of mink, great blue heron, and osprey are not at risk. However, individual river otter (listed as threatened by the Tennessee Wildlife Resources Agency) may be at risk from exposure to mercury, primarily at the Lower White Oak Creek/White Oak Lake and White Oak Creek subbasins; kingfisher populations may be at risk from exposure to mercury and selenium.

Risks from exposure of piscivorous wildlife to radionuclides are not anticipated in the Melton Valley watershed. Exposure of piscivorous wildlife to radionuclides were modeled using available surface water data and measured fish body burden data. Potential risks were identified in only one subbasin [SWSA 5 White Oak Creek (OHF Pond)]. Doses were below recommended limits for all piscivorous receptors.

Potential risks to white-tailed deer exposed to thallium by drinking surface water were identified for three subbasins. risks were not identified for any other receptors, and thallium was the only analyte that exceeded the lowest observed adverse effect level for deer. However, it is unlikely that thallium in drinking water poses a risk to deer because of uncertainty in the thallium benchmark and use of unfiltered water data. The maximum HQ was 1.5 for deer.

2.6.3 Characterization Summary

A summary of site characterization and risk from contaminated sites in Melton Valley is presented below.

- *Melton Valley contains areas with high inventories of radioactive wastes.*

Several portions of the Melton Valley watershed contain high inventories of radioactive wastes. Hydrofracture sites alone account for more than 1 million Ci of activity. Other high inventory areas include the Seepage Pits and Trenches Area (400,000 Ci), SWSA 6 (540,000 Ci), SWSA 5 South (34,000 Ci), and SWSA 4 (20,000 Ci). Fission products with half-lives of approximately 30 years or less comprise an estimated 95 percent of the buried radionuclide waste in Melton Valley.

- *Long half-life radionuclides pose a future potential risk for several areas.*

Buried wastes containing long-lived isotopes such as uranium, thorium, plutonium, and americium were disposed of in shallow land burial trenches and auger holes, primarily in SWSA 5 North and portions of SWSA 5 South, SWSA 4, and SWSA 6. Exact locations of such wastes are not known for some areas. Approximately 5 percent or less of buried radioactive materials is long-lived radionuclides.

- *Several source areas in the Melton Valley watershed contribute the majority of the tritium (^{3}H), ^{90}Sr, and ^{137}Cs to surface water.*

Releases of contaminants to surface water in the Melton Valley watershed produce radionuclide concentrations that result in unacceptable risk levels at the confluence of White Oak Creek with the Clinch River and at points upstream in Melton Valley. The principal radionuclides causing unacceptable potential human health risk at White Oak Dam under a residential exposure scenario are ^{3}H (48 percent of the risk), ^{90}Sr (45 percent), and ^{137}Cs (7 percent).

Figure 2.10 shows the five sources in Melton Valley that are contributing 83 percent of risk in surface water as measured at White Oak Dam. Sources contributing to the greatest risk are not necessarily the same as those with the largest inventories of radiological waste. Primary sources of uncontrolled releases are SWSA 5 South (42 percent of the risk), SWSA 4 (27 percent), HRE Pond (8.4 percent), SWSA 6 (2.9 percent), and the Seepage Pits and Trenches Area (2.4 percent).

NOTES:

1. Risk contributions are approximate and refer to percent of risk in surface water to hypothetical resident at White Oak Dam (see Table 3.5 of the RI). Risk contributions shown in this figure do not sum to 100 because of other contributions from Bethel Valley and from diffuse and less significant sources in Melton Valley.
2. Age refers to elapsed time (yrs) since site became inactive.
3. Inventories are approximate and refer to total 1996 activity residing in primary source areas.

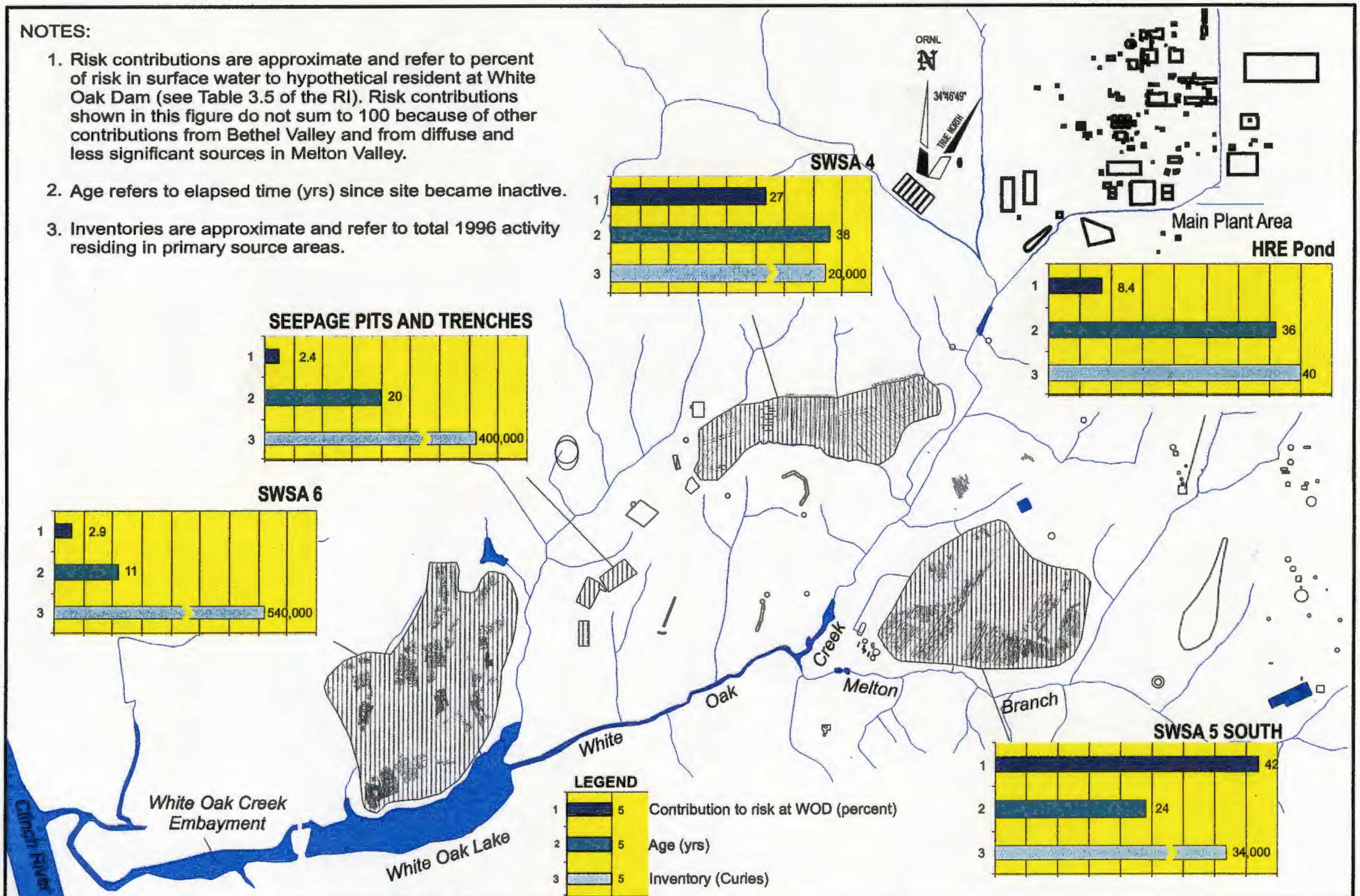


Fig. 2.10	Risk contribution, age, and inventory of primary sources of off-site migration DOE - ORNL, Melton Valley watershed - Oak Ridge, Tennessee	DOCUMENT ID: 35T080 0089-20 / ROD	DRAWING ID: RISK_fig2.11.CDR	DRAWING DATE: August 14, 2000 WaM

In addition to contaminant sources located within the Melton Valley watershed, Bethel Valley sources (comprising the main plant area of ORNL), which are upstream of the Melton Valley watershed, contribute significantly to the total watershed ^{3}H, ^{90}Sr, and ^{137}Cs measured at White Oak Dam. Contaminant sources within Bethel Valley contribute approximately 29 percent of the ^{90}Sr flux and 3 percent of the ^{3}H flux measured at White Oak Dam (based on 1995 data). In addition, Bethel Valley sources contribute most of the total ^{137}Cs flux measured at the dam. Approximately 50 percent of the ^{137}Cs released to surface water adsorbs onto sediment particles that settle out in White Oak Lake or in reaches with slow-moving water. Estimated annual (1995) totals from Melton Valley and Bethel Valley sources entering Clinch River are 1.6 Ci and 2300 Ci for ^{90}Sr and ^{3}H, respectively.

- *Most areas releasing significant quantities of contamination to surface water appear to be associated with perennially inundated shallow land burial trenches.*

For releases to surface water to occur, wastes must be susceptible to leaching, water must come in contact with wastes, and a pathway to a discharge point to surface water must exist. Most areas associated with the largest contaminant releases to surface water contain waste that is perennially or seasonally inundated with groundwater (i.e., SWSA 5 South, SWSA 4, and HRE). Generally, inundated trenches are located near White Oak Creek, Melton Branch, or one of the tributaries.

- *Surface water within the watershed exceeds some AWQC and risk-based goals for the protection of human health and the environment.*

Several locations in White Oak Creek, Melton Branch, and other streams in the watershed contain contaminants that exceed AWQC and recreational risk-based levels. The principal contaminants that exceed numeric and narrative AWQC are listed in Table 2.5. Other contaminants including nickel and thallium exceed AWQC less consistently than the principal COCs. White Oak Creek and Melton Branch have been classified for fish and aquatic life, recreation, and livestock watering and wildlife uses. White Oak Creek and Melton Branch are not classified for domestic water supply, industrial water supply, or irrigation, although other tributaries in Melton Valley are classified for irrigation by default. Rules of the TDEC Chap. 1200-4-3-.03 lists AWQC for protection of human health from consumption of aquatic organisms (recreational AWQC) and AWQC for protection of aquatic organisms.

- *Radiologically contaminated surface soils are a significant problem in the valley, as shown by human health and ecological risk assessments.*

Table 2.5. Principal contaminants that exceed surface water criteria, Melton Valley watershed, ORNL, Oak Ridge, Tennessee

Ambient water quality COCs[a]		Recreational risk-based COCs[b]
Human health	Fish and aquatic life	
Mercury	Cadmium	Arsenic
Arsenic	Copper	Cesium-137
	Lead	Cobalt-60
	Selenium	Radium-228
	Mercury	Strontium-90
		Tritium
		Uranium-234
		Vinyl chloride
		Tetrachloroethene

[a]AWQC are from Rules of the TDEC Chap. 1200-4-3 (effective October 1999). Seven AWQC locations of potential concern were identified in the *Feasibility Study for Melton Valley Watershed at Oak Ridge National Laboratory, Oak Ridge, Tennessee* (DOE/OR/01-1629/V1,V2&D2). Following site remedation, DOE will meet numeric and narrative AWQC for all site-related compounds in surface water in approximately 10 years.

[b]Recreational risk-based levels are calculated using CERCLA guidance and are consistent with the baseline risk assessment in the *Remedial Investigation Report on the Melton Valley Watershed at Oak Ridge National Laboratory, Oak Ridge, Tennessee* (DOE/OR/01-1546/V1,V2&D2). The feasibility study indicated that 10^{-4} levels were exceeded primarily in Melton Branch by SWSA 5 South and in the SWSA 4 Tributary south of SWSA 4. The recreational risk-based COCs listed here include all those listed in the proposed plan with the exception of beryllium. Beryllium is not listed as a COC here because, since publication of the proposed plan, EPA has revised its position on the carcinogenicity of beryllium by the oral exposure pathway. The oral slope factor for beryllium has been removed from the Integrated Risk Information System. Also, beryllium concentrations do not exceed the preliminary remediation goals for noncarcinogenic effects.

AWQC = ambient water quality criteria
COC = contaminant of concern
ORNL = Oak Ridge National Laboratory
SWSA = solid waste storage area
TDEC = Tennessee Department of Environment and Conservation
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980

Contaminated surface soils that present potential risks to human health occur in contaminant source units, in secondarily contaminated soils along seepage pathways, and in broad floodplain areas. The most common radionuclide present in contaminated surface soils is ^{137}Cs, although ^{60}Co is also present in some areas. Potential ecological risks to terrestrial receptors from exposure to radionuclides in surface soil were also identified. In addition to ^{137}Cs and ^{60}Co, $^{239/240}$Pu is of ecological concern.

Radiological contaminants dominate the human health risk assessment; however, nonradiological contaminants detected in soil and sediment contribute to risk in several areas. Nonradiological contaminants—metals, in particular—dominate in the ecological risk assessment. The BERA evaluated risk to small mammals and other terrestrial wildlife from exposure to chemicals in contaminated soil. Chemical risk was attributed to elevated levels of Hg, Ni, Cr, PCBs, Mo, and Se. Potential risk was also identified for sediment-dwelling organisms exposed to metals and PCBs in sediment.

- *Hydrofracture wastes and wells are a long-term site management problem.*

The large quantity of injected waste, the presence of TRU as a small percentage (< 1 percent) of the waste, and likely deterioration of the deep wells associated with the waste require long-term site management. Although the bedrock permeability is low and the flow rate is very slow at depths where the waste-grout mixture was injected, contaminant migration from the grout sheets into shallow groundwater is a possibility that will require well closure, groundwater monitoring, and long-term institutional controls.

- *Groundwater exceeds MCLs throughout much of the Melton Valley watershed.*

A relatively continuous zone of shallow groundwater contamination exists throughout Melton Valley. As presented in the Melton Valley RI report (DOE 1997), groundwater exceeds SDWA MCLs in all 14 drainage basins that comprise Melton Valley watershed. Contaminated groundwater originates from source areas (i.e., seepage pits, waste disposal trenches, lagoons, etc.) and typically follows shallow pathways to nearby surface water bodies. Consequently, groundwater is not expected to migrate along deep pathways outside the current zone of groundwater contamination at concentrations exceeding MCLs. However, the possibility cannot be absolutely eliminated.

- *TRU waste is stored in segregated areas of Melton Valley. Transuranic-contaminated waste is located in several areas in Melton Valley.*

TRU waste (a specific waste classification) is defined as waste, without regard to source or form, that is contaminated with alpha-emitting transuranium radionuclides (atomic number > 92) with half-lives > 20 years and concentrations > 100 nCi/g. When this definition was first created in 1970, TRU waste was segregated from other wastes for later retrieval. Most TRU wastes generated after 1970 were placed in SWSA 5 North. The intent of this segregation was to comply with the 1970 U.S. Atomic Energy Commission (predecessor to DOE) policy that TRU waste would be segregated and stored pending final determination of long-term disposal. The original concentration requirement for classification as TRU waste was > 10 nCi/g (1970–1984). As a result, it is unknown how much of the waste emplaced as TRU would be considered TRU using the current definition. Long-lived radionuclides (those having half-lives of hundreds of thousands of years) comprise a small percentage of the waste disposed in Melton Valley. Approximately five percent of the radioactive material (estimated by curies of activity) disposed as buried waste is categorized as long-lived material. Some of this type material is distributed throughout the buried waste.

As presented in this section, actual or threatened releases of hazardous substances from this watershed may present a current or potential future threat to public health, welfare, or the environment if not addressed by implementing the response action selected in this ROD.

2.7 REMEDIAL ACTION OBJECTIVE

The major problems identified in Melton Valley are the presence of high inventories of short-half-life radiological waste and lesser quantities of long-half-life radiological wastes, contaminant releases to surface water, and widespread contamination in secondary media. A remedial action objective (RAO) was developed during the FS phase to focus remedial planning to address these environmental problems. This RAO evolved slightly to its present form (Table 2.6) during the process of remedy selection.

Figure 2.11 shows the approximate boundaries of the three land use endpoints: industrial area, waste management area, and surface water and floodplain area. The exposure frequency for a worker in the industrial area and a maintenance worker in the waste management area is 2000 hours/year. Workers in the waste management area are expected to spend 90 percent of their work time (1800 hours/year) working in capped waste disposal areas and 10 percent (200 hours/year) in the remainder of the area where contaminated surface soils have been remediated. The 90 percent/10 percent partitioning is based on projected workloads dominated by vegetation control, subsidence repair, and inspections on the capped areas, with less time spent performing other tasks such as road maintenance, fence/gate repair, and environmental monitoring in the uncapped areas. However, to be conservative in its derivation of remediation levels and provide a greater degree of protectiveness, DOE assumes that the maintenance worker spends 70 percent of the work time (or 1400 hours/year) on the capped areas and 30 percent of the work time (or 600 hours/year) on the uncapped area.

The recreational scenario identified for the surface water and floodplain area is considered an endpoint because Melton Valley surface waters are classified for recreational use by the state. However, DOE does not reasonably foresee actual recreational use of Melton Valley in the near future. The Melton Valley watershed FS evaluated several different alternatives for remediation of the surface water and floodplain area. However, the three FFA parties agreed to defer remedy selection for floodplain soils with < 2500 μR/hour gamma exposures and for lakebed and streambed sediments until after implementation of source control actions. This remedy addresses water quality but does not fully address fish consumption or sediment/floodplain soil contact or exposure under the recreational scenario. This remedy also protects the hypothetical recreational user through a combination of remedial actions including land use controls. A report documenting results of this ecological monitoring will be milestoned in Appendix E of the FFA. If any additional actions are necessary, they will be included in a future remedial decision.

The selected remedy enhances overall protection of valleywide ecological populations and subbasin-level populations over a majority of the valley. However, portions of the valley that are not addressed by the selected remedy may pose potential unacceptable risks to ecological receptors. Additional data collection and evaluation will be conducted as part of this remedy to further assess the status of ecological receptors in these areas. Results of this ecological monitoring and any additional actions as necessary will be included in a future remedial decision.

2.8 DESCRIPTION AND COMPARISON OF REMEDIAL ALTERNATIVES

With a specific cleanup objective defined, specific remediation alternatives were developed to achieve these goals. Nine remedial alternatives were developed for preliminary screening. The no action alternative was included as a baseline for comparison as required by CERCLA.

All 10 alternatives were subject to a preliminary screening process using three broad criteria: effectiveness (short- and long-term), implementability, and cost as required by CERCLA. Based on the results of the screening process, six alternatives (including the no action alternative) were retained for detailed analysis. The six alternatives represent a range of remediation strategies (Table 2.7). Remedial actions that use a combination of actions, institutional controls, and time for radioactive decay were assembled for each alternative to achieve the RAO. All alternatives include institutional controls and monitoring. Table 2.8 presents a summary of remedial actions for each alternative (including the selected remedy). Detailed alternative development is contained in the FS.

2.8.1 Alternative 1—No Action

The no action alternative assumes that no remedial action will occur and that current actions (e.g., seep collection and treatment along Melton Branch) will cease. The site will be released for unrestricted use, no institutional controls will remain, and conditions will not be monitored. This alternative poses a long-term unacceptable risk to human health and the environment.

Table 2.6. RAO for the Melton Valley watershed selected remedy, ORNL, Oak Ridge, Tennessee

Area/receptor	Goal
Waste management area (includes SWSA 4, 5, and 6 and Seepage Pits and Trenches)	• Manage waste disposal sites as a restricted waste management area • Protect maintenance workers • Meet AWQC in surface water in a reasonable amount of time • Mitigate further impact to groundwater
Industrial use area (generally the area east of SWSA 5)	• Manage areas generally east of SWSA 5 as an industrial area • Protect industrial workers • Meet AWQC in surface water in a reasonable amount of time • Mitigate further impact to groundwater
Surface water and floodplain area	• Achieve numeric and narrative AWQC for waters of the state in a reasonable amount of time • Remediate contaminated floodplain soils to 2500 µR/hour[a] • Protect an off-site resident user of surface water at the confluence of White Oak Creek with the Clinch River from contaminant sources in Melton Valley • Make progress toward meeting Clinch River's stream use classification as a drinking water source at the confluence of White Oak Creek with the Clinch River
Human receptors	• Protect maintenance workers, industrial workers, and off-site resident users of surface water (at the confluence of White Oak Creek with Clinch River) to a 10^{-4} to 10^{-6} excess lifetime cancer risk and an HI of 1 • Protect hypothetical recreational users of waters of the state[b]
Ecological receptors	• Protect ecological populations[c]

[a]A future CERCLA decision will be prepared to determine whether additional actions are required for floodplain soils <2500 µR/hour. During the FS phase, this goal was to remediate all contaminated sediments and floodplain soils to recreational risk-based limits.

[b]This remedy addresses water quality but does not fully address fish consumption or sediment/floodplain soil contact or exposure under the recreational scenario. This remedy protects the hypothetical recreational user through a combination of remedial actions including land use controls. A future CERCLA decision will be prepared to assess whether any additional actions are required.

[c]The selected remedy enhances overall protection of valleywide ecological populations and subbasin-level populations over a majority of the valley. However, portions of the valley that are not addressed by the selected remedy may pose potential unacceptable risks to ecological receptors. Additional data collection and evaluation will be conducted as part of this remedy to further assess the status of ecological receptors in these areas. A report documenting results of this ecological monitoring will be milestoned in Appendix E of the FFA. If any additional actions are necessary, they will be included in a future remedial decision.

AWQC = ambient water quality criteria
HI = hazard index
ORNL = Oak Ridge National Laboratory
RAO = remedial action objective
SWSA = solid waste storage area
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980

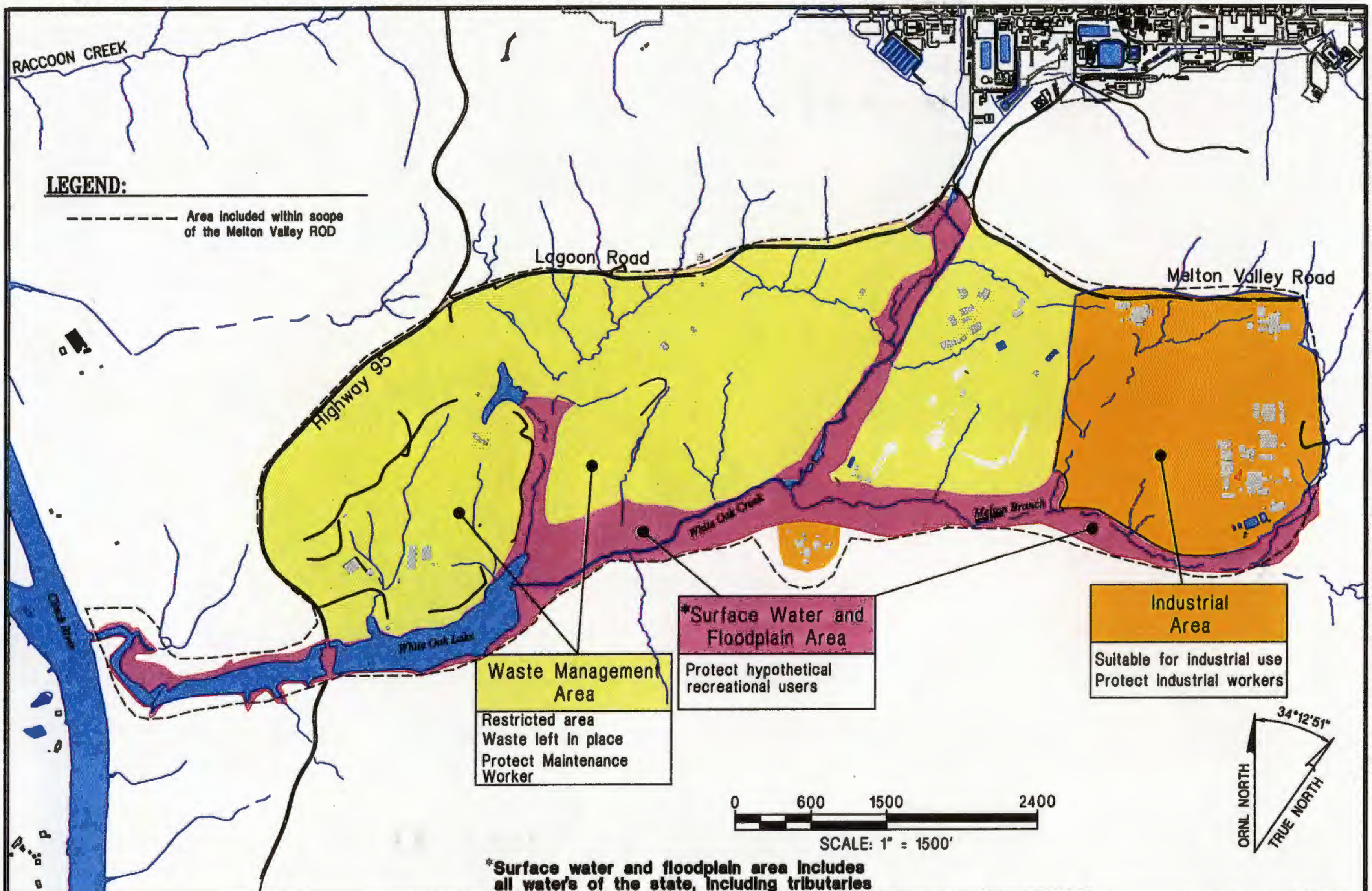


Fig. 2.11	Approximate boundaries for Melton Valley watershed land use DOE - ORNL, Melton Valley watershed - Oak Ridge, Tennessee	DOCUMENT ID: 35T080 0089-20/ ROD	DRAWING ID: 00-16707.DWG	DRAWING DATE: August 14, 2000 WaM

Table 2.7. Remediation alternatives, Melton Valley watershed, ORNL, Oak Ridge, Tennessee

Alternative	Key remediation strategy
1	No action
2	Limited source containment
3	Source containment
4	Source treatment and containment
5	Source treatment and comprehensive source containment
6	Aggressive source controls

ORNL = Oak Ridge National Laboratory

2.8.2 Alternative 2—Limited Source Containment

Alternative 2 uses limited source containment of selected, major sources of contaminant releases as its key remediation strategy. SWSA 4 (middle and western portion), SWSA 5 South (including the OHF Pond), the HRE Pond and, to a lesser extent, portions of SWSA 6 are the primary contributors to exceedances of human health and ecological remediation levels and ARARs. Ecological populations would be protected with some uncertainties.

Hydraulic isolation techniques would be implemented at SWSA 5 South and at the western and central portions of SWSA 4. Such techniques would include capping the disposal sites, surface water controls for run-on and runoff, and installation of an upgradient stormflow diversion trench. Vertical cryogenic barriers have been installed around the HRE Pond as a DOE technical demonstration (not under the CERCLA scope). This alternative proposes maintaining the cryogenic barriers.

Because removal of tritium from large volumes of waste water is technically difficult and costly, some continued tritium discharge would be expected. Tritium contributions to exceedances of remediation levels at White Oak Dam would be controlled through hydraulic isolation.

Institutional controls in this alternative would include access restrictions (fences and security), posted signs, and restrictions on water usage. Contaminated surface soils within the Melton Valley watershed would be institutionally controlled to minimize exposures to workers. Figure 2.12 presents the actions included in this alternative.

Table 2.8. Remedial action summary by alternative, Melton Valley watershed, ORNL, Oak Ridge, Tennessee

FS unit name/location	Unit type	Alternative 2 actions	Alternative 3 actions	Alternative 4 actions	Alternative 5 actions	Alternative 6 actions	Selected remedy actions
SWSA 4	Buried wastes	Hydraulic isolation of trenches contributing to Seeps 1–6 (no downgradient collection)	Hydraulic isolation	In situ grouting of tritium trench; hydraulic isolation	In situ grouting of tritium trench; hydraulic isolation	Removal of trenches contributing to Seeps 1–6; removal of auger holes just south of Lagoon Road; hydraulic isolation	Hydraulic isolation
SWSA 5 South	Buried wastes	Capping majority of SWSA (no downgradient collection)	Hydraulic isolation of majority of SWSA	Hydraulic isolation of majority of SWSA	Hydraulic isolation	Removal of inundated trenches; hydraulic isolation	Hydraulic isolation
SWSA 5 North	Buried wastes and contaminated soil	Institutional controls	Institutional controls	Institutional controls	In situ grouting; hydraulic isolation of 27 trenches	Removal of 27 trenches	Hydraulic isolation of upper 4 trenches; management of excavated soils remaining after TRU waste retrieval from 23 trenches[a]
SWSA 6	Buried wastes	Capping selected RCRA units	Hydraulic isolation of selected areas (no downgradient collection); institutional controls	In situ grouting and hydraulic isolation of selected areas (no downgradient collection); institutional controls	In situ grouting of selected areas and hydraulic isolation (no downgradient collection)	Removal of selected areas and hydraulic isolation (no downgradient collection)	Hydraulic isolation (no downgradient collection)
Grout sheets	Hydrofracture	Institutional controls and monitoring	Institutional controls and monitoring	Institutional controls and monitoring	Institutional controls and monitoring	Institutional controls and monitoring	Land use controls and monitoring
Injection and monitoring wells	Hydrofracture	Plug and abandon high priority wells and wells under cap boundaries; institutional controls for other wells	Plug and abandon high priority wells and wells under cap boundaries; institutional controls for other wells	Plug and abandon high priority wells and wells under cap boundaries; institutional controls for other wells	Plug and abandon all wells	Plug and abandon all wells	Plug and abandon all wells not used for future monitoring

Table 2.8 (continued)

FS unit name/location	Unit type	Alternative 2 actions	Alternative 3 actions	Alternative 4 actions	Alternative 5 actions	Alternative 6 actions	Selected remedy actions
Process Waste Sludge Basin (7835)	Impoundment	Soil cover	Soil cover	Soil cover	Grouting (shallow soil mixing)	Removal	Sediment removed and basin backfilled under removal action
HRE Pond (7556)	Impoundment	Cryogenics	Cryogenics	Removal	Removal	Removal	Cryogenics until removal
HFIR/TRU Waste Collection Basins (7905, 7906, 7907, and 7906)	Impoundment	Soil cover	Soil cover	Soil cover	Removal	Removal	Removal
HRE fuel wells (7809)	Liquid seepage unit	Institutional controls	Institutional controls	Institutional controls	Institutional controls	Institutional controls	Grout wells
Pit 1 and Trench 6 (7805 and 7810)	Liquid seepage unit	Maintain existing cap	Hydraulic isolation	Hydraulic isolation	Hydraulic isolation	Hydraulic isolation	Hydraulic isolation
Pits 2, 3, and 4 (7806, 7807, and 7808)	Liquid seepage unit	Maintain existing cap	Hydraulic isolation	In situ grouting; hydraulic isolation	ISV; hydraulic isolation	ISV; hydraulic isolation	Hydraulic isolation
Trenches 5 and 7 (7809 and 7818)	Liquid seepage unit	Maintain existing caps	Hydraulic isolation	In situ grouting; hydraulic isolation	ISV	ISV	ISV
MSRE, HRE, and OHF ancillary facilities	Structure	Mostly decontaminate and stabilize	Mostly decontaminate and stabilize	Mostly decontaminate and stabilize	Mostly decontaminate and stabilize	Mostly decontaminate and stabilize	Mostly decontaminate and stabilize
Inactive process and transfer pipelines	Inactive pipelines	Institutional controls	Institutional controls	Institutional controls	In situ grouting of pipes	Removal of pipes	Some removal, plugging end of pipes, stabilization, and land use controls
Various hot spots throughout Melton Valley	Surficially contaminated soil	Generally institutional controls; actions depend on exposure potential	Generally institutional controls or soil covers; actions depend on exposure potential	Generally institutional controls or soil covers; actions depend on exposure potential	Generally soil covers or removal; actions depend on exposure potential	Generally removal or soil covers; actions depend on exposure potential	Removal or capping; actions depend on exposure potential

Table 2.8 (continued)

FS unit name/location	Unit type	Alternative 2 actions	Alternative 3 actions	Alternative 4 actions	Alternative 5 actions	Alternative 6 actions	Selected remedy actions
WOL and WOC Embayment and streams	Lakebed and streambed sediment	Institutional controls	Institutional controls	Institutional controls	Drain lake and embayment; containment of sediments	Excavate floodplain soils and sediments (> 50 μR/hour)	Interim land use controls selected (final action deferred)
Floodplain soil WOC and Melton Branch and tributaries	Floodplain soil	Institutional controls	Institutional controls; soil covers	Institutional controls; soil covers; excavate IHP	Excavation of floodplain soils and sediments (> 500 μR/ hour)	Excavation of floodplain soils and sediments (> 50 μR/hour)	Excavation of floodplain soils > 2500 μR/hour. Balance deferred
Groundwater throughout Melton Valley	Groundwater	Deferred	Deferred	Deferred	Deferred	Deferred	Deferred

[a] Alternatives developed in the FS addressed the TRU-waste containers in 27 trenches in SWSA 5 North. During ROD preparation, the FFA parties agreed that TRU waste in 23 of the 27 trenches in SWSA 5 North will be removed as a separate AEA action in support of the National TRU Waste Program.

AEA = Atomic Energy Act
FS = feasibility study
> = greater than
HFIR = High Flux Isotope Reactor
HRE = Homogeneous Reactor Experiment
IHP = Intermediate Holding Pond
ISV = in situ vitrification
μrem = microrem
MSRE = Molten Salt Reactor Experiment
OHF = Old Hydrofracture Facility
ORNL = Oak Ridge National Laboratory
RCRA = Resource Conservation and Recovery Act of 1976
SWSA = solid waste storage area
WOC = White Oak Creek
WOL = White Oak Lake

ALTERNATIVE 2 SUMMARY

RAO used during FS development:
- Achieve AWQC in waters of the state
- Protect ecological populations
- Restrict waste management areas
- Protect maintenance workers
- Protect industrial workers east of SWSA 5
- Protect recreational receptor
- Achieve 1x10^{-4} residential risk limits in surface water before its discharge into Clinch River
- Protect Clinch River as a drinking water source
- Protect groundwater outside contaminated areas; mitigate further impacts in contaminated areas

PRINCIPAL ACTIONS:
- Multilayer caps over portions of SWSA 4, SWSA 5 South and SWSA 6
- Upgradient diversion trench at SWSA 4
- HRE Pond isolation (cryogenics)
- Soil covers over PWSB and HFIR impoundments
- Institutional controls for surface water leaving the site until the residential risk limit is achieved (primarily through tritium decay)
- Monitoring
- Some wetlands replacement, D&D, limited well P&A, maintenance, and waste management activities

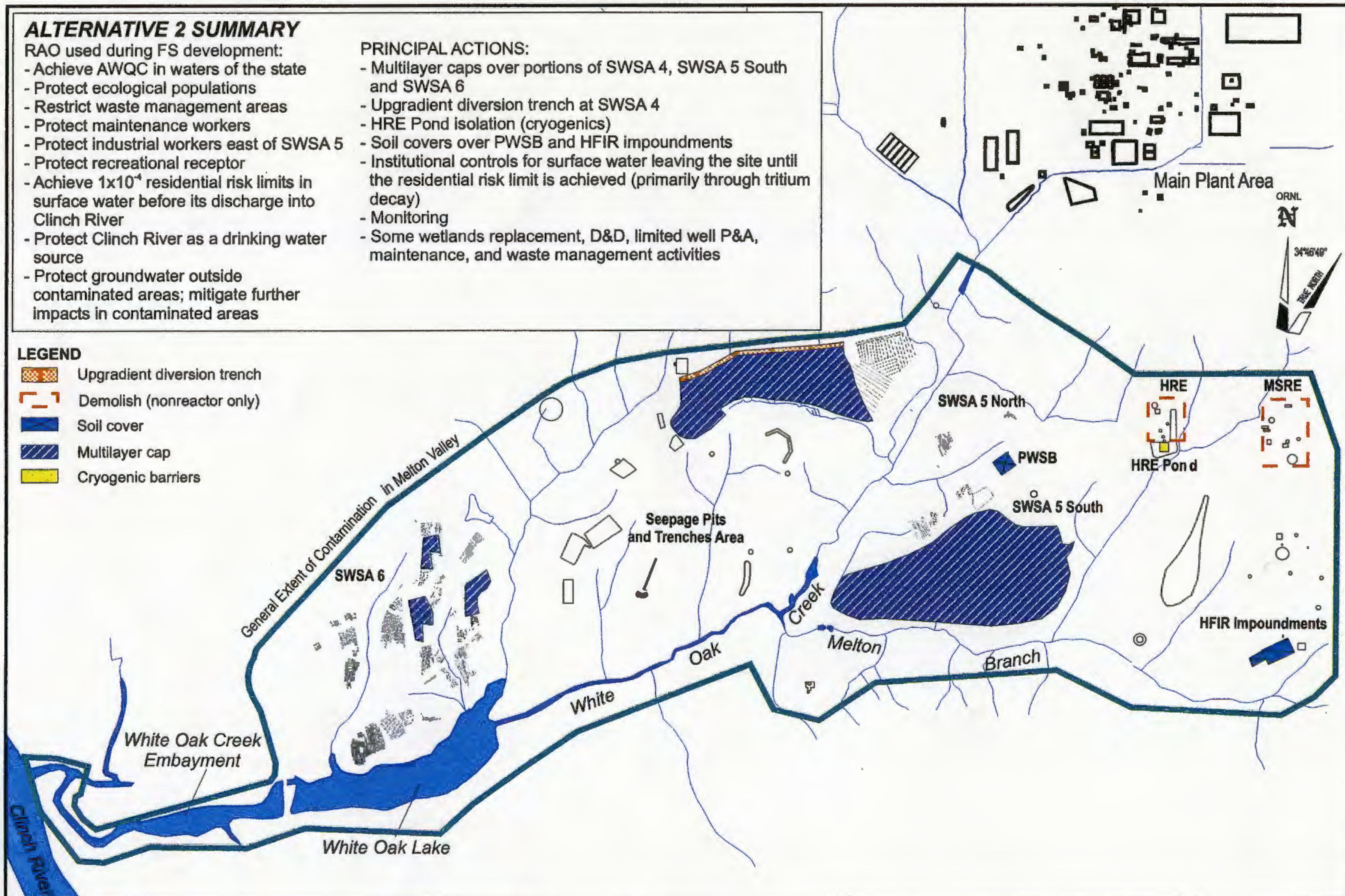


Fig. 2.12	**Alternative 2 - Limited Source Containment** DOE - ORNL, Melton Valley watershed - Oak Ridge, Tennessee	DOCUMENT ID: 35H830 0089-20 / ROD	DRAWING ID: ALT-2_fig2.12.CDR	DRAWING DATE: March 23, 2000 SB

2.8.3 Alternative 3—Source Containment

Alternative 3 meets the RAO using source containment as its key remediation strategy. SWSA 4, SWSA 5 South, and the HRE Pond are the primary contributors to RAO exceedances.

SWSA 6 and the Seepage Pits and Trenches Area are smaller contributors, but releases from these sites could significantly increase in the future as the waste units age.

Base actions for this alternative are essentially the same as for Alternative 2 except that the hydraulic isolation is more comprehensive to attain a greater assurance of success in meeting the RAO. Hydraulic isolation techniques would be implemented at SWSAs 4, 5, and 6, and the Seepage Pits and Trenches Area. The isolation would include capping the disposal sites, surface water controls for run-on and runoff, installation of upgradient diversion trenches, installation of downgradient collection drains (except at SWSA 6), and treatment of the collected drain water at an enhanced Seep D treatment plant (located near the confluence of White Oak Creek and Melton Branch). The caps in this alternative would cover more acreage than in Alternative 2, and the downgradient water collection would significantly improve the effectiveness of the hydraulic isolation. In addition, soil covers over the IHP and other contaminated surface soils in the Melton Valley watershed would minimize worker risk. Figure 2.13 presents the actions included in this alternative.

2.8.4 Alternative 4—Source Treatment and Containment

Alternative 4 meets the RAO by combining source treatment and some limited removal with source containment to provide a higher degree of permanence than in Alternatives 2 and 3.

Base actions are similar to those of Alternative 3 except for the source treatments and limited removal. Grout would be pumped into selected waste units in SWSA 4 and SWSA 6 and the Seepage Pits and Trenches Area using a technique called in situ grouting. The SWSA 4 trench selected for treatment is called the tritium trench. This trench is responsible for most of the tritium releases in SWSA 4. The SWSA 6 trenches selected for grouting are considered to be significant potential future sources of surface water contamination based on their waste inventories and their inundation with groundwater. Some of the Seepage Pits and Trenches are also considered to be significant potential future releases of contamination.

In situ grouting would solidify the waste materials, thereby reducing their hydraulic conductivity (i.e., water intrusion) and the amount of leachate from the treated wastes to the surrounding media. Contaminants within the grout envelope would be bound within the solid monolith created by the grout injection.

Two sources to be excavated in this alternative are the HRE Pond and the IHP. Excavation is an aggressive remedial technique for permanently eliminating surface water risk contributions from the HRE Pond and eliminating potential gamma exposures to workers from the IHP area. Figure 2.14 presents the actions included in this alternative.

2.8.5 Alternative 5—Source Treatment and Comprehensive Source Containment

Alternative 5 meets the RAO using source treatment and comprehensive source containment. More comprehensive hydraulic isolation would be provided for the SWSAs capped in Alternatives 3 and 4, and additional hydraulic isolation would be provided for SWSA 5 North and secondary contaminated media associated with the HRE Pond and Seepage Pits 2, 3, and 4. The HRE and HFIR impoundments would be removed. The other impoundment, PWSB, would be treated using shallow soil mixing. In situ grouting would be performed for SWSA 5 North, the SWSA 4 tritium trench, and inundated, high-activity trenches in SWSA 6.

In situ vitrification (ISV) is performed in Seepage Pits 2, 3, and 4 and in Seepage Trenches 5 and 7. Soil covers or excavation of contaminated surface soils above remediation levels in the Melton Valley watershed would minimize worker risks.

A large fraction of the sediments and floodplain soils exceeds recreational risk-based limits. Those materials with exposure rates > 500 μR/hour would be excavated from White Oak Creek, Melton Branch, and various tributaries; materials with < 500 μR/hour would be placed under access restrictions and allowed to approach the recreational risk limit of approximately 50 μR/hour via radioactive decay over a 100-year period. The excavated materials would be sent to the proposed EMWMF or another suitable disposal facility. White Oak Creek would be rerouted along the southern edge of White Oak Lake and the embayment, the lake and embayment would be drained, and the sediment in the drained areas would be covered with soil. Figure 2.15 presents the actions included in this alternative.

2.8.6 Alternative 6—Aggressive Source Controls

Alternative 6 meets the RAO using aggressive source controls. Source excavation and treatment would be used to achieve a high degree of permanence. Hydraulic isolation would also be implemented to provide an additional degree of protectiveness. Soil covers and excavation of contaminated surface soils above remediation levels in the Melton Valley watershed would minimize worker risks.

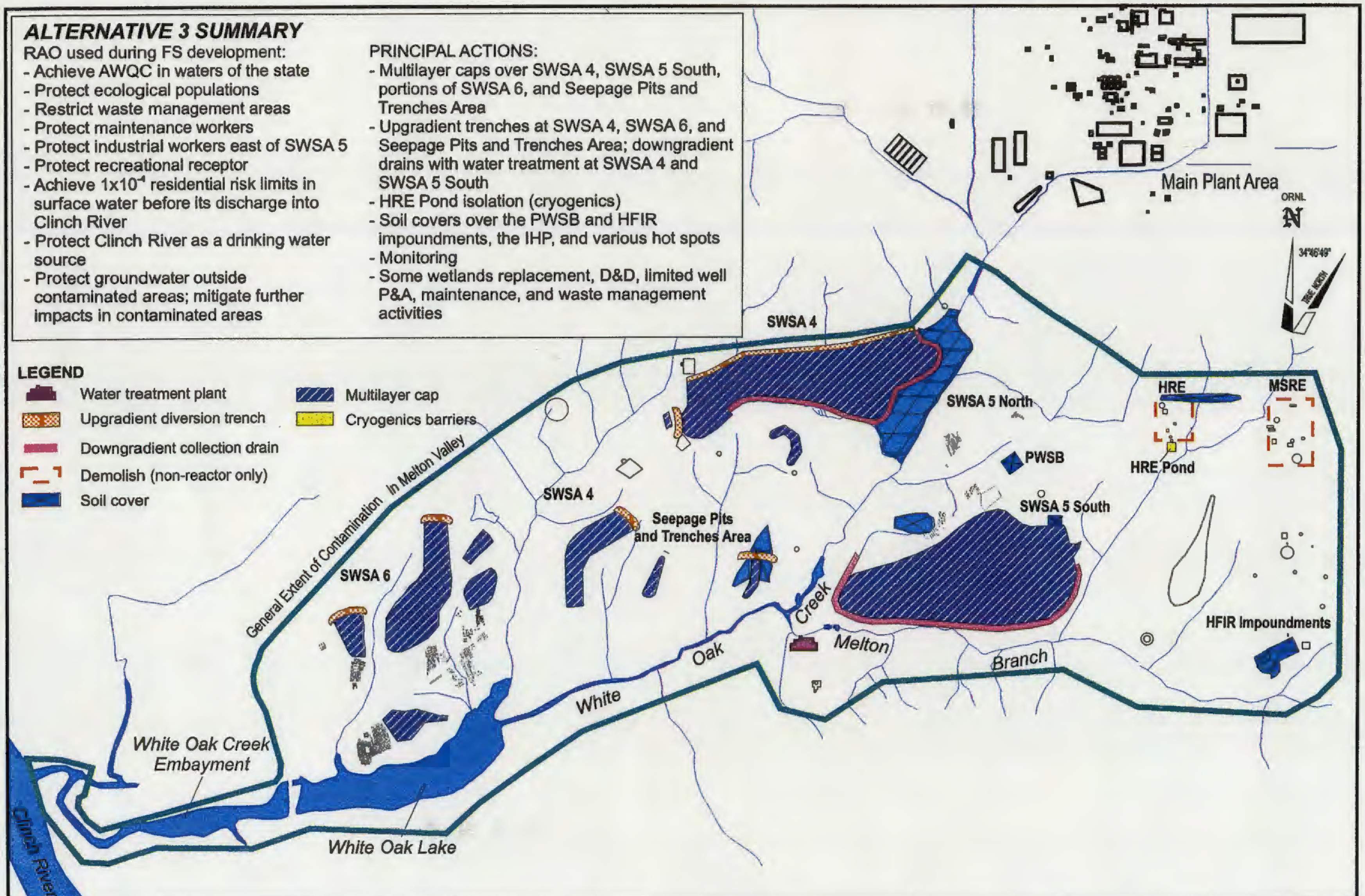


Fig. 2.13	**Alternative 3 - Source Containment** DOE - ORNL, Melton Valley watershed - Oak Ridge, Tennessee	DOCUMENT ID: 35H830 0089-20/ ROD	DRAWING ID: 97-14317b.CDR	DRAWING DATE: MARCH 23, 200 SB

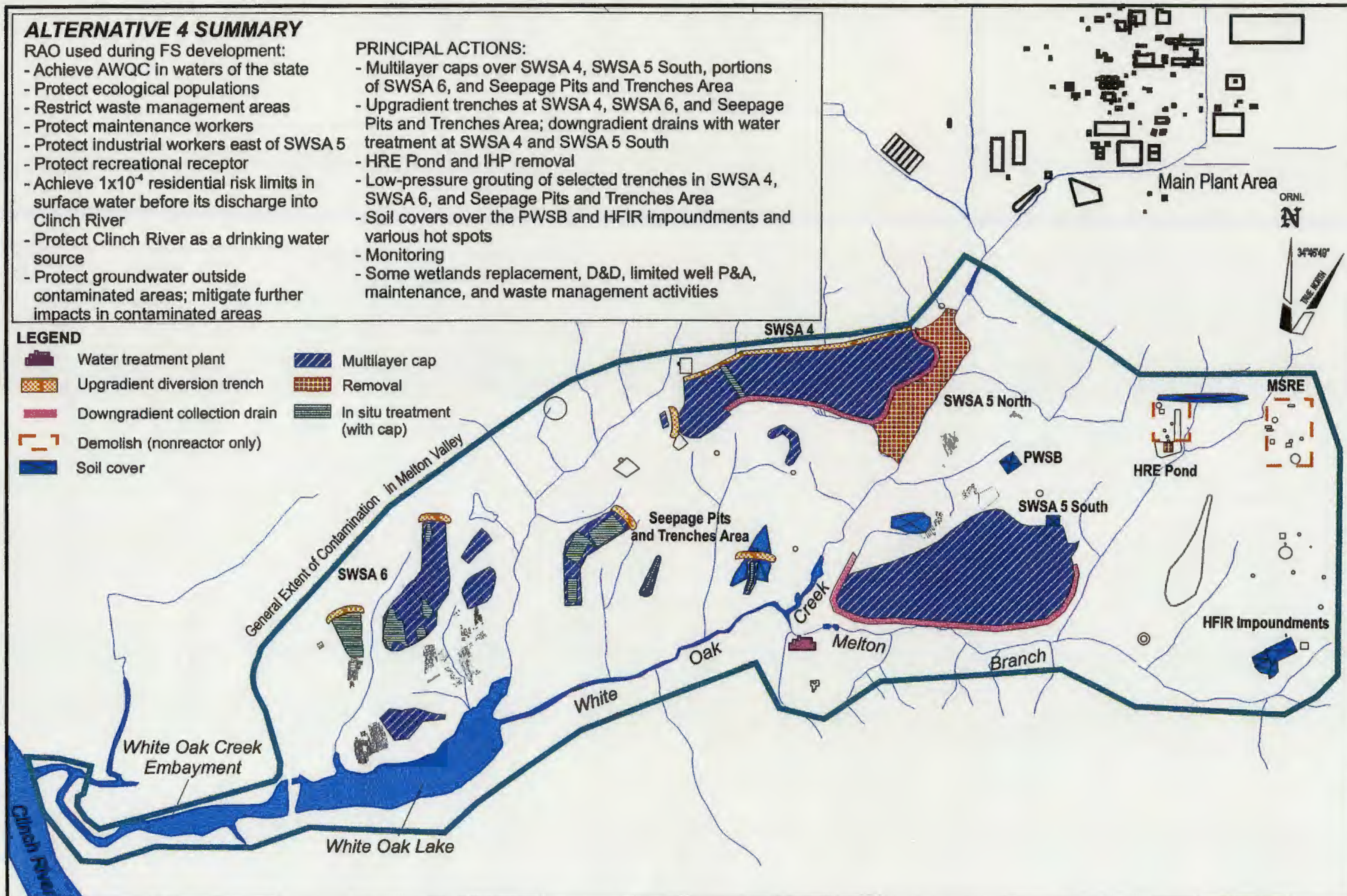


Fig. 2.14 Alternative 4 - Source Treatment and Containment

DOE - ORNL, Melton Valley watershed - Oak Ridge, Tennessee

DOCUMENT ID: 35H830 0089-20 / ROD | DRAWING ID: ALT4_FIG2.14.CDR | DRAWING DATE: March 23, 2000 SB

ALTERNATIVE 5 SUMMARY

RAO used during FS development:
- Achieve AWQC in waters of the state
- Protect ecological populations
- Restrict waste management areas
- Protect maintenance workers
- Protect industrial workers east of SWSA 5
- Protect recreational receptor
- Achieve $1x10^{-4}$ residential risk limits in surface water before its discharge into Clinch River
- Protect Clinch River as a drinking water source
- Protect groundwater outside contaminated areas; mitigate further impacts in contaminated areas

PRINCIPAL ACTIONS:
- Multilayer caps over SWSA 4, SWSA 5 South, SWSA 5 North, SWSA 6, the Seepage Pits and Trenches Area, and HRE Area
- Upgradient trenches at SWSA 4, SWSA 5 North, SWSA 6, and Seepage Pits and Trenches Area; downgradient drains with water treatment at SWSA 4, SWSA 5 South, Seepage Pits and Trenches Area, and HRE Area
- HRE and HFIR ponds removal
- Shallow soil mixing of PWSB
- Low-pressure grouting in SWSA 4, SWSA 6 and SWSA 5 North
- In situ vitrification in Seepage Pits and Trenches Area
- Excavation or placement of soil covers over various hot spots; maintenance of existing soil covers
- Rerouting of WOC; removal of contaminated sediments (>500 urem/hour) from stream beds; containment of sediments in WOL and WOCE
- Monitoring
- Some wetlands replacement, D&D, well P&A, pipeline grouting, and waste management activities

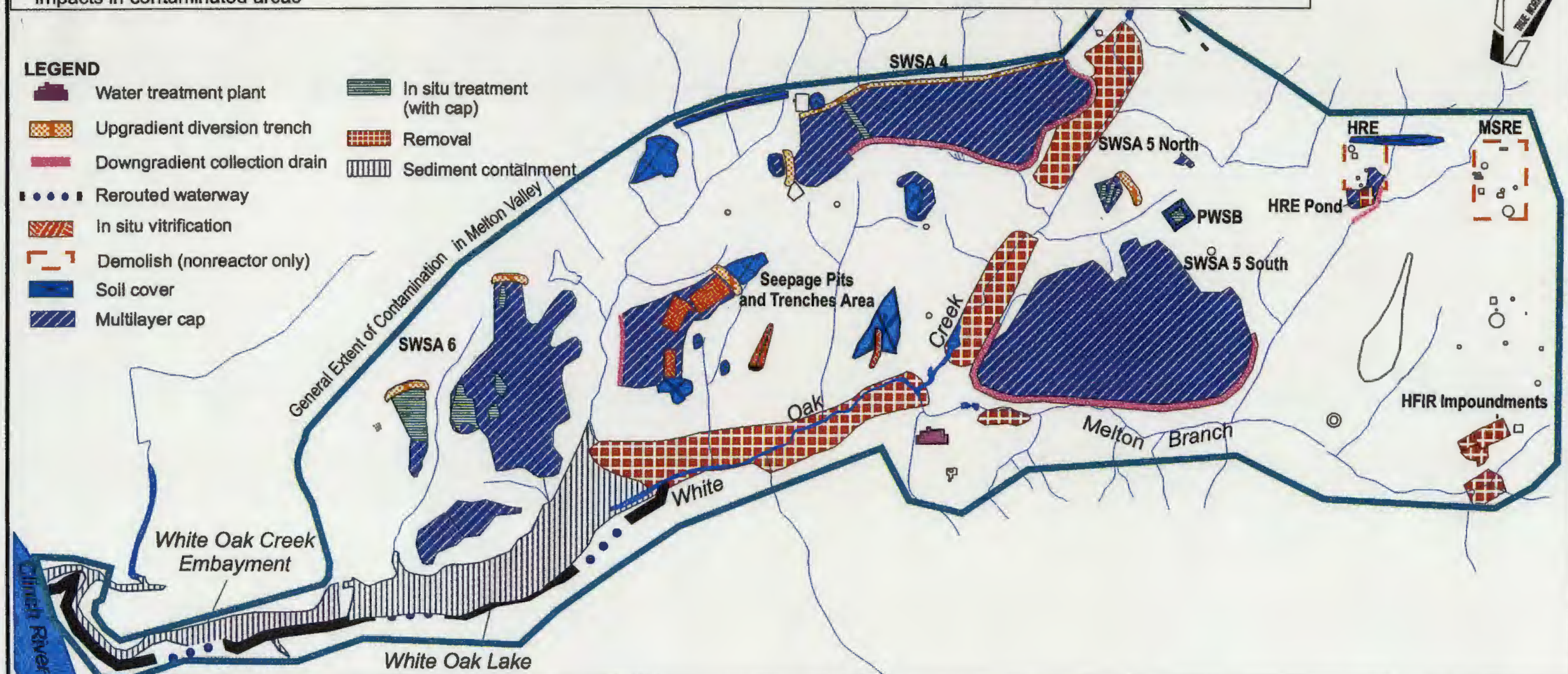


Fig. 2.15	Alternative 5 - Source Treatment and Comprehensive Source Containment DOE - ORNL, Melton Valley watershed - Oak Ridge, Tennessee	DOCUMENT ID: 35T080 0089-20 / ROD	DRAWING ID: ALT5_fig2.15.CDR	DRAWING DATE: March 23, 2000 SB

Source excavation would be performed in inundated trench areas of each of the major SWSAs. Excavated waste materials would be carefully sorted and treated to meet RCRA land disposal restrictions and then transported to the proposed EMWMF or another suitable disposal facility for disposal. In addition, SWSA 5 North, which contains retrievable TRU waste, would be excavated, and the materials would be processed and packaged for disposal at the Waste Isolation Pilot Plant (WIPP) in New Mexico. Other removals include the SWSA 4 auger holes, inactive piping, a significant number of areas with contaminated surface soils, contaminated floodplain soils and sediments (including those in White Oak Lake and the embayment) with radioactivity > 50 µR/hour, and all impoundments. ISV would be performed in the Seepage Pits and Trenches Area. Figure 2.16 presents the actions included in this alternative.

2.9 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

EPA has identified nine evaluation criteria against which remedial action alternatives must be evaluated. These criteria are derived from statutory requirements in Sect. 121 of CERCLA, which specify that a selected remedy must protect human health and the environment, attain all ARARs or provide grounds for invoking a waiver, be cost-effective, and use permanent solutions and alternative treatment or resource recovery technologies to the maximum extent practicable. These criteria are used as the basis for individual and comparative analyses to determine the optimal alternative for the specific problems at each site. Table 2.9 summarizes the nine CERCLA evaluation criteria.

The first two criteria (i.e., overall protection of human health and the environment and compliance with ARARs) are the threshold criteria that must be met by any alternative considered for implementation. The next five criteria (i.e., short-term effectiveness; long-term effectiveness and permanence; reduction of toxicity, mobility, and volume through treatment; implementability; and cost) are considered the primary balancing criteria and are evaluated together to identify the advantages and disadvantages in terms of effectiveness and cost among the alternatives. The last two criteria (i.e., state and community acceptance) are considered modifying criteria and are evaluated after regulatory agency review and public comment on the RI/FS and proposed plan.

In addition to these evaluation criteria specified under CERCLA, the environmental consequences of the remedial alternatives were also evaluated against requirements of NEPA. This evaluation is in accordance with DOE policy to incorporate NEPA values to the extent practicable into the procedural and documentation requirements of CERCLA for sites where DOE has responsibility. The environmental consequences and values under NEPA have been incorporated into the CERCLA evaluation criteria, primarily under long-term effectiveness and permanence and under short-term effectiveness and environmental impacts. There are no environmental justice concerns because there are no nearby low-income or minority populations that would be adversely affected.

The comparative analysis evaluates the relative ability of the alternatives to meet the nine CERCLA evaluation criteria and the RAO discussed previously. Table 2.10 summarizes the comparative analysis of the first seven CERCLA criteria for the six FS remedial alternatives. The last two evaluation criteria, state, and community acceptance, are addressed below. The lower-end alternatives (Alternatives 2 and 3) achieve the RAO; however, these alternatives generally do so with less permanence and certainty and require more time to meet ARARs. They also require more restrictions on industrial use in the east end of Melton Valley. However, they cost less and result in less short-term damage to the environment and risk to workers. Higher-end alternatives (Alternatives 4, 5, and 6) achieve the RAO with more permanence and certainty and fewer restrictions on land use. Alternatives 4 and 5 take less time to meet ARARs than Alternatives 2 and 3; Alternative 6 meets all ARARs upon completion of remedial actions. However, as alternatives become more aggressive, cost and short-term impacts generally increase.

2.9.1 State Acceptance

The state consulted with DOE during development of the preferred remedy presented in the proposed plan. This remedy, which is not identical to any of the five action alternatives, most closely resembles Alternative 5. After review and comment resolution of the proposed plan was completed, the state approved the proposed plan for release to the public and concurred with the proposed remedy.

2.9.2 Community Acceptance

During the public comment period for the proposed plan, the community expressed its support for the proposed remedy. Although a significant number of comments were received (see Part 3, "Responsiveness Summary"), the overall reception of the preferred remedy was positive. Removing all the buried waste and other contamination was prohibitively expensive and incurred unacceptable risk for the workers and the ecology risk. The preferred alternative represented a viable and reasonable "middle ground" for remediating Melton Valley and also conformed to the recommendations of the End Use Working Group.

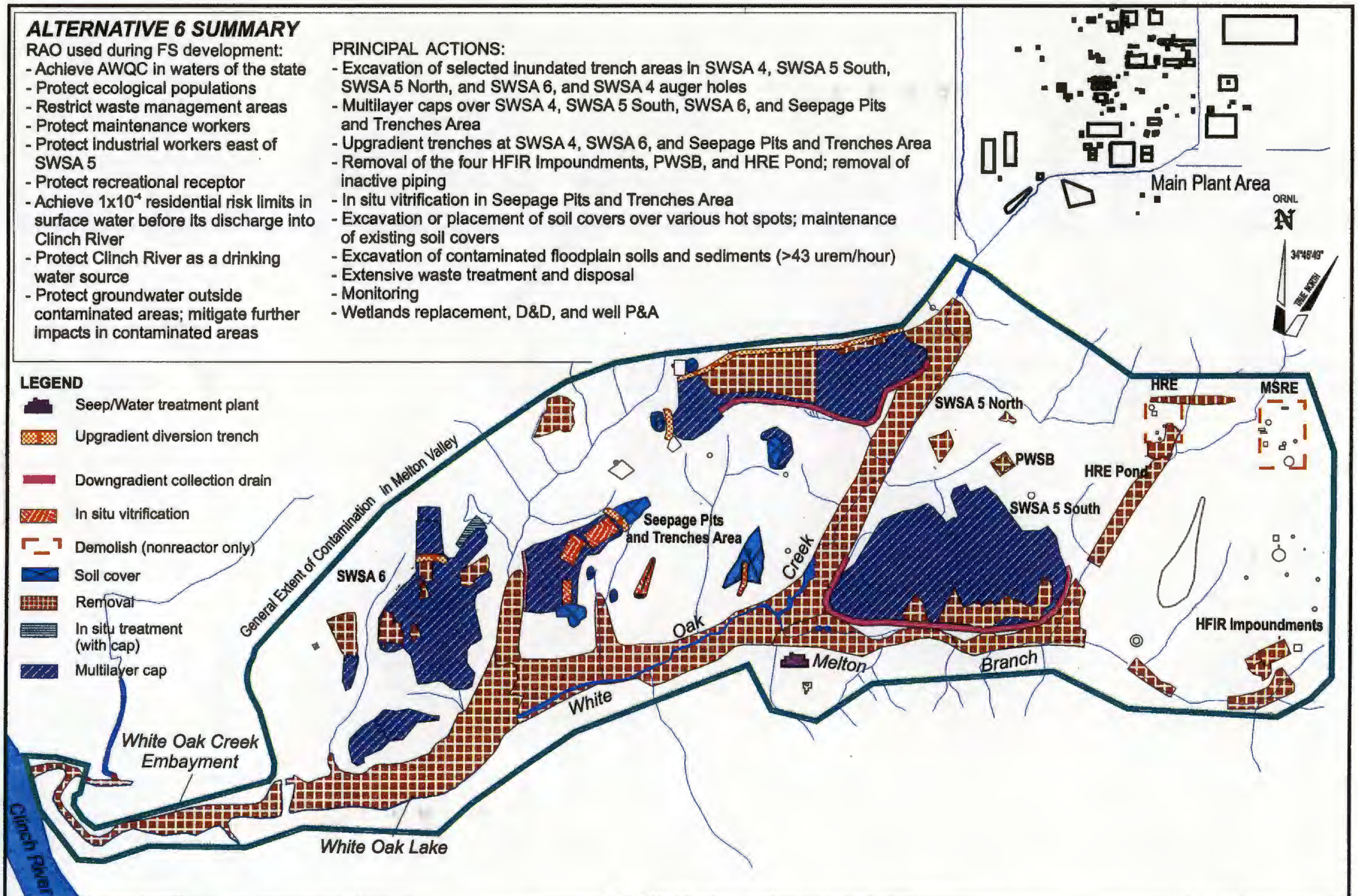


Fig. 2.16	Alternative 6 - Aggressive Source Controls DOE - ORNL, Melton Valley watershed - Oak Ridge, Tennessee	DOCUMENT ID: 35T080 0089-20 / ROD	DRAWING ID: ALT6_fig2.16.CDR	DRAWING DATE: March 24, 2000 SB

Table 2.9. Evaluation criteria, Melton Valley watershed, ORNL, Oak Ridge, Tennessee

1.	**Overall protection of human health and the environment** addresses whether an alternative eliminates, reduces, or controls threats to public health and the environment
2.	**Compliance with ARARs** addresses whether an alternative meets federal and state environmental laws and regulations
3.	**Short-term effectiveness** considers the time needed for an alternative to achieve remedial response objectives and the risks posed to workers, residents, and the environment during the remedial action
4.	**Long-term effectiveness** considers the ability of an alternative to protect public health and the environment long after remedial action is complete
5.	**Reduction of toxicity, mobility, and volume through treatment** evaluates an alternative's use of treatment to reduce the harmful nature of contaminants; the contaminants' ability to move in the environment; and the amount, or volume, of contamination present
6.	**Implementability** addresses the feasibility of an alternative from a technical and an administrative standpoint
7.	**Cost** considers the amount of money it will take to design, construct, operate, and maintain the alternative
8.	**State acceptance** addresses TDEC comments concerning the alternatives considered
9.	**Community acceptance** addresses public comments on the alternatives being considered. At the end of the public comment period for the proposed plan, DOE responded to every relevant question and comment. These responses are part of this ROD

ARAR = applicable or relevant and appropriate requirement
DOE = U.S. Department of Energy
ORNL = Oak Ridge National Laboratory
ROD = record of decision
TDEC = Tennessee Department of Environment and Conservation

2.10 PRINCIPAL THREAT WASTES

The NCP establishes an expectation that treatment will be used to address the principal threats posed by a site wherever practicable [40 CFR 300.430(a)(1)(iii)(A)]. Identifying principal threat wastes combines concepts of both hazard and risk. In general, principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur.

The majority of the waste and contaminated media in Melton Valley meets the definition of principal threat material. The primary contaminants in this waste and media are short- and long-lived radionuclides. Given that this waste and media are spread throughout the valley, and given its sheer volume, DOE (with the approval of the FFA parties) has selected hydraulic isolation as the primary mechanism to address these principal threats. Excavation was not included as a major component of the selected buried waste remedial action because of a number of factors. The wastes are voluminous, extremely heterogeneous, poorly characterized, and have the potential to emit high levels of radiation. Significant uncertainties exist related to the safe handling and treatment of these wastes, and there is limited experience in retrieval and treatment of heterogeneous wastes. Successful ex situ treatment would require a relatively high degree of waste characterization, but personnel exposures and costs to characterize the wastes adequately would likely be prohibitive. Excavation and multistage treatment processes would be complex and require an unusually high degree of continuing coordination and hazard evaluation. In situ treatment (i.e., grouting) was also not included as a major component of the buried waste remedial action. Uncertainties impacting grouting reliability include adequacy of mixing and binding of the grout in heterogeneous (and sometimes inundated) waste. Despite these uncertainties, grouting would likely reduce the overall hydraulic conductivity of the waste, but at relatively high cost. Also, the grouting is not a stand-alone action but is best performed in combination with hydraulic isolation. Given the high incremental cost of grouting balanced against the low incremental return on effectiveness, grouting was deemed not to be cost-effective for comprehensive application in the burial grounds. However, the selected remedy includes treatment and removal in selected areas where it will provide significant, cost-effective benefits.

2.11 SELECTED REMEDY FOR MELTON VALLEY INTERIM ACTIONS

DOE, with the concurrence of EPA and TDEC, has determined that the preferred alternative presented in the proposed plan (DOE 1999) is the most appropriate option for remediation in the Melton Valley watershed. This remedy protects human health and the environment, complies with ARARs, offers the best balance of CERCLA evaluation criteria, and is cost-effective.

This remedy meets the end-use criteria recommended for Melton Valley by the End Use Working Group. The selection of this remedy is based on the comparative analysis of alternatives detailed in the FS and the Proposed Plan and summarized in this ROD. This remedy uses permanent solutions and alternative treatment technologies to the maximum extent practicable. It satisfies the statutory preference for remedial actions that use treatment to reduce toxicity, mobility, or volume.

While the remedy is based upon Alternative 5 of the FS, it is not identical to any of the five action alternatives as presented in the FS (DOE 1998). The selected remedy achieves the best mix of actions possible given the relatively large number of units being addressed. This alternative thus addresses goal-driven, regulatory, and programmatic considerations as effectively as possible.

Table 2.10. Comparison of alternatives, Melton Valley watershed, ORNL, Oak Ridge, Tennessee

Criteria	Alternative 1 (No Action)	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Selected remedy
Overall protection of human health and the environment: General	Not protective	Protects on-site maintenance worker, recreational user of surface water bodies, and off-site resident	Protects on-site maintenance worker, recreational user of surface water bodies, and off-site resident	Protects on-site maintenance worker, recreational user of surface water bodies, and off-site resident	Protects on-site maintenance worker, recreational user of surface water bodies, and off-site resident	Protects on-site maintenance worker, recreational user of surface water bodies, and off-site resident	Protects on-site maintenance worker, recreational user of surface water bodies, and off-site resident
Provide ecological protection	Not applicable; risk increases	Protects populations in 9 of 22 subbasins; uncertainties in others	Protects populations in 12 of 22 subbasins; uncertainties in others	Protects populations in 12 of 22 subbasins; uncertainties in others	Protects populations in 20 of 22 subbasins; uncertainties in others	Protects populations in all 22 basins	Protects populations in 17 out of 22 subbasins
Achieve 1 x 10^{-4} residential risk level in surface water at confluence of White Oak Creek and the Clinch River (Predictions based on Melton Valley and current Bethel Valley contribution)	Not applicable (current risk for MV and BV: 6.4 x 10^{-4})	~34 years after remediation	~27 years after remediation	~27 years after remediation	~23 years after remediation	~22 years after remediation	~23 years after remediation
Achieve recreational risk-based levels for all media in waters of the state	Not applicable; risk of contamination increases	Risk limits met with radioactive decay after 230 years	Risk limits met with radioactive decay after 200 years	Risk limits met with radioactive decay after 200 years	Goal met after 100 years of decay (excavating > 500 μrem/hour)	Goal met when remedial actions are complete	Goal met after ~170 years of decay (excavating > 2500 μrem/hour)
Compliance with ARARs: General	ARARs not applicable	Likely to meet all ARARs	Meets all ARARs	Meets all ARARs	Meets all ARARs	Meets all ARARs	Meets all ARARs
AWQC compliance in surface water	No	Yes, but some uncertainty (SWSA 6 area)	Yes	Yes	Yes	Yes	Yes
MCLs met in the Clinch River	No	Yes (assumes a mixing zone)	Yes (assumes a mixing zone)	Yes (assumes a mixing zone)	Yes (assumes a mixing zone)	Yes (assumes a mixing zone)	Preferred alternative makes progress toward criterion (no mixing zone assumed)
Estimated decay time needed to meet MCLs in surface water before confluence of White Oak Creek and the Clinch River (Predictions based on Melton Valley and current Bethel Valley contribution)	~144 years	~114 years	~105 years	~104 years	~99 years	99 years	99 years
Long-term effectiveness and permanence: General	Unacceptable risks remain for unrestricted use	Relies on containment and institutional controls	More containment actions give greater effectiveness	Reliability or permanence higher because treatment added to containment and institutional controls	Greater effectiveness because of comprehensive containment and some treatment	Most permanent because of reliance on removal and treatment	Comprehensive containment and focused treatment and removal are very effective
Risk reduction at WOD for Melton Valley sources (compared to no action)	0%	72%	82%	84%	87%	89%	87%
Floodplain soil removal	None	0 yd^3	0 yd^3	25,000 yd^3	55,000 yd^3	253,000 yd^3	25,000 yd^3
Reduction of toxicity, mobility, or volume through treatment	None	Minor	Larger water volumes treated	Significant in situ treatment of wastes reduces mobility	ISV (for Seepage Pits and Trenches) reduces toxicity, mobility, and volume	Most waste treated of any alternative	In situ treatment reduces toxicity, mobility, and volume; toxicity reduced by water treatment
Short-term impacts: Worker risk	None	Standard construction risks	Standard construction risks	Added worker risk from trench grouting and IHP excavation	Greater scope means greater risks (e.g., through ISV and more excavation)	Waste removal and treatment presents significant worker risk	Limited waste removal presents significant but manageable worker risk
Ecological	None	Minor; impacted wetlands ≤ 4.6 acres	Minor; impacted wetlands ≤ 15 acres	Minor; impacted wetlands ≤ 15 acres	WOL habitat is destroyed; impacted wetlands ≤ 45 acres	Full recovery of stream/lake habitats may need several decades; impacted wetlands ≤ 46 acres	Moderate; impacted wetlands ~20 acres
Implementability	No action	Feasible	Feasible; water treatment to meet NPDES and RCRA requirements	In situ treatment adds to technical difficulty, particularly for seepage pits and trenches	Feasible but difficult (e.g., reroute of WOC, ISV of Seepage Pits and Trenches, extensive sediment removal)	Difficult due to waste removal/management challenges; relies on availability of WIPP and on-site disposal cell	Feasible; ISV and waste removal/management may be challenging
Cost of base actions Capital escalated dollars Capital 1998 dollars (present worth) O&M 1998 dollars (present worth for 30 years)	 $0 $0 $0	 $52 million $45 million ($37.4 million) $15 million ($7.2 million)	 $78 million $66 million ($53.3 million) $17 million ($8.3 million)	 $219 million $184 million ($137.9 million) $16 million ($7.8 million)	 $338 million $279 million ($195.8 million) $20 million ($9.7 million)	 $1.25 billion $933 million ($592.7 million) $20 million ($8.8 million)	 $165 million $136 million ($105.1 million) $21.5 million ($11.1 million)

~ = approximately
ARAR = applicable or relevant and appropriate requirement
AWQC = ambient water quality criteria
BV = Bethel Valley
$ = dollar
> = greater than
IHP = Interim Holding Pond
ISV = in situ vitrification
≤ = less than or equal to
μrem = microrem
MCL = maximum contaminant level
MV = Melton Valley
NPDES = National Pollutant Discharge Elimination System
O&M = operation and maintenance
ORNL = Oak Ridge National Laboratory
% = percent
RCRA = Resource Conservation and Recovery Act of 1976
SWSA = solid waste storage area
WIPP = Waste Isolation Pilot Plant
WOC = White Oak Creek
WOD = White Oak Dam
WOL = White Oak Lake

The selected remedy in this ROD is, with few exceptions, the preferred alternative in the Melton Valley watershed proposed plan. Changes to the preferred alternative since the public comment period for the proposed plan (June 1999) are documented in Sect. 2.13. The selected remedy was composed using the nine CERCLA criteria. Assembly of the selected remedy was accomplished by first satisfying the threshold criteria (protection of human health and the environment and compliance with ARARs). The additional five balancing criteria were then used to modify the assemblage of the remedial actions. A major factor in devising this strategy involves the desire to maximize containment of buried wastes and to use treatment as an enhancing component where it would provide significant cost-effective benefits. It also involves the desire to minimize the need for surface use restrictions outside the waste disposal areas and to allow for continued industrial use in the east end of the valley.

The selected interim remedy addresses contaminant releases and potential risk from various sources containing both short- and long-lived radionuclides. The primary mechanism for site remediation in this remedy is hydraulic isolation of major waste sources with in situ treatment or excavation of selected waste sources. Radioactive decay over time will significantly reduce the risk associated with the short-lived radionuclides. However, long-lived radionuclides and other contaminants pose some future potential risks. These long-term risks will be addressed by a future remedial decision. The selected remedy for the Melton Valley watershed is summarized in Table 2.11 and Fig. 2.17 and. Table 2.11 also summarizes the preference for treatment as a principal element of the remedy or indicates why the preference was not satisfied.

Following is a description of the selected remedy that addresses construction activities, monitoring, land use controls, uncertainties, cost, NEPA values, and remedy implementation. Implementation issues addressed include sequencing and milestones, performance objectives, and remediation levels.

2.11.1 Construction Activities

2.11.1.1 Capping

The selected remedy includes multilayer caps in SWSA 4 and SWSA 6 and in the majority of SWSA 5 and the Seepage Pits and Trenches Area. Designs will meet RCRA closure requirements. An example of a multilayer cap cross section is shown in Fig. 2.18. This figure is an example of typical construction only. Actual capping configuration will be established during detailed design as approved by the regulators in the remedial design report (RDR). These caps serve to minimize infiltration during precipitation and to protect ecological receptors and workers from exposure to the underlying soils and wastes. These caps are expected to reduce infiltration to < 1 ft^3 of water/acre/year and lower the water table beneath the burial grounds. Because this infiltration rate is contingent on proper cap function, maintenance actions are a

Table 2.11. Summary of remedial actions in the selected remedy, Melton Valley watershed, ORNL, Oak Ridge, Tennessee

Unit name/location	Unit type	Selected remedial action	Preference for treatment
SWSA 4	Buried wastes	Hydraulic isolation[a]	Ex situ treatment not used because of significant cost and worker risk; in situ treatment not cost effective
SWSA 5 South	Buried wastes	Hydraulic isolation[a,b]	
SWSA 6	Buried wastes	Hydraulic isolation[c]	
SWSA 5 North	Contaminated soil	Lower 23 trenches—management of excavated soils resulting from retrieval of TRU waste	Dewatering as needed to meet EMWMF WAC
	Buried wastes	Upper 4 trenches—hydraulic isolation[a,b]	Ex situ treatment not used because of significant cost and worker risk; in situ treatment not used because bulk waste already grouted in place
Grout sheets	Hydrofracture	Institutional controls and monitoring	Additional treatment neither cost effective nor technically feasible
Injection and monitoring wells	Hydrofracture	Plug and abandon, except wells designated for future monitoring	Pressure grouting (part of P&A) used to block migration and immobilize contaminants
Process Waste Sludge Basin	Impoundment	Removed	Sediment excavated under removal action
HRE Pond	Impoundment	Removal (continue cryogenics until removal)	Excavated material dewatered prior to disposal at EMWMF
HFIR/TRU Waste Collection Basins	Impoundment	Removal	Sediment dewatered prior to disposal at EMWMF
HRE fuel wells	Liquid seepage unit	Grout wells	In situ grouting performed to immobilize contaminants
Pits 1, 2, 3, and 4 and Trench 6	Liquid seepage unit	Hydraulic isolation[a]	ISV not used because of incompatibility with shallow water table
Trenches 5 and 7	Liquid seepage unit	In situ vitrification	ISV performed
OHF, NHF, and MSRE and HRE ancillary facilities	Structure	Mostly demolish; decontaminate and stabilize some subsurface structures	Size reduction performed where appropriate
Inactive process and transfer pipelines	Inactive pipelines	Isolation, removal, or stabilization	Grouting performed to immobilize contaminants
Contaminated surface soils throughout Melton Valley	Surficially contaminated soil	Hydraulic isolation[a] or removal; actions depend on exposure potential	Removal generally preferred; treatment as needed to meet WAC
WOL, WOC Embayment, and streams	Lakebed and streambed sediment	Institutional controls and monitoring	Sediments deferred to future CERCLA decision
WOC, Melton Branch, tributaries, and Intermediate Holding Pond	Floodplain soil	Excavation of floodplain soil > 2500 μR/hour	Excavated floodplain soils dewatered prior to disposal at EMWMF; other soils deferred to future CERCLA decision

Note: See Appendix A for a complete listing of contaminated sites and selected actions.

[a]Hydraulic isolation includes capping and in some cases upgradient diversion and downgradient collection trenches.

[b]A post-ROD engineering study will evaluate further the feasiblilty of removal and ex situ treatment for the upper four trenches in SWSA 5 North (i.e., 11, 14, 16, and 17) and five trenches in SWSA 5 South (i.e., T-128, T-168, T-214, T-188, and T-206).

[c]Required removals will be completed before hydraulic isolation.

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
EMWMF = Environmental Management Waste Management Facility
HFIR = High Flux Isotope Reactor
HRE = Homogeneous Reactor Experiment
in. = inch
ISV = in situ vitrification
μR = microroentgen
MSRE = Molten Salt Reactor Experiment
NHF = New Hydrofracture Facility
OHF = Old Hydrofracture Facility
ORNL = Oak Ridge National Laboratory
P&A = plugging and abandonment
ROD = record of decision
SWSA = solid waste storage area
TRU = transuranic
WAC = waste acceptance criteria
WOC = White Oak Creek
WOL = White Oak Lake

SELECTED REMEDY SUMMARY

RAO :
- Achieve AWQC in waters of the state
- Protect maintenance workers in waste management area
- Protect industrial workers east of SWSA 5
- Protect hypothetical recreational users of waters of the state
- Protect an off-site resident user of surface water at the confluence of WOC with the Clinch River
- Remediate contaminated floodplain soils to 2,500 μR/hour
- Make progress toward protecting the Clinch River as a drinking water source
- Mitigate further impacts to groundwater
- Protect ecological populations

PRINCIPAL ACTIONS:
- Multilayer caps over SWSA 4, SWSA 5 South, SWSA 5 North, SWSA 6, and the Seepage Pits and Trenches Area
- Upgradient trenches at SWSA 4 and SWSA 6; downgradient drains with water treatment at SWSA 4, SWSA 5 South, and Seepage Pits and Trenches Area
- HRE pond cryogenics until removal
- PWSB, HFIR impoundments, and HRE Pond removal
- Grouting the HRE Fuel wells
- In situ vitrification in Seepage Pits and Trenches Area
- Excavation or placement of caps over various contaminated soil areas
- Removal of contaminated soils (>2500 μR/hr) from stream beds; removal of IHP
- Monitoring
- D&D, well P&A, and waste management activities

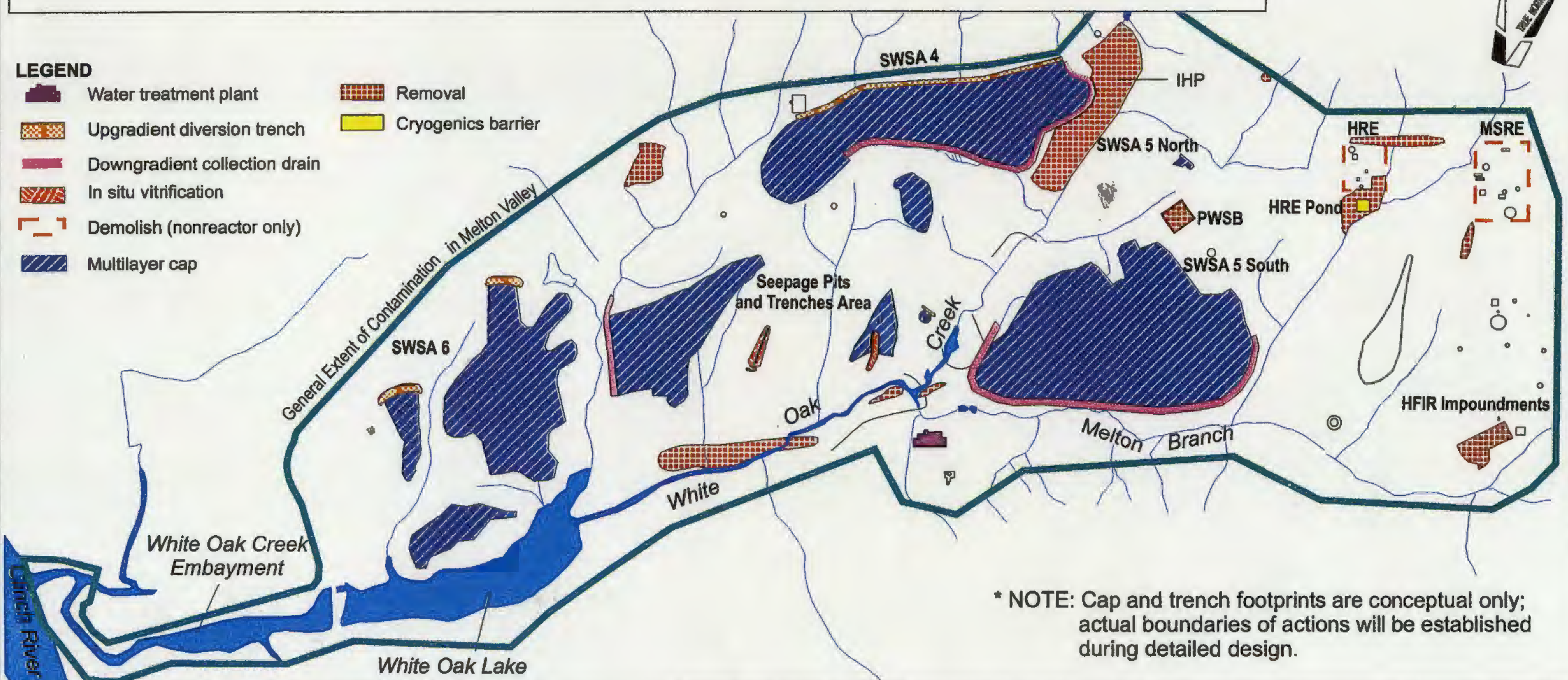
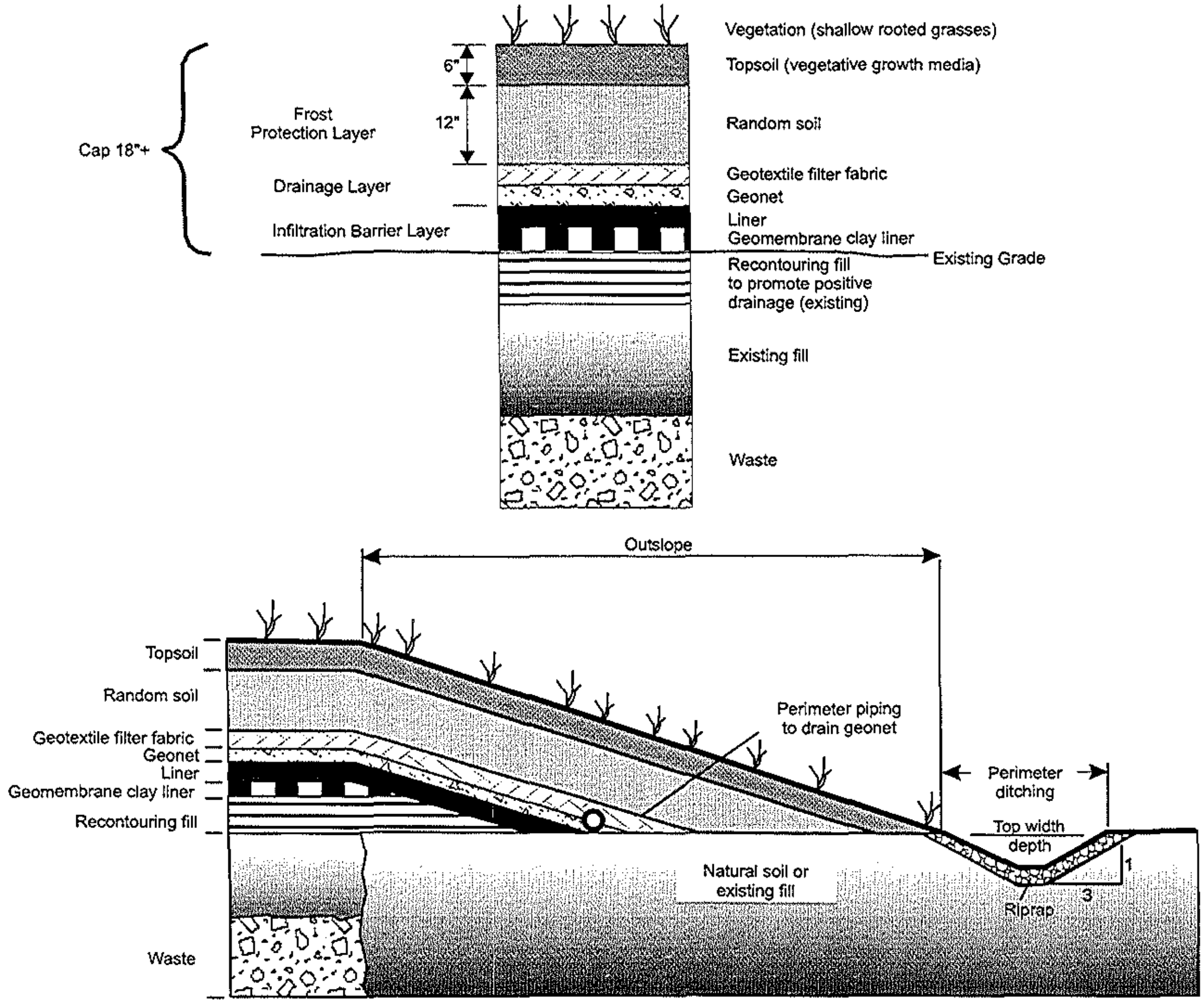


Fig. 2.17	Summary of selected remedy for the Melton Valley watershed DOE - ORNL, Melton Valley watershed - Oak Ridge, Tennessee	DOCUMENT ID: 35T080 0089-20 / ROD	DRAWING ID: MVW_FIG2.17a.CDR	DRAWING DATE: March 31, 2000 SB



NOTE: Schematic as shown is conceptual only; actual configuration will be established during detailed design.

Cap to extend over buried waste and outslope

Fig. 2.18	Typical multilayer cap DOE - ORNL, Melton Valley watershed - Oak Ridge, Tennessee	DOCUMENT ID: 35T080 0089-20 / ROD	DRAWING ID: 99-15230.CDR	DRAWING DATE: March 17, 2000 SB

component of this alternative to ensure effective operation of caps over time. Borrow soil used for cap construction is expected to come from the borrow area illustrated in Fig. 2.19.

Remedial actions included in the selected remedy are expected to require on the order of one million cubic yards of soil for use as cap material or clean backfill in excavated areas. Soils suitable for this use have been identified in an area on Copper Ridge to the southeast of Melton Valley. A borrow area will be opened as part of the first capping project to provide qualified soil for cap construction and general fill soil for other uses.

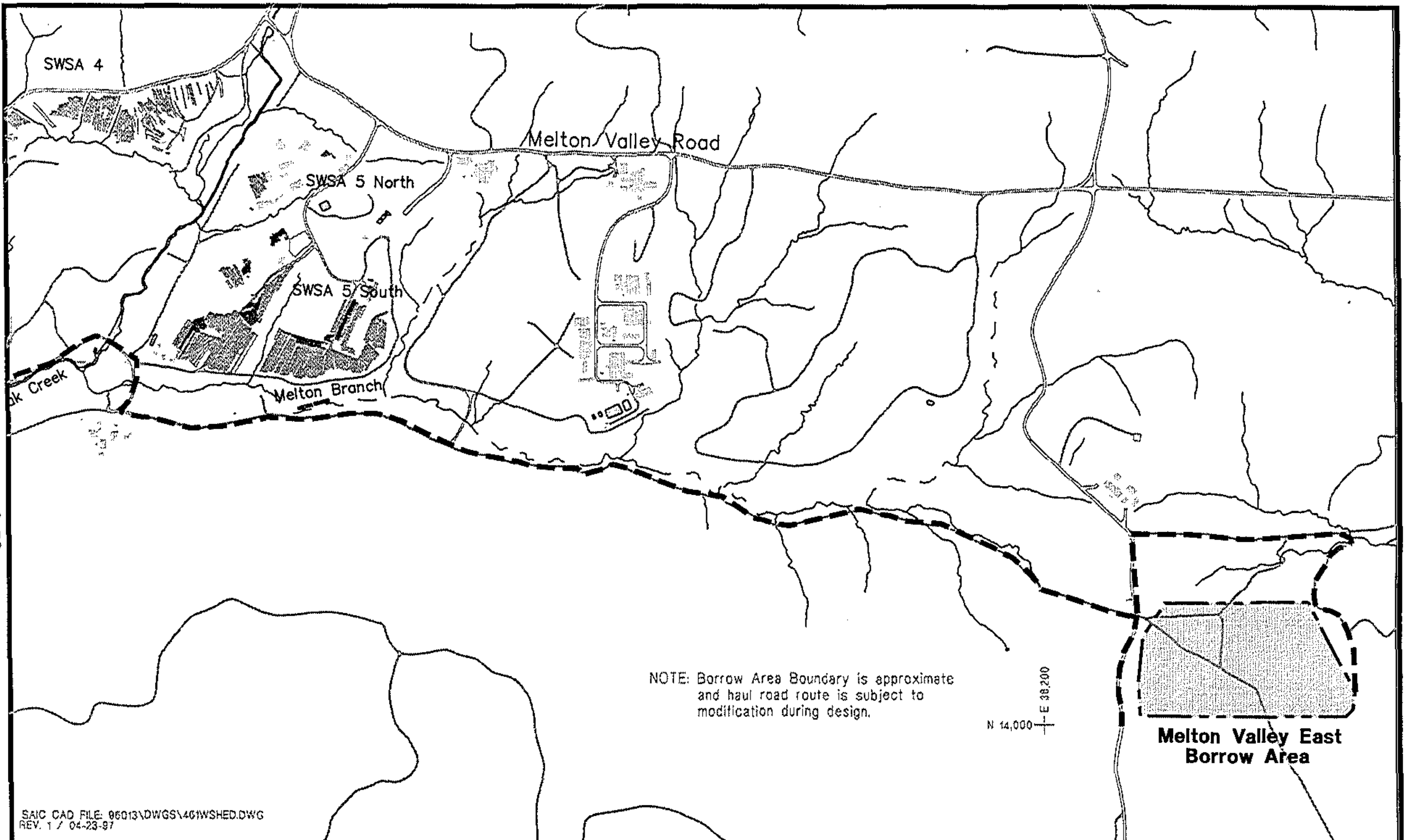
The selected remedy will use hydraulic isolation for the upper four trenches in SWSA 5 North and the five trenches in SWSA 5 South that contain buried TRU waste. Disposal records indicate that wastes placed in these trenches were encapsulated in concrete, which may preclude their removal. However, an engineering study will be performed (post-ROD, but before cap construction in SWSA 5 South) to document the types of wastes buried in these trenches, the original burial conditions, TRU disposal options, risk, technical practicability, and cost of removal. Based on the results of the engineering study, alternative actions for the referenced trenches may be pursued.

The anticipated capping activities would slightly reduce the soil infiltration capacity and increase surface runoff over about 130 acres (0.2 sq. miles). This area is approximately 3 percent of the 6-sq.-mile White Oak Creek watershed. The consequences of additional runoff from capped areas would be a slight increase in peak flood discharge and flood height at White Oak Dam. Such impacts would be most significant during floods in excess of the 100-year frequency. DOE has response plans in place to handle high water conditions at White Oak Dam for protection of public safety. Remedial design of area caps will include assessment of the necessity for storm water detention to prevent downstream impacts.

Actions to be completed before SWSA 6 is capped include removal of the buried KEMA fuel in SWSA 6. This activity will be conducted as a separate action and is not within the scope of this ROD.

2.11.1.2 Upgradient stormflow diversion trenches

The selected remedy includes upgradient diversion trenches for SWSA 4, SWSA 6, and a portion of the Seepage Pits and Trenches Area. The purpose of these trenches is to intercept and divert upgradient stormflow and shallow groundwater before they flow into waste areas. An upgradient diversion trench is not proposed for SWSA 5 South because the cap is expected to extend across the topographic divide, eliminating the need for a diversion trench. Each trench will be designed and constructed to minimize surface water from entering the trench; only stormflow/shallow groundwater will be collected (surface water will be routed around caps using



LEGEND:
- BUILDINGS
- PRIMARY & SECONDARY ROADS
- CREEK & TRIBUTARIES
- PONDS & IMPOUNDMENTS
- POTENTIAL HAUL ROAD LOCATION
- ORNL GRID

34°12'51"
ORNL NORTH
TRUE NORTH

0 600 1200 2400
SCALE: 1" = 1200'

Fig. 2.19

Proposed borrow area location

DOE - ORNL, Melton Valley watershed - Oak Ridge, Tennessee

DOCUMENT ID: 35T080 0089-20/ ROD	DRAWING ID: fig-4.5.DWG	DRAWING DATE: FEBRUARY 24, 2000 SB

perimeter ditches). DOE intends to design and construct the upgradient diversion trenches in a way that will make interception of contaminated water unlikely. Surface water monitoring for remedial effectiveness will include detection of contaminants that may originate from the diversion trenches. If diverted water contributes to AWQC exceedances, it will be treated before release. An example of an upgradient diversion trench is shown in Fig. 2.20. This figure is an example of typical construction only. Actual upgradient stormflow diversion trenches configuration will be established during detailed design as approved by the regulators in the RDR. Detailed design in the Remedial Action Work Plan will also address the contingent treatment needed if diverted groundwater contributes to surface water exceedances.

2.11.1.3 Downgradient collection trench

The selected remedy includes construction and operation of collection trenches downgradient of capped areas in SWSA 4, SWSA 5 South, and in the Seepage Pits and Trenches Area. These drains will collect groundwater contaminated by leachate from the waste sites, preventing contaminants from discharging to local surface water (such as White Oak Creek or Melton Branch). Contaminated groundwater collected by the downgradient drains will be treated before discharge (Sect. 2.11.1.10). An example of a downgradient collection trench is shown in Fig. 2.21. This figure is an example of typical construction only. Actual downgradient collection trench configuration will be established during detailed design as approved by the regulators in the RDR.

2.11.1.4 Waste removal

DOE is constructing a TRU Waste Treatment Facility (TWTF) in Melton Valley to process TRU wastes stored in bunkers, silos, and tanks in Melton Valley. In support of the National TRU Waste Program goal to remove TRU waste from temporary storage and dispose of it at the Waste Isolation Pilot Plant, DOE plans to retrieve buried TRU waste from the lower 23 trenches in SWSA 5 North as a separate non-CERCLA action. The 23 trenches contain approximately 200 concrete casks, several boxes, and drums of TRU waste for a total of 6000 ft^3. These retrieved wastes will be transported to the TWTF. The waste will be processed and packaged to meet waste acceptance criteria for an appropriate facility. The TRU waste stream from this process will be sent to WIPP for disposal. Any non-TRU waste stream from this process will be disposed at the Nevada Test Site or managed at another suitable facility.

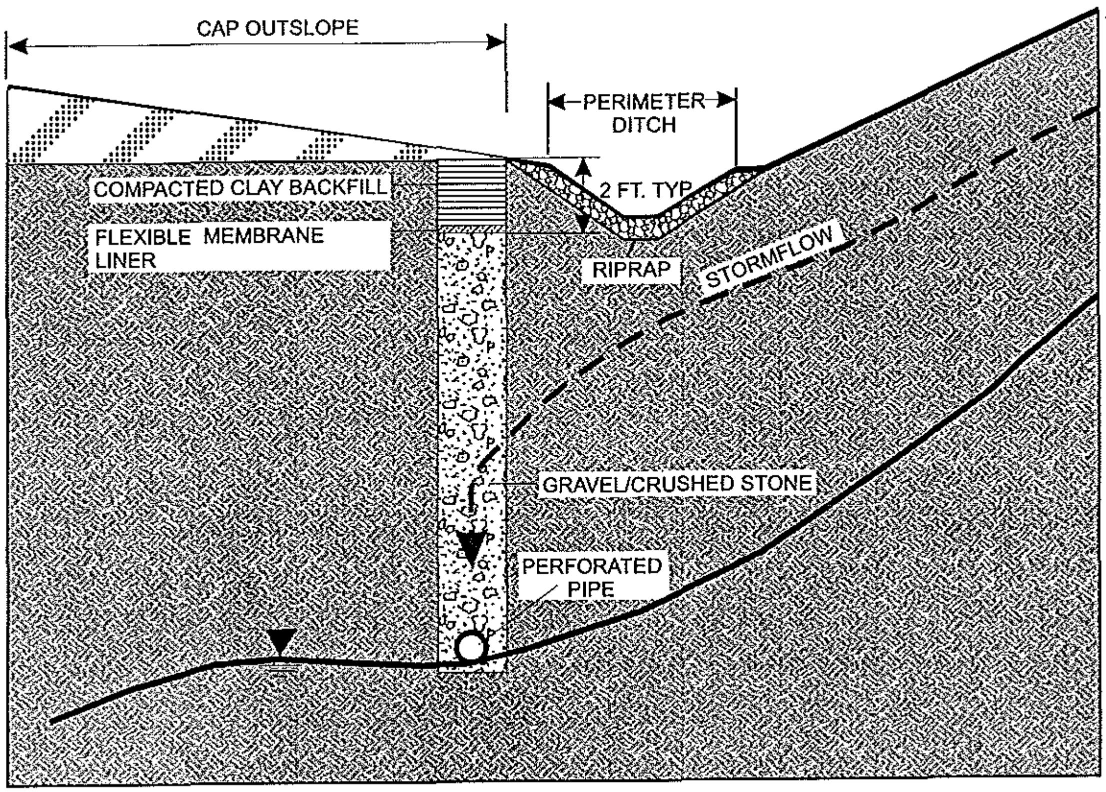


Fig. 2.20

Typical upgradient diversion trench schematic diagram

DOE - ORNL, Melton Valley watershed - Oak Ridge, Tennessee

DOCUMENT ID. 35H830 0089-20 / ROD	DRAWING ID: 99-15232.CDR	DRAWING DATE: February 24, 2000 SB

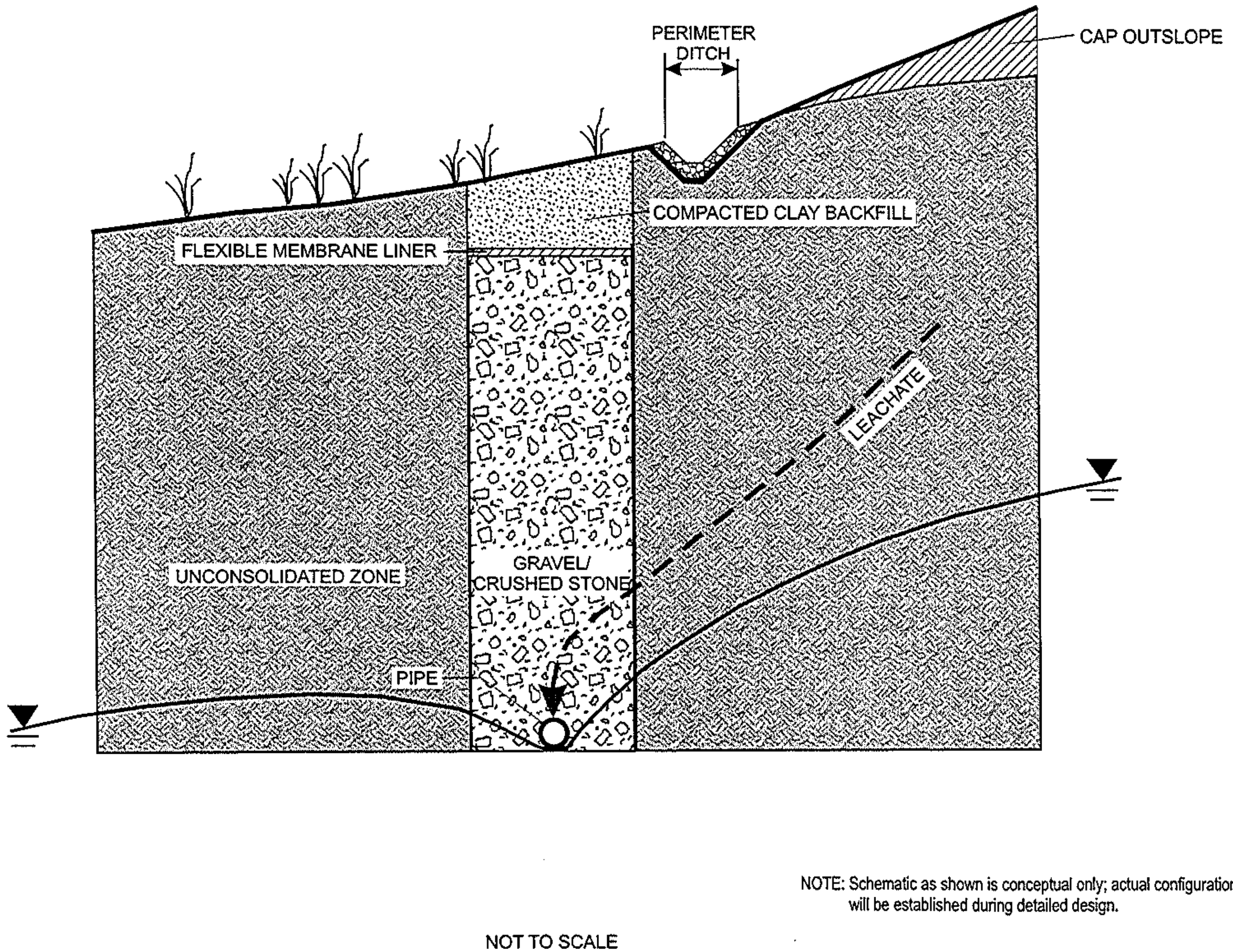


Fig. 2.21	Typical downgradient collection trench schematic diagram DOE - ORNL, Melton Valley watershed - Oak Ridge, Tennessee	DOCUMENT ID: 35H830 0089-20 / ROD	DRAWING ID: 99-15233.CDR	DRAWING DATE: February 24, 2000 SB

Contaminated soil resulting from the TRU waste excavation is included in the selected remedy and will be disposed of at the planned EMWMF (or managed at another suitable facility), used as fill material, or treated at the planned TRU Waste Treatment Facility in Melton Valley and disposed of off-site as appropriate.

As discussed in "Capping," Sect. 2.11.1.1 of this ROD, DOE will conduct an engineering study to determine the feasibility of TRU waste removal from five trenches in SWSA 5 South and four trenches in SWSA 5 North. Based on the results of the engineering study, the hydraulic isolation remedy may be modified for the referenced trenches. If the hydraulic isolation remedy for the referenced trenches is modified based on results of the engineering study, supporting CERCLA documentation will be prepared.

The KEMA fuel will be removed from SWSA 6 before construction of the SWSA 6 cap. The fuel removal will be conducted as a separate action and is not within the scope of this ROD (Sect. 2.2.1.2).

2.11.1.5 Impoundment removal

The selected remedy includes sediment excavation from the HRE Pond and the HFIR Waste Collection Basins. The previously filled and capped HRE Pond is isolated with a cryogenic barrier to control groundwater seepage. The cryogenic barrier will be maintained until pond sediment and contaminated soil in the area are removed. Sediment and soil from the HRE Pond and HFIR Waste Collection Basins will be excavated and disposed of at the EMWMF (or managed at another suitable disposal facility). The OHF Pond and the PWSB are currently being addressed as part of a CERCLA removal action. This action is incorporated into this ROD. Sediment from both ponds will be stabilized with grout in the OHF Pond basin, which will eventually be covered by the SWSA 5 South cap. The HFIR Cooling Tower Surface Impoundment is deferred to a later ROD due to its close proximity to the operating cooling towers.

2.11.1.6 Floodplain soil removal

In the selected remedy, floodplain soils that exhibit > 2500 μR/hour will be excavated. This remediation level results in excavation of the IHP area and several other downstream areas. The IHP has been shown to pose the greatest risk to ecological receptors in the Melton Valley watershed and would pose a risk to workers constructing the SWSA 4 cap. Waste removed as part of this action will be managed in a manner appropriate to its hazard at the proposed EMWMF (or managed at another suitable facility) or used as contour fill under the various multilayer caps included in the selected remedy. TDEC and EPA will review and approve plans to use generated waste as contour fill prior to DOE taking such actions. Any wetland areas that are disturbed as a result of soil or sediment removal will be restored or replaced within the White Oak Creek watershed through mitigation strategies developed in cooperation with the TDEC and EPA wetlands programs.

After excavation of contaminated floodplain soils > 2500 μR/hour, residual contamination present in the remaining floodplain soils would pose risks to hypothetical recreational receptors. A period of approximately 170 years would allow sufficient radioactive decay so that recreational risks would be acceptable. The floodplain soils areas will be further evaluated to determine whether additional actions are required to protect ecological resources. Any additional actions required to reduce ecological risk or to further address hypothetical recreational exposures will be specified with a future CERCLA action for Melton Valley. In the interim, DOE will maintain land use controls to ensure protection against inadvertent exposures.

2.11.1.7 Contaminated surface soil actions

In the selected remedy, radiologically contaminated surface soil outside of capped areas (Appendix A) will be removed (according to "Remediation Levels" Sect. 2.11.7.3) to protect workers in the industrial area and maintenance workers in the waste management area. Waste resulting from these CERCLA actions will be disposed of in a manner appropriate to its hazard at the EMWMF (or managed at another suitable facility) or used as contour fill under the various multilayer caps included in the selected remedy. TDEC and EPA will review and approve plans to use these CERCLA generated waste as contour fill prior to DOE taking such actions. Debris piles, known or newly discovered during remedial actions, will be evaluated to determine the nature of waste, and debris will be disposed of in approved facilities according to waste type. Soils beneath and surrounding the debris piles will be evaluated and remediated consistent with the requirements as outlined in "Remediation Levels" (Sect. 2.11.7.3).

2.11.1.8 Inactive pipelines

In the selected remedy, inactive liquid waste transfer pipelines within Melton Valley will be managed in the following manner. Aboveground inactive waste lines will be removed. Underground inactive waste lines that coincidentally lie underneath a multilayer cap will be cut at the edge of the cap and plugged to ensure isolation from the connecting pipeline. Seepage barriers will be installed in pipelines bedding material at capped area boundaries. The main stem waste transfer pipelines that do not lie under a multilayer cap will be stabilized (e.g., by grouting). Remaining secondary waste pipelines will be isolated, stabilized, or removed as necessary to address residual contamination. Specific actions for secondary waste pipelines will be planned during the RDR with regulatory review and approval.

2.11.1.9 Structure and tank remediation

The remedial action for inactive buildings and other aboveground structures is demolition to slab. Subsurface structures will be stabilized. Stabilization will be preceded by removal or fixation of transferable contamination. Uncontaminated waste generated from demolition will go to a construction debris landfill as appropriate; LLW will go to the EMWMF or be managed at another suitable facility. Appendix A identifies those structures currently included in the remedy. The reactors will be addressed in a separate CERCLA decision.

The remedial action for belowground inactive tanks is stabilization by grouting and removal for aboveground tanks. Surrounding contaminated soils are treated as other soils and are removed if located outside of capped areas and remediation levels are exceeded. Appendix A identifies those tanks included in the remedy. Early grouting of the five OHF tanks is proceeding under a separate CERCLA removal action and will eventually be covered by the SWSA 5 cap. The two HRE tanks have already been grouted. No additional remediation of these tanks is selected under this ROD. Five tanks in Melton Valley (ID numbers 5.16, 8.5, 8.6, 8.7A, and 8.7B) are included in the Bethel Valley decision process.

2.11.1.10 Water treatment

Water generated as a result of cleanup actions (such as dewatering of HFIR Impoundments, displaced water from ISV, water generated from well P&A activities, and well development water generated from the installation of groundwater monitoring wells) will be treated at existing ORNL water treatment facilities. These facilities include the PWTP, Nonradiological Wastewater Treatment Plant, and Liquid Low-Level Waste Evaporation Facility.

Groundwater collected from downgradient collection trenches will be transported to a treatment system. The proposed plan assumed that the treatment system would be located in the Seep D area near the confluence of Melton Branch and White Oak Creek (the remedial design may result in one or more different locations). The treatment system will remove contamination that would adversely impact surface water quality (i.e., cause numeric or narrative AWQC exceedances). DOE intends to design and construct the upgradient diversion trenches in locations that will avoid collecting contaminated groundwater. Surface water monitoring for remedial effectiveness will include detection of contaminants that may originate from diversion trenches. If water from upgradient diversion trenches contributes to AWQC exceedances, it will also be treated by this (or equivalent) system. Detailed design will address the contingent treatment needed if diverted groundwater contributes to surface water exceedances.

The proposed system is a modification of the existing Seep D treatment system that is currently in use. The proposed system is likely to consist of four unit operations: flow equalization, filtration, sorption, and ion exchange. This representative system is shown in Fig. 2.22. Actual water treatment configuration will be established during detailed design as approved by the regulators in the RDR. The flow equalization unit will serve to minimize fluctuations in short-term flow rates and chemical concentrations. The filtration step will be used to remove suspended solids. Granular activated carbon will be used for sorption (e.g., removing contaminants such as mercury, arsenic, and organics). The proposed ion exchange unit operation uses a zeolite (such as the zeolite currently in use, which has been shown effective for the removal of ^{90}Sr). Contaminants listed in Table 2.5 will be effectively treated by this system. One exception is tritium, which cannot be cost-effectively treated. Water treated to meet identified ARARs will be discharged to surface water. Performance measures for the water treatment system are included in Sect. 2.11.7.2.

2.11.1.11 In situ vitrification

In the selected remedy, ISV is proposed for two trenches (Trenches 5 and 7) located in the Seepage Pits and Trenches Area. ISV involves using electricity to generate extremely high temperatures that melt contaminated soil (an example is shown in Fig. 2.23). The actual ISV configuration will be established during detailed design as approved by the regulators in the RDR. The glass-like matrix remaining after ISV is expected to trap radionuclide inventories for tens of thousands of years. ISV is proposed for Trenches 5 and 7 because they hold a large inventory of radionuclides in a relatively small volume of contaminated area. ISV at these locations is an appropriate and cost-effective use of treatment that will contribute to protection of human health and the environment. Because of the difficulty of using ISV in heterogeneous waste, the potential hazard of using ISV in saturated waste, and the overall high cost of ISV compared to other actions, ISV is not deemed to be appropriate in other areas of Melton Valley.

2.11.1.12 In situ grouting

In the selected remedy, in situ grouting is proposed for the HRE Fuel Wells in the Seepage Pits and Trenches Area. In situ grouting at the HRE Fuel Wells will be performed using an auger or similar method to mix grout with soil in the wells to reduce groundwater contact with the waste (Fig. 2.24). The actual in situ grouting configuration will be established during detailed design as approved by the regulators in the RDR. In situ grouting at the HRE Fuel Wells was not originally considered in the FS; however, it was added to the preferred alternative in the proposed plan (now the selected remedy) to minimize the potential for future contaminant migration from the wells.

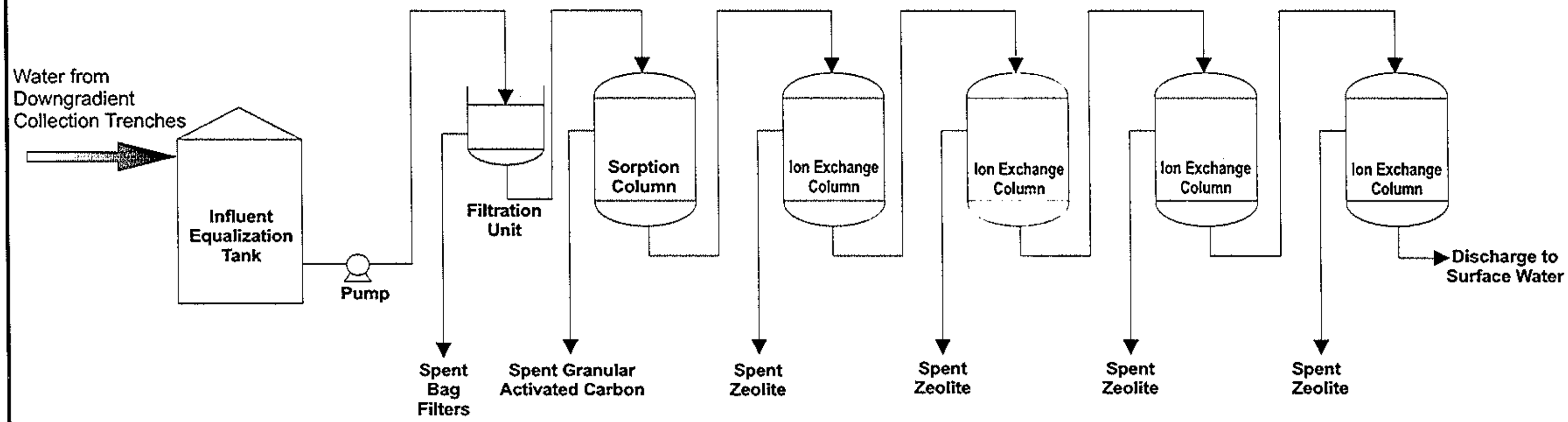


Fig. 2.22	Example of Modified Seep D water treatment process design DOE - ORNL, Melton Valley watershed - Oak Ridge, Tennessee	DOCUMENT ID: 35T080 0089-20 / ROD	DRAWING ID: 99-15234.CDR	DRAWING DATE: February 24, 2000 SB

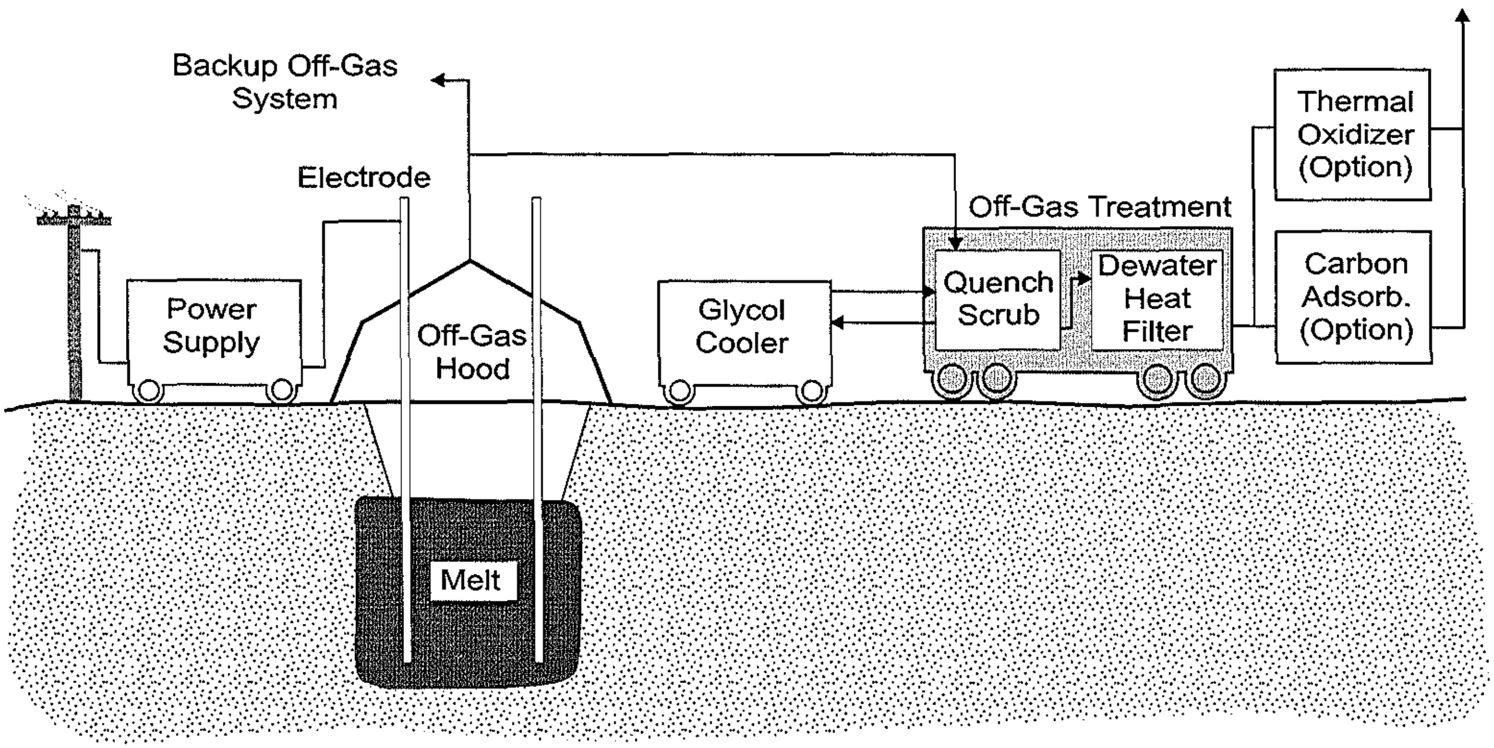
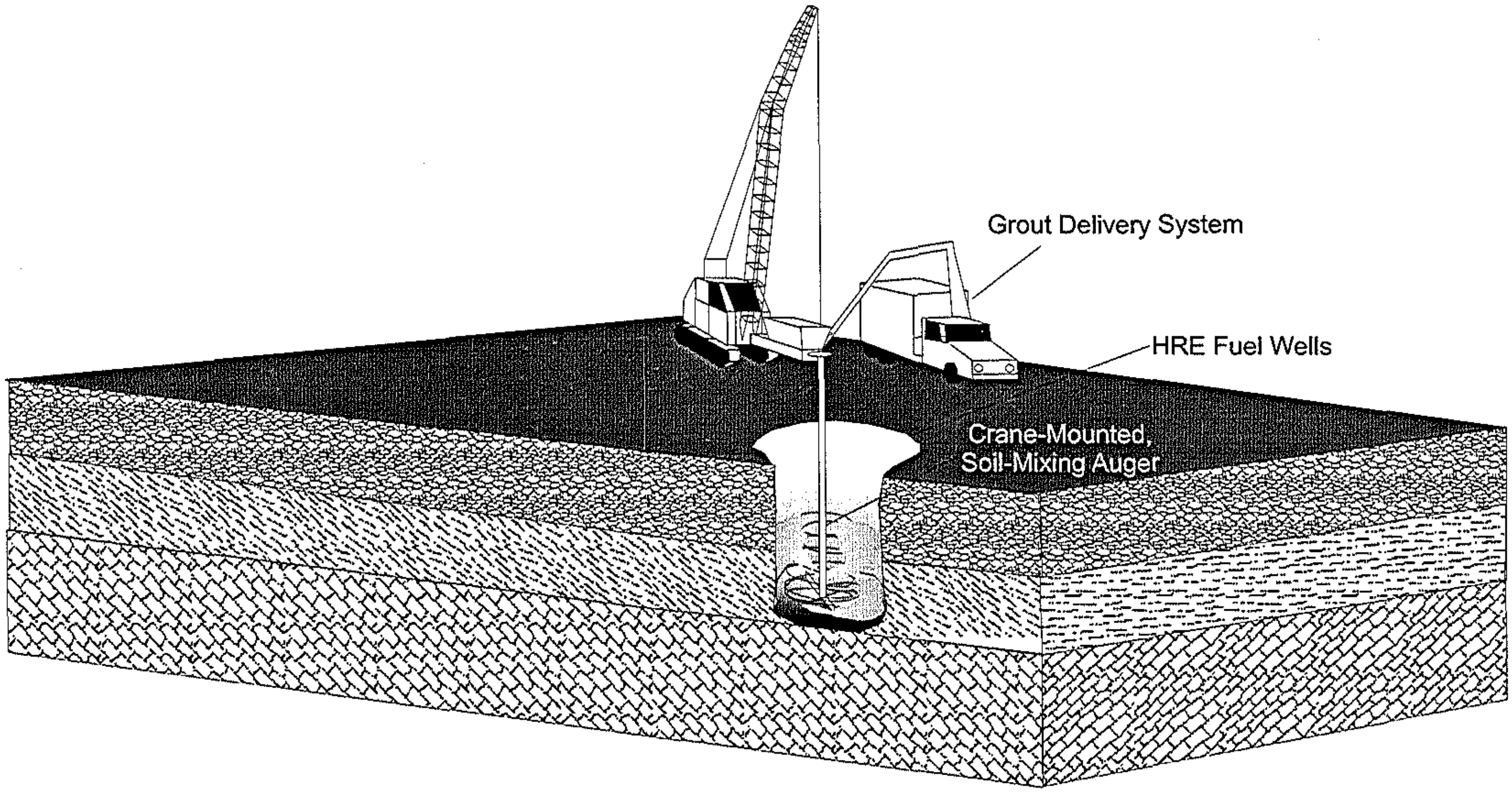


Fig. 2.23	**Example of ISV technology diagram** DOE - ORNL, Melton Valley watershed - Oak Ridge, Tennessee	DOCUMENT ID: 35T080 0089-20 / ROD	DRAWING ID: 99-15236.CDR	DRAWING DATE: February 24, 2000 SB



NOTE: This schematic shows one possible approach to HRE fuel well remediation;
actual approach will be established during detailed design.

Fig. 2.24	**Grouting of the HRE Fuel Wells** DOE - ORNL Melton Valley watershed - Oak Ridge, Tennessee	DOCUMENT ID: 35T080 0089-20 / ROD	DRAWING ID: 99-15235.CDR	DRAWING DATE: February 24, 2000 SB

2.11.1.13 Well P&A

Existing wells not required for monitoring will undergo P&A. The selected remedy will P&A the four hydrofracture injection wells and the associated monitoring wells not ultimately designated for future monitoring (a total of 90 hydrofracture monitoring wells exist). The four hydrofracture injection wells and associated monitoring wells will undergo P&A using proven technologies and standard well plugging practices from the petroleum and hazardous waste injection industries. In addition, P&A will be performed on many other, typically shallow groundwater monitoring wells that interfere with installation of multilayer caps and other remediation activities. The objective of well P&A is to seal a well in a manner to maintain hydraulic separation among strata penetrated by the well bore, thus ensuring that appropriate state regulations are met. Selection of wells for retention for future use as monitoring wells versus P&A is a design detail for the remedial actions. This determination will be made with regulator review and approval in the project remedial design phase.

2.11.2 Environmental Monitoring

This section describes monitoring of environmental media. This monitoring will determine the effectiveness of remedial actions, will verify protection of ecological receptors (or will help define the need for additional actions), and will support future decision making for the deferred areas of Melton Valley.

2.11.2.1 Surface Water Monitoring

To measure the effectiveness of the remedial actions implemented under this decision, surface water and groundwater will be monitored. Surface water that receives contaminants from surface runoff or groundwater seepage is the only known contaminant release pathway from the Melton Valley watershed, and a system of flow volume and contaminant measurement stations exists within the area. Measurement stations on the main stems of White Oak Creek and Melton Branch will be maintained and operated to measure concentration and release fluxes of contaminants from Melton Valley source areas (SWSA 4, SWSA 5, and downstream areas) as well as the incoming contaminants from Bethel Valley. Additional flow measurement stations and established surface water sampling locations exist on tributaries to the main streams in Melton Valley, and these facilities may be used as remedial actions are completed to document contaminant releases from tributary areas (HRE/MSRE, HFIR, SWSA 6, and Seepage Pits and Trenches). Surface water monitoring will be used to verify compliance with ARARs (such as AWQC) and to verify reduction of off-site contaminant releases to acceptable levels. Figure 2.25 shows the locations of surface water monitoring stations in the Melton Valley watershed that have been used historically to measure contaminant discharges. Continuous measurement of flow volume with flow-proportional sampling for contaminant measurement will occur at the

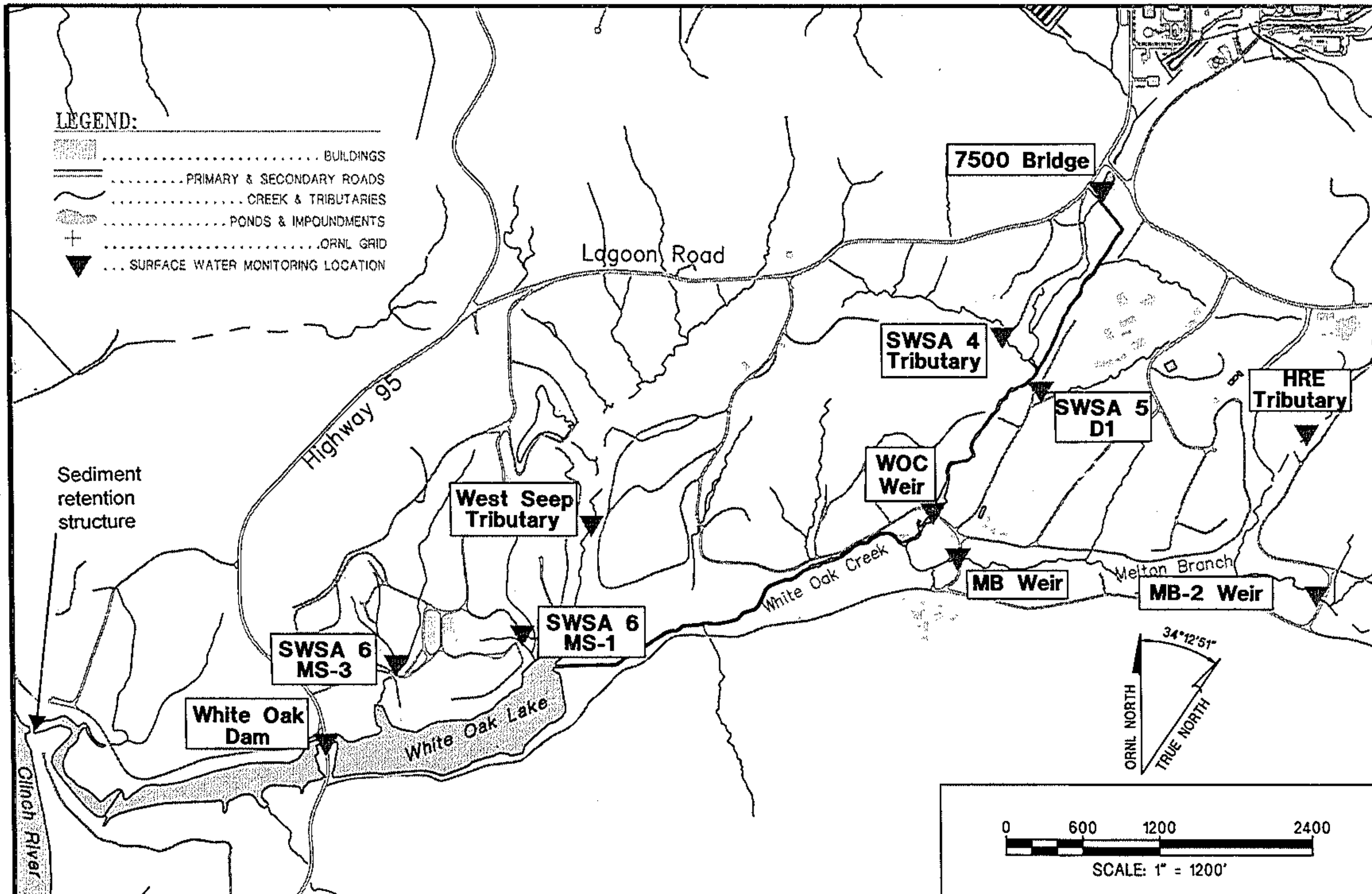


Fig. 2.25	**Surface water monitoring locations** DOE - ORNL, Melton Valley watershed - Oak Ridge, Tennessee	DOCUMENT ID: 35T060 0089-20/ ROD	DRAWING ID: 99-17822.DWG	DRAWING DATE: March 23, 2000 SB

four main stations in Melton Valley (White Oak Dam, Melton Branch Weir, White Oak Creek Weir, and the 7500 Bridge Weir) and other stations dictated by the design of the selected remedial actions. Details of surface water monitoring will be developed and approved during the remedial design process. Results of monitoring will be included in remedial effectiveness reports.

2.11.2.2 Groundwater Monitoring

Groundwater monitoring objectives in Melton Valley include four aspects of site surveillance:

- Melton Valley groundwater exit pathway wells (new and existing wells) will be monitored to verify that contaminants are not leaving the contaminated area.
- Deep wells in the vicinity of the hydrofracture waste disposal areas will monitor the stability of contaminants in the hydrofracture waste disposal zone.
- Groundwater in the vicinity of contaminant source control areas will be monitored to measure effectiveness of contaminant source control actions.
- Compliance with RCRA Subpart F groundwater monitoring requirements for SWSA 6.

Exit pathway groundwater monitoring will be performed to determine whether contaminants are leaving the known contaminated area by groundwater transport and to document concentrations of any groundwater contaminants at the area boundary. The frequency of groundwater monitoring at the exit pathways will reflect the rates of groundwater movement in shallow versus deep monitoring zones. Groundwater will be analyzed routinely for contaminants known to occur within the Melton Valley watershed with periodic analysis for a broad spectrum of contaminants.

Groundwater monitoring in the area associated with the hydrofracture waste disposal sites will be performed to verify the stability of the contaminated fluids. A number of existing deep wells will be configured to allow sampling of fluid both above and at the outer edge of the hydrofracture waste disposal zone.

Groundwater and/or seep monitoring will be used to measure some aspects of remedial action effectiveness in areas where source control actions are implemented. Examples of types of groundwater monitoring that may be used include measurement of water level fluctuations inside and outside hydraulically isolated areas and sampling of monitoring wells to measure contaminant concentrations within and at the edges of existing contaminant plumes. Monitoring of seeps at certain locations is appropriate to sample discharging groundwater to measure changes in contaminants entering the streams. In areas where groundwater is collected for treatment, collected groundwater volumes and contaminant concentrations will be monitored.

As with surface water monitoring, the details of groundwater monitoring will be developed and approved during the remedial design process. Results of monitoring will be included in remedial effectiveness reports.

2.11.2.3 Surface Monitoring

Postremediation radiation surveys and sampling (including sampling for radionuclides and nonradionuclides, such as metals, organics, and PCBs) will be performed to ensure that remedial actions are protective of human health.

2.11.2.4 Ecological Monitoring

An ecological monitoring plan will be developed in consultation with the U.S. Fish and Wildlife Service. The approach for the ecological monitoring will be addressed in the remedial design work plan. This plan, to be approved by the FFA parties, will:

- Close data gaps and reduce uncertainties regarding the protection of ecological receptors.
- Provide input to revision of remediation levels should some receptors be shown to be unacceptably at risk due to site-related contaminants.
- Refine the ecological risk assessment for surface water, floodplain soils, and sediments to support a future CERCLA decision.

2.11.3 Land Use Controls

LUCs are an essential component of the selected remedy for the Melton Valley area. DOE is committed to maintaining LUCs, including institutional controls, for as long as they are necessary to ensure protection of public health and the environment.

The anticipated future uses of the valley and the components of the selected remedial action do not support the unrestricted use of all areas of Melton Valley. Potential future land uses are listed in the description of the selected remedy (Part 1) (Fig. 2.11 delineates these areas) and elsewhere in this ROD.

DOE has agreed in an MOU with EPA and TDEC (DOE, EPA, and TDEC 1999) to comply with the ORR LUCAP whenever (as in this ROD) LUCs, including institutional controls, are selected as part of a remedial action being taken. The LUCAP, which is attached to the MOU, establishes procedures designed to ensure that each selected LUC will be implemented and properly maintained for as long as the LUC is needed to protect public health and the environment. Included in the LUCAP are requirements for planning implementation of each selected LUC, regular periodic monitoring of each LUC following its implementation, and annual certification by the manager of Oak Ridge Operations that each LUC continues to be effectively implemented.

The ORR LUCAP mandates that when a remedial action that includes LUCs has been selected, a LUCIP will be developed as a component of the post-ROD documentation. DOE will develop a LUCIP for the Melton Valley watershed that addresses the same units covered under the ROD and submit it to EPA and TDEC for approval. The Melton Valley watershed LUCIP will be submitted and reviewed with the Melton Valley watershed remedial design work plan in accordance with the FFA schedule for submittal, review, and approval. The anticipated schedule for the LUCIP is shown in Table 2.12. The LUCIP will specify how DOE will implement, maintain, and monitor the land use control elements of the remedy identified in this ROD to ensure that the remedy remains protective of human health and the environment. Upon regulatory approval, the Melton Valley watershed LUCIP will be added to Appendix B of the ORR LUCAP.

Table 2.12. Schedule for land use control implementation plan, Melton Valley watershed, ORNL, Oak Ridge, Tennessee

Activity	Duration of activity[a]
DOE issues LUCIP (D1 version)	See footnote[b]
EPA and TDEC review D1 LUCIP	90
DOE responds to regulatory comments on the D1 LUCIP and prepares the D2 LUCIP	60
EPA and TDEC review and approve the D2 LUCIP	30

[a] The duration is the anticipated number of calendar days in accordance with Federal Facility Agreement protocol for review and approval of primary documents. Actual number of calendar days may vary in accordance with FFA protocol.

[b] The D1 LUCIP will be submitted with the remedial design work plan per the Federal Facility Agreement milestone (Appendix E).

This LUCIP, when approved, for the Melton Valley watershed, will remain in effect until the follow-on or final ROD for the Melton Valley watershed has been signed and the follow-on or final LUCIP has been approved. However, the watershed LUCIP may be modified or expanded as needed over the intervening period to address LUCs stipulated in other forthcoming decision documents for Melton Valley.

The LUCs that will be used in Melton Valley are summarized in Table 2.13. This table lists types of controls, purposes of the controls, duration, implementation, and affected areas. These controls are not mutually exclusive but are used in combination. In fact, "layering"—use of redundant controls—is used for the Melton Valley watershed as a way of enhancing the overall reliability of the controls.

The Melton Valley watershed ROD establishes three different remediation areas within the watershed with different potential future land uses and different remediation levels. However, the interim LUC objectives for the three remediation areas are similar. There is little direct correlation between the potential future land uses and the interim LUC objectives because DOE will not relax current restrictions on the industrial use area and the surface water and floodplain area in the near future. Because of the similarity in interim LUC objectives between the remediation areas, most of the identified LUCs apply generally throughout the watershed.

In accordance with the LUCAP, the DOE-ORO assistant manager for Environmental Management is responsible for monitoring, maintaining, and enforcing the requirements in the LUCAP and the Melton Valley watershed LUCIP. Unauthorized access to the Melton Valley watershed will be prevented as long as unacceptable risks remain. After construction of the selected remedial actions, only properly trained or escorted personnel will be allowed access to Melton Valley. Typical activities performed by these personnel would include supporting operating facilities; performing inspections and maintenance of caps, fences, dams/weirs, and roads; and continued monitoring and surveying of contaminated media and ecological receptors. Results of remedial effectiveness monitoring and LUC compliance will be reported in the remediation effectiveness report. Characterization data will be maintained in the appropriate records and databases.

2.11.4 Uncertainties

This ROD defines actions that DOE will take concerning contaminant source units and contaminated media in approximately 600 acres in Melton Valley. The decision-making basis for actions specified in the ROD includes historic operating records and the results of historic sampling and analysis of environmental media throughout the area. The database available to perform human health and ecological risk assessments is considered adequate for the purpose of identifying COCs, estimating risk levels at a broad scale over the Melton Valley area, and determining appropriate remedial actions. Additional data of various types will be required to support remediation project design activities. Examples of the types of additional data collection that may be required include sampling and analysis soil to verify required excavation limits for contaminated soils to ensure that agreed-upon risk levels are achieved (including all COCs in remediation areas) and obtain additional data required to design area caps, surface water

Table 2.13. Land use controls for the Melton Valley watershed, ORNL, Oak Ridge, Tennessee

Type of control	Purposes of control	Duration	Implementation	Affected areas[a]
1. Deed Restrictions[b] A. Land use B. Groundwater	Restrict use of property by imposing limitations Prohibit uses of groundwater	As long as deemed necessary	Drafted and implemented by DOE upon completion of remedial actions and/or transfer of effected areas. Recorded by DOE in accordance with state law at County Register of Deeds office	All waste management areas and other areas where hazardous substances left in place at levels requiring land use and/or groundwater restrictions
2. Deed notice[c] RCRA postclosure notice	Provide notice to anyone searching records about the existence and location of a hazardous waste landfill(s)	As long as deemed necessary	Recorded by DOE in accordance with state law at County Register of Deeds office upon completion of remedial actions and/or transfer of affected areas	SWSA 6 ICMAs/HTF All waste management areas and other areas where hazardous substances left in place at levels requiring land use and/or groundwater restrictions
3. Zoning notice[d]	Provide notice to city about the existence and location of hazardous waste landfill(s) for zoning/planning purposes	As long as deemed necessary	Survey plat of SWSA 6 ICMAs/HTF filed by DOE with City Planning Commission	SWSA 6 ICMAs/HTF All waste management areas and other areas where hazardous substances left in place at levels requiring land use and/or groundwater restrictions
4. Permits program[e]	Provide notice to developer on extent of contamination and prohibit or limit activity	As long as deemed necessary	Implemented by DOE (or its contractors) Provide permits program with contamination information Initiated by permit request	All waste management areas and areas where hazardous substances left in place at levels requiring land use and/or groundwater restrictions
5. State advisory/posting[f] (e.g., no fishing or contact advisory)	Provide notice to potential resource users of contamination and risks associated with uses	Indefinite, or until use conditions change as determined by state	Established and maintained by TDEC	White Oak Lake and Embayment
6. Access controls (e.g., fences, gates, and portals)[g]	Control and restrict access to workers, public to prevent unauthorized uses	As long as deemed necessary For SWSA 6 ICMAs / HTF (30 yrs. minimum)	Established and maintained by DOE	Required for SWSA 6 ICMAs/HTF All waste management areas and other areas where hazardous substances left in place at levels requiring land use and/or groundwater restrictions

Table 2.13 (continued)

Type of control	Purposes of control	Duration	Implementation	Affected areas[a]
7. Signs[h]	Provide notice or warning to prevent unauthorized access	As long as deemed necessary	Signage maintained by DOE Signs to be determined in consultation with EPA and TDEC	At select locations throughout Melton Valley
8. Security guards	Control and monitor access by workers/public	As long as deemed necessary	Established and maintained by DOE Existing, routine patrols continued	Patrol of select areas throughout Melton Valley, as necessary

[a] Affected areas – Specific locations of such areas to be further described in post-ROD documentation.

[b] Deed Restrictions – Includes conditions and/or covenants that restrict or prohibit certain uses of real property and are recorded along original property acquisition records of DOE and its predecessor agencies.

[c] Deed Notice – Refers to any non-enforceable, purely informational document recorded along with the original property acquisition records of DOE and its predecessor agencies that alerts anyone searching property records to important information about contamination/waste on the property.

[d] Zoning Notice –Includes information on the location of hazardous waste disposal areas depicted on a survey plat, which is provided to a zoning authority (i.e., City Planning Commission) for consideration in appropriate zoning decisions for Non-DOE property.

[e] Permits Program – Refers to the DOE/DOE contractor administrative program(s) that requires developers and others to obtain authorization, usually in the form of a permit (although it may be simply a written approval), before beginning construction (e.g., excavation, drilling) for the purpose of ensuring that the proposed activity will not affect underground utilities, or in the case of contaminated soil or groundwater, will not disturb the affected area without the appropriate precautions and safeguards. Current permit program will be modified as necessary.

[f] State Advisory – Refers to health advisory information provided by the TDEC Division of Water Pollution Control related to use or restrictions thereon, of surface waters that currently do not meet the designated uses established in Rules of the TDEC Chapter 1200-4-4. Such information is included on signs that are posted along affected reaches to provide notice to potential users.

[g] Access Controls – Barriers to entry.

[h] Signs – Posted command, warning, or direction.

ARAR = applicable or relevant and appropriate requirement
CERCLA = Comprehensive Environment Response, Compensation, and Liability Act of 1980
DOE = U.S. Department of Energy
EPA = U.S. Environmental Protection Agency
HTF = Hillcut Test Facility
ICMA = Interim Corrective Measure Area
NPL = National Priorities List
ORNL = Oak Ridge National Laboratory
ORR = Oak Ridge Reservation
RCRA = Resource Conservation and Recovery Act of 1976
ROD = record of decision
SWSA = solid waste storage area
TDEC = Tennessee Department of Environment and Conservation

diversion features, and groundwater seepage collection devices. A similar uncertainty is the nature of materials in several identified disposal units, including the Contractors Landfill near the HFIR area and in miscellaneous dump sites in several locations in Melton Valley. Table 2.14 provides a discussion of uncertainties and their management.

A potential uncertainty exists for risk and required cleanup actions for strontium titanate. Strontium titanate is an insoluble fine particulate material disposed in SWSA 5 during the 1960s. Wind carried some particles to the northeast into the eastern end of Melton Valley where they settled out onto the ground. Additional statistically based soil sampling will be performed in the portion of the industrial use area nearest to SWSA 5 as part of contaminated soil remediation to determine whether cleanup actions are required for strontium titanate.

Tritium present in some groundwater seepage pathways and in surface water discharges from Melton Valley creates an uncertainty in the time required for DOE to meet the surface water risk goal of this ROD. The remedial actions being planned are expected to reduce the amount of tritium that is released from the watershed by reducing the volume of water that contacts buried waste materials. Contaminant source units where tritium is being released will be hydraulically isolated using combinations of caps and groundwater seepage collectors. The collected groundwater will be treated to remove the identified COCs. However, it is recognized that since tritium is a highly mobile radionuclide and there is no effective treatment method for its removal from large volume wastewater streams, there will be a continuing but diminished tritium release from Melton Valley. Assuming Bethel Valley releases remain constant, the Melton Valley FS estimated that within approximately 20–25 years the combination of remedial actions and radioactive decay will reduce the total residential risk (including exposures to tritium) in surface water at the confluence of White Oak Creek and Clinch River to less than 1×10^{-4}.

2.11.5 Cost Estimate for the Selected Remedy

The cost estimate for the selected remedy is presented in Table 2.15. The total escalated capital cost is $165 million. The present worth cost of the selected remedy is $105 million. The present worth cost for 30 years of operations and maintenance (O&M) activities is $11 million. The O&M cost includes such activities as surveillance/inspections, cap maintenance, monitoring, water treatment, temporary maintenance of cryogenic controls, and legal costs (e.g., deed notices, deed restrictions, and zoning notices). The O&M cost does not include landlord activities (e.g., road maintenance), maintenance of information systems, (e.g., databases, reports, maps), security (e.g., guard patrols), and other land use-related activities that currently exist or will be created for reasons unrelated to the remedy.

Table 2.14. Management of uncertainties for the Melton Valley watershed, ORNL, Oak Ridge, Tennessee

Uncertainty	Expected condition	Potential deviation	Relative probability of deviation	Potential impact of deviation	Response to deviation
		Surface water			
Effectiveness of actions to meet surface water quality goals (e.g., numeric AWQC and risk-based limits)	Properly designed and implemented remedy will achieve surface water quality goals within 10 years after completion of the remedy	Contaminated groundwater flows under the downgradient collection trench at levels sufficient to cause an exceedance	Low—trench will be installed to or below surface of bedrock. Multiple, significant occurrences not expected	Low	Consider need for further action in future CERCLA decision
		New releases occur from unidentified sources in unremediated areas	Low—significant characterization and site knowledge suggest that all significant sources have been identified. Multiple, significant occurrences not expected	Low	Consider need for further action in future CERCLA decision
		Reduction of tritium discharge less than anticipated	Medium—the reduction is based on effectiveness of the capping only; treatment of tritium in groundwater is not feasible	Low to medium	Maintain land use controls at confluence of WOC with the Clinch River
		Releases from floodplain soil and sediment occur at levels sufficient to cause an exceedance	Low—exceedances primarily caused by releases from burial grounds and related sources	Low	Need for actions for floodplain soils and sediments to be assessed in a future CERCLA decision
		Flushing of secondary pathways or media extends the period allowed for demonstrating compliance	Low to medium—flushing would vary by source unit and distance to receiving water body; significant flushing after 10 years not expected	Low	Consider need for further action in future CERCLA decision
	The Bethel Valley remedy performs as expected in helping to achieve surface water quality goals	Bethel Valley remedy does not provide at least 45 percent risk reduction at 7500 Bridge	Low to medium—flux information and source identification both have uncertainties	Medium—Bethel Valley makes a significant contribution to offsite releases	Bethel Valley ROD will include contingent actions or decision rules for addressing remedy insufficiencies

Table 2.14 (continued)

Uncertainty	Expected condition	Potential deviation	Relative probability of deviation	Potential impact of deviation	Response to deviation
Soil					
Extent of contamination	Process knowledge is sufficient to determine contaminated soil does not extend outside known or suspected areas of contamination	Contaminated soil found outside known or suspected areas	Low—walkovers and radiological flyover indicate no large, undiscovered sources	Medium—cost impact dependent on extent	Apply remediation level logic to new source material (see Sect. 2.11.7.3)
Strontium titanate contamination in the industrial area soil	Strontium titanate is not a contaminant of concern based on preliminary risk screening and analysis of limited on-site data	Strontium titanate exists at levels that exceed industrial risk-based limits	Medium—only limited data available for strontium titanate in industrial area	Medium to high—significant cost impact associated with characterization and large-scale excavation	Establish remediation levels for strontium titanate, determine extent of contamination above remediation levels, and excavate soil as needed in industrial area
Ecology					
Ecological risk	Populations of ecological receptors are not subject to unacceptable risk	The post-ROD ecological study indicates some populations of ecological receptors are subject to unacceptable risk	Medium—ecological risk is currently demonstrated with only one line of evidence	Medium to high—remediation would impact a larger area of aquatic and floodplain ecosystems	Investigate remedial options in future CERCLA decision document
Remedial actions					
Buried TRU waste	Hydraulic isolation is the selected action for the upper 4 trenches in SWSA 5 North and the TRU trenches in SWSA 5 South	Based on a feasibility analysis, the post-ROD engineering study indicates that a remedial action other than hydraulic isolation is the preferred action	Low—site knowledge indicates that these TRU trenches are partially entombed	Medium to high—remediation would have a large cost impact	Determine new action for TRU trenches through appropriate CERCLA documentation

Note: Management of groundwater condition uncertainties is deferred to a future CERCLA decision.

Table 2.15. Selected remedy cost estimate, Melton Valley watershed, ORNL, Oak Ridge, Tennessee

Remedial project	Capital cost ($ thousands)				O&M cost ($ thousands)	
	Direct[a]	Indirect[a]	Total[a]	Present worth[b]	Annual[c]	Present worth[b]
Base actions[d]						
Perimeter groundwater monitoring wells	1,042	200	1,242			
Pond removal/cryogenics	2,085	361	2,446		3	
SWSA 5 North soils[e]	2,307	0	2,307			
D&D: OHF, Alpha Greenhouse Facility[f]	2,357	611	2,968		128	
HRE fuel wells grouting	3,047	59	3,106			
Hydrofracture well P&A	13,395	2,223	15,618			
Hydraulic isolation	70,791	13,723	84,514		383	
Water treatment	2,577	761	3,338		210	
Inactive pipeline remediation	1,741	376	2,117			
D&D: HRE/MSRE/NHF areas	2,176	506	2,682			
Floodplain soil excavation	14,692	2,563	17,255			
In situ vitrification	20,539	6,714	27,253			
Monitoring, O&M	NA	NA	NA		305	
Base action totals	**136,749**	**28,097**	**164,846**	**105,096**		**11,064**

Note: The remedial projects are based on the alternative components in the FS and are not necessarily the same as the major activities shown in the construction sequencing diagram.

[a]Costs are escalated (average 2.7 percent escalation rate in accordance with DOE guidance).
[b]Present worth costs for 30-year study based on building life-cycle cost analysis (Version 4.20-95).
[c]The total unescalated O&M cost is divided by the number of years duration and then escalated to the first full year of implementation.
[d]LLW disposal costs are based on anticipated costs for the on-site disposal facility.
[e]The indirect costs (design and oversight) for SWSA 5 North soils are included under a related concurrent project.
[f]Project includes building and operating a decontamination facility in Melton Valley.

$ = dollar
D&D = decontamination and decommissioning
DOE = U.S. Department of Energy
HRE = Homogeneous Reactor Experiment
LLW = low-level (radioactive) waste
MSRE = Molten Salt Reactor Experiment
NA = not applicable
NHF = New Hydrofracture Facility
O&M = operation and maintenance
OHF = Old Hydrofracture Facility
ORNL = Oak Ridge National Laboratory
P&A = plugging and abandonment
SWSA = solid waste storage area

The information in the cost estimate summary table, Table 2.15, is generated from cost estimates produced during the FS process for Alternative 5, modified to match the scope of the selected remedy and the anticipated duration of construction. The detailed cost estimates are included in the Administrative Record. The cost estimates were based on the best available information at the time of estimate development regarding the anticipated scope of the selected remedy. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the selected remedy. Final costs will depend on actual labor and material cost, actual site conditions, productivity, competitive market conditions, action sequencing, final scope, final engineering design, and other variables. Accordingly, final costs could vary significantly from the estimates presented. Major changes may be documented in the form of a memorandum in the Administrative Record file, an Explanation of Significant Difference, or a ROD amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to –30 percent of the actual project cost.

2.11.6 NEPA Values

In accordance with DOE Orders and NEPA policy, DOE evaluation under CERCLA and associated documents incorporate NEPA values to the extent practical. These NEPA values include physical values of air quality, water quality, groundwater quality, and ecological resources; human-related values of cultural and historical resources, visual and aesthetic effects, socioeconomics, environmental justice, and transportation; and the overall cumulative and indirect impacts anticipated. This summary addresses the change from current conditions in each of the NEPA value areas during and following remedial action (Table 2.16). Another major concern under NEPA is public participation in the decision-making process. The public has been involved throughout the CERCLA process for Melton Valley, as detailed in Sect. 2.3 "Highlights of Community Participation."

Short-term impacts on the human environment will include minor visual impacts, some increase in road traffic, and minor local employment impacts. Long-term impacts will include reduction in off-site contaminant releases and eventual lessening of access restrictions required to prevent contact with radioactive contaminants. Institutional controls will continue to be required, and permanent adverse impacts on the use of the site and surrounding area can be expected. Depending on actions at other sites on ORR, permanent impacts on area socioeconomics may remain.

Table 2.16. NEPA values, Melton Valley watershed, ORNL, Oak Ridge, Tennessee

NEPA value	Definition	Impacts associated with selected remedy
Air quality	Cleanliness of air measured by pollutant level relative to regulatory standards or guidelines	Standard dust-control practices will prevent significant releases of airborne contaminants during action. Minor emissions from equipment used for construction and transportation can be expected. No potential exists for any long-term impacts on air quality
Surface water quality	Condition of surface waters of the state relative to AWQC. Residual risk from contaminated media associated with surface water	Current exceedances of AWQC are anticipated to cease in a reasonable amount of time. Minor impacts to surface water may occur during remedial action. Some floodplain media will continue to remain radioactive and will present risk to a recreational user for approximately 170 years
Groundwater quality	Condition of groundwater relative to EPA-specified maximum contaminant levels	Source control actions will mitigate further adverse impacts to groundwater
Ecological impacts	Ecological health measured by reduction in populations of indicator species, impacts on an individual level to indicator or specially designated species, and by general biodiversity	In the short term, actions at the site will destroy some terrestrial, floodplain, and aquatic habitat and disturb adjacent areas. In the long term, current risks to ecological receptors on a population level will be largely eliminated
Cultural and historical resources	Impacts to materials of special cultural interest, graveyards, or structures eligible for listing on the National Register of Historic Places	The area subject to remedial action contains no identified cultural or historical resources. However, if such resources are discovered during implementation of the action, the ARARs will be met
Visual and aesthetic effects	Changes in the skyline or appearance of an area, especially with regard to the aesthetics of the area	The area is currently visible mainly from access roads and adjacent ridges, with the exception of a short sight line from SR95 at the White Oak Creek Dam. Short-term visual impacts will be minor. In the long term, should areas adjacent to the controlled area be opened for public use, the controlled and maintained waste areas will represent a continuing visual impact. Removal of old facilities and capping with grass cover will enhance visual effects
Socioeconomic impacts	Changes in the employment profile, population, total wage base or other economic elements of work and life in the affected area	Remediation workers will likely be drawn from the local work force, generating a minor positive impact in the short term. Only negligible long-term employment will result from continuing institutional controls, while the remaining restrictions on land use and access will continue to have a negative impact on area socioeconomics, as they do today

Table 2.16 (continued)

NEPA value	Definition	Impacts associated with selected remedy
Environmental justice impacts	The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies (see EO 12898)	No specific low-income or minority population as defined under EO 12898 exists in the vicinity of Melton Valley. In a general sense, the citizens of Roane County have expressed concern that they continue to disproportionately shoulder the burden of ORR waste disposal facilities. This action will only partially address those concerns
Transportation impacts	Potential impacts include road damage, disruption of current and future transportation, emissions of dust and exhaust, and injuries or death from accidents	Estimates based on state road accident statistics indicate that < 1 accident should occur during remedial action. No long-term impacts are anticipated
Irreversible and irretrievable commitment of resources	Some resources, such as fuel or soil, cannot be replaced once used in an action or committed to a permanent use	The resource represented by the waste sites in Melton Valley will continue to be committed to waste disposal and will not be useful for other purposes. Fuel, borrow soil, and other materials will be directly used during remedial action
Cumulative impacts	Impacts that result from the incremental impact of a proposed action added to other present, past, and reasonably foreseeable future actions	The overall cumulative impact during and after remedial action will depend on other actions that may occur at the same time. Action at Melton Valley will contribute to transportation and socioeconomic impacts in the short term. Excavations at the borrow area will contribute to overall loss of habitat. The level of impact will depend on decisions reached for other sites
Indirect impacts	Impacts that accrue as a peripheral result of direct actions	The primary indirect impact is the long-term socioeconomic impact described above

AWQC = ambient water quality criteria
EO = Executive Order
EPA = U.S. Environmental Protection Agency
< = less than
MCL = maximum contaminant level
NEPA = National Environmental Policy Act of 1969
ORNL = Oak Ridge National Laboratory
ORR = Oak Ridge Reservation
SR = State Route

Cumulative impacts will depend on the extent of other actions on ORR and the development of future land use plans for ORR. If other sites manage waste in place, the presence of waste in place at Melton Valley will represent only one of several contributors to future impacts. If other sites on ORR remove waste rather than managing it in place, the relative impact of Melton Valley on future development of ORR may be more significant. The resources represented by the solid waste storage areas in Melton Valley will continue to be designated as waste management areas. Fuel, borrow soil, and other materials will be directly used during remedial action and will constitute an irreversible and irretrievable commitment of resources.

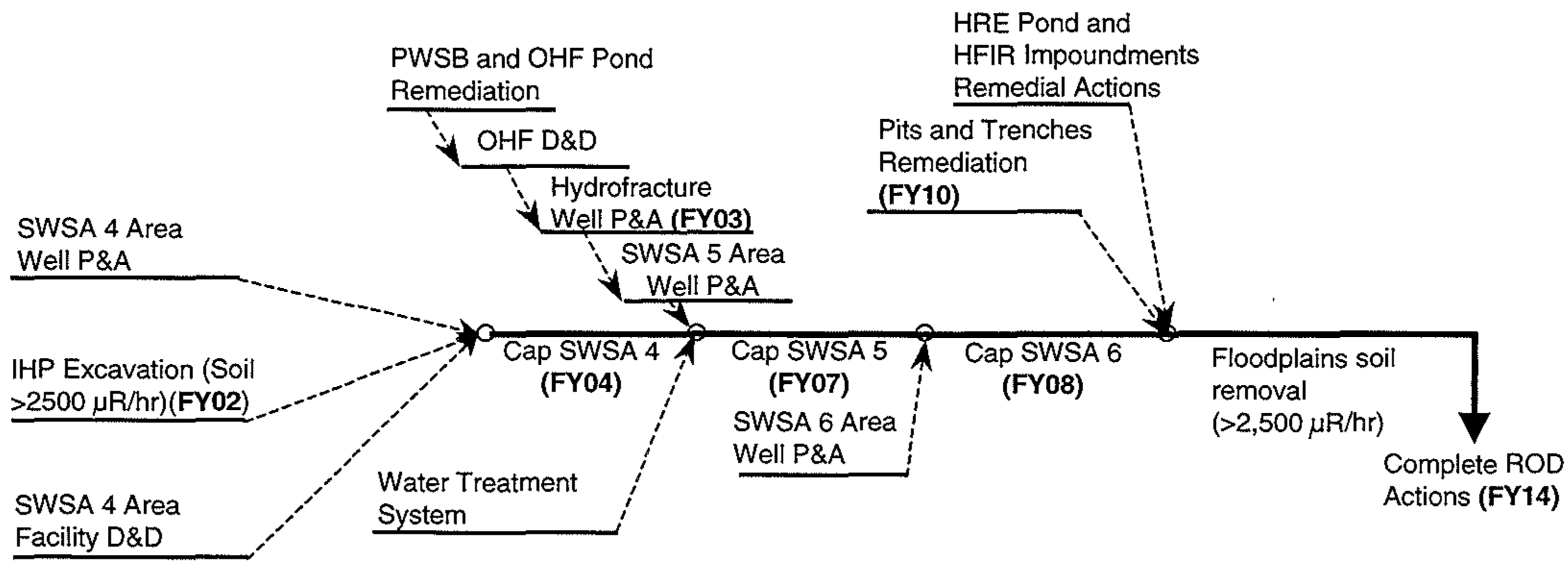
2.11.7 Remedy Implementation

This section presents information pertaining to implementation of the selected remedy including a discussion of sequencing and milestones, performance actions for the remedial actions, and remediation levels for surface water and soil.

2.11.7.1 Sequencing and milestones

Remedial actions in Melton Valley will be sequenced over a period of approximately 14 years. The general sequence of major remedial actions is shown in Fig. 2.26. This sequence of cleanup actions for the Melton Valley watershed is based on several factors including construction sequencing requirements (i.e., some actions are logical precursors to other actions), consideration of source unit contributions to off-site releases in the watershed (e.g., SWSAs 4 and 5 are larger contributors to watershed surface water risks than SWSA 6 and Seepage Pits and Trenches), and resource availability (planning includes expected annual funding levels). The sequence of actions shown in Fig. 2.26 is intended only to show that some actions are precursors to other projects and to convey a general activity sequence for major activities. The figure does not attempt to show all aspects of remedial actions in Melton Valley.

Figure 2.26 also shows the currently anticipated fiscal year dates for completion of selected major projects. Pursuant to Section XXXVIII of the FFA, DOE shall take all necessary steps to obtain sufficient funding for activities required by this ROD. This is to be accomplished, as set forth in that section of the FFA, through consultation with EPA and TDEC and the submission of timely budget requests. As depicted in Fig. 2.26, all remedial actions included in this ROD currently are projected to be completed by FY 2014. However, schedules for completion of projects, as set forth in Fig. 2.26, are estimates provided for informational purposes only and are not considered to be enforceable elements of the selected remedy. The enforceable milestones and nonenforceable FY +3 milestones for performance of remedial actions for sites included in this ROD are set forth in Appendix E and Appendix J of the FFA, respectively. Any additional



Related Actions
(not included in this ROD)

- Construct on-site disposal cell
- Open borrow pit
- Road and power line relocation
- Closure of Tumulus & IWMF
- Retrieve KEMA fuel
- Retrieve stored TRU waste (bunkers, sleeved wells)
- Retrieve buried TRU waste (23 trenches)

NOTE: Fiscal years shown in parenthesis are the anticipated construction completion milestones

Fig. 2.26	Melton Valley project sequence of major activities and target completion dates DOE - Melton Valley watershed - Oak Ridge, Tennessee	DOCUMENT ID: 35U950 089-50 / ROD	DRAWING ID: NFA-RODB.PPT-2	DRAWING DATE: February 24, 2000 SB

milestones, timetables, or deadlines for sites included in this ROD will be identified and established independent of this ROD, in accordance with the existing FFA protocols.

2.11.7.2 Performance objectives

The primary mechanism for site remediation in this alternative is hydraulic isolation of major waste sources with in situ treatment or excavation of selected waste sources. The selected remedy for the Melton Valley watershed is summarized in Fig. 2.17. Each component action in the selected remedy contributes in some way to meeting the RAO for Melton Valley. The roles of each major action in fulfilling the RAO and required performance of the major actions are outlined in Table 2.17. Performance requirements included for the major actions show the level of protectiveness required of major action toward meeting the overall watershed goals.

2.11.7.3 Remediation levels

Remediation levels establish the permissible risk, concentration, or exposure level of contaminants at a site that must be achieved by the completed remedy. The remediation levels for surface water and soil are discussed in the following separate subsections.

Documentation of remediation level attainment must provide an acceptable level of confidence that this has occurred. It is necessary to use statistical methods to provide a quantitative estimate of the probability that the residual risk or exposure in an area does not exceed the respective remediation level. Statistical methods provide for specifying (controlling) the probability of making decision errors and for extrapolating from a limited set of measurements to a specified area in scientifically valid fashion. One resource from which statistical principals may be borrowed for application to the Melton Valley watershed is the *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM) (DoD et al. 1997).

To estimate risk of a particular substance in a given medium in a particular area it is necessary to quantify estimate is needed of the concentration of the substance that is present. Under current EPA guidance for risk assessment, the average concentration is the value to be used in such estimation. Because only a finite number of samples can be taken, the average concentration cannot be determined precisely. For this reason, EPA requires that a 95 percent upper confidence limit (UCL) on the arithmetic average concentration be calculated to estimate concentrations used in risk assessments. The 95 percent UCL of the average concentration is the value that, when calculated repeatedly for randomly drawn subsets of area data, will equal or exceed the true average 95 percent of the time. An exception to the general guideline for using a 95 percent UCL for the average concentration is when multiple surface water samples are taken from a continuous sampler. In this case, the continuous sampler adequately averages the

Table 2.17. Performance measures for major actions in the Melton Valley watershed, ORNL, Oak Ridge, Tennessee

Unit type/ unit names project scope	Performance objectives	Selected remedy actions	Performance measure[a,b]
Buried waste sites SWSA 4 • SWSA 4 • Liquid Seepage Pit 1 & Secondary Media • Inactive Waste Transfer Lines @ Lagoon Rd. • Pilot Pits Area Shallow Well P&A	• Contain disposed & contaminated materials • Meet RAO for the waste management use area (Table 2.6)	• Construct a cap to cover buried wastes in SWSA 4, Seepage Pit 1, the Pilot Pits area, and associated contaminated areas including inactive waste transfer pipelines along Lagoon Rd. • Construct barriers to surface water run-on, upslope stormflow intrusion into the site, and downgradient contaminated groundwater seepage • Treat all intercepted contaminated water to meet discharge requirements. • Stabilize abandoned pipelines & trench backfill at cap boundaries • Design and construct all necessary water handling features to prevent erosional impacts to adjacent land and stream channel areas • Plug and abandon all unneeded shallow wells within the project area • Design and implement a monitoring system(s) for surface water and groundwater to demonstrate the performance of the remedial action components	• Prevent releases from SWSA 4 from causing AWQC exceedances in waters of the state within 2 years after SWSA 4 construction is complete • Reduce SWSA 4 contaminant releases to surface water by approximately 80% to meet computed 1×10^{-4} total residential risk at the confluence of White Oak Creek with Clinch River in ~10 years after all ROD actions are complete • Reduce groundwater throughflow in buried waste units by >75% as measured by >75% decrease in water level fluctuations in selected monitoring locations inside the contained area
SWSA 5 South • SWSA 5 South • Stabilized OHF Pond and Tanks • Stabilized subsurface OHF facilities • Contaminated soils at OHF site • Shallow Well P&A	• Contain disposed materials • Meet RAO for the waste management use area (Table 2.6)	• Construct a cap to cover buried wastes in SWSA 5 South including stabilized facilities, stabilized tanks and pond and contaminated soils at the Old Hydrofracture Site area • Construct barriers to surface water run-on, upslope stormflow intrusion into the site as needed, and downgradient contaminated groundwater seepage • Treat all intercepted contaminated water to meet discharge requirements • Design and construct all necessary water handling features to prevent erosional impacts to adjacent land and stream channel areas • Plug and abandon all unneeded shallow wells within the project area • Design and implement a monitoring system(s) for surface water and groundwater to demonstrate the performance of the remedial action components	• Prevent releases from SW 5 South from causing AWQC exceedances in waters of the state in Melton Branch, Lower HRE Tributary, and SWSA 5 D1 within 2 years after SWSA 5 South construction is complete • Reduce SWSA 5 contaminant releases to surface water by approximately 80% to meet computed 1×10^{-4} total residential risk at the confluence of White Oak Creek with Clinch River in ~10 years after all ROD actions are complete • Reduce groundwater throughflow in buried waste units by >75% as measured by >75% decrease in water level fluctuations in selected monitoring locations inside the contained area
SWSA 6 • SWSA 6 • Shallow Well P&A	• Contain disposed materials • Meet RAO for the waste management area	• Construct a cap to cover buried wastes in SWSA 6 • Construct barriers to surface water run-on, upslope stormflow intrusion into the site as needed, and downgradient contaminated groundwater seepage • Collect and treat all intercepted contaminated water to meet discharge requirements • Design and construct all necessary water handling features to prevent erosional impacts to adjacent land and stream channel areas • Plug and abandon all unneeded shallow wells within the project area • Design and implement a monitoring system(s) for surface water and groundwater to demonstrate the performance of the remedial action components	• Prevent releases from SWSA 6 from causing AWQC exceedances in waters of the state within 2 years after SWSA 6 construction is complete • Comply with RCRA postclosure requirements for designated RCRA areas • Reduce groundwater throughflow in buried waste units by >75% as measured by >75% decrease in water level fluctuations in selected monitoring locations inside the contained area

Table 2.17 (continued)

Unit type/ unit names project scope	Performance objectives	Selected remedy actions	Performance measure[a,b]
TRU waste sites • Contaminated soils at SWSA 5 North 23 Trenches • Shallow Well P&A	• Meet RAO for the waste management use area	• Plug and abandon all unneeded shallow wells within the project area • Remove and manage contaminated soils in 23-trench area	• Complete shallow well P&A • Excavate contaminated soils surrounding the cask burial area that exceed 1×10^{-4} industrial worker risk. • Remove contaminated soils that cause contamination of groundwater leading to surface water exceedances
• SWSA 5 North 4 trenches	• Contain disposed materials • Meet RAO for the waste management use area	• Construct a cap to cover the 4 hilltop TRU waste burial trenches and adjacent soils to prevent water infiltration into the buried waste • Plug and abandon all unneeded shallow wells within the project area	• Verify that groundwater does not contact the buried waste through water level monitoring in and adjacent to the trenches after capping
Hydrofracture grout sheets	• Prevent inadvertent intrusion into the grout zone. Ensure land use controls are effective and maintained	• Institutional controls and monitoring	• Meet requirements of the Melton Valley LUCIP
Hydrofracture injection and monitoring wells • Wells	• Contain disposed materials • Meet RAO for the waste management use area	• Plug and abandon hydrofracture monitoring and injection wells, except wells designated for future monitoring • Plug and abandon selected additional deep wells using special plugging techniques	• Plug wells consistent with technical intent of TDEC UIC well plugging and abandonment standards (1200-4-6-.09(6)
Process Waste Sludge Basin (7835) • Pond • Inactive liquid waste transfer pipeline	• Remove disposed materials (performed as part of a CERCLA removal action) • Meet RAO for the waste management use area	• Remove liquid, sludge, PVC liner, and 1 ft of soil beneath the PVC liner • Plug both ends of the process liquid waste pipeline used to transfer waste from the Process Waste Treatment Plant (Bldg. 3544) to the Process Waste Sludge Basin	• Remove and properly dispose of pond liquid, sludge, pond liner, and 1 ft of soil beneath liner • Remove contaminated soils that cause contamination of groundwater leading to surface water exceedances
HRE Pond (7556) • Filled pond • Shallow well P&A	• Remove disposed materials • Meet RAO for the industrial use area	• Remove filled pond and contaminated soils that cause surface water criteria exceedances in the HRE tributary of Melton Branch (continue cryogenic containment until removal) • Plug and abandon all unneeded shallow wells within the project area	• Prevent releases from the HRE site from causing AWQC exceedances in the HRE tributary within 2 years after construction is complete • Reduce HRE area contaminant releases to surface water by approximately 80% to achieve hypothetical residential water use goal of 1×10^{-4} at the confluence with the Clinch River in ~10 years after all ROD actions are complete • Remove contaminated soils shallower than 10 ft or bedrock that cause contamination of groundwater leading to surface water exceedances (Sect. 2.11.7)
HFIR Waste Collection Basins • Ponds	• Remove disposed materials • Meet RAO for the industrial use area	• Remove and dispose of pond waters, sludges, and soils beneath and surrounding the ponds • Plug and abandon all unneeded shallow wells within the project area	• Remove and properly dispose of liquids, sludges, and soils beneath and around the HFIR Ponds • Prevent releases from the HFIR Ponds from causing AWQC exceedances in Melton Branch within 2 years after construction is complete • Remove a minimum of 1 ft of soil beneath the pond floor and sides • Remove any additional contaminated soils that cause contamination of groundwater leading to surface water exceedances (Sect. 2.11.7)

Table 2.17 (continued)

Unit type/ unit names project scope	Performance objectives	Selected remedy actions	Performance measure[a,b]
HRE Fuel Wells • Liquid seepage facility	• Immobilize disposed materials • Meet RAO for the waste management use area	• Grout wells	• Grout auger holes containing HRE fuel residue
Pits 2, 3, and 4 and Trench 6 • Liquid seepage pits • Inactive waste pipelines • Shallow well P&A	• Contain disposed materials • Meet RAO for the waste management use area	• Construct a cap to cover buried wastes in Seepage Pits 2, 3, and 4, and associated contaminated areas including inactive waste transfer pipelines within the project area • Construct a cap to cover buried wastes in Seepage Trench 6 and associated contaminated areas including inactive waste transfer pipelines in the project area • Construct barriers to surface water run-on, upslope stormflow intrusion into the site as needed, and downgradient contaminated groundwater seepage • Collect and treat all intercepted contaminated water to meet discharge requirements • Stabilize abandoned pipelines & trench backfill at cap boundaries • Design and construct all necessary water handling features to prevent erosional impacts to adjacent land and stream channel areas • Plug and abandon all unneeded shallow wells within the project area • Design and implement a monitoring system(s) for surface water and groundwater to demonstrate the performance of the remedial action components	• Prevent releases from Liquid Waste Seepage Pits 2, 3, and 4, and Trench 6 from causing AWQC exceedances in waters of the state within 2 years after construction is complete • Reduce groundwater throughflow in the contained area by >75% as measured by >75% decrease in water level fluctuations in selected monitoring locations inside the contained area
Trenches 5 and 7 • Liquid seepage trenches • Inactive waste pipelines • Shallow well P&A	• Immobilize disposed materials • Meet RAO for the waste management use area	• In situ vitrify Seepage Trench 5 and 7 to include total trench volume plus a minimum of 3 feet on each side • At Trench 7, construct hydraulic isolation components for contaminated soils at pipeline leak site • Stabilize abandoned pipelines & trench backfill at project area boundaries • Plug and abandon all unneeded shallow wells within the project area • Design and implement a monitoring system(s) for surface water and groundwater to demonstrate the performance of the remedial action components	• Prevent releases from Seepage Trenches 5 and 7 from causing AWQC exceedances in waters of the state within 2 years after ISV is complete • Vitrify any additional contaminated soils that cause contamination of groundwater leading to surface water exceedances (Sect. 2.11.7)
OHF, NHF, and MSRE and HRE ancillary facilities • Inactive buildings • Inactive pipelines	• Remove inactive facilities • Meet RAO for the industrial use area	• Remove contaminated contents of buildings for appropriate disposal. Demolish buildings to ground level (slab) as appropriate • Decontaminate and stabilize or remove subsurface structures as feasible • Plug waste transfer pipelines outside building foundation if not previously stabilized	• Remove and properly dispose of primary contaminant sources
Inactive waste transfer pipelines • Inactive pipelines outside hydraulically isolated areas	• Isolate, remove, or stabilize inactive waste transfer pipelines to prevent release of contaminants	• Above-ground inactive waste lines will be removed • Underground inactive waste lines that coincidentally lie underneath a multilayer cap will be cut at the edge of the cap and the pipe and trench backfill material will be plugged to ensure isolation from the connecting pipeline	• Prevent contaminants associated with inactive waste transfer pipelines from causing AWQC exceedances in waters of the state • Prevent contaminants associated with inactive waste transfer pipelines from causing human health risks to workers because of secondary contamination of soil

Table 2.17 (continued)

Unit type/ unit names project scope	Performance objectives	Selected remedy actions	Performance measure[a,b]
	• Meet RAO according to designated area use category (industrial or waste management area)	• The main stem waste transfer pipelines that do not lie under a multilayer cap will be stabilized (e.g. by grouting) except in cases where they are demonstrated to contribute to surface water criteria exceedances where they will be contained or removed • Remaining secondary waste pipelines will be isolated, stabilized, or removed	• Prevent groundwater from intruding into inactive waste transfer pipelines
Contaminated soils • Leak and spill sites not included in other specified actions • Other contaminated soil sites such as debris piles	• Meet RAO according to designated area use category (industrial or waste management area)	• Hydraulic isolation or removal, depending on exposure potential and contribution to groundwater/surface water contamination • In areas where shallow soil actions are required deeper contamination will be evaluated to determine if removal or containment is required to protect groundwater and surface water	• Remove contaminated surface soils outside capped or otherwise treated areas to established remediation levels based on area exposure scenario (industrial or waste management area)(Sect. 2.11.7) • Remove or contain contaminated soils that cause contamination of groundwater leading to surface water exceedances as appropriate
Surface water quality	• Meet TDEC numeric AWQC and narrative (risk-based) water quality criteria in all waters of the state for specified uses • Meet risk levels for hypothetical recreational water use (contact and consumption under the recreational exposure scenario)	• Hydraulic isolation of most contaminant source units with selected waste removal or in situ treatment. Collection and treatment of contaminated groundwater at boundaries of waste containment areas	• Achieve numeric AWQC and narrative (risk-based) water quality criteria in waters of the state within 2 years after completion of all actions that are part of the selected remedy. Meet recreation use criteria for water contact and consumption (excluding fish consumption) • Reduce contaminant releases to meet water quality conditions that would allow hypothetical residential use (risk level of 1×10^{-4} for water only – no fish consumption or sediment contact scenarios) at confluence with the Clinch River in ~10 years after completion of all ROD actions. Reductions in ^{90}Sr and tritium of 75-80% are required
Wastewater treatment facility	• Treat collected water to numeric and narrative AWQC requirements to meet RAO for surface water quality	• Construct and operate one or more wastewater treatment facilities to treat collected contaminated groundwater to levels consistent with watershed water quality goals	• Monitoring of the facility effluent to ensure compliance with numeric AWQC and narrative criteria instream will be used to determine the effectiveness of treatment • Discharge water will be treated to achieve 1×10^{-4} risk for ^{90}Sr (residential scenario = ~ 85 pCi/L)
WOL and WOC embayment • Lakebed and streambed sediment	• RAO for these units will be determined in a future CERCLA decision	• Impose land use controls (remediation of these units will be performed under a future CERCLA decision)	• Meet requirements of the Melton Valley LUCIPs

Table 2.17 (continued)

Unit type/ unit names project scope	Performance objectives	Selected remedy actions	Performance measure[a,b]
Floodplain soils, WOC, Melton Branch, tributaries, and Intermediate Holding Pond • Floodplain soils	• Remove the most highly contaminated floodplain soil to protect construction workers in adjacent areas	• Excavate floodplain soil in areas where gamma exposure measurements exceed 2500 μR/hour	• Walkover survey combined with verification soil sampling and analysis will be performed to verify post-excavation exposure rate <2500 μR/hour

[a] To meet a target post-remediation risk level of 1×10^{-4} for surface water under the residential scenario at the mouth of White Oak Creek an 80% reduction of risk from the sum of individual contaminants from combined sources in Melton Valley is required. This calculation includes anticipated reductions in surface water contaminant risk that originate in Bethel Valley. Reduction of releases from individual source areas in Melton Valley as a result of remedial actions may vary somewhat.

[b] For all remediated areas, post-construction surveillance and maintenance monitoring will be implemented, which includes inspection of cap integrity, proper functioning and maintenance of surface water and groundwater flow control features, and conformance with land use control requirements.

AWQC = ambient water quality criteria
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
> = greater than
HRE = Homogeneous Reactor Experiment
LUCIP = Land Use Implementation Plan
μR = mocroroentgen
OHF = Old Hydrofracture Facility
ORNL = Oak Ridge National Laboratory
% = percent
P&A = plugging and abandonment
RAO = remedial action objective
ROD = record of decision
Sr = strontium
SWSA = solid waste storage area
TDEC = Tennessee Department of Environment and Conservation
TRU = transuranic
UIC = underground injection control
WOC = White Oak Creek
WOL = White Oak Lake

concentration over the sampling period; therefore, an arithmetic average of the concentrations measured in the multiple samples is acceptable.

2.11.7.3.1 Remediation Levels for Surface Water

The three general surface water remediation goals are:

1. *Achieve AWQC in waters of the state.* White Oak Creek and Melton Branch are classified for Fish and Aquatic Life, Recreation, and Livestock Watering and Wildlife uses, but not for Domestic or Industrial Water Supply or Irrigation. All other named and unnamed surface waters in the watershed are also classified for Irrigation by default under the Rules of the TDEC Chapter 1200-4-4. Numeric AWQC and narrative criteria for the protection of human health (based on ELCR of 1×10^{-4} and HI less than 1 for recreational exposure scenario) and aquatic organisms will be met for site-related contaminants in all waters of the state in Melton Valley in ~10 years from completion of source actions in Melton Valley. Numeric AWQC exists for selected compounds under the Recreation and Fish and Aquatic Life Classifications. Consistent with EPA guidance, compliance with numeric AWQC for Recreation and Fish and Aquatic Life Classifications is sufficiently stringent to ensure protection of other uses for which there are narrative, but not numeric, criteria (i.e., Irrigation or Livestock Watering and Wildlife). A recreational risk scenario considered representative of the surface water classifications is used to calculate cumulative risk from measured concentrations of surface water contaminants or conversely to derive allowable concentrations from risk-based limits.

2. *Protect an off-site resident user of surface water.* This goal provides residential risk-based limits for surface water at the confluence of White Oak Creek with Clinch River. This goal will be met within 10 years from completion of actions in Melton Valley and Bethel Valley.

3. *Protect Clinch River to meet its stream use classification.* This goal protects Clinch River as a domestic water supply (i.e., meet SDWA MCLs) from contaminated surface water coming from Melton Valley.

Specific remediation levels are established for the first two surface water goals in this remedy (Table 2.18). It is expected that the actions under this ROD will make significant

Table 2.18. **Surface water remediation levels for the Melton Valley watershed, ORNL, Oak Ridge, Tennessee**

Melton Valley watershed	Goal: AWQC in waters of the state		Residential risk
	Numeric AWQC	Narrative AWQC/ recreational risk	
Receptor	Hypothetical recreational user; fish and aquatic life	Hypothetical recreational user	Hypothetical off-site resident
Areas affected	All waters of the state	All waters of the state	Confluence of White Oak Creek with Clinch River
Anticipated compliance locations	See Fig. 2.25	See Fig. 2.25	Confluence of White Oak Creek with Clinch River
Remediation level	Levels established in Rules of the TDEC Chapter 1200-4-3-.03	See Table 2.19	See Table 2.20
Exposure scenarios	NA (numeric criteria tabulated in regulation; no separate calculation using exposure scenarios needed)	Hypothetical recreational swimming for White Oak Lake and White Oak Creek Embayment; recreational wading for White Oak Creek, Melton Branch, and other waters of the state. The exposure scenarios do not take into account fish ingestion and sediment contact	Hypothetical residential (i.e., general household use)

AWQC = ambient water quality criteria
ELCR = excess lifetime cancer risk
HI = hazard index

progress to meeting the third goal, which will be addressed in a future ROD. Bethel Valley contributions to surface water exceedances will be taken into account in evaluating remedy effectiveness for Melton Valley.

AWQC in Waters of the State—Numeric AWQC. The numeric AWQC for (1) Fish and Aquatic life and (2) Recreation (organisms only) apply to waters of the state in Melton Valley and are tabulated in Rules of the TDEC Chapter 1200-4-3-.03 for most of the COCs. Compliance will be based on statistically valid data assessments, and take into account frequency of detection and data trends. The historic sampling locations for surface water monitoring are shown in Fig. 2.25. The sampling locations for the selected remedy will be finalized in a post-ROD sampling plan. The locations are generally at the downstream end of individual reaches but upstream of any confluence with other major streams. Samples taken from such locations would essentially integrate contamination entering the reach from any sources upstream of the sampling location.

AWQC in Waters of the State—Narrative Criteria. In accordance with EPA guidance, the CERCLA risk assessment process is used to address the narrative criteria for waters of the state. A recreational risk scenario considered representative of the surface water classifications is used to calculate cumulative risk from measured concentrations of surface water contaminants or conversely to derive allowable concentrations from risk-based limits. However, DOE does not reasonably foresee actual recreational use of Melton Valley surface water in the future.

Waters of the state containing COCs that do not have numeric AWQC will achieve an annual average ELCR less than 1×10^{-4} and an HI less than 1 for a recreational exposure scenario. This goal applies only to surface water and only to those contaminants of concern that do not have numeric AWQC, such as radionculides. The numeric AWQC for individual contaminants is generally equivalent to risk levels ranging up to 10^{-5}. The annual average risk goal of 1×10^{-4} meets the intent of the AWQC because when multiple contaminants are present in the surface water, as is likely, their individual risk levels would be roughly equivalent to the AWQC-equivalent risk of 10^{-5}. A lower risk goal could routinely require individual contaminant risks to be below the AWQC-equivalent risk of 10^{-5}.

Under this ROD, the recreational scenario is defined as a swimming scenario for the impounded water bodies, such as White Oak Lake and the White Oak Creek Embayment, and a wading scenario for streams such as White Oak Creek and Melton Branch. Since contaminated sediments are left in place under the remedy in this ROD, the swimming or wading scenarios do not include external exposure to or contact with sediment. Also, the scenarios do not include fish consumption because some contaminants in fish may be linked to contaminated sediments. Table 2.19 lists the remediation levels for the recreational surface water COCs identified in the FS. The historic sampling locations for surface water monitoring are shown in Fig. 2.25. The sampling locations for the selected remedy will be finalized in a post-ROD sampling plan.

Protection for Resident User of Surface Water. Remediation levels at the confluence of White Oak Creek with Clinch River will achieve an annual average ELCR less than 1×10^{-4} and an HI less than 1 for a residential exposure scenario (i.e., general household use). Samples to demonstrate compliance with these remediation levels may be taken from the White Oak Creek Embayment and/or White Oak Dam. Table 2.20 lists the remediation levels for the contaminants contributing to residential risk at White Oak Dam.

Table 2.19. Recreational risk-based surface water remediation concentrations for the Melton Valley watershed, ORNL, Oak Ridge, Tennessee

COCs identified in the FS[a]	Units	Reference concentration[b]	Minimum detection limit[c]	Concentrations based on a recreational swimming scenario[d] (for White Oak Lake and White Oak Creek Embayment)	Concentrations based on a recreational wading scenario[e] (for White Oak Creek, Melton Branch, and other waters of the state)
Arsenic	mg/L	ND	0.003	NA[f]	NA[f]
Tetrachloroethylene	mg/L	ND	0.001	NA[f]	NA[f]
Vinyl chloride	mg/L	ND	0.001	NA[f]	NA[f]
Cesium-137+D	pCi/L	40	10.0	4.69E+04	2.37E+05
Cobalt-60	pCi/L	ND	10.0	7.84E+04	3.92E+05
Radium-228+D	pCi/L	ND	0.5	5.97E+03	2.99E+04
Strontium-90+D	pCi/L	ND	2.0	2.65E+04	1.33E+05
Tritium	pCi/L	1,626	300	2.07E+07	1.04E+08
Uranium-234	pCi/L	ND	0.5	3.34E+04	1.67E+05

Note: The remediation levels are calculated at 1×10^{-4} ELCR or HI of 1 using standard risk assessment protocols for a swimming or wading scenario. These values apply to single contaminants only. To account for the total risk from multiple contaminants, sum of ratios calculations may be applied to all contaminants that are present above background. Actual remediation concentrations when multiple contaminants are present will therefore likely be lower than the single contaminant concentrations listed in the table. Concentrations for other site-related contaminants not listed in the table will be determined as necessary and in a manner similar to that followed above.

[a] Beryllium was identified as a COC in the FS but was not included here because EPA has since revised its position on the carcinogenicity of beryllium (see Table 2.5).

[b] Reference concentrations equal twice the arithmetic mean of the background; these concentrations were used for surface water analyte screening in the Melton Valley watershed risk assessment.

[c] The minimum detection limits are based on existing regulatory methodology and current laboratory instrument capabilities.

[d] The recreational swimming scenario assumes a 70-kg adult receptor, an exposure frequency of 45 hours/year, an exposure duration of 30 years, an ingestion rate of 0.05 L/hour, and a skin surface area (for dermal exposure) of 1.94 m^2.

[e] The recreational wading scenario assumes a 70-kg adult receptor, an exposure frequency of 45 hours/year, an exposure duration of 30 years, an ingestion rate of 0.01 L/hour, and a skin surface area (for dermal exposure) of 0.632 m^2.

[f] Risk-based concentrations to meet the narrative criteria were not derived for these COCs since numeric AWQC exists for them.

COC = contaminant of concern
ELCR = excess lifetime cancer risk
FS = feasibility study
HI = hazard index
L = liter

Table 2.20. Residential risk-based surface water remediation concentrations for the Melton Valley watershed, ORNL, Oak Ridge, Tennessee

Contaminants at White Oak Dam[a]	Units	Reference concentration[b]	Minimum detection limit[c]	Concentrations based on a residential scenario[d] (for White Oak Creek Embayment and/or White Oak Dam)
Arsenic	mg/L	ND	0.003	0.0056
Chloroform	mg/L	ND	0.001	0.021
1,2-dichloroethane	mg/L	ND	0.001	0.016
PCBs	mg/L	ND	0.001	0.011
Cesium-137+D	pCi/L	40	10.0	150
Cobalt-60	pCi/L	ND	10.0	250
Strontium-90+D	pCi/L	ND	2.0	85
Tritium	pCi/L	1626	300	58,000

Note: The remediation levels are calculated at 1×10^{-4} ELCR or HI of 1 using standard risk assessment protocols for a general household use scenario. These values apply to single contaminants only. To account for the total risk from multiple contaminants, sum of ratios calculations may be applied to all contaminants that are present above background. Actual remediation concentrations when multiple contaminants are present will therefore likely be lower than the single contaminant concentrations listed in the table. Concentrations for other contaminants not listed in the table will be determined as necessary and in a manner similar to that followed above.

[a] Beryllium was identified as a COC in the FS but was not included here because EPA has since revised its position on the carcinogenicity of beryllium (see Table 2.5). Also, some of these contaminants have SDWA MCLs. The selected remedy will make progress toward protecting Clinch River as a drinking water source (i.e., meet SDWA MCLs).

[b] Reference concentrations equal twice the arithmetic mean of the background; these concentrations were used for surface water analyte screening in the Melton Valley watershed risk assessment.

[c] The minimum detection limits are based on existing regulatory methodology and current laboratory instrument capabilities.

[d] The residential scenario assumes a 70-kg adult receptor, an exposure frequency of 350 days/year, an exposure duration of 30 years, an ingestion rate of 2 L/day, and a skin surface area (for dermal exposure) of 1.94 m^2.

COC = contaminant of concern
ELCR = excess lifetime cancer risk
HI = hazard index
kg = kilogram
mg = milligram
L = liter
m = meter
ND = not detected or analyzed
pCi = picocurie
SDWA = Safe Drinking Water Act of 1974

2.11.7.3.2 Remediation levels for soils

The following goals directly impact soil remediation levels:

- Protect maintenance workers, industrial workers, and hypothetical recreational users. Protection of the hypothetical recreational user is only partially addressed by the remedy and will be fully addressed in a subsequent ROD.

- Control releases from contaminated soil to reduce surface water exceedances and minimize further groundwater impacts.

The soil remediation levels discussion uses the following terms:

- Exposure unit—an area over which compliance with the remediation levels would be demonstrated or verified after remediation has been completed. The exposure unit is representative of the general areal extent of a receptor's movements for a designated period of time (i.e., exposure duration).

- Average remediation level—a risk (or equivalent) limit not to be exceeded by the total, aggregate risk (or equivalent) calculated for the exposure unit. The risk limit would lie within EPA's acceptable risk range of 10^{-6} to 10^{-4}. The aggregate risk (or equivalent) calculated for the exposure unit would be based on non-biased data and appropriate statistical principles; MARSSIM will be used as a resource in determining protocols for gathering and analyzing data.

- Maximum remediation level—a risk (or equivalent) limit not to be exceeded by the risk (or equivalent) determined for any particular location or hotspot (e.g., small contaminated surface area) within the exposure unit.

Contaminated soil within an exposure unit will be remediated such that the residual exposure unit risk is at or below the corresponding average remediation level, and the maximum soil risk is at or below the corresponding maximum remediation level. The soil remediation levels will be achieved upon completion of all remediation identified in this ROD. Given that the principal COCs are gamma emitters, characterization and verification protocols will maximize use of direct-reading field instruments (e.g., radiation walkovers, in situ gamma measurements) and limit sampling to the extent practicable.

Derivation of radionuclide concentrations to meet a specified risk limit in soil will consider both radioactive decay and ingrowth of daughter radionuclides over the exposure duration. The rate of radioactive decay is a fixed physical characteristic of each radionuclide. The simplistic assumption in risk calculations that the receptor is always exposed to a constant radionuclide concentration in soil over the entire exposure duration would be excessively conservative, and depending on the radionuclide, could result in a derived remediation level that corresponds to a risk level far below the risk limit. Therefore, decay will be included in the risk calculations. Similarly, any ingrowth of radioactive decay products over time will be included, particularly for cases where radioactive daughter products are more radiotoxic than the parent radionuclide, to ensure that the receptor would be protected to the selected risk limit.

Soil remediation levels were determined for each of three Melton Valley remediation areas: the industrial area, the waste management area, and the floodplain area (Fig. 2.11). Table 2.21 summarizes soil remediation levels for each of these remediation areas.

Table 2.21. Soil remediation levels for the Melton Valley watershed, ORNL, Oak Ridge, Tennessee

Melton Valley area	Industrial area (eastern portion of Melton Valley containing reactor sites)	Waste management area (western portion of Melton Valley containing disposal sites)	Floodplain area
Number of exposure units	4 units (see Fig. 2.27)	1 unit (see Fig. 2.27)	NA
Receptors	Industrial worker	Maintenance worker	Near-term construction worker in adjacent areas; hypothetical recreational user
Exposure frequency	2000 hours/year	2000 hours/year, of which 30 percent (or 600 hours/year) is on uncapped areas	NA
Target contaminants	All significant COCs (predominantly ^{137}Cs and ^{60}Co)	All significant COCs (predominantly ^{137}Cs and ^{60}Co)	Gamma emitters such as ^{137}Cs and ^{60}Co
Average remediation level not to be exceeded for the exposure unit	ELCR = 1×10^{-4}, HI = 1, and EDE = 25 mrem/year	ELCR = 1×10^{-4}, HI = 1, and EDE = 25 mrem/year (see table note below)	NA
Concentrations corresponding to average remediation level	See Table 2.22 for concentrations	See Table 2.22 for concentrations	NA
Maximum remediation level not to be exceeded at individual locations	Ten times the average remediation level (assumes an acute exposure to a receptor of 200 hours/year)	The maximum does not apply to capped areas. For the uncapped area, the maximum is 30 times the average remediation level (this assumes an acute exposure to a receptor of 60 hours/year in the uncapped area; see table note below)	2500 μR/hour
Maximum depth of remediation	Generally 10 ft; 2 ft in source-related areas that are closed in place. Soils causing surface water exceedances will be excavated down to the groundwater table	2 ft. Soils causing surface water exceedances will be excavated down to the groundwater table	Depth of deposited floodplain soils

Note: The waste management area consists of capped (or covered) areas and uncapped areas. The reasonably maximally exposed maintenance worker is expected to spend 70 percent of the exposure frequency of 2,000 hours per year on the capped areas and 30 percent on the uncapped areas. Compliance with the average remediation level will take into account this partitioning of the exposure frequency. For example, the cancer risk limit of 1×10^{-4} will equal the sum of the aggregate risks from the capped and uncapped areas, weighted by the fraction of time spent by the worker in each area:

1×10^{-4} ELCR = (0.7) (aggregate risk for capped area) + (0.3) (aggregate risk for uncapped area).

Assuming that the aggregate risk for the capped area is approximately 1.5×10^{-5} (background risk), then the aggregate risk for the uncapped area would not exceed 3×10^{-4}. The maximum remediation level for the uncapped area would be 3×10^{-3}. This is a factor of 10 above the aggregate risk limit of 3×10^{-4} for the uncapped area, or a factor of 30 above the average remediation level of 1×10^{-4} for the entire exposure unit.

COC = contaminant of concern
Co = cobalt
Cs = cesium
EDE = effective dose equivalent
ELCR = excess lifetime cancer risk
HI = hazard index
mrem = millirem
NA = not applicable

Industrial Area. One of the two remediation areas designated for industrial use is located in the eastern portion of Melton Valley; the other is located to the south of the confluence of White Oak Creek and Melton Branch. The inactive HRE and MSRE facilities and the operating HFIR facility are located in the eastern area. The intent of remediation in these areas is to protect the industrial worker, improve surface water quality, and minimize impacts to groundwater. Although the remediation levels will be met upon completion of all remediation identified in this ROD, industrial use would not actually be considered for implementation by DOE until after the HRE and MSRE are decommissioned under a separate ROD, and the HFIR is decommissioned. DOE-imposed access controls would continue to be used in the intervening period to protect the DOE worker.

The four exposure units shown in Fig. 2.27 have been defined for the hypothetical industrial worker (exposure frequency of 2000 hours/year) in the industrial area. One exposure unit covering 35 acres contains the inactive HRE and MSRE facilities; another covering 40 acres contains the active HFIR facility; a third covering 60 acres contains Hydrofracture Experimental Site 2 (HF-2), the Contractor Spoils Area, and wooded land; and a fourth covering 6 acres contains the NHF.

At the completion of all remediation identified in this ROD, the residual aggregate risk within an exposure unit in the industrial area will not exceed the average remediation level of 1×10^{-4} ELCR and an HI of 1. The exposure unit risk limit of 1×10^{-4} ELCR was established at a level slightly higher than the estimated background risk of approximately 1.5×10^{-5} ELCR, the lowest risk level technically feasible. An additional limit that must not be exceeded for radionuclide COCs is the effective dose equivalent of 25 mrem/year (ARARs-based limit). The maximum remediation level for any individual location within the exposure unit is set at 10 times the average remediation level.

The predominant COCs for this remediation area are ^{137}Cs and ^{60}Co, which are estimated to contribute approximately 4.3 percent and 95.6 percent of the total excess cancer risk respectively. The relative percentage of ^{137}Cs and ^{60}Co is skewed for the industrial area because of the higher proportion of ^{60}Co detected in the HFIR Ponds. As indicated in Table 2.22, soil remediation levels for these primary COCs are 14 pCi/g for ^{137}Cs and 7.4 pCi/g for ^{60}Co. These soil concentrations can be correlated with an area-averaged external exposure rate measurement of approximately 5 or 13 μR/hour, respectively. Remediation will be conducted to achieve the acceptable residual risk from all COCs. Attainment of remediation criteria will be verified based on statistical sampling and analysis protocols to be further specified during remedial design. In situ gamma measurements may be used to support verification.

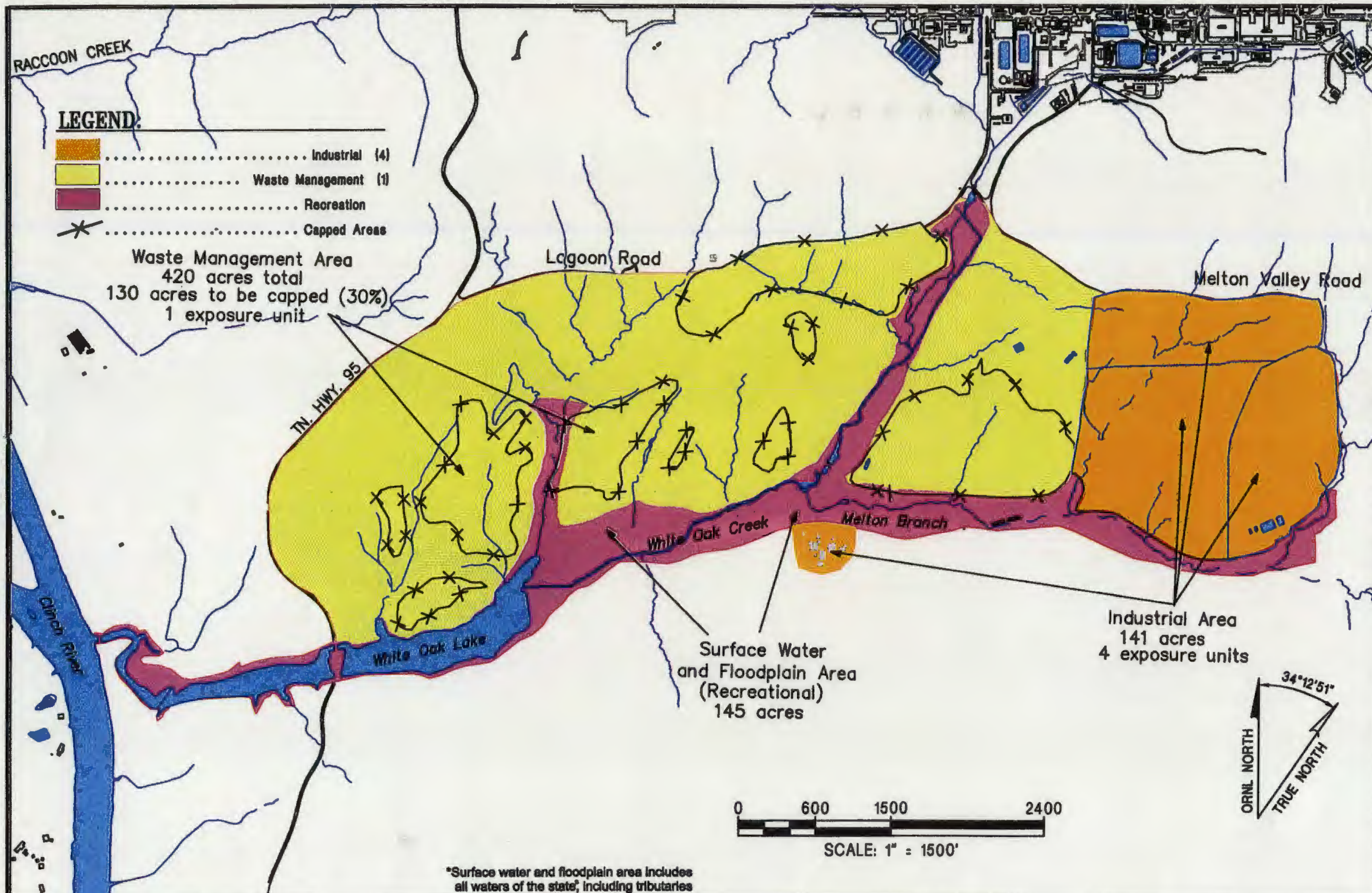


Fig. 2.27	**Exposure units for Melton Valley watershed** DOE - ORNL, Melton Valley watershed - Oak Ridge, Tennessee	DOCUMENT ID: 35T080 0089-20/ ROD	DRAWING ID: 00-18706.DWG	DRAWING DATE: August 14, 2000 WaM

Table 2.22. Soil remediation concentrations that correspond to the average remediation level for the industrial and waste management areas in the Melton Valley watershed, ORNL, Oak Ridge, Tennessee

Principal soil COCs[a]	Units	Reference concentration[b]	Minimum detection limit[c]	Risk-based remediation concentration[d] (1×10^{-4} ELCR)	Dose-based remediation concentration[e] (25 mrem/year)	Alternate remediation concentration[f]	Selected remediation concentration[g]	Basis of selected remediation Concentration[g]
Arsenic	mg/kg	12.5	0.5	330	NA	NA	330	Risk-based
Aroclor 1260	mg/kg	ND	0.02	47	NA	NA	47	Risk-based
Cesium-137	pCi/g	1.53	1.0	14	40	NA	14	Risk-based
Cobalt-60	pCi/g	ND	1.0	7.4	8.4	NA	7.4	Risk-based
Curium-244	pCi/g	ND	1.0	2300	950	NA	950	Dose-based
Europium-154	pCi/g	ND	1.0	11	18	NA	11	Risk-based
Lead-210	pCi/g	ND	1.0	450	270	NA	270	Dose-based
Radium-226	pCi/g	1.19	0.5	NA	NA	5[g]	5	Alternate
Radium-228	pCi/g	ND	0.5	NA	NA	5[g]	5	Alternate
Strontium-90[h]	pCi/g	1.1	1.0	1200	3400	NA	1200	Risk-based
Thorium-228	pCi/g	1.69	1.0	NA	NA	5[g]	5	Alternate
Thorium-232	pCi/g	1.89	1.0	NA	NA	5[g]	5	Alternate
Uranium-233	pCi/g	ND	1.0	5100	5500	NA	5100	Risk-based
Uranium-234	pCi/g	ND	1.0	6500	6000	NA	6000	Dose-based
Uranium-235	pCi/g	ND	1.0	81	170	NA	81	Risk-based
Uranium-238	pCi/g	ND	1.0	310	850	NA	310	Risk-based

Note: These values apply to single contaminants only. To account for the total risk or dose from multiple contaminants, sum-of-ratios calculations may be applied to all site-related contaminants that are present above background. Actual remediation concentrations will therefore likely be lower than the concentrations listed in the table. Concentrations for other contaminants not listed in the table will be determined as necessary and in a manner similar to that followed above. Exceptions are contaminants such as radium that have a remediation concentration similar to that in DOE Order 5400.5, "Radiation Protection of the Public and the Environment." These alternative concentrations are commonly used by EPA.

[a] COCs identified in the RI but not listed here include beryllium, cesium-134, cobalt-57, potassium-40, and sodium-22. (These analytes also were not included in the background risk estimate of 1.5×10^{-5} ELCR.) Beryllium was excluded from the table because EPA has reevaluated its carcinogenicity and eliminated its slope factor for ingestion. Potassium-40 was excluded because it is considered to be naturally occurring (the maximum value detected was within the concentration range for the country). Cesium-134, cobalt-57, and sodium-22 were excluded because they have half-lives of 2 years or less and were identified in the RI as a COC for only one subbasin.

[b] The reference concentration is the 95th tolerance limit of the background.

[c] The minimum detection limits are based on existing regulatory methodology and current laboratory instrument capabilities.

Table 2.22 (continued)

[d] The risk-based remediation levels for the nonradionuclides are calculated at 1×10^{-4} ELCR using standard risk assessment protocols for an industrial scenario: a 70-kg adult receptor, an exposure frequency of 250 days/year, an exposure duration of 25 years, an inhalation rate of 20 m^3/day, an ingestion rate of 0.00005 kg/day, and a skin surface area of 0.316 m^2. The risk-based remediation levels for the radionuclides are calculated at 1×10^{-4} ELCR using the RESRAD computer code. RESRAD used input parameters constrained to mimic the standard risk assessement algorithms and parameters with the addition of radioactive decay and ingrowth.

[e] The dose-based remediation concentration is calculated using the RESRAD computer code assuming 25 mrem/year.

[f] The alternate concentration limit of 5 pCi/g above background for the radium and thorium isotopes is applied over the exposure unit and to the established depth of remediation. Otherwise, the concentration limit is applied as in the DOE Order 5400.5 The radium and thorium isotopes are not included in the aggregate risk calculation for the exposure unit. (The radium and thorium isotopes also were not included in the background risk estimate of 1.5×10^{-5} ELCR.)

[g] The remediation concentrations are the lower of the risk-based or dose-based concentrations. Alternate concentrations are used for radium and thorium.

[h] The strontium-90 remediation level does not apply to strontium titanate. A separate remediation level will be established for strontium titanate if further (post-ROD) characterization of the industrial area indicates that strontium titanate is a contaminant of concern.

ARAR = applicable or relevant and appropriate requirement
COC = contaminant of concern
DOE = U.S. Department of Energy
ELCR = excess lifetime cancer risk
EPA = U.S. Environmental Protection Agency
g = gram
kg = kilogram
mg = milligram
mrem = millirem
NA = not applicable
ND = not detected or analyzed
pCi = picocurie
RI = remedial investigation
RESRAD = Residual Radioactivity Mode

In Table 2.22, the radium and thorium isotopes are exceptions to the general risk- or dose-based approach in that they have alternate concentration-based remediation levels of 5 pCi/g above background and are not included in demonstrating compliance with the risk limit of 1×10^{-4} ELCR. This alternate concentration limit is commonly used by EPA and DOE and has been implemented in various forms at numerous sites across the country containing radium or thorium as COCs. Sampling data for the Melton Valley watershed indicates that ^{228}Ra was detected much more frequently than ^{226}Ra. Based on an industrial exposure scenario, a 5 pCi/g concentration of ^{228}Ra (and ^{232}Th, the parent of ^{228}Ra that is in equilibrium with ^{228}Ra) equates to 2×10^{-4} ELCR. Adding this incremental risk to the remediation level of 1×10^{-4} ELCR for the other COCs gives a total of 3×10^{-4} ELCR. This total risk is consistent with levels generally considered protective in governmental actions, particularly regulations and guidance developed by EPA in its radiation control programs. Risk levels higher than 3×10^{-4} are generally not used to establish remediation levels under CERCLA (EPA 1997).

The goal for the industrial area is to have vadose-zone soils clean to a 10 ft depth except in areas where the remedy allows known subsurface source units or associated secondary contaminated media to remain in place (e.g., pipeline corridors, reactor ancillary facilities, secondary contamination resulting from pipeline leaks or ancillary facilities). Areas suspected of being uncontaminated (based on available data or process knowledge) will at a minimum be verified as such through use of walkover surveys. These areas will be assumed to be clean if no surface debris or contamination above the remediation levels is found from the walkover surveys. The need for any further verification (e.g., sampling and analysis) will be established during design and evaluated through review of the walkover surveys. Contamination in source-related areas will be remediated to a maximum depth of 2 ft unless the remedy requires otherwise for specific units (see Appendix A), or unless deeper contaminated soils exist that are causing surface water exceedances.

The average remediation level will be assessed against the residual exposure unit risk (or equivalent) for both (1) surface soil (0- to 6-in. depth) and (2) all soil to the prescribed cleanup depth (0 to 10 ft generally; 0 to 2 ft above source units closed in place). The maximum remediation level will be assessed against the residual risk (or equivalent) for (1) contaminated surface soils having an area greater than 1 m^2 and a depth of 0 to 6 in., (2) subsurface soil over the depth interval of 6 in. to 2 ft, and (3) subsurface soil over the depth interval of 2 ft to 10 ft. To facilitate these assessments, soil sampling to verify cleanup will be based on composites over the following depth intervals: 0 to 6 in., 6 in. to 2 ft, and 2 ft to 10 ft. The basis for selecting the latter two intervals are hypothetical construction scenarios where 2-ft or 10-ft excavations are performed and the excavated material is spread over the ground surface.

As mentioned in "Uncertainties" (Sect. 2.11.4), additional work will be performed under the selected remedy to characterize the amount of strontium titanate that is present in soils within the industrial area. In conjunction with walkover surveys for other significant COCs, a statistically-based sampling protocol for strontium-titanate will be implemented for selected portions of the industrial area. Because strontium titanate poses some significant challenges with respect to field detection and sampling and analysis, the sampling protocol will be reviewed and approved by the regulators. A preliminary risk assessment model has been developed to evaluate the potential risk to humans from inhaling this contaminant. Any concentration-based remediation level for strontium titanate is expected to be significantly higher than that for ^{90}Sr because of the unique physical and chemical characteristics of strontium titanate. A remediation level for strontium titanate will be determined, as needed, before or during remediation of the industrial area.

During soil removals, soil in the excavation floors and wall will be characterized to determine whether the contaminant levels meet the specified remediation levels for worker protection. Based on the characterization data, the potential for residual soils to cause surface water exceedances will be assessed. The assessment will be performed as outlined in Appendix C "Soil Cleanup to Protect Surface Water Quality." If contaminated soils at soil removal sites pose a threat of causing surface water exceedances, further actions will be taken under this ROD such as additional soil removal, treatment, or containment depending on the analyses of effectiveness, implementability, and cost. If the soil remediation significantly changes the expected scope, performance, or cost of the remedy, this remediation will be evaluated and documented as a post-ROD change in accordance with the NCP.

Waste Management Area. The remediation area designated as waste management is located in the western portion of Melton Valley (Fig. 2.11). This area contains burial grounds and seepage pits and trenches.

The intent of remediation in this area is to protect the maintenance worker, improve surface water quality, and minimize impacts to groundwater and the ecology. Access for this remediation area will continue to be restricted, and exposures for workers will continue to be controlled through a radiological exposure protection program.

One exposure unit has been defined for the maintenance worker in the waste management area. As shown in Fig. 2.27, this exposure unit is identical in size and boundary to the waste management area, which covers approximately 420 acres. The areas to be capped comprise approximately 130 acres or 30 percent of the total waste management area acreage.

The exposure frequency of the maintenance worker within this exposure unit is 2000 hours/year. Of this 2000 hours, it is anticipated that 90 percent of the time (1800 hours) will be spent on capped or covered areas performing primarily vegetation control, subsidence repair, and inspections. The remaining 10 percent (or 200 hours) will be on uncapped or uncovered areas performing activities such as road maintenance, fence/gate inspection and repair, and environmental monitoring. This anticipated partitioning is based on the much greater maintenance worker occupancy requirements for the capped areas. However, to be conservative in its cleanup and provide a greater degree of protectiveness, DOE has elected to assume that the maintenance worker spends 70 percent of the work time (or 1400 hours/year) on the capped areas and 30 percent of the work time (or 600 hours/year) on the uncapped areas. Surface water monitoring or inspections of facilities in the surface water and floodplain soil area is not included in the exposure frequency partitioning because the surface water and floodplain soil area is a separate exposure unit.

The average remediation level for the waste management area is identical to that for the industrial area. At the completion of all remediation identified in this ROD, the residual aggregate risk within the waste management area will not exceed the average remediation level of 1×10^{-4} ELCR and an HI of 1. In calculating the residual aggregate risk for the exposure unit, the amount of time spent by the maintenance worker on capped areas (1400 hours/year) and uncapped areas (600 hours/year) will be considered. An additional limit that must be met for radionuclide COCs is the effective dose equivalent of 25 mrem/year (ARARs-based limit). The predominant contaminants of concern for the waste management area are ^{137}Cs and ^{60}Co, which are estimated to contribute approximately 66.2 percent and 33.6 percent of the total excess cancer risk, respectively. The allowable average concentrations of these primary contaminants are shown in Table 2.22.

The maximum remediation level for any individual location or hot spot in the uncapped areas of the waste management exposure unit is set at 30 times the average remediation level. This factor of 30 is higher than the factor applied to the industrial area because the receptor spends comparatively little time in the uncapped areas.

Areas suspected of being uncontaminated (based on available data or process knowledge) will at a minimum be verified as such through use of walkover surveys. These areas will be assumed to be clean if no surface debris or contamination above the remediation levels is found from the walkover surveys. The need for further verification (e.g., sampling and analysis) will be established during design and evaluated through review of the walkover surveys.

Contaminated soil in the waste management area will be excavated to a depth sufficient to protect the maintenance worker to the specified remediation levels; the depth of excavation normally will not exceed 2 ft.

The average remediation level will be assessed against the residual exposure unit risk (or equivalent) for both (1) surface soil (0- to 6-in. depth) and (2) all soil to the maximum cleanup depth (0 to 2 ft maximum). The maximum remediation level will be assessed against the residual risk (or equivalent) for (1) contaminated surface soils having an area greater than 1 m^2 and a depth of 0 to 6 in., (2) subsurface soil over the depth interval of 6 in. to 2 ft maximum. To facilitate these assessments, soil sampling to verify cleanup will be based on composites over the following depth intervals: 0 to 6 in. and 6 in. to 2 ft maximum.

During soil removals, soil in the excavation floors and wall will be characterized to determine whether the contaminant levels meet the specified remediation levels for worker protection. Based on the characterization data, the potential for residual soils to cause surface water exceedances will be assessed. The assessment will be performed as outlined in Appendix C: "Soil Cleanup to Protect Surface Water Quality." If contaminated soils at soil removal sites pose a threat of causing surface water exceedances, further actions will be taken under this ROD such as additional soil removal, treatment, or containment depending on the analyses of effectiveness, implementability, and cost.

Floodplain Area. Remedial measures for the floodplain area are limited to the removal of areas of highly elevated contamination in the floodplain soils that could present an unacceptable risk to construction workers in adjacent areas and workers engaged in surveillance and maintenance activities. These measures also make progress toward protecting the hypothetical recreational user. Final remediation criteria for floodplain soils and sediments are deferred to a future ROD. Access to the area will continue to be restricted, and the area will be maintained under institutional controls as long as unacceptable risks remain.

The primary contaminants of concern for this remediation area are ^{137}Cs (estimated to contribute 91 percent of the total ELCR) and ^{60}Co (estimated to contribute 8 percent of the total cancer risk). An external exposure rate measurement of 2500 μR/hour is adopted as the maximum remediation level or trigger level for remedial action in this area; floodplain soils will be remediated only at locations that exceed the 2500 μR/hour trigger level. Excavations of floodplain soil will be performed to the depth of deposited material. Removal of streambed sediments could also occur if the streambed borders or traverses the floodplain soils being removed.

While the determination of final remediation criteria for this area is deferred to a future ROD, it is estimated that residual risk following completion of these remedial actions will be within the acceptable risk range at the conclusion of approximately 170 years based on a recreational land use scenario. It is recognized that the remediation level of 2500 μR/hour presents some uncertainties from potential ecological impacts. It is intended that these uncertainties will be addressed in the future decision for this area.

2.12 STATUTORY DETERMINATIONS

Under CERCLA, Sect. 121, selected remedies must protect human health and the environment, comply with ARARs (unless a statutory waiver is justified and granted), be cost-effective, and use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practical. In addition, CERCLA includes a preference for remedies that use treatments as their principal elements that significantly and permanently reduce the volume, toxicity, or mobility of hazardous wastes. The following sections discuss how the selected remedy meets those statutory requirements.

2.12.1 Overall Protection Of Human Health and the Environment

The selected remedy would protect human health under expected land use scenarios through a combination of waste removal, treatment, containment, and land use control activities. Because significant inventories of contaminated materials would remain in Melton Valley, this approach requires restrictions to be placed on the future use of the valley. These restrictions are necessary to ensure protection of current and potential receptors. These receptors include maintenance workers who are protected in the waste management area containing the major SWSAs and industrial workers who are protected in the industrial area east of SWSA 5. Until final decisions are made concerning remediation of the remaining contamination in Melton Valley, LUCs will be used to preclude access that may result in unacceptable exposures.

The selected remedy will reduce contaminant contributions to groundwater in Melton Valley. Additionally, the selected remedy will reduce the Melton Valley watershed contribution to surface water contamination migrating off site. Assuming the selected remedy is effective, and assuming the current inflow from Bethel Valley does not change (i.e., no remediation in Bethel Valley occurs), approximately 20 to 25 years of radioactive decay will be required before acceptable residential risk levels are met in surface water at the confluence of White Oak Creek with Clinch River (Table 2.10). If the Bethel Valley remediation achieves its proposed goal of at least 45 percent risk reduction in surface water, acceptable residential risk at the confluence will be achieved much sooner, ideally within 10 years of the completion of remedial actions. The 10-year period provides a reasonable margin to account for adequate flushing of secondary contaminated media and the uncertainty with regard to remedy effectiveness for controlling tritium releases.

The selected remedy enhances the overall protection of valleywide ecological populations. The selected remedy also ensures the protection of subbasin-level populations over the majority of the valley. However, there are portions of the valley (such as various sediment floodplain areas) where potential unacceptable risks exist that are not addressed by the selected remedy, either through direct actions or through radioactive decay. While DOE believes that these populations are not actually at risk, the selected remedy requires additional data collection and evaluation to assess the status of ecological receptors in these areas and to ensure their protection. Additional data collection and evaluation are preferred over the excavation of contaminated sediments and soils, which would damage a larger area of the aquatic and floodplain ecosystems.

2.12.2 Compliance with ARARS

The selected remedy meets those ARARs (listed and described in Appendix B of this ROD) related directly to implementing the remedial actions selected in this ROD. Specifically, upon completion of all actions included in the selected remedy, numeric AWQC for Recreation and Fish and Aquatic Life use classifications and narrative criteria for Recreation, Fish and Aquatic Life, Irrigation, and Livestock Watering and Wildlife use classifications will be met in all surface waters located in Melton Valley. The selected remedy makes significant progress in reducing contamination and risks present in Melton Valley. However, the remedy may not achieve all ARARs that would be required of a final cleanup plan for all contamination in Melton Valley. Because the selected remedy is considered interim, a future decision will be required to complete this project and demonstrate compliance with appropriate ARARs. Upon completion of the cleanup actions implemented pursuant to this ROD, DOE, TDEC, EPA, and the public may determine that additional actions (i.e., additional excavation or containment) are warranted to achieve final remediation goals. However, it may also be determined that the monitored natural attenuation of radionuclides combined with land use restrictions will meet final remediation goals in an acceptable manner. These determinations will be documented as part of the future decision.

The selected remedy achieves progress towards meeting MCLs for radionuclides at the confluence of White Oak Creek with the Clinch River, which is designated for domestic water supply. The need for additional actions to meet MCLs in this area will be decided and documented in a future final decision. The ability to meet MCLs is dependent on the effectiveness of the actions selected in this ROD as well as actions being developed for Bethel Valley. If no additional actions are implemented pursuant to a future decision, the concentration of contaminants being released to Clinch River will be reduced through radioactive decay so that in ~100 years the SDWA standards would be met at the confluence of White Oak Creek with the Clinch River (Table 2.10).

Excavation of floodplain soils exhibiting dose rates of greater than 2500 μR/hour removes highly contaminated portions of the White Oak Creek system. This action represents an interim action because decisions on the remaining contaminated portions of the floodplain soils and sediments are being deferred to a future final decision. LUCs will be maintained to ensure protectiveness until this future decision is made.

Groundwater in Melton Valley exceeds MCLs for VOCs and radionuclides in many areas. However, groundwater is deferred to a later decision document. Following completion of all source actions in Melton Valley, a final groundwater decision will be made. Depending on the classification of the groundwater, remediation goals will include restoring groundwater to meet any corresponding criteria (both numeric and narrative) that are considered ARAR.

For hydraulic isolation activities, the primary ARARs are the TDEC LLW disposal site closure and postclosure care requirements and RCRA closure requirements. The proposed multilayer caps for all areas will be designed to meet these ARARs.

2.12.3 Cost-Effectiveness

The selected remedy is cost-effective because it meets the following definition: "A remedy shall be cost-effective if its costs are proportional to its overall effectiveness" [40 CFR 300.430(f)(1)(ii)(D)]. In evaluating the remedial actions chosen from the FS to become the selected remedy, DOE followed additional guidance found in the preamble to the NCP, which states that decision makers should compare "the cost to effectiveness of each alternative individually and the cost and effectiveness of alternatives in relation to one another" (55 FR 8728). The more aggressive alternatives evaluated in the FS (Alternatives 5 and 6) cost on the order of $100 million to $1 billion more than the selected remedy and would have added little additional risk reduction (see Table 2.10). The selected remedy costs more than the less aggressive alternatives (Alternatives 2, 3, and 4), but its overall effectiveness is comparable to that of the most expensive alternatives. The level of effectiveness of the selected remedy, which DOE believes to be appropriate, is achieved by using comprehensive source containment with limited removal and in situ treatment in selected areas. Focusing removal and in situ treatment on selected areas helps to limit costs while maintaining high overall effectiveness.

Hydraulic isolation is considered cost-effective. It represents one-half of the total capital cost of the remedy, but it addresses the major watershed sources that contain approximately 35 percent of the waste inventory and contribute approximately 75 percent of the releases to surface water. Periodic maintenance and repair will be required to ensure continued adequacy of the action. However, hydraulic isolation in combination with land use controls and proper maintenance is expected to be reliable to a high degree of confidence. Changes in flow patterns and local hydrology caused by the hydraulic isolation could alter floodplains, wetlands, and other aquatic habitats, but the long-term effect is expected to be minimal. Water treatment of the groundwater collected from the downgradient collection drains will provide a reduction in contaminant mobility.

In situ vitrification, another major component of the remedy, is also considered cost-effective. It represents approximately 17 percent of the total capital cost, but performs a surgical strike on two high-inventory trenches containing a total of 460,000 Ci (1996 inventory). The vitrified wastes would last for geologic periods. Although most of the fission products will have decayed after several hundred years, the glass matrix will continue to immobilize any long-lived actinides. Given that the trenches are located above the groundwater table, the probability of potential melt disruptions and off-gas pressurizations during vitrification should be minimal.

2.12.4 Use of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The selected remedy provides the best balance of trade-offs among the alternatives with respect to the evaluation criteria, such that it represents the maximum extent to which permanent solutions can be practically used for the Melton Valley watershed. Of the remediation alternatives considered, the selected remedy provides the best balance of trade-offs in terms of long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost.

The selected remedy includes several components that DOE believes constitute permanent solutions. ISV is considered effective for extremely long periods of time, as is in situ grouting (HRE Fuel Wells) to a lesser extent. Removal of waste (e.g., HFIR impoundments) and contaminated soils (e.g., certain floodplain soils) are also considered permanent solutions. A primary component of the selected remedy is hydraulic isolation with its associated cap maintenance, water treatment, and LUCs. It was deemed impracticable to remove or permanently treat these waste areas.

2.12.5 Preference for Treatment as a Principal Element

CERCLA, Sect. 121, establishes a preference for alternatives that use treatment to permanently reduce toxicity, mobility, or volume of hazardous substances. The selected remedy will use ISV to treat two high activity trenches in the Seepage Pits and Trenches Area, in situ grouting to treat the HRE Fuel Wells, and water treatment for contaminated wastewater collected in downgradient collection drains. Thus the statutory preference for treatment as a principal element is satisfied with the selected remedy. More extensive treatment (most notably in the major SWSAs) is not included in the selected remedy for several reasons. First, hydraulic isolation will satisfactorily meet the goals of this CERCLA action. Additionally, the characteristics of the waste and contaminated media in Melton Valley and the large areas involved do not lend themselves to extensive treatment. This type of treatment would result in unacceptably high worker risk and would entail enormous cost.

2.13 DOCUMENTATION OF SIGNIFICANT CHANGES

The proposed plan was released for public comment in June 1999. Since that public review, several changes have been made to the preferred alternative (now selected remedy).

Waste removal from the lower 23 trenches (including Trench 27) in SWSA 5 North was included in the preferred alternative presented in the proposed plan but was later removed by the FFA parties from the selected remedy during ROD preparation. DOE will retrieve the buried TRU waste from the lower 23 trenches as a separate action under AEA authority in support of the National TRU Waste Program. Accordingly, the costs associated with the waste from these 23 trenches have been removed from the cost estimate for the selected CERCLA remedy. Pursuant to the Dispute Resolution Agreement with the State of Tennessee under the Federal Facility Compliance Act Site Treatment Plan for the Oak Ridge Reservation, the retrieval of the TRU waste from the 23 trenches will be considered a regulatory commitment for purposes of the DOE Oak Ridge Operations Office annual funding request.

The following areas that were listed in the proposed plan are now considered out of scope for the selected remedy:

- TSF Entrance Road Dump Site
- Bearden Creek Road Dump Site

The geographic boundaries of this ROD are identified in Fig. 2.11 of this document. Waste areas outside of this boundary are being addressed through a separate decision document. The two units listed above, which are located outside the ROD boundary, were originally listed in the proposed plan under "ID no. General." They are now considered outside the scope of this ROD due to their location.

The following units have been added to the scope of the selected remedy:

- MSRE Storage Well (ID# 8.16) - Stabilize
- MSRE Diesel Generator House 7555 (ID# 8A.1C) - Demolish
- MSRE Filter Pit (Off-Gas Filter House) (7551) (ID# 8A.1F) - Demolish
- MSRE Stack (7512) (ID# 8.C) - Demolish
- MSRE Supply Air Filter House Building (7514) (ID# 8.D) - Demolish

- MSRE Tank VT-1 (condensation tank) (ID# 8.E)
- MSRE Tank VT-2 (expansion tank) (ID# 8.F)

These units have been added to the scope of the selected remedy because actions for them are consistent with actions for similar type structures included in the Melton Valley watershed ROD near the MSRE and HFIR facilities. These units are also minor units and will not significantly change the remedy.

Additionally, this ROD acknowledges the previous disposal of CERCLA wastes in SWSA 6. These wastes were generated during partial remediation of WAGs 11 and 13, and the wastes were disposed in silos or underground vaults.

Another change to the selected remedy involves remediation levels for soils. The remediation levels in the proposed plan are presented in terms of average exposure rates for areas of different size. In the ROD, the remediation levels follow a more standard risk assessment approach and are presented in terms of both risk and concentration limits for defined exposure units. Risk and concentration-based limits provide for more effective verification of remediation levels, particularly for those contaminants of concern that are not gamma emitters. However, the remediation levels in the proposed plan and the ROD both achieve the CERCLA risk range.

DOE will not remediate streambed sediment in White Oak Creek or its tributaries during actions specified under this ROD. Decisions and actions for streambed sediment will be included in a future ROD that addresses White Oak Lake and embayment and their lakebed sediments.

REFERENCES

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DOE (U.S. Department of Energy), EPA, and TDEC 1999. *Memorandum of Understanding for Implementation of a Land Use Control Assurance Plan (LUCAP) for the United States Department of Energy, Oak Ridge Reservation, Oak Ridge, TN.*

EPA (U.S. Environmental Protection Agency) 1997. *Memorandum: Establishment of Cleanup Levels for CERCLA sites with Radioactive Contamination,* OSWER No. 9200.4-18.

EPA (U.S. Environmental Protection Agency) 1995. *Land Use in the CERCLA Remedy Selection Process*, OSWER Directive No. 9355.7-04.

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FR (*Federal Register*) March 8, 1990. 55 FR 8704.

PART 3. RESPONSIVENESS SUMMARY

Stewardship Working Group Comments

Sponsored by the ORR SSAB, the Stewardship Working Group is an independent, broad-based group representing various local organizations. The group is considering steps necessary to achieve an effective long-range stewardship program for ORR. Although our work is in mid-course, we want to take this opportunity to comment on the proposed plan for Melton Valley. The Melton Valley proposed plan and the ROD to follow are among the first watershed decision documents, and as such, they will set a precedent for other CERCLA watershed documents. Thus our concern is for adequate treatment of stewardship in the forthcoming ROD.

Stewardship for Melton Valley is particularly important because the valley contains radioactive and chemically hazardous wastes for which complete cleanup is neither technically nor economically feasible at this time. As outlined in the 1998 *Stakeholder Report on Stewardship*, RODs must contain a commitment to stewardship and sufficient detail on stewardship to justify a proposed alternative that leaves contamination in place. A ROD also must contain enough detail so that regulators, local governments, and the public can judge at some future time whether stewardship commitments have been kept. We see a disturbing trend developing to relegate discussion of stewardship requirements to post-ROD documents (see page 2-45 of the draft Waste Disposal Facility ROD), which have no legal standing and may not be part of the Administrative Record. Planning for long-term stewardship must accompany planning for remediation in order to have an holistic approach for long-term protection of human health and the environment.

Although some of the topics listed here are mentioned in the proposed plan, adequate performance measures are lacking. Other topics are missing from the proposed plan, but we understand they are under consideration for inclusion in the ROD. It is unacceptable to delay details of long-term stewardship until a "future decision document" is written. (See page 3 of the proposed plan.)

The following list includes stewardship-related topics that must be addressed in the Melton Valley ROD. These topics are essential to a stewardship program for the entire ORR.

1. A clear commitment to maintain site remediation at levels and conditions required to meet RAOs (p. 15, Table 3) and to perform monitoring to determine

and ensure the status of remediation. The ROD must include a clear commitment to maintain federal ownership of and liability for lands to which access is restricted.

DOE Response: As part of the selected remedy discussion, this Melton Valley ROD contains a "Monitoring" section and an "Land Use Controls" section. The monitoring described in the selected remedy will be designed to evaluate the effectiveness of remedial actions. The institutional controls discussion includes a commitment on the part of DOE (or any successor federal agency) to maintain appropriate restrictions as long as they are required to protect human health and the environment. Please refer to the Declaration ("Description of the Selected Remedy" section) where DOE makes this commitment.

2. Descriptions of institutional controls that are realistic for particular areas and/or receptors and whose success is verifiable. For example, restrict access sufficiently to prevent an intruder from receiving a radiation dose greater than applicable standards, a toxic chemical dose larger than the EPA Reference Dose, or a dangerous fall or electric shock. In addition, an intruder should be unable to significantly damage installed remediation features. Another example is stating that "deed restrictions" for future land transfers will be enforced through civil actions.

DOE Response: This ROD contains a description of types of institutional controls envisioned for the Melton Valley watershed. Specific LUCs and the area to which these controls apply will be contained in the Melton Valley LUCIP, which will be generated in parallel with the remedial design process.

3. A redundant system for capture and permanent retention of records of the origin, composition, location, migration, and monitoring of contamination, and maintenance and review requirements expected over time.

DOE Response: DOE will use its existing Environmental Management records management capability at ORR. This system will preserve and manage many types of information, including historic site engineering records, historic data, decision documents, reports produced to make remedial action decisions, remedial action design and as-built information, and ongoing environmental monitoring data.

4. Description/discussion of city and county property records (e.g., deeds, notices, property maps, zoning) for the contaminated areas in Melton Valley. The details must conform to Tennessee law and custom. Such records should include general information about the location, kinds, and quantities of waste in order to provide an additional source of vital information.

DOE Response: This ROD contains a description of types of institutional controls envisioned for the Melton Valley watershed. Specific LUCs and the area to which these controls apply will be contained in the Melton Valley LUCIP, which will be generated in parallel with the remedial design process.

5. A commitment to continue community involvement and to provide periodic opportunities for the public to review and question remediation effectiveness. Assurance that a public meeting accompanies the CERCLA 5-year reviews.

DOE Response: DOE will make monitoring information available to the public at appropriate regular intervals not less frequently than the required 5-year ROD review. DOE will involve the public in the 5-year review process and will share the results of those reviews with the public. For the foreseeable future, DOE will continue to produce an annual remediation effectiveness report as required by the FFA, which summarizes all CERCLA response actions taken and the results of performance monitoring. This document is available in the public reading rooms. Second, DOE intends to make an annual presentation to the SSAB or SSAB subcommittee regarding the remediation effectiveness report.

Alfred Brooks

The Melton Valley proposed plan is a good document and the public participation in its preparation has been excellent. Two specific comments follow. The complexities and extent of Melton Valley offer the greatest challenge not only to remediation technology but also to stewardship technology. In fact, Melton Valley will define the ORR stewardship program. For these reasons and due to the lapse of time before the completion of the remediation, the Melton Valley ROD should include a substantive section on stewardship. This section should contain sufficient detail to document the level and nature of the stewardship actions that the advocates of the selected alternative considered appropriate to make the remediation valid with respect to long-term performance. Adequate stewardship is an integral part of any remediation plan that does not effect complete removal. If this is not done promptly, there is too high a probability that information and intent will be lost.

DOE Response: This ROD contains a section entitled "Land Use Controls." This section contains a description of DOE's (or successor federal agency's) commitment to institutional control, and the mechanism (e.g., LUCAP and LUCIP) DOE will use to implement institutional control.

A discussion of the necessary borrow areas should be added to the ROD.

DOE Response: The borrow area DOE anticipates using for remedial action in Melton Valley is referenced (including a figure) in the "Selected Remedy" section of the ROD.

Josh Johnson

The July 8, 1999, draft looks good to me, so far as it goes. My only real reservation is the lack of any comment on funding aspects. This is a subject of considerable concern to the State and to some of us locals. Although it is not clear at this time what should be done or what can be done, we should in my opinion keep the subject on the table. Perhaps a paragraph added to the five would be appropriate: 6. A brief outline of the origin and uncertainty of the O&M costs in Table 6. (Preferred alternative cost estimate) should be included. These presumably represent the current estimates of the long-term stewardship costs after remediation is complete. Although at present DOE probably projects funding by annual appropriations, it would be helpful to acknowledge that other methods may be preferable to the State or local governments.

DOE Response: The O&M costs for the selected remedy account for such activities as cap maintenance, water treatment, monitoring, and cryogenic barrier maintenance. These costs do not include administrative long-term institutional control costs. This is clarified in the ROD. Administrative long-term institutional control costs are not addressed in the proposed plan or ROD because additional analysis is required to finalize the elements of long-term institutional control and associated costs. This analysis will be documented in the future CERCLA decision for Melton Valley.

Herman Weeren (June 28, 1999)

My chief concern with the message (messages) imparted to the public by the above references is that the message is contradictory, not to say garbled. What I think I culled from it all is:

1. The RI document believes that the formations in the injection zone are saturated with radionuclide-containing water, starting at a depth of 700 ft and with a lateral extent of a considerable distance, "beyond DOE's controlled area boundaries." This belief is mostly qualitative—few numbers are given and I suspect that they are not known. Thus the seriousness of the situation cannot be evaluated (how many curies are involved?), but the scenario appears quite grim. The basis of the scenario is apparently the Bechtel reports (DOE/OR/01-1471/V1&D1, et al.), which extrapolated the whole descriptive picture from a few low activity (0.0000000006 Ci/gal) samples taken from the open hole monitoring wells. As like as not, this activity was introduced from above by logging, anyway.

DOE Response: The conceptual model presented in the RI is based on interpretation of all the hydrogeologic data available from the Melton Valley area. These data include bedrock permeability data, water level and artesian pressure measurements, and groundwater chemistry data including natural and man-made constituents. The conceptual model as presented in the RI indicates that there is a "*possibility*" that groundwater from deep zones, possibly as deep as the hydrofracture waste disposal zones, "*may slowly migrate through the deep bedrock fracture system to mix with the shallower fresh groundwater system . . . beyond DOE's controlled area boundary.*" Figures presented in the RI show the extent of injected grout as inferred from hydrofracture operational monitoring and show that the liquid grout filtrate containing elevated (1 million pCi/L) beta contamination was encountered in the hydrofracture injection zone 1000 ft away from the well. Several of wells that penetrate the injection zone, or deeper, are artesian, and discharge of contaminated water from some wells has been a historic problem. This observation indicates that there is a pressure driver in and beneath the disposal zone. Tightness of the bedrock overlying the injection zone contains the pressurized fluids except where breaches, such as open wellbores, allow upward seepage.

2. The memorandum expresses support for the Bechtel conclusions "sound" but then calls the Bechtel theory of radionuclide migration through small fractures in the cover rock "improbable." These conclusions seem inconsistent to me. Is any significant quantity of radionuclides migrating or not?

DOE Response: There is no evidence that significant quantities of hydrofracture-related radionuclides are being released from DOE property. Long-term

monitoring is required and planned to ensure that any changes in the hydrofracture waste inventory are known.

3. The proposed plan is noncommittal. It merely observes that "hydrofracture wastes are a long-term site management problem." This statement is probably fair enough, taken in isolation and given the general ignorance of what is really at 700–900 ft.

DOE Response: Table B.1 in the proposed plan specifies that DOE will plug and abandon hydrofracture-related wells not useful for long-term monitoring, will use institutional controls to protect humans from contacting hydrofracture contaminants, and specifies long-term monitoring as an appropriate action.

4. At the meeting I was told (and I think I am getting this right) that the RI was mostly window dressing, that the official requirement for this type of document mandated a "worst case" presentation, without ever stating that what was being presented was a worst case. For the case of the grout sheets the project people hadn't really evaluated the situation yet and probably wouldn't for years. In the meantime they were merely describing what might be the situation—best and worst case. I never found the best case description, unless it was the word "improbable" in the memorandum.

DOE Response: The purpose of an RI report is to document site conditions including historic activities that may have contributed to site contamination, quantify the types and concentrations of contaminants present, and assess potential risk to humans and the environment based on current and potential future site use scenarios. The risk assessment scenarios include a consequence analysis for a range of human activities including consumption of water. This process is performed to properly identify the contaminants of concern and indicate the problems that the FS should address. Based on the historic data, the potential for contaminant migration via well bores, and the environmental consequences of potential releases through deteriorated wells, the Melton Valley FS and proposed plan have identified appropriate actions for long-term management of those sites.

If this is all indeed correct, I have a couple of questions/observations.

1. Why could it not be stated somewhere that the presentation in the RI was a worst case situation and that some evaluation would follow? I saw no mention in the documents I read that the drill went anything like this. Is the public (who were supposed to be informed by this meeting) really likely to know about such an arcane matter unless they are told?

DOE Response: The RI presented a brief history of activities in Melton Valley, general conceptual models for how the environmental contaminant transport systems operate, and calculated risk to humans and ecology for a wide range of sites including the hydrofracture waste disposal sites. The RI does not focus on "worst case" but does evaluate the "Reasonable Maximum Exposures" scenario. Through several years of continuous work by DOE, TDEC, EPA, and contractors, the many problems in Melton Valley have been scrutinized, and actions have been scoped to improve the environmental quality throughout the area and to reduce contaminant releases. Actions that are being planned for the hydrofracture facilities are based on risk and the CERCLA remedy selection criteria.

2. The so-called worst case is not really such. It assumed that the contaminated water disperses laterally (rate not given), but does not (except along well bores) migrate upward. One of the few quantitative values in the Bechtel reports is that the contamination has moved upward about 300 ft (from 900 to 600 ft) in some 10 years—about 30 ft/year. No reason is suggested as to why this upward migration should go just so far and no further, so an updwelling to the surface groundwater is a possibility. The curie count of this updwelling can be calculated on the basis of various assumptions, but I had no difficulty coming up with a value of 2000 Ci/year. This is a frightening possibility and is certainly a much worse case than anything pictured in the RI.

DOE Response: It is certainly possible to select contaminant transport parameters that indicate rapid migration of a large mass of contamination, however geochemical retardation through ion exchange and fluid trapping in bedrock micropores greatly retard the actual migration of dissolved contaminants. In actuality, rapid movement of dissolved hydrofracture waste constituents in groundwater is most likely to occur through wellbores and casings of deteriorated process monitoring wells or through open bedrock fractures. There is good evidence that old hydrofracture process monitoring well casings are deteriorated and that artesian pressures enable

up-well movement of contaminated fluid. Flow volumes of a few gallons per day have been observed in some instances. There is little evidence that a well-connected system of bedrock fractures is allowing fluids in the hydrofracture injection zone to move vertically. The bulk of contaminated fluid is observed to have migrated away from the injection wells within the Pumpkin Valley shale—laterally away from the point of injection.

Further questions:

1. Table 1 in the proposed plan lists locations in Melton Valley that contain TRU waste. The grout sheets are not listed, but I personally injected waste at HF-4 that averaged 160 nCi/gm.

DOE Response: DOE acknowledges the presence of TRU waste in some of the waste injected at the HF-4 facility. The only feasible actions responsive to the presence of TRU waste in the hydrofracture grout are long-term institutional controls to prevent intrusion into the waste and monitoring groundwater above and surrounding the injection zone to determine if waste constituents are migrating in the subsurface. These actions are clearly specified in the Melton Valley proposed plan.

2. The RI talks at length of the cleanup of the HF-1 site. It says nothing that I could find about the cleanup of the HF-2 site, although a roughly equivalent amount of radionuclides was used here (a significant fraction of which was probably spilled—operations were sloppy back then). The meeting presentation discussed turning this area into an industrial park. Is some preliminary cleanup not required?

DOE Response: Site surveys indicate the presence of surface soil contamination at the HF-1 and HF-2 sites. Surface soil cleanup actions will be performed at both sites to enable safe use of the areas for the agreed-upon future land uses.

3. Great faith is expressed that new monitoring wells (or modified wells) will provide definitive information as to just what is underground at the HF-3 and HF-4 sites. Descriptions of these marvelous wells are not provided, so their efficiency is at least somewhat questionable. During my working days I was told repeatedly that for the type of formation in Melton Valley a monitoring well would not likely provide information from formations more than a foot or so

distance, hence many wells would be required. I saw nothing in the descriptive verbiage that suggested that more than a few wells were contemplated. How many? What information will be obtained? How reliable will it be?

DOE Response: Detailed planning for the hydrofracture area monitoring will be scheduled upon completion of the Melton Valley ROD. Specific well designs will be part of that planning process. The monitoring concept is to use existing wells at the perimeter of the injection zone and in the rock-cover zone to monitor changes in contaminant concentrations through time. Additionally, several multi-zone sampling wells (wells from which samples can be taken from multiple depth locations) will be constructed west of Tennessee Highway 95 to serve as an enhanced Melton Valley exit pathway monitoring system.

I keep suggesting that the open-hole wells be resampled to determine if the radionuclide concentration below the casing has changed significantly. This would be relatively cheap operation (compared to new wells) and might lay the specter of updwelling radionuclides to rest (or confirm that DOE really has something to worry about). I keep being ignored.

DOE Response: DOE plans to complete some of the open-hole, rock-cover wells as part of the long-term hydrofracture monitoring system. These wells will be sampled and analyzed periodically after they are upgraded.

4. RI, page 3-213, asserts that 10 million gallons were injected.

DOE Response: The RI referenced information from Bechtel's investigation of hydrofracture operations. Recalculation of the total mix volume of waste and grout injected is approximately 5.5 million gal. This volume does not include any pre- or post-injection water used to condition the formation or flush the injection well string. Although the injection wells were normally allowed to discharge excess fluid (termed "bleedback") between injections, it is not clear that all excess fluids were recovered. The total volume of waste injected into the hydrofracture system is considered with other information to determine remedial action decisions and long-term site management decisions. Information that is perhaps more important to those decisions are depth to the waste, waste inventory (including the presence of TRU waste), and knowledge concerning the integrity of waste containment.

5. RI, page 3-215. Set retardant was so used in injections at NHF. This canard appeared in the Bechtel reports and was never corrected. It may not matter, but the statement is wrong.

DOE Response: This statement was carried from the Bechtel report into the RI.

6. RI, Figure 3-57, indicated grout sheets extending far beyond anything I saw in my monitoring. The proposed plan (page 9) states that grouted waste extended 1000 ft. It doubt this. Steve Haas' well (at 1000 ft laterally) detected radionuclides, but radionuclides do not necessarily indicate a grout sheet. I logged this well a day or two before radionuclides appeared and saw no indication of anything. The activity appeared later.

DOE Response: Operational logging of hydrofracture process monitoring wells showed that some grout sheets extended more than 200–400 ft radial to the injection wells. Contaminated liquids, referred to as grout filtrate, are detected in wells 1000 ft radial to the HF-4 injection well.

7. Where is the worst case scenario for in situ vitrification?

DOE Response: As project plans are developed for use of any remediation technology in Melton Valley, there will be extensive safety planning and reviews to determine technology safety.

Herman Weeren (July 11, 1999)

I commented on the proposed plan at the June 22 public meeting and subsequently in writing. Since that time I have mulled over what I was told about the plan and about what DOE apparently regards as a definitive statement of the current status of the site—the Remedial Investigation DOE/OR/01-1546&D2—and I am more frightened and appalled by the day. The party line seems to be that:

1. The formations in the hydrofracture disposal zone are awash with radionuclide-containing fluids which saturate the pores of the rock over an area of some 10 to 20 acres and vertical height of some 300 ft.

2. This contamination may extend beyond the site boundary to various surface seeps.

3. No radioactive content is given—low? High? Very high? Very low? The authors don't say (or don't know).

4. Continued vertical migration of the radionuclides is possible (probable?), but doesn't seem to be a matter of much concern. Page 3-3, first paragraph, states "the potential for hydrofracture waste disposal contamination to migrate beyond the watershed boundary ... and upward through deep wells into the shallow groundwater system."

I think that most of this is arrant nonsense, but I live here too and find the prospect of any such migration extremely disturbing. I know (as apparently the report writers/editors do not) what the radionuclide assay of the underground solution is likely to be, and any such word picture as the above scares me.

DOE Response: Please refer to the Weeren 6/28/99 comment responses as they are responsive to these concerns.

A routine part of the hydrofracture operations was the procedure known as "bleed-back." After the grout had had at least 10 days to set, the injection valve was opened; any free water was allowed to bleed-back up the well. Several of the bleed-backs were sampled; the radionuclide content was of the order of 0.005 Ci/gal. Also, one particularly cold winter one of the observation wells froze at the surface and ruptured. An analysis of the water that flowed out after the ice block thawed show a radionuclide count of 0.0003 Ci/gal, which (considering that the flow had probably not been great enough to completely flush the well) is not inconsistent. It seems probable, therefore, that the formation water has (or had) a radionuclide content of something like 0.005 Ci/gal, and any seepage flow through cracks, or whatever to surface seeps or the groundwater system, would involved hundreds (or thousands) of curies and would necessarily be a very serious matter. What did the RI assume (if anything)?

DOE Response: The RI acknowledged the presence of "grout filtrate" in the injection zone to distances exceeding 1000 ft radial from the injection wells. A human health risk assessment was not performed explicitly for the dissolved contaminants in the injection zone because (1) the contaminants reside in a geologic zone that contains natural highly saline waters (making them non-potable), and the rock permeability is so low that well yields would not provide useable quantities of water and (2) the radionuclide concentrations are so high that carcinogenic risks would exceed unity for the risk assessment scenario. The RI focused on the contaminant release pathway model for hydrofracture-related contaminants and concluded that the well bores of deep monitoring wells that penetrate the injection zone are the most probable pathways for contaminant movement to the land surface.

This ROD concluded that long-term institutional management of the injected waste will be required.

I have my usual problems with the accumulation of egregious errors in these reports, but the question of the curie content of the formation water is, I think, overriding.

The editor of a Nashville newspaper delights in picturing Oak Ridge as a place where radionuclides are bubbling up everywhere (he reportedly thinks he can get a Pulitzer out of it). If he ever thinks to hire a reporter who can read technical reports he could have no end of fun with headlines and stories he could write.

DOE Response: Comment noted.

Oak Ridge Site Specific Advisory Board (July 8, 1999)

The ORR SSAB has had many opportunities to discuss the development of this well-written proposed plan. The Board considers the preferred alternative to be a generally viable plan to move toward appropriate remedial action objectives. Removing all contaminated sources would involve too much worker and ecological risk even if the cost were not estimated to be prohibitive. The less ambitious alternatives considered in the feasibility study would not deal adequately with some of the primary (e.g., the "trenches") and secondary contamination (e.g., the IHP) sources. The preferred alternative does represent a reasoned "middle ground."

The board reluctantly agrees that it is wise to delay a "final" decision on some matters such as residual surface contamination, though usually the Board supports comprehensive planning so that "surprises" may be avoided. The persuasive arguments for delay are (1) that the decision tends to guarantee a full evaluation of these problems when the source removal and hydraulic isolation actions are complete and (2) it really is impossible to predict now the exact risk management status of the valley after the planned actions. It is predictable that the combinations of contaminant removal and stabilization along with water control actions that comprise the preferred alternative have been judiciously chosen and will greatly reduce risks on and off of the site.

The Board does have some concerns that are detailed below, but these do not challenge the wisdom of the principal remediation choices. The following topics should be fully addressed in the upcoming record of decision:

- The interim hazard levels chosen to trigger removal of contamination soil may be so high as to require expensive attention to control the size of postremediation worker risks. The need for such attention could be reduced by removal of near-surface contamination from a few more acres. The proposed plan appears to assume an unrealistically low number of exposure hours per worker per year.

DOE Response: **DOE is establishing cleanup levels consistent with the applicable worker protection standards. Based on the assumption that the waste management area is a single exposure unit that includes the capped areas, the exposure frequency of the maintenance worker would be 2000 hours/year. However, of this 2000 hours, it is anticipated that 90 percent of the time will be spent on capped or cover areas performing primarily vegetation control, subsidence repair, and inspections. The remaining 10 percent (or 200 hours) will be uncapped or uncovered areas performing such activities as road grading, fence/gate inspections and repair, groundwater monitoring, and weather monitoring. Thus the occupancy requirements are much greater for the capped areas. To be conservative in its cleanup, DOE has elected to assume that the maintenance worker spends 70 percent of the work time (or 1400 hours/year) on the capped areas and 30 percent of the work time (or 600 hours/year) on the uncapped areas. The "Remediation Levels" section of the ROD was modified to explain that both the exposure duration of 2000 hours/year and the occupancy partitioning for the capped and uncapped areas are used in establishing cleanup requirements for the waste management area.**

- The preferred alternative proposes to use some contaminated soils as "contour fill" under caps over burial grounds that will remain in place. It is reasoned that these soils are far less contaminated than the waste that resides beneath the present ground surface. The Board cautions that for small savings in cost and risk to workers this practice would increase the losses from the occasional cap failures that eventually will occur.

  In addition, since the contaminated soil is "in hand," this waste disposal practice would amount to adding new waste to a burial ground known not to be protective. The Board suggests that any such "new" waste beneath the planned caps be considered just like the contents of newly constructed waste disposal facilities. If the waste acceptance criteria (WAC) for a facility so constructed would allow acceptance of the contaminated soils being considered, the practice would be agreeable to our Board. A general protocol could be devised to make such decisions practicable at construction time when a surface soil is being considered for removal.

DOE Response: Contaminated soils used as contour fill will most likely be less contaminated than the wastes in the respective burial grounds. The use of contaminated soil for contour fill will also reduce the amount of soil that will be needed from the borrow area. DOE intends to follow the general protocol of precluding the use of TRU or greater than Class C soil from being used as contour fill. Consolidation of contaminated soil in areas that will be hydraulically isolated would be constrained by considerations of potential risk to construction workers during the capping of the soil, and such soils could only be placed in topographically elevated areas where no contact with water could occur. Supplemental containment of such soils, using geosynthetic materials, beneath the final cap may also be a consideration to ensure stability. A hypothetical example of a case where consolidation of soil in an area that would be capped is excavation of contaminated floodplain soil from the Intermediate Holding Pond and using it as fill under the cap on SWSA 4. The IHP floodplain soils contain approximately 125 curies of ^{137}Cs and subcurie inventories of ^{60}Co and other radionuclides. The estimated disposed radionuclide inventory of SWSA 4 was approximately 110,000 curies with an estimated remaining inventory of about 20,000 curies. The incremental addition of floodplain soil to SWSA 4 is negligible (approximately 5 percent).

- Because the waters of Melton Valley must eventually attain standards for recreational use, the proposed plan often refers to recreational standards for the area being met after a time. Elsewhere the proposed plan suggests that public use will be restricted. The Board finds these statements confusing, and asks that the ROD very carefully define its usage of the word "recreational." Everybody interested should be able to understand what this important ROD means.

DOE Response: The ROD recognizes that the waters in Melton Valley are classified by the state of Tennessee for recreational use but will remain restricted because of the presence of nearby burial grounds and other sources. Attainment of recreational standards remains a component of the Melton Valley remedial action objective. This allows DOE to achieve compliance with ARARs by meeting conditions consistent with the designated use.

- The ROD must express a definite commitment to seek funding for maintenance and other stewardship work needed to attain compliance with the remedial action objectives. The Board is also concerned that the coverage in the proposed plan of just what actions stewardship will require would not be adequate for the ROD. We expect that the Stewardship Working Group will comment on these needs.

DOE Response: As noted in the LUCAP, "The Parties expect that all obligations of DOE-ORO arising under this LUCAP, including, but not limited to, implementation of LUCIPs and maintenance of LUCs will be fully funded through congressional appropriations or such other available mechanism. The DOE-ORO will take all necessary steps and use its best efforts to obtain funding to meet its obligations under this agreement. The DOE will notify the EPA and the TDEC if appropriated funds are not available to fulfill the DOE's obligations." This ROD contains a description of "Land Use Controls." The LUCIP will include detailed actions and requirements. DOE is also preparing a stewardship plan that will address stewardship concerns not addressed in the ROD. The ROD should increase the attention given to the radiation levels expected from longer-lived radionuclides a few hundred years hence, at least by reference. At that time the levels of buried strontium-90, cesium-137, and especially tritium will be very much reduced.

DOE Response: Additional information has been included in the ROD.

In the SWSA 4 Main subbasin (a main portion of SWSA 4), the initial disposed inventory of about 71,500 Ci, consisting primarily of mixed fission products of short to medium half-lives (< 1 to 30 years), will have declined to about 3000 Ci by the year 2050 and to < 500 Ci by the year 2200.

- Page 13 of the proposed plan suggests that waste from grout sheets can possibly migrate to shallow groundwater. After wells are plugged, the words overstate the likelihood of serious migration. We understand that the sparse groundwater near the grout sheets is saline. The shallow groundwater is not saline. Some of the wells may be contaminated, but the threat of that spreading widely seems less ominous.

DOE Response: This text has been modified somewhat from the proposed plan to the ROD. It now states that the possibility of contaminant migration from hydrofracture waste to shallow groundwater will require well closure. Groundwater monitoring and institutional controls are still required, even though the possibility of contaminant migration is low (especially given planned well P&A).

The Board looks forward to the early approval of the ROD for this watershed. The remediation of Melton Valley is particularly important to us, and we understand that the job will be long and demanding. Completing the job requires approval of the ROD as well as all the required remediation work.

Oak Ridge Reservation Local Oversight Committee (LOC) (July 29, 1999)

The Citizens' Advisory Panel (CAP) of the ORR LOC offers the comments below on the proposed plan for the Melton Valley watershed. The LOC Board has not had the opportunity to review and approve these, and so they should be considered as submitted by the CAP only.

General Comments

The proposed plan for the Melton Valley watershed is a well written and reasoned approach for a difficult and complex watershed. The preferred alternative, although leaving most of the wastes in place, is a viable plan to accomplish suitable remedial action objectives. The removal of all contamination sources would not only be enormously expensive, but would also introduce an unacceptable risk for the workers and the ecology as well as present currently unsolvable technical challenges.

The proposed plan does conform with the recommendations of the End Use Working Group, and the community will find this acceptable and proper.

The LOC CAP is concerned about treatment of stewardship in the ROD, which evolves from the proposed plan. The 1998 Stakeholder Report on Stewardship clearly states that the ROD must pledge stewardship in adequate detail to defend leaving contamination in place. Leaving discussion of stewardship to post-ROD documents is not a solution. By law, the ROD is the legal document and post-ROD documents are not required to be a part of the Administrative Record. Page 3 of the proposed plan states "Any future measures, including long-term institutional controls for Melton Valley, will be addressed in a future decision document." This is not acceptable. The CAP supports completely the recently submitted Stewardship Working Group comments on the proposed plan for the Melton Valley watershed.

DOE Response: Land use controls are an essential component of stewardship and of the selected remedy for the Melton Valley watershed (see ROD Sect. 2.11.3 "Land Use Controls"). Such LUCs identified in the ROD include deed restrictions, deed notices, zoning notices, permits program, state advisories/postings, access controls, signs, and security guards. DOE and the other FFA parties are committed to maintaining LUCs, including institutional controls, for as long as they are necessary to ensure protection of public health and the environment. However, the LUCs under this ROD

will remain in effect only until a final ROD has been signed. Long-term stewardship and its associated LUCs will be addressed in the final ROD and its associated LUCIP.

Specific Comments

1. Page 10, Site Characterization and Risk Conclusions, second bullet: Long-lived radionuclides are not discussed in detail in the proposed plan. The radiation levels of these long-lived radionuclides (and associated risks) after the majority of the short-lived radionuclides have decayed (approximately 300 years) should be mentioned in the ROD.

DOE Response: Please see response to comment from ORR SSAB above.

2. Page 14-15, Cleanup Objective, and Table 3: Although public use will be restricted, the word "recreational" is used in reference to waters of the state and associated floodplain areas. Furthermore, final decisions for surface water, sediments, and floodplain soils of White Oak Creek are to be deferred until a later decision document (as stated on pages 3 and 25). Considering the planned restrictions and deferral of final decisions, it is unclear why the remedial action objective of recreational risk-based limits is discussed for these areas.

DOE Response: Recreational risk-based limits are considered an endpoint because of the regulatory classification of surface waters in Melton Valley. Satisfying these risk-based limits, therefore, is required to comply with ARARs. However, most floodplain soils (those $< 2500\ \mu R/hour$) are deferred, and an interim period of use restrictions is included in this ROD until a future, final decision is made.

3. Page 22, Waste Removal: The Waste Isolation Pilot Plant, the Nevada Test Site, and the Environmental Management Waste Management Facility are referred to in the proposed plan here and elsewhere. Are there contingency plans if the assumed availability of any of these facilities does not occur?

DOE Response: Each component of the selected remedy that requires waste disposal includes a reference to "another suitable facility" for waste management. However, it should be noted that the ROD for the EMWMF was signed in early November 1999, and the WIPP is currently receiving non-RCRA TRU waste.

4. Table A.2 shows that Alternatives 2 to 6 assume a mixing zone in the Clinch River below White Oak Creek to meet the maximum contaminant level. Is this also true of the preferred alternative?

DOE Response: It is expected that without a mixing zone, decay will achieve MCLs within a reasonable amount of time. However, that was not selected as the remedy to achieve MCLs for Clinch River. In terms of compliance with MCLs, this remedy is interim. The future decision may determine that more actions are needed to meet the MCLs or it may decide that time for decay is acceptable.

5. What is the extent of contaminated wetlands, and what proportion is planned to be actively remediated? If the wetlands are drained and remediated, will their eventual reversion back to wetlands contribute to recontamination of the surface water?

DOE Response: Approximately 20 acres of wetlands will be adversely affected by implementation of the selected remedy. DOE will employ such strategies as restoration, enhancement, or creation of new wetlands to mitigate these adverse impacts. Remediated wetlands will not be sources of contaminants to the environment.

U.S. Department of Interior (Lee Barclay)

DOE has grouped, summarized, and condensed comments from the Department of the Interior for clarity of response.

- It is not clear if nonradionuclide contaminant levels correlate to the > 2500 μrem/hour benchmark, and no cleanup levels for nonradionuclide contaminants were discussed in the proposed plan or included in the preferred alternative.

DOE Response: Because remedial action for sediments is deferred, removal of sediment based on nonradioactive contamination is not part of the remedy. Nonradionuclide contaminants are detected in soil from most sampled locations on the White Oak Creek floodplain. A direct correlation between nonradiological and radiological contaminant levels has not been demonstrated. However, removal of sediments and floodplain soils that have levels > 2500 μR/hour will also reduce nonradiological contaminants.

- Since no remedial action is contained in the preferred alternative for a majority of White Oak Creek and all of White Oak Lake and White Oak Creek Embayment, there will be no post-remediation change in predicted risk from radionuclides, methyl mercury, chromium (VI), molybdenum, selenium, zinc, and PCBs.

DOE Response: Additional data collection and evaluation are included as a component of the preferred alternative. The goal of this effort will be to close data gaps and reduce uncertainties regarding ecological protection. The adverse effects of both radionuclide and nonradionuclide contaminants will be evaluated and will ultimately lead to cleanup levels for all contaminants (and for all areas including White Oak Lake and White Oak Creek Embayment) as appropriate.

- DOE should develop risk-based screening values for the nonradionuclide site-related contaminants to ecological receptors, and incorporate those values into the interim proposed plan and future remedial decision.

DOE Response: Risk-based screening values are expected to be a component of the final decision after completion of the additional data collection and evaluation process noted previously.

- We believe the DOE contention that subbasin-level populations or individuals will be fully protected is erroneous and we strongly disagree that excavation of contaminated sediments would destroy the entire ecosystem.

DOE Response: An ecological monitoring plan will be developed (in consultation with the U.S. Fish and Wildlife Service) and carried out as part of the selected remedy. Results from this monitoring will be used to evaluate whether subbasin-level ecological populations are actually protected or whether a modification of remediation levels is required. This monitoring will also serve as input to decisions on areas deferred in this decision (such as floodplain soil < 2500 μR/hr). Regarding the ecosystem portion of the comment, DOE has changed "... ***the excavation of all contaminated sediments and soils that would destroy the entire ecosystem*****" to "... which would damage a larger area of the aquatic and floodplain ecosystems."**

- The Service supports source containment and remediation as the highest short-term priority for CERCLA actions on the ORR; however, we do not believe that the proposed RAOs and cleanup levels contained in the proposed plan for Melton Valley uniformly adhere to the intent of Sect. 121 of CERCLA, the Clean Water Act, or the National Environmental Policy Act.

DOE Response: The preferred alternative meets the intent of the CERCLA, Clean Water Act of 1972, and NEPA. Additional cleanup measures will be considered and documented in future decision documents.

- Since the federally endangered gray bat (*Myotis grisescens*) has been collected on the Oak Ridge Reservation (ORR) near the Melton Valley area and the federally endangered pink mucket (*Lampsilis abrupta*) has been collected in the Clinch River immediately downstream of the confluence of White Oak Creek, the Endangered Species Act is an ARAR which should have been incorporated and discussed in this document.

DOE Response: Surveys by DOE in 1994 (DOE/OR/01-1302/V1) and 1996 (ES/ER/TM-188/R1) indicated there were no threatened or endangered species or designated critical habitat identified in the Melton Valley watershed. For this reason, the federal Endangered Species Act was not included as an ARAR for Melton Valley in the proposed plan. However, it is included as an ARAR for this ROD based on this comment.

- There are numerous karst features in the Bethel and Melton valleys and gray bats will forage in riparian areas, and over lakes, embayments, and upland habitats within the project area.

DOE Response: Small caves are known to exist on Copper Ridge and Chestnut Ridge in the general vicinity of ORNL; however, no caves have been identified in Melton or Bethel valleys near ORNL. Gray bats are known to be an obligatory cave-dwelling species. No confirmed observations of gray bats have been made in caves on ORR. Some bat surveys (using mist nets) have been performed on ORR, and no gray bats have been found to date. There is a large amount of foraging area in East Tennessee including areas on the ORR. Remedial actions under consideration in this Melton Valley proposed plan would not diminish available foraging area for bats.

- It is not clear whether the referenced human health criteria were for primary or secondary recreational contact or fish tissue consumption.

DOE Response: Exceedance of mercury and arsenic are based on the AWQC for protection of human health (ingestion of fish tissue only).

- There is no discussion of the five subbasins where unacceptable ecological risk will remain under the preferred alternative.

DOE Response: Table C.2 discusses potential risks associated with the referenced five subbasins. Additionally, these uncertainties are noted in the "Overall Protection of Human Health and the Environment" section in the proposed plan, where additional data collection and evaluation is proposed to evaluate the uncertainties.

- It does not appear that any of the referenced ecological populations that were modeled were aquatic vertebrates.

DOE Response: The BERA, as part of the RI, included an evaluation of potential risk to aquatic vertebrates in the White Oak Creek system.

- Although the White Oak Creek and Melton Branch system is classified for recreational use, the utilization of hypothetical recreational receptors and residential scenarios in areas that have controlled access and have predominant adjacent land uses of industrial and restricted access waste management would not appear to be logical or appropriate.

DOE Response: DOE agrees that recreational use of White Oak Creek and Melton Branch waters is not likely or logical; this scenario is included as a goal for the preferred alternative only because the state's recreation use classification is an ARAR for remedial action. However, most floodplain soils (those < 2500 μR/hour) are deferred, and an interim period of use is in the restrictions included in this ROD until a future, final decision is made.

- Furthermore, the more stringent state water and organisms criteria for the recreational use designation contained in Rule 1200-4-3-.03 of the State of Tennessee General Water Quality Criteria do not apply to surface waters without a domestic water supply (DWS) designation. White Oak Lake, White Oak Creek, Melton Branch, and their tributaries are not designated for DWS use, and it is questionable whether the recreational use was existing on or after November 28, 1975.

DOE Response: DOE recognizes that Melton Valley surface waters are not designated for domestic water supply; AWQC for recreational use from ingestion of aquatic organisms alone is cited as an ARAR, not AWQC for ingestion of water and organisms.

- It is also unclear as to why radionuclide Maximum Contaminant Levels (MCLs) are listed as an applicable criterion in surface water before discharge to the Clinch River.

DOE Response: Radionuclide MCLs are considered a goal at the point of discharge to Clinch River because it is designated for DWS.

- These water bodies presently cannot be used for recreation due to logistical and security reasons.

DOE Response: As noted in response to a comment above, DOE recognizes that recreational use of these waters is unlikely, but includes the scenario as a goal because it is an ARAR (TDEC stream classification). However, most floodplain soils (those < 2500 μR/hour) are deferred, and an interim period of use restrictions is included in this ROD until a future, final decision is made.

- We would expect that if a municipality proposed to withdraw water from the Clinch River near the White Oak Creek confluence, a significant investment in treatment technology would be required for the raw water to achieve a potable status. We doubt that the State of Tennessee would approve a water withdrawal request at this location. The Service must emphasize that federal MCLs and the numeric and narrative State AWQC for DWS are not as protective as the numeric and narrative AWQC for fish and aquatic life. The DWS numeric criteria do not include copper, silver, or zinc, and permit an allowable higher criterion for the referenced individual site-related contaminants. They also allow a lower pH (6.0 versus 6.5), do not have a numeric limit on dissolved oxygen, and contain no biological integrity narrative. The toxic substances narrative for the DWS criteria does not consider exposure pathways, biochemical and physiological impairment, growth and reproductive effects, and other bioindicators of contaminant exposure to fish and aquatic life.

DOE Response: Although it is unlikely that water withdrawal requests would be granted in Clinch River at the confluence with White Oak Creek, federal MCLs for radionuclides are exceeded at White Oak Dam and are ARARs for discharge to Clinch River. Neither the more stringent AWQC for fish and aquatic life nor federal MCLs for organic or inorganic contaminants

are being exceeded at White Oak Dam. Note that AWQC for fish and aquatic life are cited as ARARs for Melton Branch, White Oak Creek, and all other tributaries. Postremediation monitoring will confirm compliance with all numeric AWQC throughout the watershed and with radionuclide MCLs at the point of discharge to Clinch River. It should be noted that EPA considers narrative criteria for all designated uses to be met if the more stringent numeric AWQC for Recreation Use and Fish and Aquatic Life are met.

- Based on the existing land uses in the Melton Valley, we are unsure as to why the designated use of livestock watering and wildlife is even discussed as an ARAR by DOE.

DOE Response: The Livestock Watering and Wildlife Use Classification is included as an ARAR for the Melton Valley preferred alternative because streams in Melton Valley are classified as such by the state of Tennessee. It should be noted that, consistent with EPA guidance (EPA-823-B-94-005A), it is assumed that compliance with numeric criteria for the Recreation and Fish and Aquatic Life Use Classification is sufficiently stringent to ensure protection for the Livestock Watering and Wildlife Use Classification for which there are narrative, but not numeric, AWQC.

- It is not clear in this document exactly which AWQC will be met at what location in a reasonable, and as yet undetermined, amount of time.

DOE Response: Appropriate AWQC will be met in all surface waters at the completion of all proposed activities within the preferred alternative, which will to be verified at the CERCLA 5-year review. This clarification has been added to page 25 of the D3 proposed plan. Exact monitoring locations will be determined as part of the remedial design.

- The referenced ecological risk assessment determined that "a shrew" was the most sensitive receptor. We are not certain whether this result was from direct measurement or modeling.

DOE Response: The shrew was the most sensitive terrestrial receptor evaluated in the baseline ecological risk assessment; therefore, it was used to evaluate alternatives for soil remediation. Exposure to the shrew is modeled assuming that its food source consists of 100 percent earthworms.

- If the ecological risk assessment produced hazard quotients (HQ) > 1 for nonradionuclide contaminants, why do the RAOs only consider cleanup levels for radionuclide contaminants?

DOE Response: The RAO includes protection of ecological populations, whether from radiological or chemical contaminants. While the 2500 μR/hour remediation level is directed at the recreation use classification ARAR, it results in the removal of sediments and floodplain soils containing the highest levels of chemical contaminants. Given the interim nature of the entire selected remedy, and the intention of DOE to conduct additional data collection and evaluation, DOE believes this remediation approach is appropriate.

- Since the state of Tennessee does not have promulgated numeric wildlife AWQC, sediment quality criteria, or ecological risk-based screening values, the Service is extremely concerned that sensitive resident and foraging ecological receptors were not afforded adequate evaluation and protection under the proposed plan. These receptors may also include individual endangered species.

DOE Response: The BERA evaluated a variety of receptors including fish, benthic invertebrates, plants, soil invertebrates, shrew, mice, deer, fox, hawks, mink, wild turkey, river otter, belted kingfisher, great blue heron, and osprey. Both osprey and river otter are listed as threatened species by the Tennessee Wildlife Resource Agency.

- Considering that this document represents an interim measure and future remedial decisions will be necessary, the Service is willing and prepared to participate with DOE, EPA, and State of Tennessee personnel to ensure that the maximum level of protection is afforded to ecological receptors, including endangered species, in Melton Valley, the Clinch River, and the entire ORR. We would gladly participate in proposed meetings in Atlanta or Oak Ridge to discuss these and other issues further.

DOE Response: DOE believes that input from the Service could be useful and is willing to discuss participation as appropriate.

- We recommend that future studies and evaluations consider and incorporate the following: (1) complete biological and physicochemical analyses of stream, wetland, and karst habitats in Melton and Bethel Valley; (2) direct measurements of site-related contaminants in aquatic and terrestrial invertebrate species; (3) direct measurements of site-related contaminants in a variety of aquatic and terrestrial receptors which reside or forage in White Oak Creek, Melton Branch, White Oak Lake, White Oak Creek Embayment, and/or the Clinch River; (4) measurement of fish health response and community structure; (5) sediment toxicity tests of sediment samples from White Oak Creek, Melton Branch, White Oak Lake, White Oak Creek Embayment, and the Clinch River utilizing invertebrate test organisms including mussels; and (6) comparisons of sediment and floodplain soils contaminant concentrations and measured sediment toxicity data to EPA's Sediment Equilibrium Partitioning Guidelines (unpublished) and published U.S. Geological Survey, National Oceanographic and Atmospheric Administration, or accepted academic methodologies for sediment toxicity testing and data interpretation. Existing studies conducted by the environmental monitoring program or from Oak Ridge National Laboratory research at the ORR may provide some of the baseline and reference data that would be necessary.

DOE Response: Although the scope of additional data collection and evaluation for ecological protection is not yet defined, input from the Service will be used and incorporated as appropriate.

- Since the Service is not a party to the Federal Facility Agreement for the ORR, we depend heavily on the timely submittal of CERCLA-related documents and regular meetings of the Natural Resources Trustee Council (NRTC) to keep abreast of current activities and research at the ORR which may have implications for Department of Interior Trust Resources. The NRTC at the ORR has met very sporadically, and all members have not been regularly informed of current CERCLA or other investigations of interest to the trustees. Since the DOE is a trustee at DOE facilities, it is incumbent upon DOE to schedule regular NRTC meetings and to ensure complete dissemination of documents and relevant information to other trustee members.

DOE Response: All members of the Natural Resources Trustee Council attended briefings in Oak Ridge on May 7, 1998, for an update on CERCLA activities on the ORR. As requested at that meeting, NRTC members are included on distribution of CERCLA documents transmitted to the regulatory agencies.

- The Service can provide technical assistance to DOE on ecological risk issues and the referenced restoration, enhancement, or creation of wetlands to mitigate the approximately 20 acres of wetlands that will be lost during this interim measure.

DOE Response: DOE acknowledges the offer of assistance from the Service and will consult as the decision and design for Melton Valley matures.

- If available, we request a digitally formatted and georeferenced version (Arc View/Arc Info) of the karst, wetlands, and sensitive habitats investigations that were included in the Oak Ridge National Laboratory Land and Facilities Plan.

DOE Response: This will be provided to the Service.

Response to Comments Received at Public Meeting for Melton Valley Watershed Record of Decision

O&M Cost/Stewardship

- Melton Valley not only offers some variety and challenges for remediation, but it is probably going to be the most challenging area as far as stewardship is concerned. The current proposed plan, while it endorses stewardship in general, is rather vague compared to what will actually have to be done. In addition, some of our past experience has shown that even though the ROD states something will be done, it does not ensure that it will be done. It seems to me in this ROD with the challenges in stewardship, the changing needs for stewardship, that there should be a considerable expansion of the stewardship plan associated with this remediation. The stewardship requirement will change as decay occurs; there are a number of areas here where you may in the beginning fence all of them. At some future time, when the radiation has decayed away, you may change your fences, and I think it would be advisable in order to reassure the public that there will be an adequate stewardship program that this ROD of all RODs pay some serious attention to that problem.

DOE Response: This ROD contains a section entitled "Land Use Controls." This section contains a description of DOE's (or successor federal agency's) commitment to institutional control and the mechanism (e.g., LUCAP and LUCIP) DOE will use to implement institutional control.

- But I am also aware that there is an incompatibility between the federal and the state requirements and the facts as they exist. The federal requirements for CERCLA, RCRA, and the state requirements to record this information on the deed are fine, except for this land there is no deed. The land is not held by a deed; it is held under a court decision, which is recorded in the appropriate places. So this is, and we know in some cases where the documents say this information will be recorded and it has not been recorded, so some particular attention needs to be paid as to how the follow-up on these things is done. It is not enough to say that this will be done when physically it cannot be done. And I just feel that this is the plot of land that we really need to make certain we do right.

DOE Response: The LUCAP and LUCIP will contain information regarding DOE's institutional control program. These plans will account for federal

and state requirements, public preferences, and what is specifically appropriate (e.g., land that is not held by a deed).

- I would like to take a follow-up to Al Brooks' point about changing stewardship requirements. Even though the EPA procedure provides for attention, which we need here, from the public point of view the ROD, I believe, needs to be more explicit as to what the performance of institutional controls will be. It is well to say access is restricted, but as Al points out, needs are different over time, or will be different over time. In order to make a promise so that we know what the plan is when we sign a ROD, we need to say, I believe, in terms of the performance that will be required. In other words, performance might be in terms of how much dose we will allow an intruder to get before he's found and led away. We don't want to hurt him badly. We don't need to give him zero dose, but at the moment that time period might be two days, it might be a week, it might be a month on down the line, a 100 years. But if we say we are going to prevent, we are going to do controls, fences, guards, so that no intruders will get more than a certain dose then as time goes on, one will know how to think about what needs there will be. We are not engineering it; we are setting a principle. Similarly, we do not want to allow an intruder to damage trenches or the collection equipment or the treatment facility or any of the parts that are important. So that criteria is we have to protect those against being damaged by an intruder. And once you've said that, you set what the goal is and the details of how much work that takes in 19, 20, or 50 years will be different than what it takes in 2015. But you know what you promised to do.

DOE Response: This ROD does pay significant attention to the institutional control issue, and it includes goals for institutional control, as well as the method of implementation (e.g., LUCAP, LUCIP). DOE agrees that significant attention needs to be paid to this issue and is committed to satisfaction of public concerns as this program is developed.

- I would like to point out two things. One is your long-term stewardship does not end at 170 years. At that point you meet recreational risk levels in creeks, sediments, and floodplains, but you still have the waste disposal areas themselves. Furthermore, if you are going to talk about long-term costs, you have got to come to some agreement whether you are going to talk about real dollars, actual dollars, or present value discounted. If you have present value discounted after 50 years, the cost of stewardship in terms of present dollars is essentially zero. So unless you establish some ground rules, these discussions are pretty meaningless.

DOE Response: DOE agrees that institutional control activities will not end after 170 years. The 170-year time frame corresponds to meeting recreational risk-based levels for the surface water and floodplain areas of Melton Valley. Regarding different ways to look at remediation costs, the ROD presents costs for all alternatives (and the selected remedy) in terms of 1998 dollars, escalated dollars, and present value. The remedy under this ROD does not address long-term LUCs or other stewardship activities such as management of information systems. The LUCs under this ROD will remain in effect only until a final ROD has been signed.

- I want to add one other thing relative to those items that will be left after this 170 years you projected. This is also considered interim? Have you made an institutional control decision here?

DOE Response: A period of approximately 170 years would allow sufficient radioactive decay so that recreational risks would be acceptable. However, the period of use restrictions for the recreational scenario is interim. Based on the monitored results of the remedial actions and other considerations regarding institutional controls and removal of surface contamination, the need for additional actions to ensure long-term protection of human health and the environment from these floodplain soils and sediments will be decided and documented through the CERCLA process.

- I understand the estimation of O&M costs is undergoing, the procedure, is undergoing a rather drastic change. In the past they have been estimating them by extrapolation of current costs, some minor adjustments, but now they are trying to pick up the pieces out of the baseline cost data base. And these are coming out quite different. Is this based on the new estimates or the old estimates?

DOE Response: Costs for O&M activities are primarily based on an assumed scope, not on any extrapolation of current activities.

- Regarding annual O&M or surveillance and maintenance costs, did you really mean FS or proposed plan? Because the FS did not have this alternative in it.

DOE Response: O&M costs referenced did come from the proposed plan. These costs were based on estimates developed for the other alternatives in the FS.

- Does that [O&M costs included in the proposed plan] include everything that DOE anticipated fall in the category of stewardship for the 170 years?

DOE Response: No. O&M costs included in the proposed plan (and ROD) account for such things as cap maintenance, water treatment, and monitoring to verify remedial effectiveness. Administrative stewardship costs are not included in the cost estimates presented here or in the proposed plan.

- It [the preferred alternative] should have an annual cost on this.

DOE Response: The estimated annual O&M cost for the preferred alternative (now selected remedy) is $1,029,000.

- Catching up in background is not good, but what is the period of performance for the actual remediation activities and what is the basis of the estimates, who did them or is it more or less, I guess you could say, the people who develop the ROD or the characterization or were they done by actually soliciting quotes or historical data from similar contractors who actually do the work?

DOE Response: The cost estimate was based on a number of factors. These include engineering estimates, quotes from vendors, and experiences with similar types of work. The estimate for removal of the TRU waste was conducted by the FS team; however, given its inherent uncertainties, an independent estimate was done by another contractor. The current estimated period of performance for completion of remedial activities (not including monitoring) is 2014.

Long-Term Risk/Remediation Cleanup Level Goals

- What kind of a precision do we have, or an estimate, of just what the worker risk will be in 200 years or 150 years? We know what will happen to the cesium and strontium, but most times with fission products if you take away those times with fission products, if you take away those of a certain life, there is another activity waiting for you, a longer life. So we have extremely long-life transuranics where I have not heard an estimate of the actual hazard when everything else is gone. And then we probably have some longer half life products and I haven't seen a number, it may be in the RI, I haven't read that document, too thick. It may be in there, but I have never heard a reference to it and it seems before we talk about just what condition it is going to be in, many half-lives of cesium in the future we have to look at what might be at the one percent level now, if there is anything, which might become an important thing. It might affect our decision.

DOE Response: DOE's calculation of risk after significant decay of short-lived radionuclides is an estimate based on the available information. The RI does estimate activity remaining after this decay has occurred. Please see response to ORR SSAB comment.

- What level of radiation are you determining to be acceptable after you have done the removal?

DOE Response: Remediation levels vary depending on the area. They are designed to protect human and ecological receptors in the anticipated future land use (e.g., industrial area, waste management area). Please see the "Remediation Level" section of this ROD.

- A 170 years from now maybe that other risk is no longer (indiscernible). The cesium, we can do that in our heads.

DOE Response: The 170 years applies to radioactive decay in the sediment and floodplain area. For a discussion of activity levels present in the future, please see response to ORR SSAB comment.

- Oh, the one about at what level are you going to clean up? What are you looking for? Is the level likely to increase as years go by?

DOE Response: As noted previously, the level of cleanup varies. These levels are protective for the anticipated future land use. Cleanup levels can be found in the "Remediation Level" section of this ROD. DOE does not anticipate that these levels will increase as years go by.

- I was at a social meeting 2 to 3 months ago with some people who were really not in science and they were kind of familiar with what we were doing in Oak Ridge and they asked me some questions that really I could not answer. They asked, you know, even though you might clean the radiation level up to a certain level or all of the toxics, what are the cumulative effects if you are exposed to "X" this week and your job compels you to continue to be exposed, what effect does this have on the body?

DOE Response: The risk assessment (conducted as part of the RI and summarized in the ROD) assumes fairly conservative exposure to these toxics. These exposure scenarios typically assume exposure over a lifetime (or occupational lifetime for worker exposure). Based on current scientific knowledge, synergetic effects (or antagonistic effects) are not accounted for

in the risk assessment process. However, as EPA guidance changes, these may be accounted for in the future.

Remediation Details/Reclamation
Incorporation of NEPA Values in CERCLA Decisions

- This being, I guess, the first major watershed-level project, we have questions about borrowed areas, wetlands, and all of that. You need to really go back and look at NEPA because I know it is DOE's policy to incorporate NEPA values and in this case it looks like you have a lot of peripheral issues that would otherwise be subject to the actions if they were apart from CERCLA and you just have to really be cognizant of any other. Maybe if you have a next public meeting, you will have something.

DOE Response: This ROD contains a summary of NEPA values as they pertain to actions included in the selected remedy.

- Is there any chance that NEPA will come into play for these borrow areas? Have you considered that? Because actually it is not a CERCLA activity, and the potential there is to disturb an awful lot of the environment?

DOE Response: At present, DOE anticipates that development, use, and reclamation of the borrow area are included in the CERCLA process.

Borrow Area and Disturbed Area Reclamation

- What do you do with the place you removed (contaminated hot spot soils) from?

DOE Response: The excavated area will be backfilled with clean soil.

- Where do you get that [clean soil] from?

DOE Response: Soil will come from a borrow area. DOE anticipates developing and using a borrow area on East Copper Ridge (this area is shown on a map in the "Selected Remedy" discussion section of this ROD).

- Is that [borrow area] in the watershed?

DOE Response: Yes, it is located on East Copper Ridge to the southeast of the waste areas.

- It [the borrow area] should be in a plan.

DOE Response: The likely location of the borrow area is shown on a map contained in this ROD. Actual design will be included as part of the remedial design report.

- You also need to address reclamation of your borrow area.

DOE Response: DOE agrees that the borrow area will require a plan for reclamation. This detail will be included in the remedial design report.

Wetlands Impacts and Mitigation

- Is wetlands mitigation going to be a separate process?

DOE Response: Wetlands mitigation is a component of this CERCLA action. Approximately 20 acres of wetlands will be adversely affected by implementation of the selected remedy. DOE will employ such strategies as restoration, enhancement, or creation of new wetlands to mitigate these adverse impacts. These strategies will be detailed in the remedial design report.

- Are you basically going to mitigate where you are taking the soil out or are you going to mitigate in another area?

DOE Response: As noted above, wetland mitigation strategies could include restoration of the existing site or creation of new wetlands.

In Situ Vitrification

- In regard to in situ vitrification, are they going to use the linear method at this point because I know they had some concerns about the burp with the test case?

DOE Response: The actual design for ISV has not been determined at this point—it will be detailed in the remedial design report. However, most certainly the implementation of ISV will be designed to manage any melt disruption ("burp"). It should be noted that the two trenches slated for ISV (Trenches 5 and 7) are at a hydrologic high point, which will in itself minimize the chances for a melt disruption.

TRU Waste Disposition

- What are you going to do with the TRU waste after it has been removed?

DOE Response: The TRU waste will be sent to the TRU Waste Processing Facility located in Melton Valley for treatment and subsequent disposal at DOE's WIPP facility in Carlsbad, New Mexico.

- Transuranic waste-containing materials and TRU waste are not necessarily the same thing.

DOE Response: TRU waste is defined as waste, without regard to form, that is contaminated with alpha-emitting transuranium radionuclides with half-lives greater than 20 years and concentrations greater than 100 nCi/g at the time of assay. This definition first appeared in 1970. Waste containing transuranic radionuclides does not necessarily fall under the definition of TRU.

- There is no mention in the document of the 16, or however many years it was ago that we injected out there was transuranic waste [in NHF].

DOE Response: DOE acknowledges (in this ROD) that TRU waste was injected in some NHF waste disposals.

OHF/Grout Sheets

- What is the reliability of hydrofracture?

DOE Response: DOE considers the reliability of the historic hydrofracture disposal method, the mixture of waste and grout injected into the ground from 800 to 1000 ft, to be very good. Significant migration of this contamination is not believed to have occurred. One uncertainty in this involves possible migration vertically upward through well bores that extend to this depth. For that reason, DOE will plug and abandon hydrofracture wells in an effort to prevent this migration. DOE will also monitor the groundwater to verify the protectiveness of the grout sheets.

- Why couldn't you at least mention that you are looking at a range of possibilities [stability of hydrofracture waste and liquids] which would save an awful lot of worry and an awful lot of confusion? Prior to the FS, put it in the proposed plan anyway that you are looking at several things and what is in the previous documents does not necessarily represent what you are thinking.

DOE Response: DOE will plug and abandon the four hydrofracture injection wells and all other hydrofracture related wells except for approximately 10 wells that will be retained for monitoring. This action is required to contain fluids in the injection zone and to comply with federal and state laws (which are ARARs) governing management of wells related to underground injection of wastes.

- You keep talking about monitoring wells and in all probability a monitoring well monitors just what is directly below it. So you are probably talking about a lot of wells. This is not made very clear either.

DOE Response: DOE's monitoring plan will be designed (subject to TDEC and EPA approval) to verify the effectiveness of remedial actions. This includes adequate monitoring of any contaminant migration from the grout sheets.

Surface Water Goals

- You mentioned that the Clinch River requirement was drinking water. What is the requirement on the White Oak Creek itself?

DOE Response: White Oak Creek (and other streams in the Melton Valley watershed) are classified for Recreation, Fish and Aquatic Life, Livestock Watering and Wildlife, and Irrigation.

- I have a simple question. What determines the level to leave the lake at? You have White Oak Lake and over the years the depth of White Oak Lake has changed up and down. I saw a set of pictures showing the areas covered by the lake over the last generation. I do not know how the dam controlled the level, but I presume you have the option. So, if you raise the lake, you have more waste in the water from groundwater, but you cover more sediments with the lake and protect people.

DOE Response: The selected remedy does not make a decision regarding the water level of White Oak Lake. It should be noted that a decision on sediments in White Oak Lake (along with sediments in White Oak Creek Embayment) is deferred in this ROD.

- We are living in a peculiar area here in East Tennessee, and one of the things that I think you know and most of us know is that it is unique because we do not have the privilege to actually bury waste and feel free that it will never become surface water because our groundwater, in many cases, becomes our surface water and vice versa.

DOE Response: Agreed. For that reason, the selected remedy focuses on hydraulic isolation of these waste sources and monitors both groundwater and surface water to help evaluate the effectiveness of this hydraulic isolation.

- What about in some of the local streams? Usually many of these are toxic, particularly the heavy metals, and many of the others like cadmium and lead, they tend to become tied up at the bottom, but due to the rainfall in this area we are not living in Nevada. When you have that turbulence in the water, they tend to become unbound and have a tendency to move downstream. Do you have any evidence that this is happening in our streams?

DOE Response: Contaminants tend to settle out in White Oak Lake and White Oak Creek Embayment. Additionally, the White Oak Creek Embayment coffer dam, which will be maintained as part of the selected remedy, serves to minimize upstream turbulence from Clinch River. This, in turn, minimizes the transport of sediment-based contaminants to Clinch River.

- Do you have any ongoing studies to tell us what's the interplay between the contamination that is continuing to flow toward the river and maybe indeed in the river? The aquatic life in the river.

DOE Response: Yes. DOE has an extensive monitoring program, including monitoring of surface water prior to its exiting the watershed. Additionally, as part of the Clinch River CERCLA decision, surface water, sediment, and wildlife species sampling occurs yearly, which helps evaluate adverse impacts, if any, on the aquatic life in the river.

APPENDIX A

SELECTED REMEDY SPECIFIC ACTIONS

Table A.1. List of remedial actions for the selected remedy, Melton Valley watershed, ORNL, Oak Ridge, Tennessee

ID no.	Unit name/location (see Fig. A.1)	FFA Appendix C unit title	Selected remedy	Described in FS alternative number	Comments
2.01	White Oak Creek Embayment	White Oak Lake and Embayment (7846)	Institutional controls	2	Institutional controls, pending a future final decision; in the absence of additional actions, acceptable risks would be achieved after allowing < 170 years for radioactive decay
2.02	White Oak Lake	White Oak Lake and Embayment (7846)	Institutional controls	2	Institutional controls, pending a future final decision; in the absence of additional actions, acceptable risks would be achieved after allowing < 170 years for radioactive decay
2.04	Middle White Oak Creek	White Oak Creek and Tributaries (0853)	Remove contaminated surface soils > 2500 μR/hour	Modified 5	Reduces worker exposure; institutional controls, pending a future final decision; in the absence of additional actions, acceptable risks would be achieved after allowing < 170 years for radioactive decay; modified from Alternative 5 (500 μR/hour to 2500 μR/hour)
2.05	Intermediate Holding Pond	White Oak Creek and Tributaries (0853)	Remove	4	IHP removal minimizes spread of contamination during flood event and addresses worst surface exposure and ecological risk areas in Melton Valley
2.11	Melton Branch Seep C Floodplain	White Oak Creek and Tributaries (0853)	Remove contaminated surface soils > 2500 μR/hour	Modified 5	Reduces worker exposure; institutional controls, pending a future final decision; in the absence of additional actions, acceptable risks would be achieved after allowing < 170 years for radioactive decay; modified from Alternative 5 (500 μR/hour to 2500 μR/hour)
2.12	Melton Branch Seep B Floodplain	White Oak Creek and Tributaries (0853)	Remove contaminated surface soils > 2500 μR/hour	Modified 5	Reduces worker exposure; institutional controls, pending a future final decision; in the absence of additional actions, acceptable risks would be achieved after allowing < 170 years for radioactive decay; modified from Alternative 5 (500 μrem/hour to 2500 μR/hour)
2.13	HF-2 Subbasin Floodplain	White Oak Creek and Tributaries (0853)	Remove contaminated surface soils > 2500 μR/hour	Modified 5	Reduces worker exposure; institutional controls, pending a future final decision; in the absence of additional actions, acceptable risks would be achieved after allowing < 170 years for radioactive decay; modified from Alternative 5 (500 μR/hour to 2500 μR/hour)
2.14	MB-15 Subbasin Floodplain	White Oak Creek and Tributaries (0853)	Remove contaminated surface soils > 2500 μR/hour	Modified 5	Reduces worker exposure; institutional controls, pending a future final decision; in the absence of additional actions, acceptable risks would be achieved after allowing < 170 years for radioactive decay; modified from Alternative 5 (500 μR/hour to 2500 μrem/hour).

Table A.1 (continued)

ID no.	Unit name/location (see Fig. A.1)	FFA Appendix C unit title	Selected remedy	Described in FS alternative number	Comments
2.15	Seep A Subbasin Floodplain	White Oak Creek and Tributaries (0853)	Remove contaminated surface soils > 2500 μR/hour	Modified 5	Reduces worker exposure; institutional controls, pending a future final decision; in the absence of additional actions, acceptable risks would be achieved after allowing < 170 years for radioactive decay; modified from Alternative 5 (500 μR/hour to 2500 μR/hour)
2.16	HRE Subbasin Floodplain	White Oak Creek and Tributaries (0853)	Remove contaminated surface soils > 2500 μR/hour	Modified 5	Reduces worker exposure; institutional controls, pending a future final decision; in the absence of additional actions, acceptable risks would be achieved after allowing < 170 years for radioactive decay; modified from Alternative 5 (500 μR/hour to 2500 μR/hour)
2.17	Tributaries	White Oak Creek and Tributaries (0853)	Remove contaminated surface soils > 2500 μR/hour	Modified 5	Reduces worker exposure; institutional controls, pending a future final decision; in the absence of additional actions, acceptable risks would be achieved after allowing < 170 years for radioactive decay; modified from Alternative 5 (500 μR/hour to 2500 μR/hour)
2.2	White Oak Dam Control Building (7812)		Out of scope		Active facility
2.3	White Oak Creek Dam (7813)		Maintain		DOE will maintain for sediment containment for the duration of the hazard
2.3B	White Oak Creek Embayment Sediment Retention Structure		Maintain	2	Selected remedy incorporates previous CERCLA action at the Sediment Retention Structure
2.4	White Oak Lake Storage Building (7858)		Out of scope		Active facility
2.5	Sample Equipment Storage Building (7859)		Out of scope		Active facility
2.6	Storage Building for Environmental Emergency Response (7875)		Out of scope		Active facility
4.01	LLW Lines and Leak Sites by Lagoon Road (7800)	LLW line north of Lagoon Road (7800)	Coincidentally cap; limited removal	2	Extent of capping of lines and leak sites dependent on final design of SWSA 4 cap; LLLW lines not under SWSA 4 cap will be stabilized. LLLW leak sites not under cap will be remediated
4.02	Pilot Pits 1 and 2 (7811)	Pilot Pits Experiments Area (7811A)	Remove miscellaneous aboveground materials; cap with SWSA 4 cap	Modified 2	Removal includes lysimeters and research waste; SWSA 4 cap extended to cover pits
4.02A	Pilot Pits 1 and 2 (7811) (structure)	Pilot Pits Experiments Area (7811A)	Demolish	2	
4.03	SWSA 4 (7800)	SWSA 4 (7800)	Hydraulically isolate all of SWSA 4	4	Hydraulic isolation includes multilayer cap, upgradient diversion trench, and downgradient collection trench

Table A.1 (continued)

ID no.	Unit name/location (see Fig. A.1)	FFA Appendix C unit title	Selected remedy	Described in FS alternative number	Comments
4.031 to 4.037	SWSA 4 Seeps	SWSA 4 Seeps	Actions taken on SWSA 4 (7800) will remediate seeps	4	Actions on sources will minimize or eliminate seep contamination; the preferred alternative incorporates previous CERCLA action at the grouted trenches
4.038	SWSA 4 Tritium Trench	SWSA 4 (7800)	Cap with SWSA 4 cap	3	Refer to 4.03
4.04	Alpha Greenhouse Facility (7833)		Demolish to slab	2	Slab and associated soils coincidentally capped by SWSA 4 cap
5.02	OHF Pond (7852A)	OHF Pond (7852A)	Stabilized by grout; coincidentally capped	2	Pond sediment being stabilized as part of a CERCLA removal action. The stabilized pond sediment will then be under the SWSA 5 cap in the selected remedy
5.03	OHF Site Surface Facilities (HF-3) (7852)	OHF Site Surface Facilities (7852)	See actions for specific areas below		
5.03A	Building 7852	OHF Site Surface Facilities (7852)	Demolish to slab; coincidentally capped	2	No future use; reduce future S&M costs
5.03C	Pump House	OHF Site Surface Facilities (7852)	Demolish to slab; coincidentally capped	2	No future use; reduce future S&M costs
5.03E	Pump P-3	OHF Site Surface Facilities (7852)	Remove; coincidentally capped	2	No future use; reduce future S&M costs
5.03F	Storage Building at OHF (7853)	OHF Site Surface Facilities (7852)	Demolish to slab; coincidentally capped	2	No future use; reduce future S&M costs
5.03G	T-4 Waste Pit	OHF Site Surface Facilities (7852)	Stabilize; coincidentally capped	2	No future use; reduce future S&M costs. Conducted as a CERCLA removal action and incorporated into this selected remedy
5.03H	Drilling Equipment Storage for OHF (7854)	OHF Site Surface Facilities (7852)	No longer exists		
5.03I	Shed 7831A		Demolish to slab	2	Active facility that will be removed before capping
5.03J	Pipelines in Vicinity of OHF	LLLW Lines and Leak Sites—Building 7852	Coincidentally capped; isolate from active system at valve box	2	Pipes and contaminated soils will be covered by the SWSA 5 cap; pipelines already isolated from active system at valve box
5.04	NHF Site Surface Facilities		Demolish to slab	2	No future use; reduce future S&M costs
5.04A	Well Pipe Storage Tower at the NHF		Demolish to slab	2	Removal may be required to allow P&A of injection well
5.05A	Inactive OHF LLLW Tank T-1	Inactive OHF LLW Storage Tank T1 Sludges	Coincidentally capped	2	Tank sludges removed in earlier CERCLA removal action. No further remedial action required beyond land use controls
		Inactive OHF Waste Storage Tank T1	Coincidentally capped	2	Tank will be stabilized with grout as part of a CERCLA removal action. Grouted tank will be covered by SWSA 5 cap in the selected remedy
5.05B	Inactive OHF LLLW Tank T-2	Inactive OHF LLW Storage Tank T2 Sludges	Coincidentally capped	2	Tank sludges removed in earlier CERCLA removal action. No further remedial action required beyond land use controls

Table A.1 (continued)

ID no.	Unit name/location (see Fig. A.1)	FFA Appendix C unit title	Selected remedy	Described in FS alternative number	Comments
		Inactive OHF Waste Storage Tank T2	Coincidentally capped	2	Tank will be stabilized with grout as part of a CERCLA removal action. Grouted tank will be covered by SWSA 5 cap in the selected remedy
5.05C	Inactive OHF LLLW Tank T-3	Inactive OHF LLW Storage Tank T3 Sludges	Coincidentally capped	2	Tank sludges removed in earlier CERCLA removal action. No further remedial action required beyond land use controls
		Inactive OHF Waste Storage Tank T3	Coincidentally capped	2	Tank will be stabilized with grout as part of a CERCLA removal action. Grouted tank will be covered by SWSA 5 cap in the selected remedy
5.05D	Inactive OHF LLLW Tank T-4	Inactive OHF LLW Storage Tank T4 Sludges	Coincidentally capped	2	Tank sludges removed in earlier CERCLA removal action. No further remedial action required beyond land use controls
		Inactive OHF Waste Storage Tank T4	Coincidentally capped	2	Tank will be stabilized with grout as part of a CERCLA removal action. Grouted tank will be covered by SWSA 5 cap in the selected remedy
5.05E	Inactive OHF LLLW Tank T-9	Inactive OHF LLW Storage Tank T9 Sludges	Coincidentally capped	2	Tank sludges removed in earlier CERCLA removal action. No further remedial action required beyond land use controls
		Inactive OHF Waste Storage Tank T9	Coincidentally capped	2	Tank will be stabilized with grout as part of a CERCLA removal action. Grouted tank will be covered by SWSA 5 cap in the selected remedy
5.05F	Valve Box at OHF (LLLW Valve Pit)	LLLW Lines and Leak Sites—From Valve Box to OHF	Stabilize; coincidentally capped	2	No future use
5.01A	LLLW Lines and Leak Site—OHF	LLLW Lines and Leak Sites—OHF	Coincidentally capped	2	Covered by SWSA 5 South cap
5.01B	LLLW Lines and Leak Site—Building 7852	LLLW Lines and Leak Sites—7852	Coincidentally capped	2	Covered by SWSA 5 South cap
5.06	Process Waste Sludge Basin (7835)	Process Waste Sludge Basin (7835)	Removed	6	Sludge removed and basin backfilled under a removal action. No further action required.
5.07	SWSA 5 South (7802)	SWSA 5 South (7802)	Hydraulically isolate	5	This alternative caps all waste disposal areas in SWSA 5 South and the upslope groundwater recharge area
5.074	SWSA 5 South Seeps C and D	SWSA 5 South Seeps	Discontinue collection systems; modify Seep D treatment system for expanded use	3	The Seep C collection system will be replaced by the new downgradient collector trench for SWSA 5 South. The Seep D collection system will be maintained until it is no longer needed (as agreed to by all FFA parties). The Seep C treatment system will be discontinued. The Seep D treatment system may be modified for treatment of all water collected in Melton Valley downgradient interceptor trenches (this strategy could be modified as part of the remedial design)

Table A.1 (continued)

ID no.	Unit name/location (see Fig. A.1)	FFA Appendix C unit title	Selected remedy	Described in FS alternative number	Comments
5.075	Undefined Trenches	SWSA 5 South (7802)	Capped	5	Included with SWSA 5 South (5.07); cap will extend upslope to prevent recharge
5.076	Dump Area	SWSA 5 South (7802)	Coincidentally capped	5	
5.077	Fissile Storage	SWSA 5 South (7802)	Capped	5	Included with SWSA 5 South (5.07); cap will extend upslope to prevent recharge
5.078	Northwest Landfill (Ravine Landfill)	SWSA 5 South (7802)	Coincidentally capped	5	
5.7A	SWSA 5 South seeps (other than Seeps C and D)	SWSA 5 South (7802)	SWSA 5 South hydraulic isolation	5	SWSA 5 South hydraulic isolation will address seeps
5.07B	SWSA 5 South Drain 1	Drainage 1, 2 in WAG 5	Remove Contaminated surface soils	Modified 6	Contaminated surface soils that exceed remediation levels are removed
5.07C	SWSA 5 South Drain 2	Drainage 1, 2 in WAG 5	Coincidentally capped	5	Covered under SWSA 5 South cap
5.07D	SWSA 5 South Drain 3	Drainage 3 next to WAG 5	Remove Contaminated surface soils	Modified 6	Contaminated surface soils that exceed remediation levels are removed
5.08A-H	Active LLLW Waste Concentrate Storage Tanks W-25 to W-31		Out of scope		Active facility
5.09	Rad-Contaminated Waste-Oil Storage Tank		Tank previously removed		Tank previously removed under RCRA closure; residual soil contamination addressed by hot spot action
5.10A	Underground Storage Building (7823)		Out of scope		Active facility
5.10B	Transuranic Waste Storage Area (7824)		Out of scope		Active facility
5.10C	Retrievable Waste Storage Facility (7826)		Out of scope		Active facility
5.10F	Retrievable Waste Storage Facility No. 2 (7834)		Out of scope		Active facility
5.10G	Storage Facility for HRL Retrievable Waste (7855)		Out of scope		Active facility
5.10H	Storage Vaults		Out of scope		Active facility
5.10J	TRU Waste Staging Facility (7879)		Out of scope		Active facility
5.14	Northeast Landfill (old landfill NE edge SWSA 5)	Old Landfill (NE edge of SWSA 5)	Remove surface debris	Modified 2	Institutional controls to allow for radioactive decay; debris removal to protect waste management worker
5.15	PWSB Pipeline from PWSB to Process Waste Treatment Plant	PWSB Pipeline from PWSB to Process Waste Treatment Plant	Plug ends of pipe	2	No future use
5.17A	SWSA 5 North Trenches (lower 23 trenches)	SWSA 5 North	TRU waste out of scope. Contaminated soils remediated as part of this ROD		Trench contents will be removed and handled at TRU waste treatment facility as a separate action. Contaminated soils remediated to MV ROD remediation criteria; disposal of contaminated soils at an appropriate disposal facility
5.17B	SWSA 5 North Trenches (upper 4 trenches)	SWSA 5 North	Hydraulically isolate (multilayer cap)	6	Hydraulically isolated with a multilayer cap
5.17C	General—SWSA 5 North waste management sites other than trenches		Out of scope		Active waste management facilities

Table A.1 (continued)

ID no.	Unit name/location (see Fig. A.1)	FFA Appendix C unit title	Selected remedy	Described in FS alternative number	Comments
5.17CA	Classified Burial Ground	SWSA 5 North	Institutional controls		No evidence of environmental releases exists
5.015	Active LLLW Slotting Tank T-13		Out of scope		Active tank
5.16	Inactive LLLW Tank T-14	Inactive LLLW Tank T-14	Out of scope		Included in Bethel Valley scope
5.17	WAG 5 Stream Pad 90-Day Accumulation Area		Out of scope		Active facility
5.19	Hazardous Waste Storage Tank (7830A)		Out of scope		Previously removed
5.20	ILW Waste Storage Tank Facility (7830)		Out of scope		Active facility
5.21	Melton Valley Storage Tanks—capacity increase		Out of scope		Active facility
5.22	RH-TRU Waste Storage Bunkers (7883 and 7884)		Out of scope		Active facility
5.23	Solid Waste Storage Compactor Facility (7831)		Out of scope		Active facility
5.24	Straw Shed (7831C)		Out of scope		Active facility
5.25	Health Physics Office (7831)		Out of scope		Active facility
5.25A	SWSA 5 Storage Pad (7831D)	SWSA 5 South (7802)	Coincidentally capped		
6.01	SWSA 6 (7822)	SWSA 6 (7822)	See actions for specific areas below		
6.04	Hillcut Test Facility	SWSA 6 (7822)	Verify RCRA closure requirements met; continue to collect and treat leachate	2	Continue to collect and treat leachate as part of deferred RCRA closure; verify RCRA performance standards of 40 CFR 264.310 are satisfied; if not, upgrade as appropriate. RCRA interim status unit
6.01A and 6.01T	HA Trenches (cap 1 + uncapped)	SWSA 6 (7822)	Hydraulically isolate	Modified 5	Capping and upgradient diversion trenches (without in situ grouting) are deemed sufficient to hydraulically isolate the waste
6.01AA	HA Trenches (uncapped)	SWSA 6 (7822)	Hydraulically isolate	5	Hydraulically isolate using capping and upgradient diversion trenches
6.01B	LA Trenches (uncapped)	SWSA 6 (7822)	Hydraulically isolate	5	Hydraulically isolate using capping and upgradient diversion trenches
6.01BB	LA Trenches (uncapped)	SWSA 6 (7822)	Hydraulically isolate	5	Hydraulically isolate using capping and upgradient diversion trenches
6.01C	HA Silos	SWSA 6 (7822)	Hydraulically isolate	5	Hydraulically isolate using capping and upgradient diversion trenches
6.01D	LA Silos	SWSA 6 (7822)	Hydraulically isolate	5	Hydraulically isolate using capping and upgradient diversion trenches
6.01E	Fissile Auger Holes	SWSA 6 (7822)	Hydraulically isolate	5	Hydraulically isolate using capping and upgradient diversion trenches (DOE will remove SNF before capping)
6.01F	Biological Trenches (Cap 5)	SWSA 6 (7822)	Hydraulically isolate	5	Hydraulically isolate using capping and upgradient diversion trenches

Table A.1 (continued)

ID no.	Unit name/location (see Fig. A.1)	FFA Appendix C unit title	Selected remedy	Described in FS alternative number	Comments
6.01G	HA Silos	SWSA 6 (7822)	Hydraulically isolate	5	Hydraulically isolate using capping and upgradient diversion trenches
6.01I	Asbestos Silos (Cap 6) (7822H)	SWSA 6 (7822)	Hydraulically isolate	5	Hydraulically isolate using capping and upgradient diversion trenches
6.01J	Biological trenches (uncapped)	SWSA 6 (7822)	Hydraulically isolate	5	Hydraulically isolate using capping and upgradient diversion trenches
6.01K	LA Trenches (Cap 7)	SWSA 6 (7822)	Capped	5	
6.01L	Biological Trenches (RFI says these are LA trenches)	SWSA 6 (7822)	Hydraulically isolate	5	Hydraulically isolate using capping and upgradient diversion trenches
6.01M	LA Trenches	SWSA 6 (7822)	Hydraulically isolate	Modified 5	Capping and upgradient diversion trenches (without in situ grouting) are deemed sufficient to hydraulically isolate the waste
6.01N	Biological Trenches	SWSA 6 (7822)	Hydraulically isolate	5	Hydraulically isolate using capping and upgradient diversion trenches
6.01P	49 Trenches Area	SWSA 6 (7822)	Hydraulically isolate	Modified 5	Capping and upgradient diversion trenches (without in situ grouting) are deemed sufficient to hydraulically isolate the waste
6.01Q and 6.01U	Northeast Auger Hole (cap 3 + uncapped)	SWSA 6 (7822)	Hydraulically isolate	5	Hydraulically isolate using capping and upgradient diversion trenches
6.01R	19 Trench Area	SWSA 6 (7822)	Hydraulically isolate	5	Hydraulically isolate using capping and upgradient diversion trenches
6.01S	LA Trenches (Cap 2)	SWSA 6 (7822)	Hydraulically isolate	Modified 5	Capping and upgradient diversion trenches (without in situ grouting) are deemed sufficient to hydraulically isolate the waste
6.01V	LA Trenches (Cap 4)	SWSA 6 (7822)	Hydraulically isolate	5	Hydraulically isolate using capping and upgradient diversion trenches
6.01W	Cap 8	SWSA 6 (7822)	Capped	5	
6.02	Emergency Waste Basin (7821)	Emergency Waste Basin (7821)	Institutional controls	2	Never used; no known contamination; no remedial action required beyond land use controls
6.XX	SWSA 6 TVA Easement	SWSA 6 TVA Easement	Contaminated surface soil removal	Modified 5	Contaminated surface soil removal will address surface contamination that is not hydraulically isolated under a cap
6.03	Explosive Detonation Trench (7822A)	Explosives Detonation Trench (7822A)	Capped	5	Coincidentally capped under SWSA 6 caps
6.4	Building 7878 (waste storage facility)		Out of scope		Active facility
6.5	SWSA 6 Waste Storage Facility (Building 7842)		Out of scope		Active facility
6.6	Epicore II Storage Building (7848)		Out of scope		Active facility
6.7	Interim Waste Management Facility (7886)		Out of scope		Active facility
7.02	HRE Fuel Wells (7809)	HRE Fuel Wells (7809)	Grout		New proposed action
7.03	Hydrofracture Experimental Site 1, Soil Contamination (HF-S1A)	Hydrofracture Experimental Site 1, Soil Contamination (HF-S1A)	Removal	6	Gamma walkover survey indicates general exposures of 500–1,000 μrem/hour; forested area

Table A.1 (continued)

ID no.	Unit name/location (see Fig. A.1)	FFA Appendix C unit title	Selected remedy	Described in FS alternative number	Comments
7.04A	LLLW Lines and Leak Sites—Gauging Station NW of Building 7852	LLLW Lines and Leak Sites—Gauging Station NW of Bldg 7852	Hydraulic isolation (upgradient trench and cap)		Some contaminated soil previously excavated; asphalt cover installed (likely source of contamination to vegetation); not previously part of any FS alternative
7.04B	LLLW Lines and Leak Sites—Pit 6 SE (Leak Site 1)	LLLW Lines and Leak Sites—Pit 6 SE (Leak Site 1)	Coincidentally capped with Trench 6	5	Asphalt cover installed at leak site; gamma walkover survey indicates general exposures of 100–500 µrem/hour west of leak site (likely source of contamination to vegetation)
7.04C	LLW Lines and Leak Sites—end of Trench 7 access road	LLLW Lines and Leak Sites—End of Trench 7 Access Rd (Leak Site 2)	Hydraulic isolation with cap with 7.04F	Modified 3	Gamma walkover survey indicates potential exposures of up to 10,000 µR/hour; 5 ft of soil was placed over the leak site after the leak occurred in 1966 (likely source of contamination to vegetation); soil cover in FS Alternative 3 modified to cap
7.04D	Leak in Transfer Line From Decon Facility (7819) to Pit 1 (7805)	LLLW Lines and Leak Sites—Decon Facility (7819) to Pit 1 (7805)	Hydraulic isolation with SWSA 4 cap	Modified 5	Gamma walkover survey indicates potential exposures up to 500 µR/hour; SWSA 4 cap extended to cover this area
7.04E	LLW Line Leak Site—line between Pit 3 (7807) and Trench 6 (7810)	LLLW Lines and Leak Sites—Between Pit 3 (7807) and Trench 6 (7810)	Hydraulic isolation with SWSA 4 cap	Modified 5	Southeast of Pit 1; isolated Contaminated surface soils up to 10,000 µR/hour, but generally under 500 µR/hour; SWSA 4 cap extended to cover this area
7.04F	LLLW Line Leak Site—leak at Valve Pit North of Trench 7 (7818)	LLLW Lines and Leak Sites—Leak at Valve Pit North of Trench 7 (7818)	Capped with 7.04C	3	Gamma walkover survey indicates potential exposures up to 10,000 µR/hour (likely source of contamination to vegetation)
7.05	Pit 1 (7805)	Pit 1 (7805)	Hydraulic isolation	Modified 5	Hydraulically isolate with SWSA 4 cap; upgradient trench removed
7.06A	Pit 2 (7806)	Pit 2 (7806)	Hydraulic isolation	Modified 5	Hydraulically isolate with cap and downgradient collection
7.06B	Pit 3 (7807)	Pit 3 (7807)	Hydraulic isolation	Modified 5	Hydraulically isolate with cap and downgradient collection; need for interceptor trench eliminated by larger cap
7.06C	Pit 4 (7808)	Pit 4 (7808)	Hydraulic isolation	Modified 5	Hydraulically isolate with cap and downgradient collection
7.07	Trench 5 (7809)	Trench 5 (7809)	ISV	5	ISV provides for extremely long-term stabilization for high curie inventory; site conditions compatible with ISV technology
7.08	Trench 6 (7810)	Trench 6 (7810)	Hydraulic isolation	3	Hydraulically isolate with cap and downgradient collection
7.09	Trench 7 (7818)	Trench 7 (7818)	ISV	5	ISV provides for extremely long-term stabilization for high curie inventory; site conditions compatible with ISV technology
7.X	WAG 7 pits and trenches secondary source areas	Pits and Trenches Secondary Source Areas	Hydraulic isolation	5	Hydraulic isolation with cap to prevent migration
7.010A	Shielded Transfer Tank (ST1) (by 7819 shed)	Shielded Transfer Tank (ST1) (by 7819 Shed)	Grout then dispose	2	No future use

Table A.1 (continued)

ID no.	Unit name/location (see Fig. A.1)	FFA Appendix C unit title	Selected remedy	Described in FS alternative number	Comments
7.010B	Shielded Transfer Tank (ST2) (by 7819 shed)	Shielded Transfer Tank (ST2) (by 7819 Shed)	Grout then dispose	2	No future use
7.010C	Shielded Transfer Tank (ST3) (by 7819 shed)	Shielded Transfer Tank (ST3) (by 7819 Shed)	Grout then dispose	2	No future use
7.010D	Shielded Transfer Tank (ST4) (by 7819 shed)	Shielded Transfer Tank (ST4) (by 7819 Shed)	Grout then dispose	2	No future use
7.010E	Shielded Transfer Tank (ST5) (by 7819 shed)	Shielded Transfer Tank (ST5) (by 7819 Shed)	Grout then dispose	2	No future use
7.11	Building 7819/Septic Tank	Septic Tank—Building 7819	Stabilize with grout	2	Grout stabilizes any remaining tank contents
7.01	Decontamination Facility—Building 7819 (rad contamination)		Demolish		New action; no future use
7.01AA	Contaminated Debris Site Adjacent to Building 7819	Contaminated Debris Site Adjacent to Building 7819	Remove		Remove debris and dispose appropriately, evaluate soil for remediation
7.12	Equipment Storage Area (7841)		Out of scope		Active facility
7.13	ESD Storage Building (7874)		Out of scope		Active facility
8.X	ARE—Contaminated Tool Storage	ARE Contaminated Tool Storage	No action	2	Radiological survey indicates that soils do not exceed background levels. No remedial action required beyond land use controls
8.1A	HFIR/TRU Waste Collection Basin (7905)	HFIR/TRU Waste Collection Basin (7905)	Removal	5	Remove and treat water; remove sediment; backfill with clean soil
8.1B	HFIR/TRU Waste Collection Basin (7906)	HFIR/TRU Waste Collection Basin (7906)	Removal	5	Remove and treat water; remove sediment; backfill with clean soil
8.1C	HFIR/TRU Waste Collection Basin (7907)	HFIR/TRU Waste Collection Basin (7907)	Removal	5	Remove and treat water; remove sediment; backfill with clean soil
8.1D	HFIR/TRU Waste Collection Basin (7908)	HFIR/TRU Waste Collection Basin (7908)	Removal	5	Remove and treat water; remove sediment; backfill with clean soil
8.02	Hydrofracture Experiment Site 2 Contaminated Soil) (HF-S2A)	Hydrofracture Experimental Site 2, Soil Contamination (HF-S2A)	Removal		Contaminated soils will be removed consistent with exposure unit cleanup criteria
8.03A	LLLW Lines and Leak Sites—Lagoon Road and Melton Valley Drive	LLLW Lines and Leak Sites—Lagoon Road and Melton Valley Drive	Removal		Contaminated soils will be removed consistent with exposure unit cleanup criteria
8.03B	LLLW Lines and Leak Sites—Melton Valley Drive and SWSA 5 access road	LLLW Lines and Leak Sites—Melton Valley Dr. and SWSA 5 Access Road	Removal		Contaminated soils will be removed consistent with exposure unit cleanup criteria
8.03C-G	LLLW Lines and Leak Sites	LLLW Lines and Leak Sites—7500 Area	Remove to industrial criteria	Modified 6	
8.10	Silver Recovery Process (7934) Waste Storage Area		Out of scope		Active facility
8.11	Building 7503 Septic Tank		Stabilize with grout		New action
8.12A	Building 7900 Waste Oil Storage Area		Out of scope		Active facility

Table A.1 (continued)

ID no.	Unit name/location (see Fig. A.1)	FFA Appendix C unit title	Selected remedy	Described in FS alternative number	Comments
8.12B	PCB Waste Container Storage Area		Out of scope		Active facility
8.13	Six-Acre Contractor Spoils Area—Melton Valley (WSW of 7900)	Contractor Spoils Area—Melton Valley, WSW of 7900	Institutional controls	2	No indication of contamination. No remedial action required beyond land use controls
8.14	HFIR Cooling Tower Surface Impoundment	HFIR Cooling Tower Surface Impoundment	Out of scope		Pond has been backfilled. To be included in a future ROD.
8.15	Aircraft Reactor Experiment Surface Impoundments	Aircraft Reactor Experiment Surface Impoundment	Out of scope		Impoundment no longer exists and has been paved over; partially underneath an HFIR Building to be included in future ROD
8.16	MSRE Storage Well	MSRE Storage Well	Stabilize	2	No future use
8.17	Abandoned Sanitary Waste Pipeline and Septic Tank N of 7910 and W of 7917	Abandoned Sanitary Waste Pipeline and Septic Tank N of 7917	Stabilize with grout	2	Stabilization for structural stability
8.18A	Active LLLW Collection Tank F-111		Out of scope		Active facility
8.18B	Active LLLW Holding Tank F-126		Out of scope		Active facility
8.19A	Active LLLW Collection Tank B-2-T		Out of scope		Active facility
8.19B	Active LLLW Collection Tank B-3-T		Out of scope		Active facility
8.19C	Active LLLW Collection Tank C-6-T		Out of scope		Active facility
8A.1B	MSRE Cooling Tower 7513	MSRE Cooling Tower 7513	Demolished	2	Demolished to facilitate MSRE removal action. No further remediation required
8A.1C	MSRE Diesel Generator House 7555	MSRE Diesel Generator House 7555 Former Storage Area	Demolish		Demolish when no longer in use
8A.1D	MSRE Reactor Building (7503)	MSRE Reactor Building (7503)	Out of scope		Included in a future reactor ROD
8A.1F	MSRE Filter Pit (Off-Gas Filter House) (7511)	MSRE Filter Pit [Off-Gas Filter House (7511)]	Demolish		Demolish when no longer in use
8.20	Inactive LLLW Tank 7503A		Out of scope		Included in a future reactor ROD
8.21	Building 7900 Pad 90-day Accumulation Area		Out of scope		Active facility
8.22	Building 7910 Pad 90-day Accumulation Area		Out of scope		Active facility
8.24	PCB Storage Area (7503 highbay)		Out of scope		Active facility
8.25	CH-TRU Waste Storage Facility (7572)		Out of scope		Active facility
8.26	NFS Waste Storage Facility (7574)		Out of scope		Active facility
8.31	Liquid/Gaseous Waste Support Facility (7582)		Out of scope		Active facility
8.A	Molten Salt Reactor Experiment Fuel Salt	MSRE Reactor Building (7503)	Out of scope		Addressed under separate ROD
8.B	MSRE Office Building (7509)	MSRE Office Building (7509)	Out of scope		Active facility
8.C	MSRE Stack (7512)	MSRE Stack 7512	Demolish		Demolish when no longer in use

Table A.1 (continued)

ID no.	Unit name/location (see Fig. A.1)	FFA Appendix C unit title	Selected remedy	Described in FS alternative number	Comments
8.D	MSRE Supply Air Filter House Building (7514)	MSRE Supply Air Filter House Bldg. 7514	Demolish		Demolish when no longer in use
8.E	MSRE Tanks VT-1 (condensation tank)		Remove		
8.F	MSRE Tanks VT-2 (expansion tank)		Remove		
8.G	Field Services Shop (7516)		Out of scope		Active facility
8.HI	Melton Valley Pumping Station		Out of scope		Active facility
8.J	HFIR Drive Disposal Site	HFIR Drive Disposal Site	Remove debris		Remove to industrial criteria
8.4	Hazardous Waste Storage Facility (7507)		Out of scope		Active facility
8.5	Active LLLW Collection/Storage Tank WC-20		Out of scope		Included in Bethel Valley ROD
8.6	LLLW Collection/Storage Tank—HFIR	Inactive HFIR Complex LLLW Tank HFIR	Out of scope		Included in Bethel Valley ROD
8.7A	LLLW Collection/Storage Tank T-1	Inactive HFIR Complex LLLW Tank T-1	Out of scope		Included in Bethel Valley ROD
8.7B	Active LLLW Collection/Storage Tank T-2	Inactive HFIR Complex LLLW Tank T-2	Out of scope		Included in Bethel Valley ROD
8.8	Mixed Waste Storage Pad (7507W)		Out of scope		Active facility
8.9	Sewage Treatment Plant for 7900 Area (7904)		Out of scope		No known contamination
9.01	HRE Pond (7556) and secondary contaminated soils	HRE Pond (7556)	Removal of both pond and secondary contaminated soils; continue with cryogenic barrier until removal	6	Pond is a significant contributor to risk exceedances at White Oak Dam
9.02A	LLLW Collection and Storage Tank (7560)	LLLW Collection and Storage Tank 7560	Institutional controls	2	Tank has been filled with grout under a separate action. No further action required beyond land use controls
9.02B	LLLW Collection and Storage Tank (7562)	LLLW Collection and Storage Tank 7562	Institutional controls	2	Tank has been filled with grout under a separate action. No further action required beyond land use controls
9.04	Trash Area East of HRE Parking Lot	Trash Area East of HRE Parking Lot	Remove and dispose of surface debris		New action
9.05	HRE Waste Evaporator 7502	HRE Waste Evaporator 7502	Demolish to slab	3	No future use
9.5X	MK-Ferguson Office Building/Shop (7505)		Out of scope		Active facility
9.5Y	MK-Ferguson Warehouse (7506)		Out of scope		Active facility
9.7	7506 90-Day Accumulation Area		Out of scope		Active facility
9.06	HRE Waste Evaporator Loading Pit (7558)	HRE Waste Evaporator Loading Pit (7558)	Decontaminate and stabilize	3	No future use; aboveground portion removed/demolished; belowground portion grouted

Table A.1 (continued)

ID no.	Unit name/location (see Fig. A.1)	FFA Appendix C unit title	Selected remedy	Described in FS alternative number	Comments
9.07	Electrical Substation Shed		Out of scope		Active facility
9.3	Sanitary Septic Tank (7501) and Drain Lines		Fill and abandon	3	No known contamination
9.09	Circulation Pump Pit (7563) for Building 7500		Decontaminate and stabilize	2	
9A.1A	HRE Cooling Tower (7554)	HRE Cooling Tower (7554)	Demolish	2	Superstructure removed under earlier maintenance action
9.10	HRE Charcoal Absorber Pit (7557)	HRE Charcoal Absorber Pit (7557)	Decontaminate and stabilize	2	No future use
9.C	HRE Reactor Building 7500	HRE Reactor Building 7500	Out of scope		Included in a future reactor ROD
9.11	HRE Waste Valve Pit	HRE Waste Valve Pit	Decontaminate and stabilize	2	No future use; remove aboveground portion and grout belowground portion for structural stability; cap ends of pipe
9.12	HRE Decontamination Pad/Shed (7561)	HRE Decontamination Pad/Shed (7561)	Remove	2	Protect maintenance worker
9.1B	Soil at HRE Decon Pad/Shed (7561)	Soil at HRE Decontamination Pad/Shed (7561)	Contaminated surface soil removal		Contaminated soils will be removed consistent with exposure unit cleanup criteria
9.13	HRE Charcoal Absorber Valve Pit (7559)	HRE Charcoal Absorber Valve Pit 7559	Decontaminate and stabilize	2	No future use
10.1	Hydrofracture Experimental Site 1 (HF-1) injection and monitoring wells	Hydrofracture Experimental Site 1 (HF-S1)	P&A wells except those designated for monitoring	2	P&A required prevent contamination migration from grout sheets
10.1B	HF-1 Grout Sheets	Hydrofracture Experimental Site 1 (HF-S1)	Institutional controls	2	Monitor groundwater and apply land use controls
10.2	Hydrofracture Experimental Site 2 (HF-2) injection and monitoring wells	Hydrofracture Experimental Site 2 (HF-S2)	P&A wells except those designated for monitoring	2	P&A required to prevent contamination migration from grout sheets
10.2E	HF-2 Grout Sheets	Hydrofracture Experimental Site 1 (HF-S1)	Institutional controls	2	Monitor groundwater and apply land use controls
10.XX	Hydrofracture Experimental Site 3 (OHF) injection and monitoring wells	OHF Grout Sheets (7852) and Injection Well	P&A wells except those designated for monitoring	2	P&A required to prevent contamination migration from grout sheets
10.3A	OHF Grout Sheets (7852)	OHF Grout Sheets (7852) and Injection Well	Institutional controls	2	Monitor groundwater and apply land use controls
10.4	Hydrofracture Experimental Site 4 (7860) (NHF) injection and monitoring wells	New HF Injection and Monitoring Wells	P&A wells except those designated for monitoring	2	P&A required to mitigate contamination migration from grout sheets
10.04A	NHF Grout Sheets	New HF Grout Sheets	Institutional controls	2	Monitor groundwater and apply land use controls
WAG 13	^{137}Cs-Contaminated Field (0800)	Cesium-137 Contaminated Field	Out of scope		IROD October 6, 1992 (interim remedial action completed); IROD cleanup criteria of < 120 pCi/g of residual contamination was

Table A.1 (continued)

ID no.	Unit name/location (see Fig. A.1)	FFA Appendix C unit title	Selected remedy	Described in FS alternative number	Comments
		(0800)			achieved; will be included in a future CERCLA decision
ER23 Area 27	^{99}Tc- and ^{237}Np-Contaminated Soil Lysimeters-Plutonium Floodplain	Tc-99 and Np-237 Contaminated Soil Lysimeters	Remove lysimeters	2	Removed coincident to IHP removal
General	Melton Valley unneeded wells		P&A wells		P&A required to prevent spread of contamination in groundwater
General	Miscellaneous Contaminated surface soils (not including floodplain soil and sediment areas)		Remove; some are coincidentally capped		Remediation levels are discussed in Part 2 (Decision Summary), "Selected Remedy" and "Remediation Levels"

Note: LLW and mixed LLW are expected to be disposed of at the proposed on-site disposal facility (or other suitable disposal facility) or used as contour fill under one of the various multilayer caps proposed for Melton Valley. Sanitary waste is expected to be disposed of at a construction and demolition landfill at the Oak Ridge Y-12 Plant.

ID numbers shown are used to correlate individual units/sites from the remedial investigation and feasibility study

ARE = aircraft reactor experiment
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR = *Code of Federal Regulations*
CH-TRU = contact-handled transuranic waste
Cs = cesium
DOE = U.S. Department of Energy
ESD = Environmental Sciences Division
FFA = Federal Facilities Agreement
FS = feasibility study
ft = foot
g = gram
>= greater than
HA = high activity
HFIR = High Flux Isotope Reactor
HRE = Homogeneous Reactor Experiment
HRL = high radiation level
ID = identification
IHP = Intermediate Holding Pond
ILW = investigative liquid waste
IROD = interim record of decision
ISV = in situ vitrification
< = less than
LA = low activity
LLW = low-level (radioactive)waste
LLLW= liquid low-level (radioactive) waste
µrem = microrem
MSRE = Molten Salt Reactor Experiment
N = north
NE = northeast
NFS = Nuclear Fuel Services
NHF = New Hydrofracture Facility
no. = number
Np = neptunium
NW = northwest
OHF = Old Hydrofracture Facility
ORNL = Oak Ridge National Laboratory
P&A = plugging and abandonment
PCB = polychlorinated biphenyl
pCi = picocurie
PWSB = Process Waste Sludge Basin
RCRA = Resource Conservation and Recovery Act of 1976
RFI = RCRA facility investigation
RH-TRU = remote-handled transuranic (waste)
ROD = record of decision
S&M = surveillance and maintenance
SE = southeast
SNF = spent nuclear fuel
SW = southwest
SWSA = solid waste storage area
Tc = technetium
TRU = transuranic
TSF = Tower Shielding Facility
TVA = Tennessee Valley Authority
W = west
WAG = waste area grouping
WSW = west southwest

Table A.2. Units in the Melton Valley watershed that are deferred or are out of scope, Melton Valley watershed, ORNL, Oak Ridge, Tennessee

ID no.	Unit name/location (see Fig. A.1)	FFA Appendix C unit title	Comment
2.01	White Oak Creek Embayment	White Oak Lake and Embayment (7846)	Sediments deferred
2.02	White Oak Lake	White Oak Lake and Embayment (7846)	Sediments deferred
2.2	White Oak Dam Control Building (7812)		Out of scope (active facility)
2.4	White Oak Lake Storage Building (7858)		Out of scope (active facility)
2.5	Sample Equipment Storage Building (7859)		Out of scope (active facility)
2.6	Storage Building for Environmental Emergency Response (7875)		Out of scope (active facility)
5.08A-H	Active LLLW Waste Concentrate Storage Tanks W-25 to W-31		Out of scope (active tanks)
5.10A	Underground Storage Building (7823)		Out of scope (active facility)
5.10B	Transuranic Waste Storage Area (7824)		Out of scope (active facility)
5.10C	Retrievable Waste Storage Facility (7826)		Out of scope (active facility)
5.10F	Retrievable Waste Storage Facility No. 2 (7834)		Out of scope (active facility)
5.10G	Storage Facility for HRL Retrievable Waste (7855)		Out of scope (active facility)
5.10H	Storage Vaults		Out of scope (active facility)
5.10J	TRU Waste Staging Facility (7879)		Out of scope (active facility)
5.17A	SWSA 5 North Trenches (lower 23 trenches)	SWSA 5 North	Trench contents will be removed as a separate action.
5.015	Active LLLW Slotting Tank T-13		Out of scope (active tank)
5.16	Inactive LLLW Tank T-14	Inactive LLLW Tank T-14	Out of scope (addressed under Bethel Valley ROD)
5.17	WAG 5 Steam Pad 90-Day Accumulation Area		Out of scope (active facility)
5.19	Hazardous Waste Storage Tank (7830A)		Previously removed
5.20	ILW Waste Storage Tank Facility (7830)		Out of scope (active facility)
5.21	Melton Valley Storage Tanks—capacity increase		Out of scope (active facility)
5.22	RH-TRU Waste Storage Bunkers (7883 and 7884)		Out of scope (active facility)
5.23	Solid Waste Storage Compactor Facility (7831)		Out of scope (active facility)
5.24	Straw Shed (7831C)		Out of scope (active facility)
5.25	Health Physics Office (7831)		Out of scope (active facility)
6.4	Building 7878 (waste storage facility)		Out of scope (active facility)
6.5	SWSA 6 Waste Storage Facility (Building 7842)		Out of scope (active facility)
6.6	Epicore II Storage Building (7848)		Out of scope (active facility)
6.7	Interim Waste Management Facility (7886)		Out of scope (active facility)

Table A.2 (continued)

ID no.	Unit name/location (see Fig. A.1)	FFA Appendix C unit title	Comment
7.12	Equipment Storage Area (7841)		Out of scope (active facility)
7.13	ESD Storage Building (7874)		Out of scope (active facility)
8.10	Silver Recovery Process (7934) Waste Storage Area		Out of scope (active facility)
8.12A	Building 7900 Waste Oil Storage Area		Out of scope (active facility)
8.12B	PCB Waste Container Storage Area		Out of scope (active facility)
8.14	HFIR Cooling Tower Surface Impoundment		Out of scope (addressed under a future ROD)
8.15	Aircraft Reactor Experiment Surface Impoundments	Aircraft Reactor Experiment Surface Impoundment	Out of scope (addressed under future ROD)
8.18A	Active LLLW Collection Tank F-111		Out of scope (active facility)
8.18B	Active LLLW Holding Tank F-126		Out of scope (active facility)
8.19A	Active LLLW Collection Tank B-2-T		Out of scope (active facility)
8.19B	Active LLLW Collection Tank B-3-T		Out of scope (active facility)
8.19C	Active LLLW Collection Tank C-6-T		Out of scope (active facility)
8A.1D	MSRE Reactor Building (7503)	MSRE Reactor Building (7503)	Out of scope (addressed under Melton Valley Reactor ROD)
8.20	Inactive LLLW Tank 7503A		Out of scope (addressed under Melton Valley Reactor ROD)
8.21	Building 7900 Pad 90-day Accumulation Area		Out of scope (active facility)
8.22	Building 7910 Pad 90-day Accumulation Area		Out of scope (active facility)
8.24	PCB Storage Area (7503 highbay)		Out of scope (active facility)
8.25	CH-TRU Waste Storage Facility (7572)		Out of scope (active facility)
8.26	NFS Waste Storage Facility (7574)		Out of scope (active facility)
8.31	Liquid/Gaseous Waste Support Facility (7582)		Out of scope (active facility)
8.A	MSRE Fuel Salt	MSRE Reactor Building (7503)	Out of scope (addressed under MSRE IROD)
8.B	MSRE Office Building (7509)	MSRE Office Building (7509)	Out of scope (addressed under Melton Valley Reactor ROD)
8.G	Field Services Shop (7516)		Out of scope (active facility)
8.H1	Melton Valley Pumping Station		Out of scope (active facility)
8.4	Hazardous Waste Storage Facility (7507)		Out of scope (active facility)
8.5	Active LLLW Collection/Storage Tank WC-20		Out of scope (addressed under Bethel Valley ROD)
8.6	LLLW Collection/Storage Tank—HFIR	Inactive HFIR Complex LLLW Tank HFIR	Out of scope (addressed under Bethel Valley ROD)
8.7A	LLLW Collection/Storage Tank T-1	Inactive HFIR Complex LLLW Tank T-1	Out of scope (addressed under Bethel Valley ROD)
8.7B	LLLW Collection/Storage Tank T-2	Inactive HFIR Complex LLLW Tank T-2	Out of scope (addressed under Bethel Valley ROD)
8.8	Mixed Waste Storage Pad (7507W)		Out of scope (active facility)

Table A.2 (continued)

ID no.	Unit name/location (see Fig. A.1)	FFA Appendix C unit title	Comment
8.9	Sewage Treatment Plant for 7900 Area (7904)		Out of scope (no known contamination)
9.5X	MK-Ferguson Office Building/Shop (7505)		Out of scope (active facility)
9.5Y	MK-Ferguson Warehouse (7506)		Out of scope (active facility)
9.7	7506 90-Day Accumulation Area		Out of scope (active facility)
9.07	Electrical Substation Shed		Out of scope (active facility)
9.C	HRE Reactor Building 7500	HRE Reactor Building 7500	Out of scope (addressed under Melton Valley Reactor ROD)
WAG 13	^{137}Cs-Contaminated Field (0800)	Cesium-137 Contaminated Field (0800)	Out of scope (addressed under a separate ROD)
General	Streambed sediments and floodplain soils		Streambed sediments and floodplain soils < 2,500 μR/hour deferred
General	Groundwater		Groundwater deferred

ID numbers shown are used to correlate individual units/sites from the remedial investigation and feasibility study

CH-TRU = contact-handled transuranic waste
ESD = Environmental Sciences Division
FFA = Federal Facilities Agreement
HFIR = High Flux Isotope Reactor
HRE = Homogeneous Reactor Experiment
HRL = high radiation level
ID = identification
ILW = investigative liquid waste
IROD = interim record of decision
LLW = low-level (radioactive)waste
LLLW= liquid low-level (radioactive) waste
μR = microroentgen
MSRE = Molten Salt Reactor Experiment
NFS = Nuclear Fuel Services
No. = number
PCB = polychlorinated biphenyl
RH-TRU = remote-handled transuranic (waste)
ROD = record of decision
SWSA = solid waste storage area
TRU = transuranic
WAG = waste area grouping

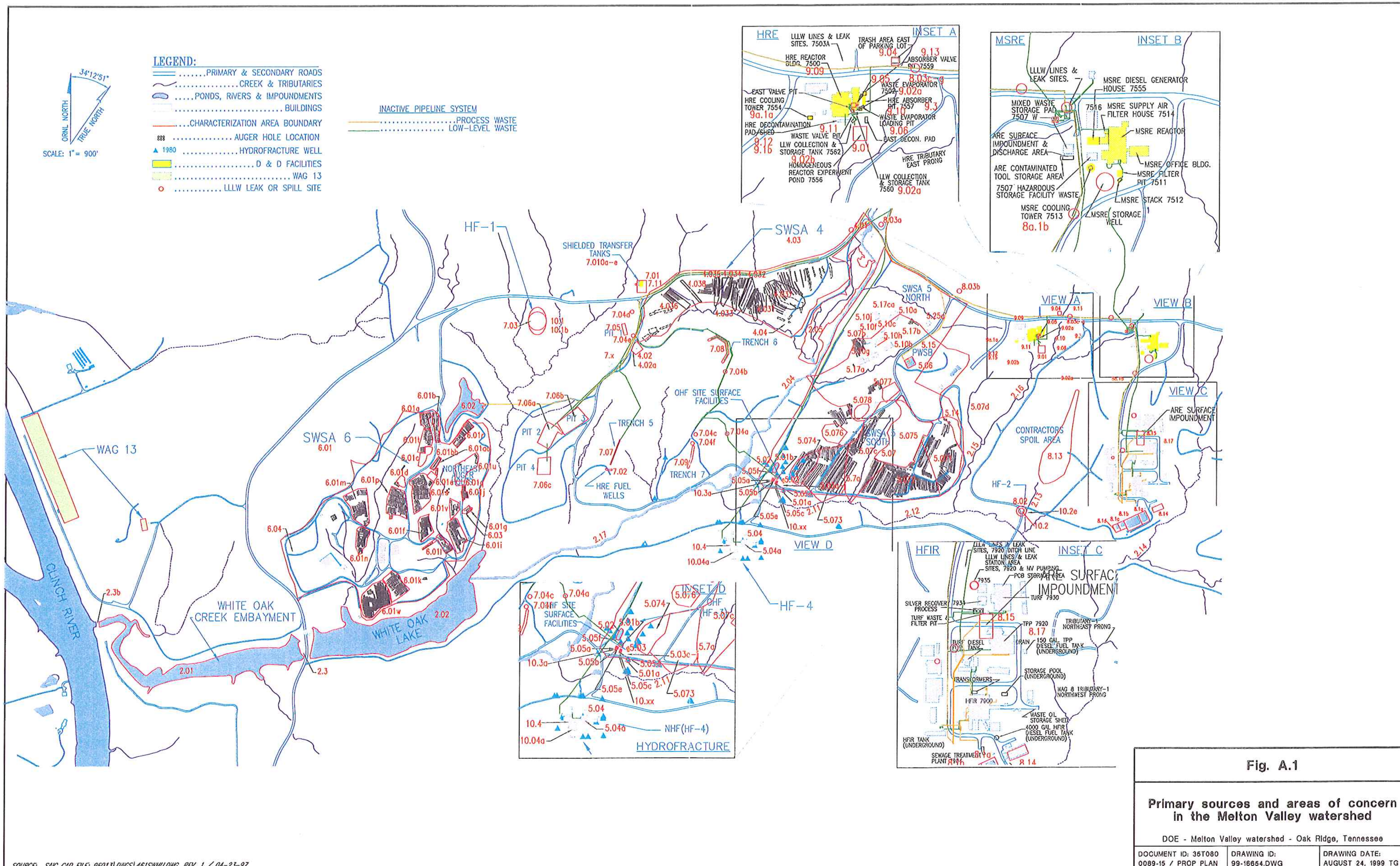

Fig. A.1

Primary sources and areas of concern in the Melton Valley watershed

DOE - Melton Valley watershed - Oak Ridge, Tennessee

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APPENDIX B

APPLICABLE OR RELEVENT AND APPROPRIATE REQUIREMENTS

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Section 121(d) of CERCLA specifies, in part, that remedial actions for cleanup of hazardous substances must comply with requirements or standards under federal or more stringent state environmental laws and regulations that are ARAR to the hazardous substances or particular circumstances at a site or obtain a waiver [see also 40 CFR 300.430(f)(1)(ii)(B)]. ARARs include only federal and state environmental or facility siting laws/regulations and do not include occupational safety or radiation protection requirements. In addition, per 40 CFR 300.405(g)(3), other advisories, criteria, or guidance may be considered in determining remedies (so-called "to be considered" or TBC category). DOE, TDEC, and EPA have identified the specific ARARs and TBC for the proposed actions in accordance with 40 CFR 300.400(g). The selected remedy complies with all identified ARARs related directly to implementing the selected action and does not require a waiver(s). However, several proposed actions and goals are considered interim in nature. Therefore, a future remedy selection process will be required that will either select actions to comply with final goals and ARARs or justify appropriate waivers. A brief description of the ARARs/TBC for this remedial action follows.

Chemical-Specific. Chemical-specific ARARs provide health or risk-based concentration limits or discharge limitations in various environmental media (i.e., surface water, groundwater, soil, air) for specific hazardous substances, pollutants, or contaminants and are listed on Table B.1 and discussed below.

Surface Water. White Oak Creek and Melton Branch are classified for *Fish and Aquatic Life, Recreation*, and *Livestock Watering and Wildlife* uses, but not for *Domestic* or *Industrial Water Supply* or *Irrigation*. All other named and unnamed surface waters in the watershed are also classified for *Irrigation* by default under the Rules of the TDEC Chapter 1200-4-4. On completion of hydraulic containment actions in Melton Valley, numeric AWQC and narrative criteria for the protection of human health and aquatic organisms will be met in all surface waters located in Melton Valley in a reasonable timeframe per 40 CFR 300.435(f)(3). Consistent with EPA guidance (EPA-823-B-94-005A, 1994), compliance with numeric AWQC for *Recreation* and *Fish and Aquatic Life* Use classifications is sufficiently stringent to ensure protection of other uses for which there are narrative, but not numeric, criteria (i.e., *Irrigation* or *Livestock Watering and Wildlife*).

Hydraulic isolation of major waste sources includes capping and/or upgradient diversion trenches and downgradient collection drains. Such isolation is expected to reduce the contribution of contaminants from Melton Valley to the White Oak Creek discharge by 87 percent. This represents a major incremental step in meeting the requirements of the SDWA

MCLs for radionuclides at the confluence of White Oak Creek and Clinch River, which is classified for *Domestic Water Supply*. It is expected that the actions called for under this ROD combined with actions contemplated for Bethel Valley under a separate remedy selection effort, as well as a limited period of use restrictions, will allow the appropriate intended uses to be met. A future decision will be necessary; therefore, because this proposed action does not include decisions relative to Bethel Valley or inclusion of institutional controls to allow long-term decay of radionuclides being discharged.

Floodplain Area. The narrative criteria for protection of human health and aquatic organisms will be met for surface water but not for exposures related to sediments and nearby floodplain soils based on the CERCLA risk assessment process. However, the scope of this decision in terms of the floodplain soils is limited to the most highly contaminated portions of the creek system. In this regard, a future decision will be necessary.

Groundwater. Groundwater in Melton Valley exceeds SDWA MCLs/maximum contaminant level goals (MCLGs) for VOCs and radionuclides in many subbasins. However, a final groundwater remedial goal is deferred to a later decision document. Nevertheless, SDWA MCLs/MCLGs will be used during this action as values to assess groundwater quality and to evaluate effectiveness of the source control actions in reducing contaminant flux. Following completion of all source actions in Melton Valley, a final groundwater decision will be made.

Radiation Protection. Relevant and appropriate Nuclear Regulatory Commission (NRC) radiation protection requirements include: (1) an exposure limit for individual members of the public of 100 mrem/year total effective dose equivalent (EDE) from all sources excluding dose contributions from background radiation, medical exposures, or voluntary participation in medical/research programs [10 CFR 20.1301(a)(1)] and; (2) the need to further reduce exposures to as low as reasonably achievable (ALARA) levels [10 CFR 20.1101(b)]. For unrestricted use of a decommissioned site, residual radioactivity that is distinguishable from background radiation must not exceed a total EDE of greater than 25 mrem/year to an average member of the critical group as defined in 10 CFR 20.1003, and residual radioactivity must be further reduced to ALARA levels (10 CFR 20.1402). Notwithstanding these ARARs, proposed actions (e.g., removal and capping) will protect the appropriate critical group for waste management areas and the industrial use area east of SWSA 5 by achieving a 10^{-4} excess cancer risk level consistent with EPA guidance on CERCLA risk levels for radionuclides (Office of Solid Waste and Emergency Response Directive 9200.4-18). These dose limits for protection of the public and the average member of the critical group will be met. However, institutional controls may be implemented in certain areas (e.g., burial grounds, floodplain soils and sediments) to ensure compliance with the dose limits and ALARA levels per 10 CFR 20.1403(a) and (b).

Location-Specific. Location-specific requirements establish restrictions on permissible concentrations of hazardous substances or establish requirements for how activities will be conducted because they are in special locations (e.g., wetlands, floodplains, critical habitats, streams). Table B.2 lists federal and state location-specific ARARs for protection of sensitive resources.

Aquatic Resources. Many of the component actions in the selected remedy involve aquatic resource alteration and include relocation or channelization of some tributaries or wet weather conveyances to divert flow from constructed caps, collection and diversion of stormwater runoff, and removal of floodplain soils, etc. ARARs listed on Table B.2 for protection of aquatic resources, including wetlands and floodplains, will be met during these activities. Mitigation strategies for destroyed or disturbed wetlands will include restoration, enhancement, or creation of wetlands in the Melton Valley area and will be developed in cooperation with TDEC and EPA wetlands programs. These strategies will be detailed in the remedial design report/remedial action work plan. Construction of gravel haul roads will be necessary for use during remedial actions. Proposed haul roads will be adjacent to Melton Branch and White Oak Creek and cross several tributaries [see Fig. 4.5 of the FS (DOE 1998)]. The Clean Water Act of 1972, as amended (CWA) Section 404 requirements for protection of aquatic resources at 40 CFR 230.10 must be met if the action involves any discharges of dredged or fill material into aquatic ecosystems. Applicable requirements to protect aquatic resources during construction and operations are listed on Table B.2.

Threatened or Endangered Species. The federally endangered gray bat (*Myotis grisescens*) and pink mucket (*Lampsilis abrupta*) have been seen in the vicinity of Melton Valley; however, there are no designated critical habitats located in the valley. Nevertheless, precautions will be taken such that any state or federally threatened or endangered species will not be adversely affected by actions included as part of the selected remedy.

Cultural Resources. Although the Melton Valley watershed contains no identified historic or archeological properties, there is a potential for discovery of such, including Native American remains, during site grading and excavation activities, in particular, near or in the floodplain areas. In the event such resources are discovered, the requirements of the Archaeological Resources Protection Act of 1979 and the Native American graves Protection and Repatriation Act of 1990 would be ARAR.

Action-Specific ARARs. Action-specific ARARs include operation, performance, and design requirements or limitations based on the waste types, media, and remedial activities. Table A.1 of this ROD includes remedial component actions for every FFA source unit in Melton Valley. Component actions include capping, upgradient stormflow diversion, downgradient groundwater collection, TRU waste removal, water treatment, impoundment removal, floodplain soil removal, contaminated surface soil removal actions, grouting, plugging and/or removal of inactive pipelines, ISV, in situ grouting, building remediation, well P&A, monitoring, and institutional controls. ARARs for each component action are listed on Table B.3 and briefly discussed below.

General Construction Activities. Requirements for the control of fugitive dust and stormwater runoff are listed on Table B.3 and potentially provide ARARs for all construction, demolition, excavation, and site preparation activities. Reasonable precautions will be taken and include the use of best management practices for erosion control to prevent runoff, and application of water on exposed soil/debris surfaces to prevent particulate matter from becoming airborne. In addition, diffuse or fugitive emissions of radionuclides to the ambient air from the remediation activities, that are only one of potentially many sources of radionuclide emissions at a DOE facility, must comply with the requirements in 40 CFR 61.92.

Capping. Multilayer caps are proposed for SWSA 4 and SWSA 6 and portions of SWSA 5 and the Seepage Pits and Trenches Area. The proposed multilayer cap for SWSA 6 will be designed to meet relevant and appropriate TDEC (NRC) LLW disposal site closure and postclosure care requirements and all applicable RCRA interim status landfill closure and postclosure care requirements. Closure of the Hillcut Test Facility (part of SWSA 6) meets the closure performance standard of 40 CFR 265.111 [Rules of the TDEC 1200-1-11-.05(7)(b)] considering the existing soil cover and facility design. Postclosure care will include using the existing leak detection system to determine existence of any releases from the unit.

Impermeable caps for SWSA 4, SWSA 5, and the Seepage Pits and Trenches Area will be designed to meet all relevant and appropriate RCRA-landfill closure and postclosure care and TDEC (NRC) LLW disposal site closure and postclosure care requirements. Rules of the TDEC 1200-2-11-.16(2) dose limits, which protect the general population from releases of radioactivity from LLW disposal facilities, are relevant and appropriate to closure with LLW in place at SWSAs 4, 5, 6, and the Seepage Pits and Trenches Area. Compliance with radiation dose limits of 25 mrem/year to the whole body, 75 mrem/year to the thyroid, and 25 mrem/year to any organ will be met through the use of engineered caps and institutional controls at the burial site.

Upgradient Diversion Ditches/Downgradient Collection Ditches. Construction of upgradient diversion ditches at SWSAs 4 and 6 and a portion of the Seepage Pits and Trenches Area, as well as downgradient collection ditches at SWSA 4, SWSA 5 South, and the Seepage Pits and Trenches Area is proposed. Construction of upgradient diversion ditches, downgradient collection drains, stormwater collection trenches, and any other methods to collect and/or redistribute surface or groundwater, including stream rechannelization, may trigger aquatic resource alteration requirements (see Table B.2). Additionally, runoff from diversion trenches, that may be considered wet weather conveyances, must not degrade or adversely affect the quality of downstream waters. There are no other ARARs for these actions other than general construction requirements previously discussed.

TRU Waste Removal. Buried TRU waste in SWSA 5 South placed before 1970 will remain in place and will be managed per DOE Order 435.1 and DOE Manual 435.1-1 as LLW. Trench 27 (a RCRA regulated unit), along with the SWSA 5 North 23 Trenches Area, will not be removed as part of the selected remedy, but instead will be removed under a separate non-CERCLA action. Contaminated soils from within the 23 Trenches Area will be excavated and consolidated in the areal extent of contamination (AOC) for additional characterization as part of the selected remedy under this ROD. Subsequent management of the soil will be in accordance with the ARARs discussed in the Waste Management subsection below. Soils not contaminated with TRU waste isotopes at concentrations of 100 nCi/g or greater will be considered LLW [see DOE M 435.1-1 (III)(A) for definition of TRU waste]. In the event certain soil is considered TRU waste and requires the degree of isolation specified in DOE M 435.1-1(III)(A)(2), it will be segregated and managed in accordance with the relevant DOE M 435.1-1 Chapter III and 40 CFR 191 treatment, storage, and/or disposal requirements.

Removal of Contaminated Media. Impoundment removal (PWSB, HRE Pond, and HFIR Impoundments), floodplain soil and sediment removal (including IHP), and contaminated surface soil removals listed on Table A.1) are designed to protect ecological and human receptors in waste management areas and industrial areas (i.e., east of SWSA 5). Waste removed as part of these actions may be LLW, RCRA, solid, hazardous or mixed waste and will either be disposed of at the EMWMF or appropriate facility (see waste generation, characterization, management, and disposal requirements on Table B.3) or used as contour fill under a multilayer cap. Regulators will review and approve plans for its use as contour fill before implementation. All contaminated areas throughout Melton Valley are for purposes of managing RCRA hazardous waste and are considered to be within the same general extent of contamination (AOC). Any RCRA hazardous soils removed from the areal extent of contamination for subsequent disposal in a land-based unit must meet the pertinent RCRA land disposal restrictions for hazardous waste at 40 CFR 268.40 *et seq.*

There are no action-specific ARARs for these actions other than the general requirements to control fugitive dust emissions and stormwater runoff (discussed above). However, chemical-specific ARARs for these actions include radiation protection requirements for the public and for unrestricted or restricted use of sites with residual radioactivity (see Table B.1). Also, applicable location-specific requirements include protection of sensitive resources, such as threatened and endangered plants or wildlife, wetlands, and floodplains (listed on Table B.2). All removal actions will be designed to protect the appropriate human receptor and to meet DOE TBC guidelines for residual radioactivity left in soil (see Table B.3).

Building Remediation. Ancillary facilities at OHF, NHF, MSRE, and HRE will be demolished or decontaminated and stabilized (e.g., grouted). Building remediation activities may result in generation of RCRA solid or hazardous waste (e.g., hazardous debris containing lead paint), LLW, mixed waste, asbestos, Toxic Substances Control Act of 1976 PCBs in fluorescent light ballasts or drained equipment, PCB bulk product waste (e.g., demolition debris having surfaces coated with paint containing PCBs greater than 50 ppm), or lead wastes (e.g., lead shielding). Characterization, treatment, storage, and disposal of these wastes will meet ARARs for waste management listed on Table B.3. Materials for unrestricted release must meet DOE Order 5400.5 TBC requirements listed on Table B.3 for residual surface contamination. Decommissioned sites will meet the radiation protection requirements listed on Table B.1 for either restricted or unrestricted use, as appropriate (see previous Chemical-specific ARARs subsection).

Water Treatment. All contaminated groundwarter originating from downgradient collection drains will be treated before discharge into surface waters. Treatment options include use of multiple treatment units (e.g., individual units at each drain location) or a single centralized unit (e.g., piping the groundwater to the Seep D area of SWSA 5 where an existing water treatment unit can be appropriately modified to handle the new flows). Strontium-90 is expected to be contaminant of concern (COC) in the collected groundwater requiring treatment. Treatment for strontium-90 and other identified COCs (excluding tritium) will be employed to ensure compliance with AWQC and narrative criteria instream. Wastes that are hazardous only because they exhibit a hazardous characteristic, and which are otherwise prohibited, are not prohibited if such wastes are managed in a treatment system that subsequently discharges to waters of the United States pursuant to permit issued under Sect. 402 of the CWA [40 CFR 268.1(c)(4)(i); Rules of the TDEC Chap. 1200-1-11-.10(1)(a)(30(iv)(I)]. Although no permits are needed for CERCLA discharges, the land disposal restriction exclusion will be applicable to discharge of treated groundwater into Melton Branch steams.

Liquids collected during construction, well drilling, dewatering, or decontamination activities will be transported to ORNL for treatment, if required, at a National Pollutant Discharge Elimination System-permitted facility and subsequently discharged via a permitted outfall.

In Situ Treatment. Inactive pipelines that are not removed or coincidentally capped will be stabilized (e.g., grouted), as will the HRE Fuel Wells in the Seepage Pits and Trenches Area, the OHF Pond, the shielded transfer tanks, and other sources listed on Table A.1. ISV will be implemented for Trenches 5 and 7 in the Seepage Pits and Trenches Area. There are no specific ARARs for in situ grouting of wastes other than the general construction requirements for control of emissions and runoff. Table B.3 lists applicable requirements for control of air emissions during ISV activities. Although CERCLA activities do not require permits, the ISV process must be evaluated for potential hazardous or radionuclide air emissions. If emissions would exceed the regulatory limits, operation of emission control devices must be implemented to ensure compliance with applicable requirements.

Well P&A and Monitoring. ARARs for these actions are listed under the appropriate headings on Table B.3. Installation of new groundwater monitoring wells will meet relevant and appropriate RCRA well construction requirements. Well P&A will be accomplished in accordance with relevant and appropriate TDEC regulations in a manner to prevent contamination of groundwater.

Land Use Controls. Consistent with 40 CFR 300.430(a)(1)(iii)(D) and per Rules of the TDEC Chap. 1200-1-13-.08(10), institutional controls such as water use and deed restrictions/notices are required under this remedy to supplement engineering controls as appropriate for the short- and long-term management to prevent or limit exposure to hazardous substances that may pose an unreasonable threat to public health, safety, or the environment and will remain in Melton Valley after conducting remediation. Such controls will be described in the LUCIP and include surface water advisories, land and groundwater use restrictions, as well as deed notices designed to warn and restrict potential users of the contaminated property throughout the valley. Deed restrictions will be recorded in accordance with state law on the original property acquisition records of DOE (and its predecessor agencies) that will notify anyone searching ORR property records that certain areas of Melton Valley are contaminated. In accordance with DOE Order 5400.5(IV)(6)(c), controls including physical barriers (i.e., fences, signs) to prevent access and appropriate radiological safety measures will be used to prevent disturbance of the residual radioactive material. An existing program for penetration permits/well construction will provide information on the extent of site contamination notice to developers and thereby possibly limit or prohibit their excavation and/or well drilling. In addition, a survey plat indicating the location and type of disposed RCRA hazardous wastes will be filed with the city/county [40 CFR 265.116; Rules of the TDEC Chap. 1200-1-11-.05(7)(g); and 40 CFR 265.119(a); Rules of the TDEC Chap. 1200-1-11-.05(7)(j)(1)]. Also, a notation will be recorded in accordance with state law on the original property acquisition records of DOE (and its predecessors) that will notify anyone searching those records that the SWSA 6 ICMAs and HTF were used to manage hazardous waste and that their use is restricted [40 CFR 265.119(b); Rules of the TDEC Chap. 1200-1-11-.05(7)(j)(2)(i)].

Waste Management. All primary (soils, debris, etc.) and secondary wastes [contaminated personal protective equipment, decontamination waste waters] generated during remedial activities will be appropriately characterized and managed in accordance with applicable RCRA, TSCA, Clean Air Act of 1990 or DOE Order requirements for LLW, TRU, hazardous, solid, asbestos or PCB waste. Some excavated contaminated soil may be used as contour fill under one of the various multilayer caps constructed in Melton Valley in accordance with protocol as reviewed and approved by TDEC and EPA. All contaminated areas throughout Melton Valley are, for purposes of managing RCRA hazardous waste, considered to be within the same general a real extent of contamination (AOC).Table B.3 lists general requirements for waste generation, characterization, treatment, and disposal of each anticipated waste type.

Transportation. Any wastes that are transferred off-site or transported in commerce along public right-of-ways must meet the requirements summarized on Table B.3, depending on the type of waste (e.g., RCRA, PCB, TRU waste, LLW, or mixed). These include packaging, labeling, marking, manifesting, and placarding requirements for hazardous materials. In addition, to the extent practicable, the volume of waste and number of shipments shall be minimized. Before shipping any waste to an off-site facility, DOE will verify with EPA that the facility is acceptable for receipt of CERCLA remediation wastes in accordance with the requirements of the "Off-Site Rule" at 40 CFR 300.440(a)(4).

Table B.1. Chemical-specific ARARs and TBC guidance for the selected alternative, Melton Valley watershed, ORNL, Oak Ridge, Tennessee

Action/medium	Requirements	Citation
Restoration of surface water(s) classified for *Fish and Aquatic Life Use*	Waters shall not contain toxic substances or a combination of substances including disease-causing agents that, by way of either direct or indirect exposure through food chains, may cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions, physical deformations, or restrict or impair growth in fish or aquatic life or their offspring—**applicable or relevant and appropriate**	Rules of the TDEC Chap. 1200-4-3-.03(3)(g)
	May not exceed AWQC in surface water(s) —**applicable or relevant and appropriate**	Rules of the TDEC Chap. 1200-4-3-.03(3)(g)
	Waters shall not contain other pollutants that will be detrimental to fish or aquatic life —**applicable or relevant and appropriate**	Rules of the TDEC Chap. 1200-4-3-.03(3)(h)
Restoration of surface water(s) classified for *Recreation* Use	Waters shall not contain toxic substances, whether alone or in combination with other substances, that will render the water unsafe or unsuitable for water contact activities including the capture and subsequent consumption of fish and shellfish, or will propose toxic conditions that will adversely affect man, animal, aquatic life or wildlife—**applicable or relevant and appropriate**	Rules of the TDEC Chap. 1200-4-3-.03(4)(h)
	May not exceed AWQC in surface water(s)—**applicable or relevant and appropriate**	Rules of the TDEC Chap. 1200-4-3-.03(4)(h)
	Waters shall not contain other pollutants in quantities that may have a detrimental effect on recreation—**applicable or relevant and appropriate**	Rules of the TDEC Chap. 1200-4-3-.03(4)(i)
Restoration of surface water(s) classified for *Irrigation* and/or *Livestock Watering and Wildlife Uses*	Waters shall not contain toxic substances, whether alone or in combination with other substances, that will produce toxic conditions that adversely affect the quality of the waters for irrigation and/or livestock watering and wildlife—**applicable or relevant and appropriate**	Rules of the TDEC Chap. 1200-4-3-.03(5)(f) and (6)(f)
	Waters shall not contain other pollutants in quantities that may be detrimental to the waters used for irrigation and/or for livestock watering and wildlife—**applicable or relevant and appropriate**	Rules of the TDEC Chap. 1200-4-3-.03(5)(g) and (6)(g)
Release of radionuclides into the environment	Exposure to individual members of the public from radiation shall not exceed a total EDE of 0.1 rem/year (100 mrem/year), exclusive of the dose contributions from background radiation, any medical administration the individual has received, or voluntary participation in medical/research programs—**relevant and appropriate**	10 CFR 20.1301(a)(1)

Table B.1. (continued)

Action/medium	Requirements	Citation
	Shall use, to the extent practicable, procedures and engineering controls based on sound radiation protection principles to achieve doses to members of the public that are ALARA **—relevant and appropriate**	10 CFR 20.1101(b)
Release of radionuclides into the environment from a decommissioned site	For unrestricted use of the site, residual radioactivity that is distinguishable from background radiation shall not cause a total EDE > 25 mrem/year (to an average member of the critical group as defined in 10 CFR 20.1003), including that from groundwater sources of drinking water. Residual radioactivity shall be reduced to levels that are ALARA**—relevant and appropriate**	10 CFR 20.1402
	A site will be considered acceptable for use under restricted conditions if provisions are made for legally enforceable institutional controls (e.g., deed restrictions, government control or ownership, engineered barriers as appropriate) that provide reasonable assurance that the total EDE from residual radioactivity (distinguishable from background), which has been reduced to ALARA levels, to the average member of the critical group will not exceed 25 mrem/year **—relevant and appropriate**	10 CFR 20.1403(a) and (b)

ALARA = as low as reasonably achievable
ARAR = applicable or relevant and appropriate requirement
AWQC = ambient water quality criteria
CCC = criterion continuous concentration
CFR = *Code of Federal Regulations*
CMC = criterion maximum concentration
COC = contaminant of concern
EDE = effective dose equivalent

L = liter
μg = microgram
mg = milligram
mrem = millirem
ORNL = Oak Ridge National Laboratory
TBC = to be considered
TDEC = Tennessee Department of Environment and Conservation

Table B.2. Location-specific ARARs and TBC guidance for the selected alternative, Melton Valley watershed, ORNL, Oak Ridge, Tennessee

Location characteristic(s)	Requirement(s)	Prerequisite	Citation(s)
	Wetlands		
Presence of wetlands as defined in 10 CFR 1022.4(v)	Avoid, to the extent possible, the long- and short-term adverse effects associated with destruction, occupancy and modification of wetlands. Measures to mitigate adverse effects of actions in a wetlands include, but are not limited to, minimum grading requirements, runoff controls, design and construction constraints, and protection of ecology-sensitive areas as provided in 10 CFR 1022.12(a)(3)	Federal actions that involve potential impacts to, or take place within, wetlands—**applicable**	10 CFR 1022.3(a)
	Take action, to extent practicable, to minimize destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands		10 CFR 1022.3(b)(5) and (6)
	Potential effects of any new construction in wetlands shall be evaluated. Identify, evaluate, and, as appropriate, implement alternative actions that may avoid or mitigate adverse impacts on wetlands		10 CFR 1022.3(c) and (d)
	Floodplains		
Presence of floodplain as defined in 10 CFR 1022.4(i)	Avoid, to the extent possible, the long- and short-term adverse effects associated with occupancy and modification of floodplains. Measures to mitigate adverse effects of actions in a floodplain include, but are not limited to, minimum grading requirements, runoff controls, design and construction constraints, and protection of ecology-sensitive areas as provided in 10 CFR 1022.12(a)(3)	Federal actions that involve potential impacts to, or take place within, floodplains—**applicable**	10 CFR 1022.3(a)
	Potential effects of any action taken in a floodplain shall be evaluated. Identify, evaluate, and implement alternative actions that may avoid or mitigate adverse impacts on floodplains		10 CFR 1022.3(c) and (d)
	Design or modify selected alternatives to minimize harm to or within floodplains and restore and preserve floodplain values		10 CFR 1022.5(b)

Table B.2 (continued)

Location characteristic(s)	Requirement(s)	Prerequisite	Citation(s)
	Aquatic resources		
Within an area potentially impacting waters of the State as defined in TCA 69-3-103(33)	Must comply with the substantive requirements of the ARAP for erosion and sediment control to prevent pollution	Action potentially altering the properties of any waters of the state — **applicable**	TCA 69-3-108(b)(1)(j)
	Erosion and sediment control requirements include, but are not limited to • Limit clearing, grubbing, and other disturbances in areas in or immediately adjacent to waters of the state to the minimum necessary to accomplish the proposed activity; • Unnecessary vegetation removal is prohibited, and all disturbed areas must be properly stabilized and revegetated as soon as practicable; • Limit excavation, dredging, bank reshaping, or grading to the minimum necessary to install authorized structures, accommodate stabilization, or prepare banks for revegetation; • Maintain the erosion and sedimentation control measures throughout construction period; and • Upon achievement of a final grade, stabilize and revegetate, within 30 days, all disturbed areas by sodding, seeding, or mulching, or using appropriate native riparian species	Action potentially altering the properties of any waters of the state —**TBC**	TDEC ARAP Program General Requirements
	Additional requirements for road crossings: • Width of fill associated with the crossing shall be limited to the minimum necessary for the actual crossing; Excavation and fill activities shall be separated from flowing waters; special requirements listed for cofferdams, berms or temporary diversion channels must be met;	Minor road crossings (limited to total length of stream encapsulation of 200 linear ft or less)—**TBC**	TDEC ARAP Program General Requirements

Table B.2 (continued)

Location characteristic(s)	Requirement(s)	Prerequisite	Citation(s)
	• Crossings shall be culverted, bridged, or otherwise designed to prevent the impoundment of normal or base flows; • Design and construction must not disrupt the movement of aquatic life; • Use of slurry walls and/or check dams must meet certain specified requirements; • Limitations on use and construction of stream crossings must be met, such crossings may not be used as transportation routes for heavy equipment; • Construction debris must be kept from entering the stream channel; and • Other specified requirements regarding spills, final grade, etc. must be met		
Location encompassing aquatic ecosystem as defined in 40 CFR 230.3(c)	No discharge of dredged or fill material into an aquatic ecosystem is permitted if there is a practicable alternative that would have less adverse impact	Action that involves the discharge of dredged or fill material into waters of the United States, including jurisdictional wetlands—**applicable**	40 CFR 230.10(a)
	No discharge of dredged or fill material shall be permitted unless appropriate and practicable steps in accordance with 40 CFR 230.70 *et seq.* have been taken which will minimize potential adverse impacts of the discharge on the aquatic ecosystem		40 CFR 230.10(d)
	Endangered, threatened, or rare species		
Presence of federally endangered or threatened species, as designated in 50 CFR 17.11 and 17.12 – or – critical habitat of such species	Actions that jeopardize the existence of a listed species or results in the destruction or adverse modification of critical habitat must be avoided or reasonable and prudent mitigation measures taken	Action that is likely to jeopardize fish, wildlife, or plant species or destroy or adversely modify critical habitat—**applicable**	16 USC 1531 *et.seq.*, Sect. 7(a)(2)

Table B.2 (continued)

Location characteristic(s)	Requirement(s)	Prerequisite	Citation(s)
Presence of Tennessee non-game species as defined in TCA 70-8-103	May not take (e.g., harass, hunt, capture, kill or attempt to kill) possess, transport, export, or process such wildlife species	Action impacting Tennessee non-game species, including wildlife species which are threatened and endangered or "in need of management" (as listed in TWRCP 94-16 and 94-17) —**applicable**	TCA 70-8-104(c)
	May not knowingly destroy the habitat of such wildlife species		TWRCP 94-16(II)(1)(a) and TWRCP 94-17(II)
	Upon good cause shown and where necessary to protect human health or safety, endangered or threatened species may be removed, captured, or destroyed		TCA 70-8-106(e) TWRCP 94-16(II)(1)(c)
Presence of Tennessee-listed endangered or rare plant species as listed in Rules of the TDEC Chap. 0400-6-2.04	May not knowingly uproot, dig, take, remove, damage or destroy, possess, or otherwise disturb for any purpose any endangered species	Action impacting rare plant species including but not limited to federally listed endangered species—**applicable**	TCA 70-8-309
	Cultural resources		
Presence of archaeological resources	May not excavate, remove, damage, or otherwise alter or deface such resource unless by permit or exception	Action that would impact archeologic resources on public lands—**applicable**	43 CFR 7.4(a)
	Must protect any such archaeological resources if discovered	Excavation activities that inadvertently discover archaeological resources—**applicable**	43 CFR 7.5(b)(1)
Presence of human remains, funerary objects, sacred objects, or objects of cultural patrimony for Native Americans	Must stop activities in the area of the discovery and take reasonable effort to secure and protect the objects discovered	Excavation activities that inadvertently discover such resources on federal lands or under federal control—**applicable**	43 CFR 10.4(c) and (d)(1)(i)

ARAP = Aquatic Resource Alteration Permit
ARAR = applicable or relevant and appropriate requirement
CFR = *Code of Federal Regulations*
ORNL = Oak Ridge National Laboratory
TBC = to be considered
TCA = *Tennessee Code Annotated*
TDEC = Tennessee Department of Environment and Conservation
TWRCP = Tennessee Wildlife Resources Commission Proclamation
USC = *United States Code*

Table B.3. Action-specific ARARs and TBC guidance, Melton Valley watershed, ORNL, Oak Ridge, Tennessee

Action	Requirements	Prerequisite	Citation
General construction standards–all proposed actions			
Activities causing fugitive dust emissions	Shall take reasonable precautions to prevent particulate matter from becoming airborne; reasonable precautions shall include, but are not limited to, the following:	Fugitive emissions from demolition of existing buildings or structures, construction operations, grading of roads, or the clearing of land —**applicable**	Rules of the TDEC Chap. 1200-3-8-.01(1)
	• use, where possible, of water or chemicals for control of dust, and		Rules of the TDEC Chap. 1200-3-8-.01(1)(a)
	• application of asphalt, oil, water, or suitable chemicals on dirt roads, materials stock piles, and other surfaces which can create airborne dusts;		Rules of the TDEC Chap. 1200-3-8-.01(1)(b)
	Shall not cause or allow fugitive dust to be emitted in such a manner as to exceed 5 minute/hour or 20 minute/day beyond property boundary lines on which emission originates		Rules of the TDEC Chap. 1200-3-8-.01(2)
Activities causing radionuclide emissions	Shall not exceed those amounts that would cause any member of the public to receive an EDE of 10 mrem per year	Radionuclide emissions from point sources, as well as diffuse or fugitive emissions, at a DOE facility—**applicable**	40 CFR 61.92 Rules of the TDEC Chap. 1200-3-11-.08(6)
Activities causing stormwater runoff	Implement good construction management techniques (including sediment and erosion controls), vegetative controls, and structural controls in accordance with Rules of the TDEC Chap. 1200-4-10-.05(6)(a-f), (g-i), and (j-m), respectively, to ensure stormwater discharge:	Dewatering or stormwater runoff discharges from land disturbed by construction activity—disturbance of ≥5 acres total—**applicable**; < 5 acres—**relevant and appropriate**	Rules of the TDEC Chap. 1200-4-10-.05(6)

Table B.3 (continued)

Action	Requirements	Prerequisite	Citation
	• does not contain distinctly visible floating scum, oil, or other matter;		Rules of the TDEC Chap. 1200-4-10-.05(6)(n)
	• does not cause an objectionable color contrast in the receiving stream;		Rules of the TDEC Chap. 1200-4-10-.05(6)(o)
	• results in no materials in concentrations sufficient to be hazardous or otherwise detrimental to humans, livestock, wildlife, plant life, or fish and aquatic life in the receiving stream		Rules of the TDEC Chap. 1200-4-10-.05(6)(p)
	Capping—SWSA 4, SWSA 5 South, SWSA 5 North, SWSA 6, and Seepage Pits and Trenches Area		
Closure of a RCRA landfill or LLW burial grounds and trenches	Must close the unit in a manner that: • minimizes the need for further maintenance, and	Closure of a RCRA hazardous waste management facility—**applicable** to SWSA 6 ICMAs , and HTF; **relevant and appropriate** to closure of all other areas	40 CFR 265.111(a) Rules of the TDEC Chap. 1200-1-11-.05(7)(b)(1)
	• controls, minimizes, or eliminates to the extent necessary to protect human health and the environment, postclosure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products to ground or surface waters or to the atmosphere, and		40 CFR 265.111(b) Rules of the TDEC Chap. 1200-1-11-.05(7)(b)(2)
	• complies with the closure requirements of 40 CFR 265.310	Closure of a RCRA hazardous waste management facility—**applicable** to SWSA 6 ICMAs, HTF; **relevant and appropriate** to closure of all other areas	40 CFR 265.111(c) Rules of the TDEC Chap. 1200-1-11-.05(7)(b)(3)
	Must cover the landfill or cell with a final cover designed and constructed to:		40 CFR 265.310(a) Rules of the TDEC Chap. 1200-1-11-.05(14)(k)(1)

Table B.3 (continued)

Action	Requirements	Prerequisite	Citation
	• provide long-term minimization of migration of liquids through the closed landfill,		40 CFR 265.310(a)(1) Rules of the TDEC Chap. 1200-1-11-.05(14)(k)(1)(i)
	• function with minimum maintenance,		40 CFR 265.310(a)(2) Rules of the TDEC Chap. 1200-1-11-.05(14)(k)(1)(ii)
	• promote drainage and minimize erosion or abrasion of the cover,		40 CFR 265.310(a)(3) Rules of the TDEC Chap. 1200-1-11-.05(14)(k)(1)(iii)
	• accommodate settling and subsidence so that the cover's integrity is maintained, and		40 CFR 265.310(a)(4) Rules of the TDEC Chap. 1200-1-11-.05(14)(k)(1)(iv)
	• have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present		40 CFR 265.310(a)(5) Rules of the TDEC Chap. 1200-1-11-.05(k)(1)(v)
Protection of capped SWSAs	Postclosure use of property must never be allowed to disturb the integrity of the final cover, liners, or any other components of the containment system or the facility's monitoring system unless necessary to reduce a threat to human health or the environment.	Closure of a RCRA landfill—**applicable** to SWSA 6 ICMAs and HTF; **relevant and appropriate** to all other capped areas	40 CFR 265.117(c) Rules of the TDEC Chap. 1200-1-11-.05(7)(h)(3)
General postclosure care of capped SWSAs	Owner or operator must • maintain the effectiveness and integrity of the final cover, including making repairs to the cap as necessary to correct effects of settling, subsidence, erosion, and other events;	Closure of a RCRA landfill—**applicable** to SWSA 6 ICMAs and HTF; **relevant and appropriate** for all other capped areas	40 CFR 265.310(b) 40 CFR 265.310(b)(1) Rules of the TDEC Chap. 1200-1-11-.06(14)(k)(2) Rules of the TDEC Chap. 1200-1-11-.06(14)(k)(2)(i)

Table B.3 (continued)

Action	Requirements	Prerequisite	Citation
	• prevent run-on and runoff from eroding or otherwise damaging final cover; and		40 CFR 265.310(b)(4) Rules of the TDEC Chap. 1200-1-11-.05(14)(k)(2) (iv)
	• maintain and monitor a groundwater monitoring system and comply with all other applicable provisions 40 CFR 264, Subpart F	Closure of RCRA landfill—**applicable** to SWSA 6 ICMAs and HTF	40 CFR 265.310(b)(3) Rules of the TDEC Chap. 1200-1-11-.06(14)(k)(2) (iii)
Closure of LLW burial grounds and trenches	Covers must be designed to minimize, to the extent practicable, water infiltration, to direct percolating or surface water away from the disposed waste, and to resist degradation by surface geologic processes and biotic activity	Land disposal of LLW—**relevant and appropriate**	Rules of the TDEC Chap.1200-2-11-.17(2)(d)
	Concentrations of radioactive material which may be released to the general environment in groundwater, surface water, air, soil, plants, or animals must not result in an annual dose exceeding an equivalent of 25 mrem to the whole body, 75 mrem to the thyroid, and 25 mrem to any other organ; a reasonable effort shall be made to maintain releases of radioactivity in effluents to the general environment to ALARA		Rules of the TDEC Chap. 1200-2-11-.16(2)
Corrective Measures for SWSAs	Must have plans for taking corrective measures if migration of radionuclides would indicate that the performance objectives of Rules of the TDEC Chap. 1200-2-11-.16 may not be met	Closure of a LLW disposal facility—**relevant and appropriate**	Rules of the TDEC Chap. 1200-2-11-.17(4)(b)
Removal of contaminated media–WOC, Melton Branch, and tributary sediment and floodplain soils; IHP, surficially contaminated soil, HRE pond, HFIR impoundments; other areas listed on Table A.1			
Remediation of radionuclide-contaminated soil	Guidelines for residual concentrations of radionuclides in soil shall be derived from the basic dose limit using an environmental pathway analysis	Residual radioactive material in soil—**TBC**	DOE Order 5400.5(IV)(4)(a)

Table B.3 (continued)

Action	Requirements	Prerequisite	Citation
D&D activities–ancillary facilities at MSRE, HRE, OHF, NHF, and other facilities as listed in Table A.1			
Decontamination of radioactively contaminated equipment and building structure	Must meet surface contamination guidelines for residual activity provided in Figure IV-1 of the Order for specified radionuclides	Residual radioactive material on equipment and building structures for unrestricted use—**TBC**	DOE Order 5400.5(IV)(4)(d) and Figure IV-1
Removal of RACM from a facility	Procedures for asbestos emission control per 40 CFR 61.145(c)(1-10) shall be followed, as appropriate	Demolition of a facility containing RACM exceeding the volume requirements of 40 CFR 61.145(a)(1) —**applicable**	40 CFR 61.145(c) Rules of the TDEC Chap. 1200-3-11-.02(2)(d)(3)
Water treatment–downgradient groundwater collection at SWSA 4, SWSA 5 South, Seepage Pits and Trenches Area, and on-site treatment and discharge; transfer of collected dewatering, decontamination, etc. water for treatment at ORNL			
Transport to ORNL NPDES water treatment facility	All tank systems, conveyance systems, and ancillary equipment used to store or transport waste to an on-site NPDES-permitted wastewater treatment facility are exempt from the requirements of RCRA Subtitle C standards	On-site wastewater treatment units that are subject to regulation under Sect. 402 or Sect. 307(b) of CWA (NPDES-permitted) —**applicable**	40 CFR 270.1(c)(2)(v) Rules of the TDEC Chap. 1200-1-11-.07(1)(b)(4)(iv)
Discharge of treated groundwater at Seep D	Shall receive the degree of treatment or effluent reduction necessary to comply with water quality standards and, where appropriate, will comply with the standard of performance as required by the Tennessee Water Quality Control Act of 1977 at TCA 69-3-103(30)	Point source discharge(s) of pollutants into surface water—**applicable**	Rules of the TDEC Chap. 1200-4-3-.05(6)
	Are not prohibited if such wastes are managed in a treatment system which subsequently discharges to waters of the United States pursuant to a permit issued under Sect. 402 of the CWA, unless the wastes are subject to a specified method of treatment other than DEACT in 40 CFR 268.40 or are D003 reactive cyanide	Restricted RCRA characteristically hazardous waste intended for disposal—**applicable**	40 CFR 268.1(c)(4)(i) Rules of the TDEC Chap. 1200-1-11-.10(1)(a)(3)(iv)(I)

Table B.3 (continued)

Action	Requirements	Prerequisite	Citation
	Absorbed dose to native animal aquatic organisms must not exceed 1 rad/day	Discharge of radioactive materials in liquid waste to surface water at a DOE facility—**TBC**	DOE Order 5400.5(II)(3)(a)(5)
In situ treatment—grout: OHF pond, HRE fuel wells, pipelines, shielded transfer tanks, other small tanks listed in Table A.1; ISV: Trenches 5 and 7			
Emissions from ISV off-gas system	Discharge of air contaminants must be in accordance with the appropriate provisions of Rules of the TDEC 1200-3 et seq., any applicable measures of control strategy and all provisions of the Tennessee Pollution Control Act	Emissions of air pollutants from new air contaminant sources—**applicable**	Rules of the TDEC Chap. 1200-3-9-.01(1)(d)
	Emission measurements in conformance with 40 CFR 61.93(b) shall be made Shall measure all radionuclides which could contribute greater than 10% of the potential EDE for a release point	Release points which have the potential to discharge radionuclides into the air in quantities which could cause an EDE in excess of 1% of 10 mrem/year to any member of the public —**applicable**	40 CFR 61.93(b)(4)(i) Rules of the TDEC Chap. 1200-3-11-.08(6)
	Periodic confirmatory measurements shall be made to verify low emissions	Other release points which have the potential to release radionuclides into the air—**applicable**	

Table B.3 (continued)

Action	Requirements	Prerequisite	Citation
	Well P&A—all HF injection and monitoring wells undergoing closure		
Closure of groundwater monitoring well(s)	Well shall be completely filled and sealed in such a manner that vertical movement of fluid either into or between formation(s) containing groundwater classified pursuant to Rules of the TDEC Chap. 1200-4-6-.05(1) through the borehole is not allowed. Shall be performed in accordance with the provisions for Seals at Rules of the TDEC 1200-4-6-.09(6)(e), (f), and (g); for Fill Materials at Rules of the TDEC 1200-4-6-.09(6)(h) and (i); for Temporary Bridges at Rules of the TDEC 1200-4-6-.09(6)(j); for Placement of Sealing Materials at Rules of the TDEC 1200-4-6-.09(7)(a) and (b); and Special Conditions at Rules of the TDEC 1200-4-6-.09(8)(a) and (b), as appropriate	Permanent plugging and abandonment of a well—**relevant and appropriate**	Rules of the TDEC Chap. 1200-4-6-.09(6)(d)

Table B.3 (continued)

Action	Requirements	Prerequisite	Citation
		Monitoring—groundwater monitoring wells	
Construction of groundwater monitoring well(s)	All monitoring wells must be cased in a manner that maintains the integrity of the monitoring well bore hole; this casing must be screened or perforated and packed with gravel or sand, where necessary, to enable collection of groundwater samples; the annular space above the sampling depth must be sealed to prevent contamination of groundwater and samples	Construction of RCRA groundwater monitoring well—**relevant and appropriate**	40 CFR 264.97(c) Rules of the TDEC Chap. 1200-1-11-.06(6)(h)(3)
	Institutional controls—all waste left in place—grout sheets, pipelines, facilities, contaminated soil or sediment, burial grounds (see Table A.1)		
Waste left in place	Institutional controls are required and shall include, at a minimum, deed restrictions for sale and use of property and securing area to prevent human contact with hazardous substances	Hazardous substances left in place that may pose an unreasonable threat to public health, safety, or the environment—**relevant and appropriate**	Rules of the TDEC Chap. 1200-1-13-.08(10)
Radioactive material left in place	A property may be maintained under interim management provided administrative controls are established to protect members of the public	Residual radioactive material above guidelines in inaccessible locations which would be unreasonably costly to remove—**TBC**	DOE Order 5400.5(IV)(6)(c)(1)
	Controls include, but are not limited to, periodic monitoring as appropriate, appropriate shielding, physical barriers (i.e., fences, warning signs) to prevent access, appropriate radiological safety measures during maintenance, renovation, demolition, or other activities that might disturb the residual radioactive material or cause it to migrate		DOE Order 5400.5(IV)(6)(c)(2)

Table B.3 (continued)

Action	Requirements	Prerequisite	Citation
Survey Plat	Must submit to the local zoning authority or the authority with jurisdiction over local land use, a survey plat indicating the location and dimensions of the landfill cells, with respect to permanently surveyed benchmarks. The plat must contain a note, prominently displayed which states the owner/operator obligation to restrict disturbance of the landfill	Closure of a RCRA landfill—**applicable** to SWSA 6 ICMAs and HTF	40 CFR 265.116 Rules of the TDEC Chap. 1200-1-11-.05(7)(g)
Postclosure Notices	Must submit to the local zoning authority a record of the type, location, and quantity of hazardous wastes disposed of within each cell of the unit	Closure of a RCRA landfill—**applicable** to SWSA 6 ICMAs and HTF	40 CFR 265.119(a) Rules of the TDEC Chap. 1200-1-11-.05(7)(j)(1)
	Must record, in accordance with state law, a notation on the deed to the facility property—or on some other legal instrument which is normally examined during a title search—that will in perpetuity notify any potential purchaser of the property that:		40 CFR 265.119(b)(1) Rules of the TDEC Chap. 1200-1-11-.05(7)(j)(2)(i)
	• the land has been used to manage hazardous wastes;		40 CFR 265.119(b)(1)(i) Rules of the TDEC Chap. 1200-1-11-.05(7)(j)(2)(i)(I)
	• its use is restricted under 40 CFR Subpart G regulations; and		40 CFR 265.119(b)(1)(ii) Rules of the TDEC Chap. 1200-1-11-.05(7)(j)(2)(i)(II)
	• the survey plat and record of the type, location, and quantity of hazardous wastes disposed within each cell or other hazardous waste disposal unit of the facility required by Sections 265.116 and 265.119(a) have been filed with the local zoning authority and with the EPA Regional Administrator		40 CFR 265.119(b)(1)(iii) Rules of the TDEC Chap. 1200-1-11-.05(7)(j)(2)(i)(III)

Table B.3 (continued)

Action	Requirements	Prerequisite	Citation
Waste generation, characterization, segregation, and storage—excavated soils, sediments, building debris, secondary wastes			
Characterization of solid waste ***(all primary and secondary wastes)***	Must determine if solid waste is hazardous waste or if waste is excluded under 40 CFR 261.4; and	Generation of solid waste as defined in 40 CFR 261.2 and which is not excluded under 40 CFR 261.4(a) and (b)—**applicable**	40 CFR 262.11(a) Rules of the TDEC Chap. 1200-1-11-.03(1)(b)(1)
	Must determine if waste is listed under 40 CFR Part 261; or		40 CFR 262.11(b) Rules of the TDEC Chap. 1200-1-11-.03(1)(b)(2)
	Must characterize waste by using prescribed testing methods or applying generator knowledge based on information regarding material or processes used. If waste is determined to be hazardous, it must be managed in accordance with pertinent sections 40 CFR 261-268		40 CFR 262.11(c) and (d) Rules of the TDEC Chap. 1200-1-11-.03(1)(b)(3) and (4)
Characterization of hazardous waste (***all primary and secondary wastes***)	Must obtain a detailed chemical and physical analysis on a representative sample of the waste(s), which at a minimum contains all the information that must be known to treat, store, or dispose of the waste in accordance with pertinent sections of 40 CFR 264 and 268	Generation of RCRA-hazardous waste for storage, treatment or disposal—**applicable**	40 CFR 264.13(a)(1) Rules of the TDEC Chap. 1200-1-11-.06(2)(d)(1)
	Must determine if the waste is restricted from land disposal under 40 CFR 268 *et seq.* by testing in accordance with prescribed methods or use of generator knowledge of waste		40 CFR 268.7 Rules of the TDEC Chap. 1200-1-11-.10(1)(g)(1)(i)
Temporary storage of hazardous waste in containers ***(e.g., PPE, D&D demolition debris)***	A generator may accumulate hazardous waste at the facility provided that: • waste is placed in containers that comply with 40 CFR 265.171-173; and	Accumulation of RCRA hazardous waste on site as defined in 40 CFR 260.10—**applicable**	40 CFR 262.34(a) Rules of the TDEC Chap. 1200-1-11-.03(4)(e) 40 CFR 262.34(a)(1)(i) Rules of the TDEC Chap. 1200-1-11-.03(4)(e)(2)(i)(I)

Table B.3 (continued)

Action	Requirements	Prerequisite	Citation
	• container is marked with the words "hazardous waste" or		40 CFR 264.34(a)(3) Rules of the TDEC Chap. 1200-1-11-.03(4)(e)(2)(iv)
	• container may be marked with other words that identify the contents	Accumulation of 55 gal. or less of RCRA hazardous waste at or near any point of generation—**applicable**	40 CFR 262.34(c)(1) Rules of the TDEC Chap. 1200-1-11-.03(4)(e)(5)(i)(II)
Use and management of hazardous waste in containers	If container is not in good condition (e.g. severe rusting, structural defects) or if it begins to leak, must transfer waste into container in good condition	Storage of RCRA hazardous waste in containers—**applicable**	40 CFR 265.171 Rules of the TDEC Chap. 1200-1-11-.05(9)(b)
	Use container made or lined with materials compatible with waste to be stored so that the ability of the container is not impaired		40 CFR 265.172 Rules of the TDEC Chap. 1200-1-11-.05(9)(c)
	Keep containers closed during storage, except to add/remove waste		40 CFR 265.173(a) Rules of the TDEC Chap. 1200-1-11-.05(9)(d)(1)
	Open, handle and store containers in a manner that will not cause containers to rupture or leak		40 CFR 265.173(b) Rules of the TDEC Chap. 1200-1-11-.05(9)(d)(2)
Characterization of LLW (*e.g., contaminated PPE, equipment, D&D demolition debris)*	Shall be characterized using direct or indirect methods and the characterization documented in sufficient detail to ensure safe management and compliance with the WAC of the receiving facility	Generation of LLW for storage or disposal at a DOE facility—**TBC**	DOE M 435.1-1(IV)(I)
	Characterization data shall, at a minimum, include the following information relevant to the management of the waste:		DOE M 435.1-1(IV)(I)(2)(a)
	• physical and chemical characteristics;		DOE M 435.1-1(IV)(I)(2)(a)
	• volume, including the waste and any stabilization or absorbent media;		DOE M 435.1-1(IV)(I)(2)(b)
	• weight of the container and contents;		DOE M 435.1-1(IV)(I)(2)(c)
	• identities, activities, and concentration of major radionuclides;		DOE M 435.1-1(IV)(I)(2)(d)
	• characterization date;		DOE M 435.1-1(IV)(I)(2)(e)

Table B.3 (continued)

Action	Requirements	Prerequisite	Citation
	• generating source; and		DOE M 435.1-1(IV)(I)(2)(f)
	• any other information that may be needed to prepare and maintain the disposal facility performance assessment, or demonstrate compliance with performance objectives		DOE M 435.1-1(IV)(I)(2)(g)
Temporary storage of ***LLW (e.g., contaminated PPE, D&D demolition debris)***	Shall not be readily capable of detonation, explosive decomposition, reaction at anticipated pressures and temperatures, or explosive reaction with water	Management of LLW at a DOE facility—**TBC**	DOE M 435.1-1 (IV)(N)(1)
	Shall be stored in a location and manner that protects the integrity of waste for the expected time of storage		DOE M 435.1-1 (IV)(N)(3)
	Shall be managed to identify and segregate LLW from mixed waste		DOE M 435.1-1 (IV)(N)(6)
Packaging of solid LLW (***e.g., contaminated PPE, equipment, D&D demolition debris)***	Shall be packaged in a manner that provides containment and protection for the duration of the anticipated storage period and until disposal is achieved or until the waste has been removed from the container	Storage of LLW in containers at a DOE facility—**TBC**	DOE M 435.1-1(IV)(L)(1)(a)
	Vents or other measures shall be provided if the potential exists for pressurizing or generating flammable or explosive concentrations of gases within the waste container		DOE M 435.1-1(IV)(L)(1)(b)
	Containers shall be marked such that their contents can be identified		DOE M 435.1-1(IV)(L)(1)(c)

Table B.3 (continued)

Action	Requirements	Prerequisite	Citation
Segregation of scrap metal for recycle	Material is not subject to RCRA requirements for generators, transporters, and storage facilities under 40 CFR Parts 262 through 266, 268, 270, or 124	Scrap metal, as defined on 40 CFR 261.1(c)(6) intended for recycle—**applicable**	40 CFR 261.6(a)(3)(ii) Rules of the TDEC Chap. 1200-1-11-.02(1)(f)(1)(iii)(II)
Release of scrap metal (***lead bricks, lead shielding, etc.***)	Before being released, items shall be surveyed to determine whether both removable and total surface contamination (including contamination present on or under any coating) is greater than the levels given in Figure IV-1 of the Order and that the contamination has been subjected to the ALARA process	Radionuclide-contaminated scrap materials and equipment intended for recycle or reuse—**TBC**	DOE Order 5400.5(II)(5)(c)(1)
Management of asbestos-containing waste prior to disposal (***e.g., D&D demolition debris***)	Discharge no visible emissions to the outside air, or use one of the emission control and waste treatment methods specified in paragraphs (a)(1) through (a)(4) of 40 CFR 61.150	Collection, processing, packaging or transporting of any asbestos-containing waste material generated by demolition activities —**applicable**	40 CFR 61.150(a) Rules of the TDEC Chap. 1200-3-11-.02(2)(j)(1)
Management of PCB waste (***e.g., contaminated PPE, demolition debris, sludges***)	Any person storing or disposing of PCB waste must do so in accordance with 40 CFR 761, Subpart D	Generation of waste containing PCBs at concentrations 50 ppm—**applicable**	40 CFR 761.50(a)
	Any person cleaning up and disposing of PCBs shall do so based on the concentration at which the PCBs are found	Generation of PCB remediation waste as defined in 40 CFR 761.3—**applicable**	40 CFR 761.61
Management of PCB/radioactive waste (***e.g., oils drained from pumps, equipment, D&D demolition debris, etc.***)	Any person storing such waste must do so taking into account both its PCB concentration and radioactive properties, except as provided in 40 CFR 761.65(a)(1), (b)(1)(ii) and (c)(6)(i)	Generation for disposal of PCB/ radioactive waste with ≥ 50 ppm PCBs—**applicable**	40 CFR 761.50(b)(7)(i)
	Any person disposing of such waste must do so taking into account both its PCB concentration and its radioactive properties		40 CFR 761.50(b)(7)(ii)

Table B.3 (continued)

Action	Requirements	Prerequisite	Citation
	If, after taking into account only the PCB properties in the waste, the waste meets the requirements for disposal in a facility permitted, licensed, or registered by a state as a municipal or nonmunicipal nonhazardous waste landfill [e.g., PCB bulk product waste under 40 CFR 761.62(b)(1)], the person may dispose of such waste without regard to the PCBs, based on its radioactive properties alone in accordance with applicable requirements		
Temporary storage of PCB waste *(e.g., contaminated PPE, D&D demolition debris, sludges)*	Container(s) shall be marked as illustrated in 40 CFR 761.45(a)	Storage of PCBs and PCB Items at concentrations 50 ppm for disposal — **applicable**	40 CFR 761.65(a)(1)
	Storage area must be properly marked as required by 40 CFR 761.40(a)(10)		40 CFR 761.65(c)(3)
	Any leaking PCB Items and their contents shall be transferred immediately to a properly marked non-leaking container(s).		40 CFR 761.65(c)(5)
	Container(s) shall be in accordance with requirements set forth in DOT HMR at 49 CFR 171-180		40 CFR 761.65(c)(6)
Storage of PCB/radioactive waste in containers *(e.g., contaminated PPE, demolition debris, sludges)*	For liquid wastes, containers must be nonleaking.	Storage of PCB/radioactive waste in containers other than those meeting DOT HMR performance standards— **applicable**	40 CFR 761.65(c)(6)(i)(A)
	For nonliquid wastes, containers must be designed to prevent buildup of liquids if such containers are stored in an area meeting the containment requirements of 40 CFR 761.65(b)(1)(ii)		40 CFR 761.65(c)(6(i)(B)

Table B.3 (continued)

Action	Requirements	Prerequisite	Citation
	For both liquid and nonliquid wastes, containers must meet all regulations and requirements pertaining to nuclear criticality safety		40 CFR 761.65(c)(6)(i)(C)
Treatment/disposal of waste—excavated sediment/soils, building debris, secondary wastes			
Disposal of RCRA-hazardous waste in a land-based unit (***debris with lead paint, lead shielding, sludges, etc.***)	May be land disposed if it meets the requirements in the table "Treatment Standards for Hazardous Waste" at 40 CFR 268.40 before land disposal	Land disposal, as defined in 40 CFR 268.2, of restricted RCRA waste—**applicable**	40 CFR 268.40(a) Rules of the TDEC Chap. 1200-1-11-.10(3)(a)
	May be land disposed if it meets the requirements in the table "Alternative Treatment Standards for Hazardous Debris" at 40 CFR 268.45 before land disposal or the debris is treated to the waste-specific treatment standard provided in 40 CFR 268.40 for the waste contaminating the debris	Land disposal, , as defined in 40 CFR 268.2, of restricted RCRA-hazardous debris—**applicable**	40 CFR 268.45(a) Rules of the TDEC Chap. 1200-1-11-.10(3) (f)(1)
	Must be treated according to the alternative treatment standards of 40 CFR 268.49(c) or according to the UTSs specified in 40 CFR 268.48 applicable to the listed and/or characteristic waste contaminating the soil prior to land disposal	Land disposal, as defined in 40 CFR 268.2, of restricted hazardous soils—**applicable**	40 CFR 268.49(b) Rules of the TDEC Chap. 1200-1-11-10(3)(j)(2)
	Are not prohibited if the wastes no longer exhibit a characteristic at the point of land disposal, unless the wastes are subject to a specified method of treatment other than DEACT in 40 CFR 268.40, or are D003 reactive cyanide	Land disposal of restricted RCRA characteristically hazardous wastes—**applicable**	40 CFR 268.1(c)(4)(iv) Rules of the TDEC Chap. 1200-1-11-.10(1) (a)(3)(iv)(IV)
Packaging of LLW for disposal ***(e.g., contaminated PPE, D&D demolition debris)***	Must have structural stability either by processing the waste or placing the waste in a container or structure that provides stability after disposal	Generation of LLW for disposal at a LLW disposal facility— **relevant and appropriate**	Rules of the TDEC Chap. 1200-2-11-.17(7)(b)(1)

Table B.3 (continued)

Action	Requirements	Prerequisite	Citation
	Void spaces within the waste and between the waste, and its package must be reduced to the extent practicable		Rules of the TDEC Chap. 1200-2-11-.17(7)(b)(3)
Treatment of LLW	Treatment to provide more stable waste forms and to improve the long-term performance of a LLW disposal facility shall be implemented as necessary to meet the performance objectives of the disposal facility	Generation of LLW for disposal at a LLW disposal facility—**TBC**	DOE M 435.1-1(IV)(O)
Disposal of solid LLW (**D&D *demolition debris, pipelines, equipment, soil, sediment***)	LLW shall be certified as meeting waste acceptance requirements before it is transferred to the receiving facility	Generation of LLW for disposal at a DOE facility—**TBC**	DOE M 435.1-1(IV)(J)(2)
Disposal of asbestos-containing waste material (**D&D *demolition debris***)	Shall be deposited as soon as practicable at:	Asbestos-containing waste material or RACM (except Category I nonfriable asbestos-containing material) from demolition activities—**applicable**	40 CFR 61.150(b) Rules of the TDEC Chap. 1200-3-11-.02(2)(j)(2)
	• an approved waste disposal site operated in accordance with Sect. 61.154 or		40 CFR 61.150(b)(1) Rules of the TDEC Chap. 1200-3-11-.02(2)(j)(2)(i)
	• an EPA-approved site that converts RACM and asbestos-containing waste material into nonasbestos (asbestos-free) material according to the provisions of 40 CFR 61.155		40 CFR 61.150(b)(2) Rules of the TDEC Chap. 1200-3-11-.02(2)(j)(2)(ii)
Disposal of fluorescent light ballasts (**e.g., from *D&D wastes***)	Must be disposed of in a TSCA-approved disposal facility, as bulk product waste under 40 CFR 761.62, or in accordance with the decontamination provisions of 40 CFR 761.79	Generation for disposal of fluorescent light ballasts containing PCBs in the potting material—**applicable**	40 CFR 761.60(b)(6)(iii)
	May dispose of in a municipal solid waste landfill	Generation for disposal of intact, nonleaking PCB Small Capacitors (as defined in 40 CFR 761.3) —**applicable**	40 CFR 761.60(b)(2)(ii)

Table B.3 (continued)

Action	Requirements	Prerequisite	Citation
Disposal of PCB-contaminated articles (e.g., ***hydraulic machines, pumps, electrical equipment, etc.***)	Must remove all free-flowing liquid from the Article, disposing of the liquid in compliance with the requirements of 40 CFR 761.60(a)(2) or (a)(3); and	Generation for disposal of PCB-Contaminated Articles (as defined in 40 CFR 761.3) **—applicable**	40 CFR 761.60(b)(6)(ii)
	Dispose by one of the following methods:	Disposal of PCB-Contaminated Articles with no free-flowing liquid—**applicable**	40 CFR 761.60(b)(6)(ii)
	• in accordance with the decontamination provisions at 40 CFR 761.79;		40 CFR 761.60(b)(6)(ii)(A)
	• in a facility permitted, licensed, or registered by a state to manage municipal solid waste or nonmunicipal nonhazardous waste;		40 CFR 761.60(b)(6)(ii)(B)
	• in an industrial furnace operating in compliance with 40 CFR 761.72; or		40 CFR 761.60(b)(6)(ii)(C)
	• in a disposal facility approved under this part		40 CFR 761.60(b)(6)(ii)(D)
Disposal of PCB liquids (***e.g., from drained electrical equipment***)	Must be disposed of in an incinerator that complies with 40 CFR 761.70, except	PCB liquids at concentrations ≥ 50 ppm **—applicable**	40 CFR 761.60(a)
	• for mineral oil dielectric fluid may be disposed of in a high-efficiency boiler according to 40 CFR 761.71(a) and	PCB liquids at concentrations ≥50 ppm and < 500 ppm—**applicable**	40 CFR 761.60(a)(1)
	• for liquids other than mineral oil dielectric fluid, may be disposed of in a high-efficiency boiler according to 40 CFR 761.71(b)		40 CFR 761.60(a)(2)

Table B.3 (continued)

Action	Requirements	Prerequisite	Citation
Disposal of PCB cleanup wastes ***(e.g., contaminated PPE, nonliquid cleaning materials)***	Shall be disposed of either: • in a facility permitted, licensed or registered by a state to manage municipal solid waste under 40 CFR 258 or nonmunicipal, nonhazardous waste subject to 40 CFR 257.5 thru 257.30; or • in a RCRA Subtitle C landfill permitted by a state to accept PCB waste; or • in an approved PCB disposal facility; or • through decontamination under 40 CFR 761.79(b) or (c).	Generation of nonliquid PCBs at any concentration during and from the cleanup of PCB remediation waste—**applicable**	40 CFR 761.61(a)(5)(v)(A)
Disposal of PCB cleaning solvents, abrasives, and equipment	May be reused after decontamination in accordance with 40 CFR 761.79	Generation of PCB wastes from the cleanup of PCB remediation waste— **applicable**	40 CFR 761.61(a)(5)(v)(B)
Performance-based disposal of PCB remediation waste ***(e.g., soils, sediments, sludges)***	May dispose by one of the following methods:	Disposal of non-liquid PCB remediation waste as defined in 40 CFR 761.3—**applicable**	40 CFR 761.61(b)(2)
	• in a high-temperature incinerator approved under 40 CFR 761.70(b), • by an alternate disposal method approved under 40 CFR 761.60(e), • in a chemical waste landfill approved under 40 CFR 761.75, • in a facility with a coordinated approval issued under 40 CFR 761.77, or		40 CFR 761.61(b)(2)(i)
	• through decontamination in accordance with under 40 CFR 761.79		40 CFR 761.61(b)(2)(ii)

Table B.3 (continued)

Action	Requirements	Prerequisite	Citation
Performance-based disposal of PCB bulk product waste ***(e.g., D&D demolition debris with PCB painted surfaces)***	May dispose of by one of the following:	Disposal of PCB bulk product waste as defined in 40 CFR 761.3—**applicable**	40 CFR 761.62(a)
	• in an incinerator approved under 40 CFR 761.70;		40 CFR 761.62(a)(1)
	• in a chemical waste landfill approved under 40 CFR 761.75;		40 CFR 761.62(a)(2)
	• in a hazardous waste landfill permitted by EPA under Sect. 3004 of RCRA or by authorized state under Sect. 3006 of RCRA;		40 CFR 761.62(a)(3)
	• under alternate disposal approved under 40 CFR 761.60(e)		40 CFR 761.62(a)(4)
	• in accordance with decontamination provisions of 40 CFR 761.79; or		40 CFR 761.62(a)(5)
	• in accordance with thermal decontamination provisions of 40 CFR 761.79(e)(6) for metal surfaces in contact with PCBs		40 CFR 761.62(a)(6)
	Transportation		
Transportation of hazardous materials	Shall be subject to and must comply with all applicable provisions of the HMTA and HMR at 49 CFR 171-180	Any person who, under contract with a department or agency of the federal government, transports "in commerce," or causes to be transported or shipped, a hazardous material —**applicable**	49 CFR 171.1(c)
Transportation of radioactive waste	Shall be packaged and transported in accordance with DOE Order 460.1A and DOE Order 460.2	Shipment of LLW and/or TRU waste off-site—**TBC**	DOE M435.1-(I)(1)(E)(11)

Table B.3 (continued)

Action	Requirements	Prerequisite	Citation
Transportation of LLW and/or TRU waste (e.g., contaminated soil)	To the extent practical, the volume of the waste and the number of the shipments shall be minimized	Shipment of LLW and/or TRU waste off site—**TBC**	DOE M 435.1-1(IV)(L)(2) DOE M 435.1-1(III)(L)(2)
Transportation of PCB wastes	Must comply with the manifesting provisions at 40 CFR 761.207 through 40 CFR 761.218	Relinquishment of control over PCB wastes by transporting, or offering for transport—**applicable**	40 CFR 761.207 (a)
Transportation of hazardous waste off site	Must comply with the generator requirements of 40 CFR 262.20–23 for manifesting, Sect. 262.30 for packaging, Sect. 262.31 for labeling, Sect. 262.32 for marking, Sect. 262.33 for placarding and Sect. 262.40, 262.41(a) for record keeping requirements and Sect. 262.12 to obtain EPA ID number	Off-site transportation of RCRA hazardous waste—**applicable**	40 CFR 262.10(h) Rules of the TDEC Chap. 1200-1-11-.03(1)(a)(8)
	Must comply with the requirements of 40 CFR 263.11–263.31	Transportation of hazardous waste within the United States requiring a manifest—**applicable**	40 CFR 263.10(a) Rules of the TDEC Chap. 1200-1-11-.04(1)(a)
	A transporter who meets all applicable requirements of 49 CFR 171–179 and the requirements of 40 CFR 263.11 and 263.31 will be deemed in compliance with 40 CFR 263		

Table B.3 (continued)

Action	Requirements	Prerequisite	Citation
Transportation of hazardous waste on site	The generator manifesting requirements of 40 CFR 262.20–262.32(b) do not apply. Generator or transporter must comply with the requirements set forth in 40 CFR 263.30 and 263.31 in the event of a discharge of hazardous waste on a private or public right-of-way	Transportation of hazardous wastes on a public or private right-of-way within or along the border of contiguous property under the control of the same person, even if such contiguous property is divided by a public or private right-of-way—**applicable**	40 CFR 262.20(f) Rules of the TDEC Chap. 1200-1-11-.03(3)(a)(6)

ALARA = as low as reasonably achievable
ARAR = applicable or relevant and appropriate requirement
CFR = *Code of Federal Regulations*
CWA = Clean Water Act of 1972
D&D = decontamination and decommissioning
DEACT = deactivation
DOE = U.S. Department of Energy
DOE M = *Radioactive Waste Management Manual*
DOT = U.S. Department of Transportation
EDE = effective dose equivalent
EPA = U.S. Environmental Protection Agency
≥ = greater than or equal to
HF = hydrofracture
HFIR = High Flux Isotope Reactor
HMR = Hazardous Materials Regulations
HMTA = Hazardous Materials Transportation Act
HRE = Homogeneous Reactor Experiment
HTF = Hillcut Test Facility
ICMAs = Interim Corrective Measure Areas
IHP = Intermediate Holding Pond
in. = inch
ISV = in situ vitrification
< = less than
LLW = low-level (radioactive) waste
mrem = millirem
MSRE = Molten Salt Reactor Experiment
mSv = milliSievert
NHF = New Hydrofracture Facility
NPDES = National Pollutant Discharge Elimination System
OHF = Old Hydrofracture Facility
ORNL = Oak Ridge National Laboratory
P&A = plugging and abandonment
PCB = polychlorinated biphenyl
PPE = personal protective equipment
ppm = parts per million
PWSB = Process Waste Sludge Basin
RACM = regulated asbestos-containing material
RCRA = Resource Conservation and Recovery Act of 1976
SWSA = solid waste storage area
TBC = to be considered
TCA = *Tennessee Code Annotated*
TDEC = Tennessee Department of Environment and Conservation
TRU = transuranic
TSCA = Toxic Substances Control Act of 1976
WAC = waste acceptance criteria
WIPP = Waste Isolation Pilot Plant
WOC = White Oak Creek

APPENDIX C

SOIL CLEANUP TO PROTECT SURFACE WATER QUALITY

SOIL CLEANUP TO PROTECT SURFACE WATER QUALITY

During soil removals, soil in the excavation floor and walls will be characterized to determine the contaminant levels for verification that remediation levels meet the specified concentrations for worker protection after remediation. Based on the verification analyses, the potential for residual soils to contaminate groundwater and cause surface water exceedances will be assessed. This assessment will be based on assumed Darcian groundwater flow in the shallow subsurface and will include estimated contaminated soil volume, contaminant mass present, local groundwater flow volume, flow path length to receiving stream or lake, and local streamflow volume.

The following conceptual model or approved alternative will be used:

Contaminated Soil Leach Rate → Groundwater Seepage Velocity →
Contaminant Retardation → Mixing in Stream

The soil leach rate will be based on K_d leaching from contaminated soil:

$$(c_{water} = c_{soil}/K_d),$$

where

C_{water} is the concentration of the COC in groundwater contacting the contaminated soil, c_{soil} is the concentration of the COC in the contaminated soil, and K_d is the distribution coefficient of the COC (Kd = mass of contaminant per unit mass of soil/concentration of contaminant in water).

Kd values for radionuclides that are contaminants of concern in Melton Valley have been determined for other ORNL projects and representative values are available (see Table C.1).

Groundwater seepage velocity will be estimated from local or valleywide hydraulic conductivity values and porosities and local seepage gradients between the contaminated soil source and the receiving stream:

$$(v=-K./n \times dh/dl),$$

where

K is hydraulic conductivity, n is soil porosity, dh is head change along the flowpath, and dl is length of the flowpath.

The contaminant transport term will be based on estimated groundwater seepage velocity, and groundwater contaminant concentration will be based on dispersion along the flow path with geochemical retardation:

$$(v/v_c = 1p/n*K_d),$$

where

v is the seepage velocity, v_c is the contaminant seepage velocity, p is the density of the soil, n is the soil porosity, and K_d is the distribution coefficient of the contaminant of concern in the soil. Radioactive decay will also be applied to radioactive contaminants in the seepage analysis.

To assess the impact of leached soil contaminants on receiving streams, the estimated annual flux of contaminants from soil contamination areas will be assumed to mix with the annual water flow volume of the receiving stream to compute the annual average concentration:

$$(C_{ave} = m_g + m_s / f_g + f_s)$$

where

m_g is mass of the COC in groundwater seepage (m_g=c_{water}*seepage volume), m_s is mass of the COC in the receiving stream upstream of the groundwater inflow point, f_g is the estimated annual seepage volume of groundwater from the soil area (f_g=v*seepage pathway cross sectional area), and f_s is the annual volume of surface water in the receiving stream.

A sample calculation for this approach to soil cleanup determination is provided. (See Table C.1)

If contaminated soils at soil cleanup sites pose a threat of increasing groundwater contamination levels or extent, or causing surface water quality exceedances, further actions will be required such as additional soil removal, soil treatment, or containment depending on the analyses of effectiveness, implementability, and cost.

Table C.1. Element-specific soil/water partition coefficients for Melton Valley

Element	Soil/water K_d (mL/g)	Element	Soil/water K_d (mL/g)
H	0	Cs	3000
Be	1000	Eu	40
C	0	Bi	500
K	30	Pb	100
Ca	300	Ra	3000
Co	800	Th	3000
Ni	2000	U	40
Se	0	Np	40
Rb	30	Pu	40
Sr	30	Am	40
Tc	0	Cm	40
Cd	200	Cf	40
I	0		

Sources:

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