2. DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

2.1 PROPOSED ACTION

DOE proposes to construct, operate, and decontaminate and decommission (D&D) a waste treatment facility for the treatment of legacy ORNL TRU, alpha low-level waste, and newly generated TRU waste (Figure 2-1) in order to reduce the risk to human health and the environment, and to comply with the TDEC Commissioner's Order of 1995, which has a primary milestone that requires DOE to make the first shipment of treated TRU sludge to the Waste Isolation Pilot Plant in New Mexico by January 2003. Impacts relative to the construction, operation, and D&D[1] of any treatment facility are presented in Chapter 4, in detail, for each treatment alternative evaluated in this EIS. All the legacy waste DOE proposes to treat as part of the TRU Waste Treatment Project is currently stored at ORNL. The newly generated TRU waste would be treated at the proposed facility until it is closed for D&D. TRU waste generated after closure of the proposed facility is not within the scope of the proposed action.

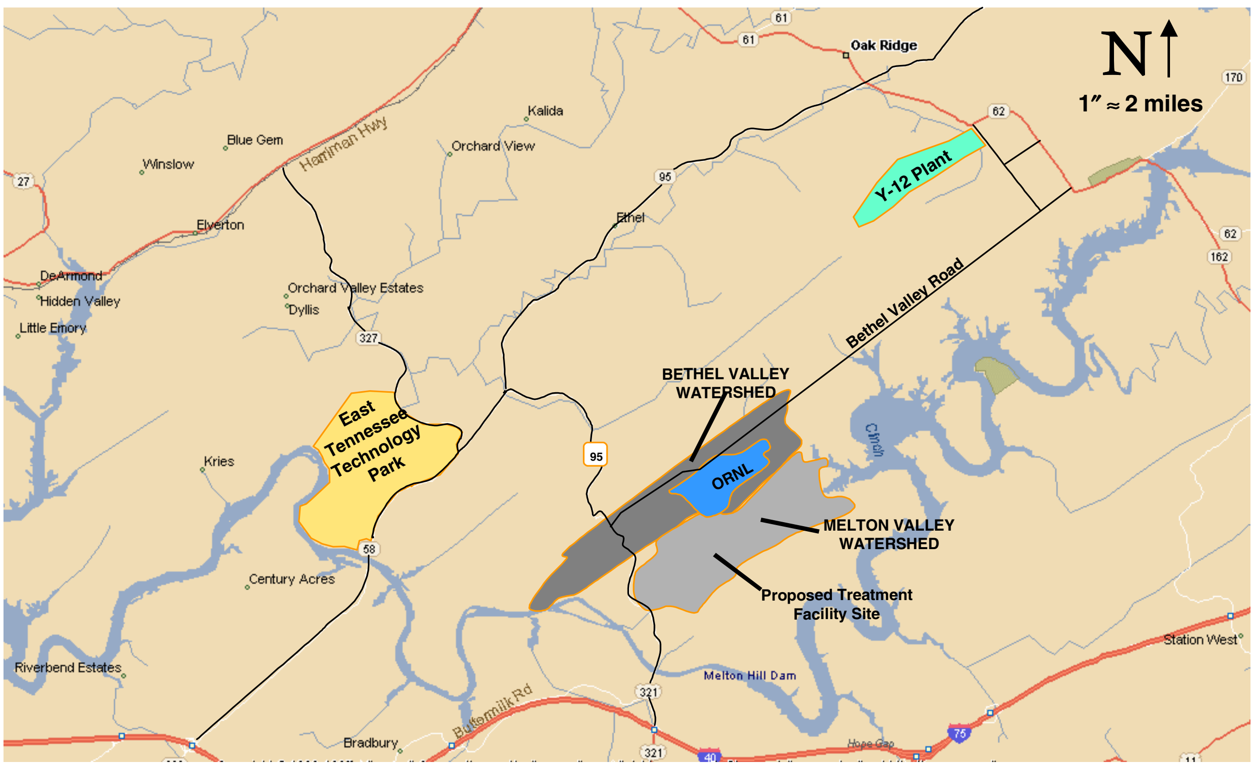

Figure 2-1. General site location of the proposed TRU Waste Treatment Project facility at Oak Ridge National Laboratory (ORNL) on the Oak Ridge Reservation (ORR).

DOE's proposed action would entail the award of a privatization contract, contingent upon the completion of the NEPA review, for the construction, operation, and D&D of the proposed waste treatment facility to a private contractor. DOE solicited bids from contractors for a treatment facility for the TRU wastes. The privatization contract request for proposal was structured so that the selected contractor would be required to use its own funds for the construction of the facility, and so that payment

[1]Specific information on impacts resulting from D&D activities can be found in Chapter 4 on pages 4-9, 4-13, 4-25, 4-50, and 4-61.

for the construction portion of the contract would not be made until the waste was treated to meet the appropriate waste acceptance criteria and certified by DOE. Three bids were received and evaluated. DOE incorporated environmental information very early in the project planning. For example, DOE required proposals to include environmental data and analysis. Prior to selection of the contractor, DOE held two public meetings with stakeholders and had ongoing discussions with regulators. In addition, DOE prepared a characterization report for the site of the proposed action and sponsored an independent study of treatment technologies and contracting alternatives, known as the Parallax study [ORNL/M-4693, *Feasibility Study for Treatment ORNL TRU Waste In Existing and Modified Facilities*, September 15, 1995 (Parallax 1995)]. DOE independently evaluated the environmental information provided in the bids. DOE developed an environmental synopsis of the environmental information in accordance with 10 *CFR* 1021.216 and published the *Environmental Synopsis for the Transuranic Waste Treatment Project at the Oak Ridge Reservation* in January 1999 (Appendix A.2). This synopsis has been filed with the EPA and made available to the public.

The proposed site for the treatment facility is adjacent to the Melton Valley Storage Tanks (the current storage area for the waste sludge and supernate). DOE would lease the Melton Valley Storage Tanks and an adjacent land area totaling up to 4 ha (10 acres) to the selected contractor for the construction of the facility (Figure 2-2), subject to notification of the EPA and the State of Tennessee to clarify the change in land use. Once the facility is closed and D&D of the facility is completed, the Melton Valley Storage Tanks and the land used for the facility would no longer be leased to the selected contractor.

The proposed facility location is based on three factors listed below:

- The treatment facility should be located close to the existing Melton Valley Storage Tanks to minimize the length of a new sludge/supernate transfer line and reduce the environmental disturbance due to construction as recommended in the *Feasibility Study for Processing ORNL Transuranic Waste in Existing and Modified Facilities* (Parallax 1995).

- The existing terrain should provide natural shielding for the proposed facility and facilitate material handling.

1. The location of the proposed facility near the Melton Valley Storage Tanks would reduce the risk associated with transporting the liquid and sludge tank waste from the Melton Valley Storage Tanks to the proposed treatment facility over public or laboratory roads. The Melton Valley Storage Tanks are located in Melton Valley, separated from the main plant area at ORNL by the Haw Ridge. The proposed treatment facility site would be fenced, with controlled access to Tennessee State Highway 95, which is located west of the proposed site. DOE would provide electrical, water, and telephone service to the edge of the leased area on the east side of the facility. DOE is upgrading the existing single-lane road from State Route 95 to the proposed facility to provide improved emergency access from the High Flux Isotope Reactor. This road will become the main access to the proposed facility. A categorical exclusion under NEPA was completed for this road upgrade (CX-TRU-98-007*, Categorical Exclusion for Construction/Relocation of Access Road at Oak Ridge National Laboratory*) (DOE-ORO 1998). Because most of the sludge is regulated under RCRA, the proposed facility would be permitted under RCRA.

The proposed action would be carried out in four phases:

- Phase I, Licensing and Permitting [includes DOE's NEPA analysis and contractor preliminary design activities; U.S. Nuclear Regulatory Commission (NRC) license is not required as the facility will only be treating DOE wastes];
- Phase II, Construction and Pre-Operational Testing;
- Phase III, Waste Treatment, Packaging, and Certification; and
- Phase IV, Decontamination and Decommissioning.

DOE will complete the NEPA process concurrent with Phase I of the contract. Phase I is a 2.5-year period during which the permitting and preliminary design process is completed for the proposed facility. If the NEPA review results in another alternative being selected, the contract would be terminated before Phase II of the contract begins.

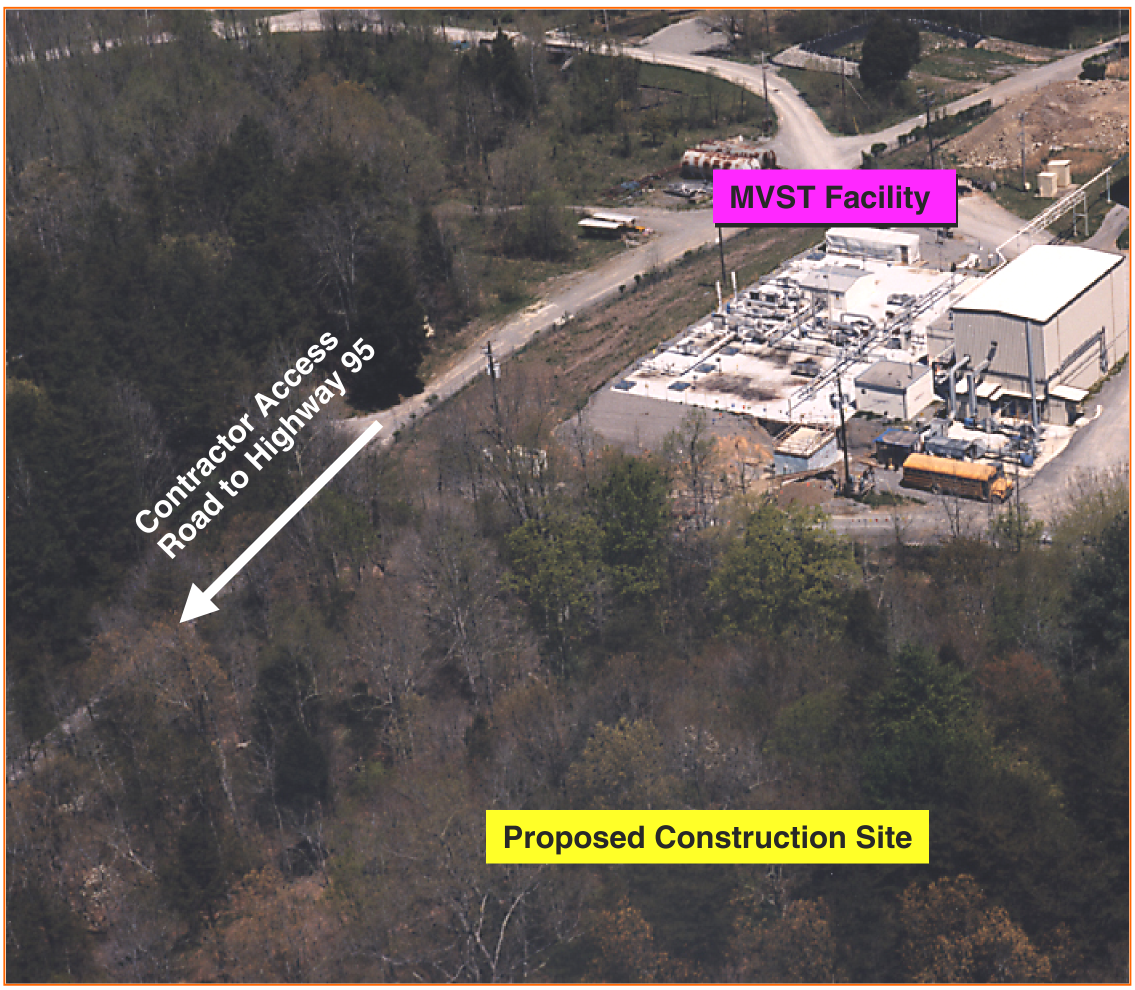

Figure 2-2. DOE would lease the Melton Valley Storage Tanks facility and an adjacent area of land to construct the waste treatment facility. The location is isolated from ORNL by Haw Ridge.

DOE requires that all activities associated with the proposed action be performed safely and in compliance with applicable federal and state regulatory requirements. The selected contractor would be responsible for achieving compliance with all applicable environmental, safety and health laws and regulations. Regulatory agencies would be responsible for monitoring compliance by the contractor. The State of Tennessee would regulate the selected contractor according to permits under the state's purview (the RCRA Part B permit issued by the State of Tennessee). DOE would regulate occupational safety and health and nuclear safety according to specific environment, safety, and health requirements.

Waste volume reduction would be a major consideration for the proposed action. Waste volume reduction would minimize waste generation during the treatment process, conserve resources, and would result in lower disposal costs. The waste treatment technique used in the proposed action would need to be flexible enough to address a wide range of waste properties, substantially reduce the TRU waste volume, and generate minimal secondary waste during treatment. After waste treatment, DOE would certify the waste for disposal as low-level radioactive waste, alpha low-level radioactive waste, or TRU waste. The contractor would be required to treat all wastes to meet specified waste acceptance criteria for disposal. In the event that the Waste Isolation Pilot Plant is not accepting remote-handled TRU waste in time to meet the TDEC Commissioner's Order, the selected contractor would be required to reduce the solubility of the RCRA metals in the sludge waste in order to form stable compounds. The stabilized sludge would not exceed the RCRA Toxicity Characteristic Leaching Procedure (TCLP) limits and would no longer exhibit RCRA characteristics. This would ensure that the treated waste meets RCRA Land Disposal Restriction (LDR) standards, required by the ORNL Site Treatment Plan, in the event that the treated waste is stored onsite before transport to the Waste Isolation Pilot Plant.

The proposed action calls for the segregation of the legacy sludge and supernate contained in the waste storage tanks. The segregation of these wastes would result in significant life cycle cost avoidance when compared to disposal of both the sludge and supernate at the Waste Isolation Pilot Plant. The supernate, which is generally classified as low-level waste, would be reduced in volume during waste treatment, and packaged for final disposal at, for example, the Nevada Test Site. For impacts analysis purposes, all low-level waste resulting from the TRU Waste Treatment Facility is assumed to be disposed of at the Nevada Test Site. This assumption is based on the initial characterization information for the low-level waste, which indicates that this waste meets the waste acceptance criteria of the Nevada Test Site. The final decision on the disposal site for low-level waste treated at the proposed TRU Waste Treatment Facility will be consistent with the pending Record of Decision from the Waste Management Programmatic Environmental Impact Statement (WM PEIS). The Nevada Test Site is one of six DOE low-level waste sites identified in the WM PEIS. The WM PEIS Record of Decision is expected to be issued before the ORNL TRU Waste Treatment Project Final EIS is completed. Because the ORNL TRU Waste Treatment Project would generate small quantities of low-level waste in comparison to the 1.5 million m^3 of low-level waste analyzed for the entire DOE complex in the WM PEIS, the assumption of the Nevada Test Site as a disposal site for low-level waste does not prejudice DOE's pending WM PEIS low-level waste disposal Record of Decision.

Because most of the current solid waste containers do not meet U.S. Department of Transportation (DOT) regulations, the proposed action would provide for repackaging the solid waste prior to shipment. The waste would be certified for disposal by DOE as either low-level radioactive, alpha low-level radioactive, or TRU waste and transported to appropriate disposal facilities that are consistent with the WM PEIS. The proposed action includes repackaging with some compaction to obtain a 50% volume reduction for the bulk of the solid waste that is not regulated under RCRA. The solid waste would be better characterized during the repackaging efforts to achieve final waste certification by DOE before disposal. Any items displaying RCRA characteristics would be isolated and treated to meet RCRA LDR standards.

2.2 CONSIDERATION OF ALTERNATIVES

DOE analyzed five alternatives in this EIS: a no action alternative; three alternative technologies for treating the legacy wastes followed by shipment to an appropriate disposal facility; and treatment by any of the three alternative treatment technologies, followed by long-term storage at ORNL. Shipment of the TRU wastes to other DOE sites for treatment was also considered, but not analyzed in detail for reasons discussed in Section 2.8.2. Other potential treatment technologies were also evaluated, but were not analyzed in detail for various reasons (Table 2-5, Section 2.8.2).

A summary of the environmental impacts for the five alternatives is included in Section 2.9. The remainder of Chapter 2 discusses the following five alternatives in detail:

2. **No Action** (i.e., continued on-site storage) for all of the legacy TRU tank waste and legacy contact-handled and remote-handled TRU/alpha low-level solid wastes.
3. **Low-Temperature Drying** (**Preferred Alternative**) for the Melton Valley Storage Tanks wastes (sludge and supernate) and segregation and compaction for the solid wastes (contact-handled and remote-handled TRU/alpha low-level heterogeneous debris).
4. **Vitrification** for the Melton Valley Storage Tanks wastes (sludge and supernate) and segregation and compaction for the solid wastes (contact-handled and remote-handled TRU/alpha low-level heterogeneous debris).
5. **Cementation** for the Melton Valley Storage Tanks wastes (sludge and supernate) and segregation and compaction for the solid wastes (contact-handled and remote-handled TRU/alpha low-level heterogeneous debris).
6. **Treatment and Waste Storage at ORNL** would provide treatment by one of the above treatment alternatives followed by long-term (indefinite) waste storage at ORNL

2.3 NO ACTION ALTERNATIVE

Under the No Action Alternative, DOE would continue to store legacy TRU waste at ORNL in underground waste storage tanks, subsurface trenches, vaults, bunkers, and metal buildings. Long-term storage, consistent with the No Action Alternative, is not permissible under RCRA, which does not allow storage of untreated hazardous wastes indefinitely.

2.3.1 Facility Description

No facility would be constructed under the No Action Alternative for the continued storage of legacy TRU waste. Existing facilities at ORNL would be used for the continued storage of the legacy TRU waste. Legacy mixed (RCRA hazardous and radioactive) TRU sludge and the associated low-level supernate wastes would continue to be stored in the Melton Valley Storage Tanks and the Melton Valley Storage Tanks–Capacity Increase Project tanks (Figure 2-2). There is slightly over 1,400 m^3 (about 370,000 gal) of storage capacity available in the existing storage tanks.

Legacy solid remote-handled and contact-handled wastes would be stored in their current facilities described below.

- Solid Waste Storage Area 5 North (SWSA 5 North) is at capacity and stores remote-handled TRU solid wastes and TRU mixed wastes in casks buried underground in trenches.

- Buildings 7855 and 7883 are bunkers, which would continue to store remote-handled TRU waste. Building 7855 is at capacity, with 157.2 m^3 (5,552 ft^3) of remote-handled TRU waste in storage. Building 7883 currently stores 10.7 m^3 (377 ft^3) of remote-handled TRU solids and has an available storage capacity of 146.7 m^3 (5,179 ft^3) ;

- Buildings 7572, 7574, 7842, 7878, and 7879 are metal buildings that would continue to store contact-handled TRU waste. These storage buildings currently store over 906 m^3 (32,000 ft^3) of contact- handled TRU wastes. Building 7842 is at capacity, but the other buildings have a combined available storage capacity of 722 m^3 about (25,500 ft^3) for contact-handled TRU wastes.

- Buildings 7826 and 7834, the below-grade concrete cells in SWSA 5 North, which currently store a total of about 68 m^3 (2,400 ft^3) of remote-handled TRU and contact-handled waste, are not RCRA permitted. This waste is scheduled to be moved to the appropriate existing facilities for contact-handled and remote-handled wastes (described above) as a legacy waste action under CERCLA in Fiscal Year 2000, thus reducing the amount of permitted storage space that is available.

Buildings 7826 and 7834, the below-grade concrete cells in SWSA 5 North which currently store a total of about 68 m^3 (2,400 ft^3) of remote-handled TRU and contact-handled TRU waste, are not RCRA permitted. This waste is scheduled to be moved to the appropriate existing facilities for contact-handled and remote-handled wastes (described above) as a legacy waste action under CERCLA in Fiscal Year 2000, thus reducing the amount of permitted space that is available.

2.3.2 Treatment Description

There would be no waste treatment under the No Action Alternative for TRU wastes.

2.3.2.1 Sludge and supernate

The No Action Alternative involves continued storage of legacy mixed (RCRA and radioactive) TRU sludge and low-level waste and supernate in the Melton Valley Storage Tanks at ORNL.[2] If this alternative were chosen, the interim Records of Decision for the Gunite and Associated Tanks (DOE 1997a) and the Old Hydrofracture Facility tanks (DOE 1997b) would require amendment since these Records of Decision indicated that the waste is being consolidated in the Melton Valley Storage Tanks in

[2]Basic research and environmental remediation activities at ORNL would continue to generate new waste at a rate of approximately 60 m^3 (15,850 gal) of liquid low-level waste and 5 m^3 (175 ft^3) of TRU sludge annually. These wastes would be added to the legacy sludge and supernate to be treated in the proposed facility. After the proposed treatment facility is closed, newly generated waste would be stored in the Melton Valley Storage Tanks and Capacity Increase Project tanks, which have enough tank capacity for approximately 21 years. In the event that construction of any new waste storage tanks would be needed, these facilities would be evaluated in a separate NEPA review, as the scope of the proposed action is for treatment of legacy TRU sludge and its associated low-level waste, and not storage of waste generated after the proposed facility's closure.

preparation of treatment prior to disposal at the Waste Isolation Pilot Plant. In addition, the continued storage of this waste onsite at ORNL would be in violation of DOE Order 435.1.

2.3.2.2 Remote-handled and contact-handled solid wastes

Remote-handled and contact-handled solid wastes would continue to be stored at ORNL in the existing solid waste storage facilities and in the SWSA 5 North trenches under the No Action Alternative.[3] If this alternative were chosen, the Record of Decision for the Melton Valley Watershed (DOE 1997c) would have to be amended, since removal of the retrievable TRU waste in the SWSA 5 North trenches is a main component of the selected remedy for the Melton Valley Watershed.

2.3.3 Schedule of Activities

The No Action Alternative assumes institutional control of the waste identified for treatment under the proposed action in this EIS for 100 years.

2.4 LOW-TEMPERATURE DRYING ALTERNATIVE (PREFERRED ALTERNATIVE)

DOE has awarded a contract with the Foster Wheeler Environmental Corporation (Foster Wheeler) to construct a waste treatment facility and to treat and package the TRU wastes for disposal offsite. The contract with Foster Wheeler was awarded contingent on the completion of the NEPA review and selection of the Foster Wheeler proposal. DOE continues to analyze environmental impacts and evaluate alternative actions while Phase I (Licensing and Permitting) of the contract awarded to Foster Wheeler is under way. If the current NEPA review results in the selection of an alternative other than the preferred alternative, Phase II (construction and pre-operational testing) of the contract would not be executed.

Foster Wheeler proposes to use a low-temperature drying treatment for the tank waste, and sorting, compaction, and repackaging for the solid waste, before the waste is certified by DOE for final disposition at a disposal facility that is consistent with the WM PEIS. The contract allows DOE and Foster Wheeler to identify other potential waste streams for treatment at this facility during Phase I of the contract and may include newly generated waste from the ORR, or small amounts of legacy TRU waste from other sites. Before any such waste streams would be considered or shipped to ORNL, they would be subject to further NEPA review, as appropriate.

2.4.1 Facility Description

The Low-Temperature Drying Alternative (Preferred Alternative) would involve the construction of a three-and-one-half-story waste treatment facility approximately 37 m (120 ft) west of the Melton Valley Storage Tank area. The proposed site would encompass 2 ha (5 acres), the approximately 4 ha (10 acres) that would be included in the lease.

The proposed waste treatment and treatment facility would have a partial floor for treatment the supernate between the first and second floors. The facility would be a steel-framed structure with concrete and steel shielding. An attached steel building would house the administrative and personnel areas on the

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[3]There would be enough storage capacity for newly generated remote-handled TRU solid waste for approximately 14.5 years, assuming a generation rate of approximately 10 m^3 (350 ft^3) per year. There would be enough storage space for contact-handled TRU waste for approximately 100 years, assuming a generation rate of approximately 5 m^3 (175 ft^3) per year. In the event that construction of any additional storage facilities for newly generated remote-handled and contact-handled solid waste would be needed, these facilities would be evaluated under a separate NEPA review.

north side of the facility, and trailers for the nondestructive examination and assay of the contact-handled solid wastes would be located on the south side of the facility. The total floor area of the facility would be approximately 3,440 m2 (37,000 ft2), comprised of an estimated 1,160 m2 (12,500 ft2) of process area, 1,720 m2 (18,500 ft2) of process support area, and 560 m2 (6,000 ft2) of administration area.

The first floor would contain the remote-handled solid waste cask receiving and staging area as well as the treated solid waste cask and load-out area. Supernate treatment would be performed on the partial floor above the low-level waste load-out area. The dried supernate would be discharged by gravity to liners positioned on truck trailers for final packaging and shipping. The second floor would contain the contact-handled solid waste receiving and characterization area and the contact-handled and remote-handled solids treatment equipment. Facilities to support the building heating, ventilation, and air conditioning (HVAC) and equipment maintenance activities would be located on the third floor. TRU sludge treatment equipment would be located on the fourth floor to receive and dry sludge that would be discharged to canisters located on the second floor. The facility ventilation exhaust stack would be located on the southeast corner of the building and would extend approximately 9 m (30 ft) above the highest point on the building. As shown in Figure 2-3, the facility's first floor elevation would be approximately 235 m (770 ft) above mean sea level, which is above the 100- and 500-year flood elevations. Site development would require an approximate 6-m (20-ft) cut into the west ridge, with fill in the low areas around the facility and roadway areas. Detailed information about the proposed floor plans can be found in Appendix B.

Storm water drainage would be directed around the facility by a series of culverts and drainage ditches as shown in Figure 2-3. This would prevent the facility from receiving storm water runoff from the ridgeline south of the facility. This runoff would be diverted west of the facility by a ditch along the third floor access ramp, and to the east by a berm and culvert arrangement. The drainage ditches would be lined with riprap, as required. Culverts carrying storm water off the facility site would be equipped with gate valves to allow sampling and analysis of the storm water and to provide storm water containment in case of potential contamination. Storm water collected from the top of the Melton Valley Storage Tank vaults would be controlled in a similar manner. In addition, drainage grates would be installed at paved exits to capture and direct runoff from paved areas to the culverts equipped with the gate valves.

Figure 2-3. Proposed site layout for the Low-Temperature Drying Alternative facility, including the locations of the existing Melton Valley Storage Tanks, the process building with truck access and turnaround areas to the first and third floors, and storm water drainage modifications. Site excavation would be minimized by optimizing the topography of the site with the layout of the Low-Temperature Drying Alternative

2.4.2 Waste Treatment Description

This alternative would entail evaporating and drying the sludges and supernates and is flexible enough to cover a wide range of waste properties. Treatment by low-temperature drying would substantially reduce the waste volume, generate minimal amounts of secondary wastes, and meet the waste acceptance criteria of the final disposal facilities. All waste streams would meet the RCRA LDR standards. TRU waste streams would be treated to meet the waste acceptance criteria of the Waste Isolation Pilot Plant. Low-level waste streams would be treated to meet the waste acceptance criteria of the Nevada Test Site or another designated disposal site identified in the Record of Decision for the WM PEIS. Several pollution prevention and waste minimization measures would be implemented with the Low-Temperature Drying Alternative. As pollution prevention measures, storm water would be diverted around the treatment facility and gate valves would be installed in the diversion basins to contain spills. Waste minimization is accomplished by the following methods:

- The Melton Valley Storage Tanks would be sluiced with recycled supernate during sludge retrieval activities.
- Sludge would be washed with recycled condensate from the air-cooled condenser, which receives the ventilation from the low-temperature dryers.
- Dried sludge solids would be loaded directly into TRU canisters to avoid additional secondary waste.
- Low-level solid waste drums that do not contain RCRA waste would be sent directly to the compactor for a 50% volume reduction.
- Secondary solid waste would be compacted for a 50% volume reduction.
- The off-gas system would minimize air emissions.

A summary of the projected volumes of primary, secondary, and decontamination and decommissioning waste is included in Table 2-1. The primary waste volumes would be reduced by low-temperature drying from 4,050 m^3 to 1,391 m^3.

Table 2-1. Summary of projected waste volumes for the Low-Temperature Drying Alternative

Waste Stream	Category	Projected Volume Out[a]	Treatment Requirement
Primary Waste Streams			
Sludge (remote-handled)	TRU	180 m^3	Dry, stabilize
Supernate/sludge wash water	Low-level waste	588 m^3	Dry, stabilize
contact-handled solids	TRU	324 m^3	Various
remote-handled solids	TRU	99 m^3	Various
Solids	Low-level waste	200 m^3	Various
Secondary Waste Streams			
Primary waste containers			
Remote-handled casks	Low-level waste	1,217 m^3	None
Contact-handled drums and boxes	Low-level waste	44 m^3	Compaction
Construction debris	Sanitary	~200 m^3	None
PPE (gloves, booties, etc.)	Low-level waste	214 m^3	Compaction
HEPA filters	Low-level waste	88 m^3	Compaction
Consumables (rags, towels, etc.)	Low-level waste	272 m^3	Compaction
Mechanical parts	Low-level waste/TRU	4 m^3	None
Aqueous waste filter media	Low-level waste	<20 m^3	Compaction
Steam from wet treatment	N/A	N/A	Condense/HEPA filter
Changing/maintenance fluids	Low-level waste/mixed waste	<1 m^3	Stabilize, if required
Laboratory solvents and residues	Low-level waste/mixed waste/TRU	1 m^3	Thermal, none
Laboratory acid digistatis	Mixed waste	<20 m^3	Neutralize/stabilize
Sanitary wastewater	Sanitary	1,560 m^3	Capture
Decontamination and Decommissioning Waste Streams			
Category C, Concrete rubble	Construction debris	5,510 m^3	None
Category A, Free release metals	Recycle, reuse	115 m^3	None
Category B, Non-contaminated metals	Construction debris	30 m^3	None
Category B, Contaminated materials	Low-level waste	135 m^3	Compaction
Category D, Miscellaneous	Construction debris	<10 m^3	None
Category E, Special materials	Low-level waste/mixed waste	<1 m^3	Stabilize

[a]Volumes are waste product volumes in final disposal containers based on total inventory of waste (base + optional volumes) expected to be processed at the facility.

HEPA - High-Efficiency Particulate Air.
PPE - personal protective equipment.
TRU - transuranic.
~ - approximately.

2.4.2.1 Tank waste treatment (sludge and supernate)

The simplified block flow diagram for the tank waste treatment systems is illustrated in Figure 2-4. Supernate would be pumped from the existing Melton Valley Storage Tanks using equipment moved from tank to tank. The supernate would be pumped through a double-contained, aboveground pipeline to the proposed treatment facility and collected into mixing/sample tanks. The supernate from the Melton Valley Storage Tanks may be transferred to an evaporator for volume reduction before transfer to the mixing/sample tanks. In order to meet RCRA LDR standards and waste acceptance criteria for a WM PEIS-approved, low-level waste disposal facility (e.g., Nevada Test Site, or another designated disposal facility), additives would be mixed with the supernate in these tanks, as required for the downstream treatment operations. The supernate dryer would receive feed batches from the mixing/sample tanks for final concentration and drying into a stabilized particulate product. The treated

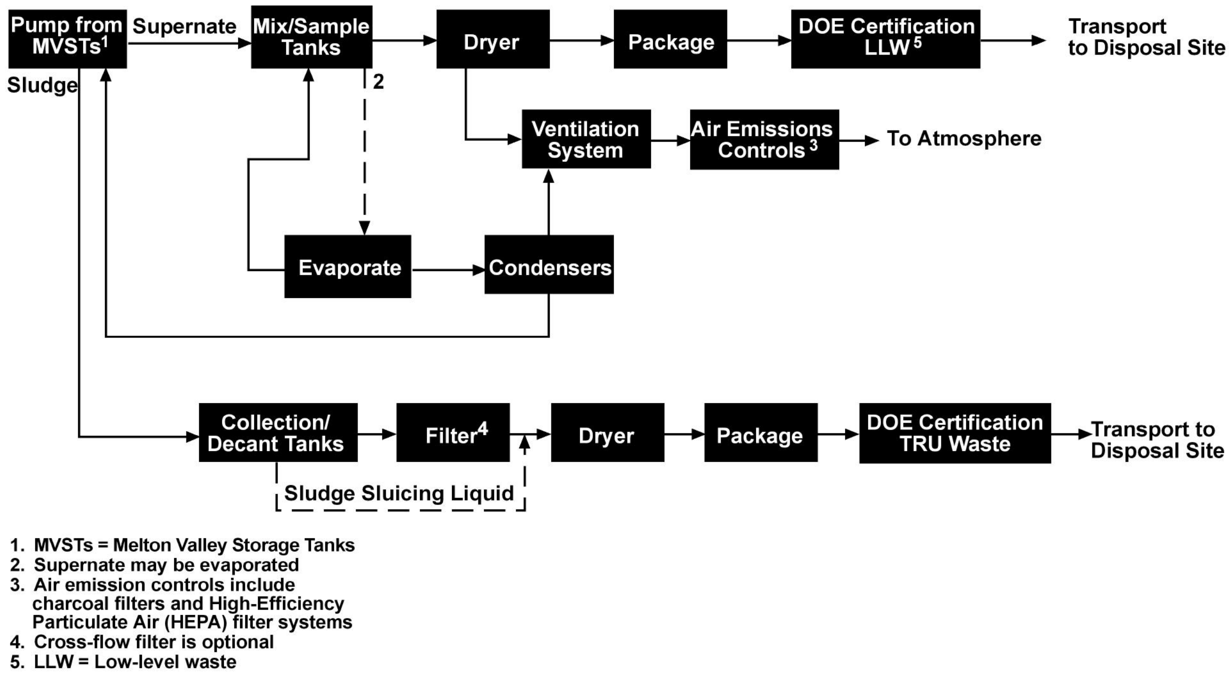

Figure 2-4. Tank waste treatment flow diagram for the Low-Temperature Drying Alternative.

waste would be loaded directly into a disposal container that is pre-loaded in a transportation cask for shipment. Vapors from the dryer would be routed through an air-cooled condenser. Condensate may be stored in a reservoir for reuse in sludge retrieval, or evaporated and discharged as part of the building ventilation flow through appropriate high-efficiency particulate air (HEPA) filtration.

Sludge that would be retrieved from the Melton Valley Storage Tanks by sluicing with recycled liquids would be directed to the supernate, condensate, or water. Recycled condensate or water would be preferentially used to allow washing of the sludge solids to separate soluble solids. The sluiced sludge would be transferred in a double-contained, aboveground pipeline to the sludge collection/decant tanks in the facility. These tanks would have the potential for concentrating the sludge by gravity settling. Sluiced sludge would be analyzed, mixed with appropriate additives, and concentrated for drying.

After analysis, the concentrated sludge/additive mixture would be transferred in batches to the sludge dryer. The sludge drying system would function in a similar fashion to the supernate dryer. For optimum efficiency, the dried sludge solids would be loaded directly into Waste Isolation Pilot Plant TRU canisters. Sludge distillate may be condensed or directed to the supernate treatment system.

2.4.2.2 Solid waste treatment (remote-handled and contact-handled solids)

DOE would deliver drums and boxes of the contact-handled solid waste to the proposed treatment facility. Foster Wheeler would perform visual inspections and radiation and contamination surveys prior to acceptance of the waste containers. The drum contents would be characterized by performing a non-destructive examination and assay in an adjoining enclosure before transfer to a staging area. The low-level waste drums that do not contain RCRA waste would be treated in a drum compactor for a 50% volume reduction, overpacked, weighed, and conveyed back to the shipping/receiving area for final certification by DOE. The simplified block flow diagram for the tank waste treatment systems is illustrated in Figure 2-5.

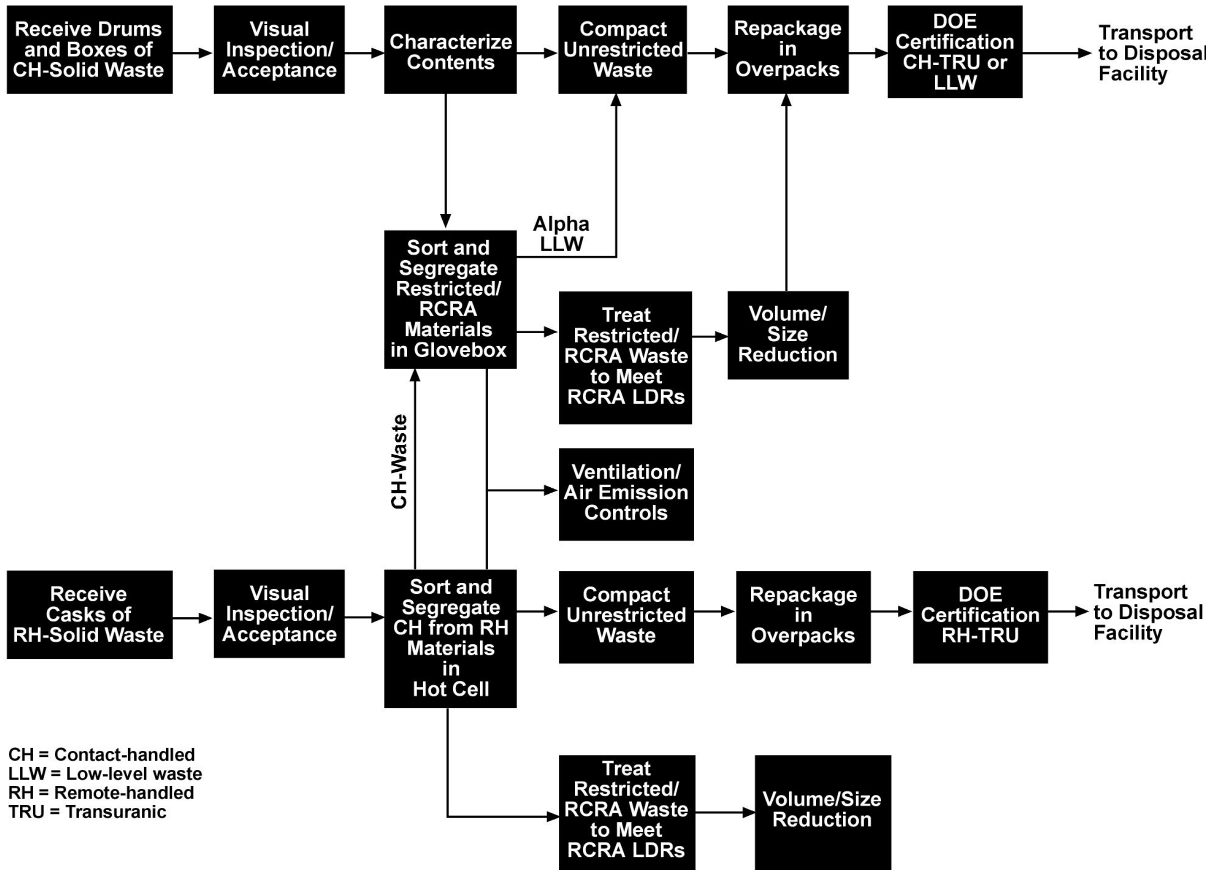

Figure 2-5. Solid waste treatment flow diagram for the Low-Temperature Drying Alternative.

The remaining drums would be transported to the process line area. The drums would be moved into a glovebox, opened, and the contents would be tipped onto a sorting tray where restricted/RCRA waste materials would be segregated manually via glove ports. The segregated low-level waste would be treated as described above. The RCRA/restricted waste materials would be treated by macroencapsulation or other techniques to meet RCRA LDR standards. Following treatment the solid waste would be volume and size reduced. Depending on the TRU activity, the waste would be repackaged to meet the appropriate waste acceptance criteria, and certified for shipment by DOE.

Incoming boxes of waste would be moved into a glovebox. Waste would be removed from the boxes and placed on the sorting trays using waste removal tools attached to manipulators. RCRA/restricted waste would be segregated for handling in an adjacent treatment station. The remaining waste would be placed in drums and compacted “in-drum” prior to transfer back to the nondestructive examination and assay area for final certification by DOE and shipment to the Waste Isolation Pilot Plant. Secondary waste, such as empty waste containers, personal protective equipment, etc., would also be compacted prior to final certification by DOE and shipment offsite by the contractor to an appropriate disposal facility.

DOE would deliver the concrete casks containing remote-handled solid waste to the proposed waste treatment facility. Foster Wheeler would inspect and survey the waste upon receipt and then transfer the cask inside the facility. Treatment is initiated by raising the cask into a docking position with a hot cell to allow access to the cask lid from inside the hot cell. The contents of the cask would be removed using waste removal tools mounted on an overhead crane. Any oversized remote-handled TRU waste that is too large to fit into a canister would be size reduced. Waste would be placed in trays and conveyed through a nondestructive examination and assay station. A local gamma detector would identify any contact-handled waste, which would be routed directly to the contact-handled solids treatment glove box for treatment as discussed above. Waste that is compliant with LDR standards would be compacted and loaded into canisters docked at the load-out port on the hot cell. Higher activity low-level waste segregated in the sorting operation would be loaded into shielded drums at a separate load-out port for waste certification by DOE. Waste that does not meet RCRA LDR standards will be treated via macroencapsulation or other methods to meet RCRA LDR standards in the event that unanticipated storage is required.

2.4.3 Schedule of Activities

The total duration of the Low-Temperature Drying Alternative would be approximately 11.5 years, with less than 5 years of waste treatment. The proposed waste treatment schedule minimizes environmental impacts by combining the tank and solid waste treatment timelines, thus optimizing the sorting and segregation of TRU wastes for shipment to the Waste Isolation Pilot Plant and low-level waste for shipment to the Nevada Test Site, or another facility to be designated in the Record of Decision for the WM PEIS. The schedule is designed to enable shipments to be certified by DOE for acceptance at the designated disposal facility within a reasonable time frame. It also allows the reduction in peak personnel loading and related personnel support facilities. The Low-Temperature Drying Alternative would consist of four phases. The four phases are depicted in Figure 2-6, with further schedule detail provided in Figure 2-7 for the treatment of the tank wastes and solid wastes.

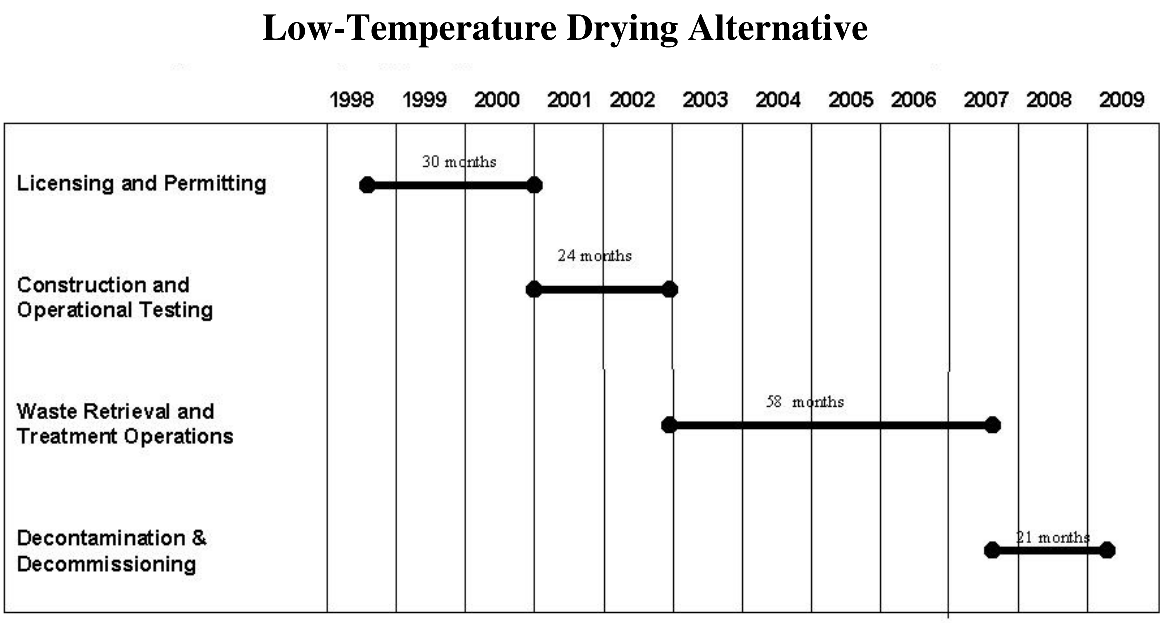

Figure 2-6. The Low-Temperature Drying Alternative would take place over a period of approximately 11.5 years.

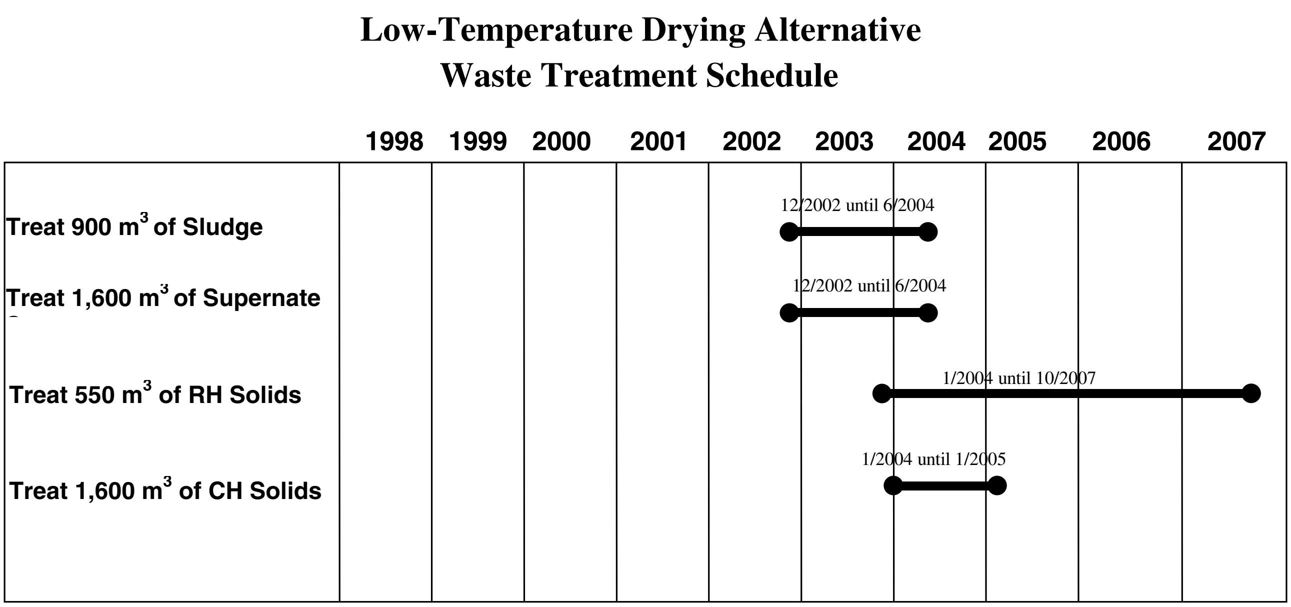

Figure 2-7. Waste treatment would be completed in approximately 3.5 years utilizing the Low-Temperature Drying Alternative.

2.5 VITRIFICATION ALTERNATIVE

The Vitrification Alternative would convert the sludge and supernate waste into a stabilized glass form, and segregate and super-compact the solid contact-handled TRU and remote-handled TRU solid wastes.

2.5.1 Facility Description

The facility for the Vitrification Alternative would be located on 2 to 2.8 ha (5 to 7 acres) west of the Melton Valley Storage Tank facility as indicated in the Proposed Action. The vitrification facility would be a three-and-one-half-story, steel-framed structure measuring 46 m × 76 m × 14 m (150 ft × 250 ft × 45 ft) with concrete and steel shielding. The total floor area would be approximately 7,400 m^2 (80,000 ft^2), with an estimated 2,800 m^2 (30,000 ft^2) for the process area and 4,600 m^2 (50,000 ft^2) for the process support area. Doublewide trailers would be brought onsite to provide a detached administration area of approximately 740 m^2 (8,000 ft^2).

2.5.2 Waste Treatment Description

The waste treatment for the Vitrification Alternative consists of sorting, compaction, grouting, and vitrification (changing the waste to a stable glass form by melting) to treat the waste (Figure 2-8). The vitrification system would treat liquids, soils, sludges, and other materials that are smaller than the RCRA definition of debris. A first-pass material balance for the vitrification treatment of remote handled TRU sludges, a material balance for the contact-handled TRU solid waste, and three material balances for the remote-handled TRU solid waste are presented in Appendix B, in the section covering Vitrification Alternative details. Assumptions used to develop these material balances and to determine a final stabilized waste form were based on information about the vitrification facilities at West Valley, New York, and Hanford, Washington, and the Melton Valley Storage Tanks treatability studies (Spence and Gilliam 1998). The assumptions also considered the characteristics of the existing waste. The Vitrification Alternative would implement several pollution prevention and waste minimization measures. As pollution prevention measures, storm water would be diverted around the facility and gate valves would be installed in the diversion basins to contain spills. Waste minimization would be accomplished by the following methods:

- Tank supernate would be used as the mixing media for sludge retrieval in the Melton Valley Storage Tanks.

- A cold cap would be maintained on the molten glass in the melter to minimize the loss of volatile organics to the atmosphere.

- The solid waste drums would go through an initial characterization process. Drums not needing sorting and repackaging would be sent directly to the super-compactor for a 50% to 80% volume reduction.

- The off-gas system would minimize air emissions.

A summary of volumes of primary, secondary, and decontamination and decommissioning waste streams are included in Table 2-2.

Table 2-2. Summary of projected waste volumes for the Vitrification Alternative

Waste Stream	Category	Projected Volume Out[a]	Treatment Requirement
Primary Waste Streams			
Sludge/Supernate	TRU	577 m^3	Vitrification
Contact-handled solids	TRU	260 m^3	Various
Remote-handled solids	TRU	116 m^3	Various
Remote-handled solids	Low-level waste	87 m^3	Various
Secondary Waste Streams			
Primary waste containers			
Remote-handled casks	Low-level waste	946 m^3	Volume reduction
Contact-handled drums and boxes	Low-level waste	44 m^3	Volume reduction
Construction debris	Sanitary	200 m^3	None
PPE (gloves, booties, etc.)[b]	Low-level waste	315 m^3	Volume reduction
HEPA filters[b]	Low-level waste	82 m^3	Volume reduction
Consumables (rags, towels, etc.)[b]	Low-level waste	181 m^3	Volume reduction
Mechanical/maintenance items	Low-level waste/TRU	97 m^3	Volume reduction
Industrial waste water	Low-level waste/ sanitary	1,108 m^3	Capture
Evaporator concentrate	Low-level waste	326 m^3	Cementation
Laboratory solvents and residues	Low-level waste/mixed waste/TRU	2 m^3	Vitrification, stabilization
Sanitary solids	Sanitary	718 m^3	Capture
Sanitary wastewater	Sanitary	6,283 m^3	Capture
Decontamination and Decommissioning Waste Streams			
Concrete rubble	Construction debris	20,712 m^3	None
Free release metals	Recycle, reuse	120 m^3	None
Non-contaminated metals	Construction debris	48 m^3	None
Contaminated materials	Low-level waste	1,894 m^3	Volume reduction
Vitrified and residual material	TRU	10 m^3	None
Special materials	Low-level waste/mixed waste	2 m^3	Stabilize, special treatment

[a]Volumes are waste product volumes in the final disposal containers.
[b]If the waste is determined to be hazardous, the waste would also be macroencapsulated
HEPA - High-Efficiency Particulate Air. TRU - transuranic.
PPE - personal protective equipment.

2.5.2.1 Tank waste treatment (sludge and supernate)

Retrieved sludge and supernate from the Melton Valley Storage Tanks would remain commingled and then immobilized in a soda-lime-silica glass matrix to form a TRU waste product that meets both RCRA LDR standards and the Waste Isolation Pilot Plant waste acceptance criteria. In the Melton Valley Storage Tanks sludge treatability study (Spence and Gilliam 1998), tests were conducted on the Melton Valley Storage Tanks sludge using soda-lime-silica glass formers. The treated waste (i.e., glass sample - Melton Valley Storage Tank - V-18) had a specific gravity of 2.8, which indicated a waste loading (by mass) of 41%. The specific gravity helps to correlate the leachability of the waste and the stability of the waste form, and helps determine if the volume of treated waste is optimized. The sludge and supernate treatment process can be subdivided into four subsystems: the waste retrieval/receipt system, the melter feed preparation system, the melter system, and the off-gas treatment system.

Retrieved waste sludge and supernate would enter the treatment facility through the waste retrieval/receipt system (Figure 2-8). This system would provide buffer storage between the treatment facility and the waste retrieval system, and homogenize the sludge and supernate mixture for feed characterization (which will also determine the required glass former blend). Sludge and supernate retrieval operations would be conducted in the Melton Valley Storage Tanks using pulsed jet mixing, rather than sluicing, which would allow the existing supernate in the Melton Valley Storage Tanks to be used as the "mixing" media. Treatment one tank at a time, the sludge would be mobilized and pumped to one of two sludge/supernate waste receipt tanks at the facility. Waste retrieval operations would be conducted only during day shifts with operations personnel stationed at a control module at the Melton Valley Storage Tanks and at the treatment facility control room.

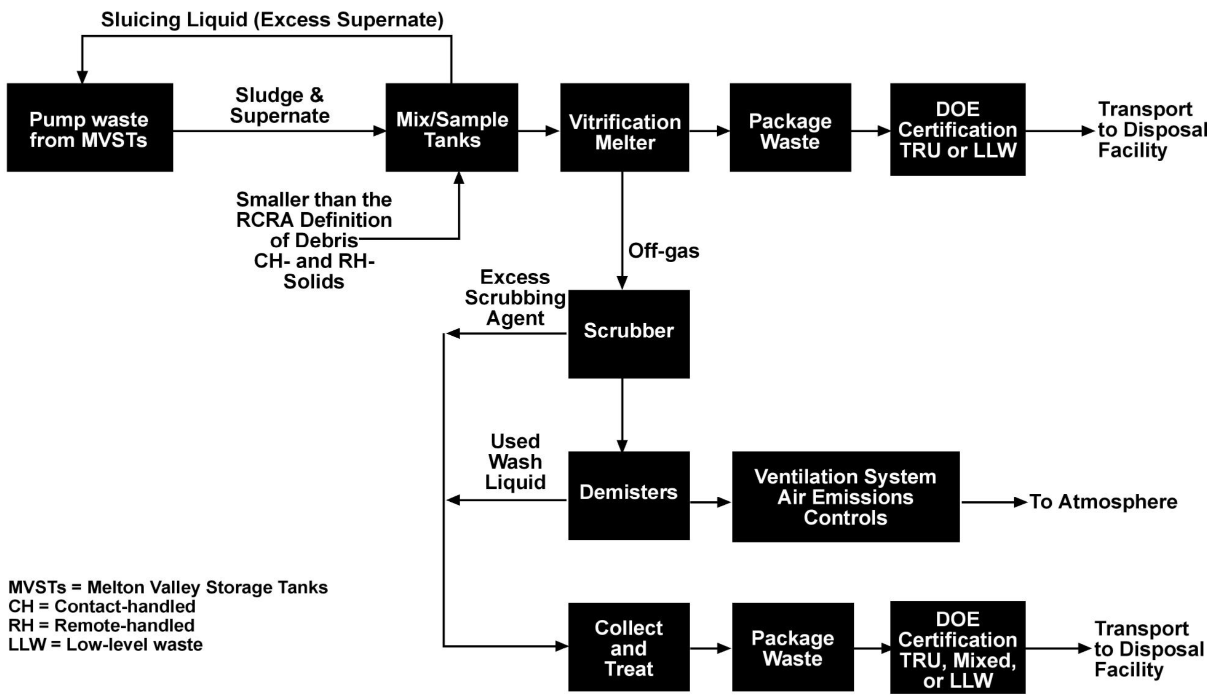

Figure 2-8. Treatment flow diagram for sludge, supernate, and solid waste smaller than the RCRA definition of debris for the Vitrification Alternative.

The stainless steel waste receipt tanks would provide feed for 7 days of full operations for the melter system. This would minimize the impact on waste treatment due to downtime in the retrieval system, or hard-to-retrieve sludge. The waste receipt tank would be isolated from the retrieval system once it is filled. The second tank, if available, becomes the waste retrieval tank. A mechanical agitator would homogenize the waste to prevent solids from settling in the waste receipt tank. Homogenized waste would be sampled to determine the chemical and radiochemical composition for Waste Isolation Pilot Plant waste certification requirements, and to confirm that the treatment facility is meeting operational parameters. Once the analysis results confirm that the composition is acceptable, the waste receipt tank is considered part of the melter feed preparation system.

The melter feed operations include preparation of the dry glass-forming chemicals, mixing the dry chemicals with the homogenized waste stream, and feeding the resultant slurry to the melter. Glass-forming chemicals anticipated to be used for waste treatment include: soda (Na_2CO_3 - to get the alkali component: Na_2O), lime (CaO), and silica (SiO_2 - for glass forming). Alumina may also be used for glass forming. Based on the average concentrations and information provided from the treatability studies

(Spence and Gilliam 1998), the glass former blend would be approximately 14.3% $CaCO_3$, 41% dried waste, and 44.7% SiO_2. Batches of waste and glass-forming compounds would be prepared for 24 hours of melter operations. The appropriate quantity of glass-forming components would be measured and fed into a hopper. An appropriate amount of homogenized waste would be transferred into a feed preparation tank along with the glass-forming chemicals from the hopper. Once the waste and dry chemicals are blended, a pump would transfer the blend to the melter feed tank. A mechanical agitator in the feed tank would keep the contents homogenous and to prevent solids settling.

The melter would have a throughput of 2 metric tons of glass per day and a minimum availability of 70%, equivalent to 260 operating days per year on a 7-day, around-the-clock basis. The glass product would occasionally be sampled to confirm that chemical composition is within the required range to produce acceptable quality glass. The melter would be a slurry-fed, joule-heated, ceramic unit, operating at a temperature of approximately 1,150°C (2,100°F). The melter would include a few safety features, such as a water-cooled refractory to contain the glass and a cold cap of unmelted glass floating on the glass surface. The cold cap helps minimize the loss of volatile chemicals to the off-gas system. Most of the feed components would be converted to their oxides, which dissolve in the molten glass. During the decomposition process, gases would be formed, heated, and released into the melter plenum and routed to the off-gas system. A fraction of the feed components would be directly carried over to the off-gas system without incorporation into the glass. However, some components would be volatile in the melter, and a significant fraction of these materials would be released to the off-gas system. The solids and semi-volatile components would be recycled back to the melter from the off-gas system to increase the incorporation rate for these components in the glass.

The major components of the off-gas resulting from the melter's thermal processes would be nitrogen and oxygen due to air in-leakage to the melter and decomposition reactions occurring in the melter. Other major components of the off-gas would be superheated steam from the evaporation of water, and NO_x from decomposition of metal nitrates. Chloride, fluoride, and SO_x would also be present due to feed decomposition, although in low concentrations compared to NO_x. The off-gas treatment system would exhaust gases from the melter plenum, maintain the melter at a negative pressure in relation to its cell, and clean the off-gas prior to stack discharge. The off-gas treatment system would consist of a primary system and a secondary system.

The primary off-gas treatment system would consist of three components: a film cooler, an off-gas quencher/scrubber, and a demister. This system would remove particulate carryover from the melter into the off-gas, the majority of radionuclides, a substantial amount of the acid gasses, and cool the off-gas prior to further treatment. The film cooler would cool the exiting off-gas to between 350 and 400°C (662 to 752°F) by injecting compressed air into the off-gas stream. The off-gas would then be drawn into an off-gas quencher/scrubber to further cool the off-gas. Hastelloy C or other similar metal alloys would be used for construction of the scrubber due to the high corrosion rate [> 0.05 in./year (Perry and Chilton 1973)] caused by the heat and high concentrations of halogen acid gases in the off-gas. The scrubbing agent could be water or slightly basic caustic. The scrubbing agent liquid would be collected and recycled back into the treatment process (as sluicing water that has better solubility capacity than supernate), or treated and disposed of as a secondary waste. Immediately downstream of the scrubber would be a pair of demisters. The demisters would remove mist and particulates from the off-gas stream, including the 90% or more of the remaining radionuclides in particulate form. The demisters would be washed regularly to prevent damaging downstream equipment such as pumps. Used demister wash liquid would be collected in a sump and recycled to help mobilize the sludge, or reprocessed.

The secondary off-gas treatment system performs final particulate filtration prior to stack discharge and consists of four HEPA filters in parallel sets of two. Each HEPA filter removes up to 99.95% of the remaining particulates in the off-gas stream. Gases (primarily air) leaving the HEPA filters are directed to the off-gas stack. Previous vitrification analysis conducted at DOE's Hanford site indicates that approximately 40% of the nitrate feed would be converted to nitrogen by the melter. Thus, it is possible that emissions from this treatment method would be below the Tennessee permit exemption levels without additional off-gas treatment systems.

2.5.2.2 Solid waste treatment (remote-handled and contact-handled solids)

In general, the remote-handled and contact-handled solid wastes would be sorted, treated, repackaged, compacted, overpacked, grouted, certified by DOE, and packed in appropriate transport containers. Certified TRU waste would be disposed at the Waste Isolation Pilot Plant, and low-level waste would be disposed in a manner consistent with the WM PEIS Record of Decision for low-level waste (e.g., the Nevada Test Site or another designated disposal facility). A small amount of the contact-handled and remote-handled solid wastes would be treated by vitrification if their size is smaller than what RCRA defines as debris. Mixed wastes that are primarily solids with RCRA metal constituents are expected to meet the definition of debris and would be macroencapsulated per the alternative treatment standards found in 40 *CFR* 268.45, Table 1. The treated waste would meet RCRA LDR standards in the event that unanticipated storage is required onsite. Materials not considered debris would be segregated and treated at the facility to allow disposal.

The solid waste treatment train would be remotely operated, and primary subsystems include solid waste receipt, the solid waste pretreatment system, the compaction and repackaging systems, and the macroencapsulation system (Figure 2-9). Solid waste containers would be unloaded in the solid waste receipt area and monitored for surface radiation dose level and contamination. Remote-handled solid waste would not be received until all of the contact-handled solid waste is processed. The wastes would be brought to the second floor bay area. This buffer storage area would remain at a minimal level (approximately one full week of treatment).

Solid waste would be characterized by nondestructive examination and assay methods, such as High Resolution Gamma Spectroscopy and passive and active neutron analysis, to determine the fissile content. Some containers may not require repackaging if their contents are confirmed as debris by real-time radiography. All other waste containers would be transferred to the hot cell for characterization. Solid wastes that may contain hazardous constituents, such as lead and mercury, would be treated in the Special Treatment Operations area. Special waste material such as batteries, aerosols, and gas bottles, would be sorted from the debris waste, collected, and sent to a special treatment cell, or some other applicable treatment facility. The sorting would be done with a remote manipulator; however, if dose limits are sufficiently low (e.g., less than 10 mrem/hour), some of the wastes contained in 30- and 55-gallon drums may be sorted by hand. Some material (e.g., metal) may be resized in order to maximize the waste volume in a sorted container. Sorted waste containers would be sent to the supercompactor.

Drums of repackaged contact-handled and remote-handled solid wastes would be characterized and weighed before compaction to provide the information for DOE waste certification. The compacted repackaged waste would be in the form of a puck between one-half to one-fifth of the height of the original container. Waste pucks would be cataloged for size, weight, and activity and then placed in 55-gallon drums in such a manner to ensure full encapsulation by the grout (the assumed macroencapsulating material). Grout would be metered to ensure encapsulation around the pucks. The grouted overpack container would be placed into the buffer storage area until the grout has set.

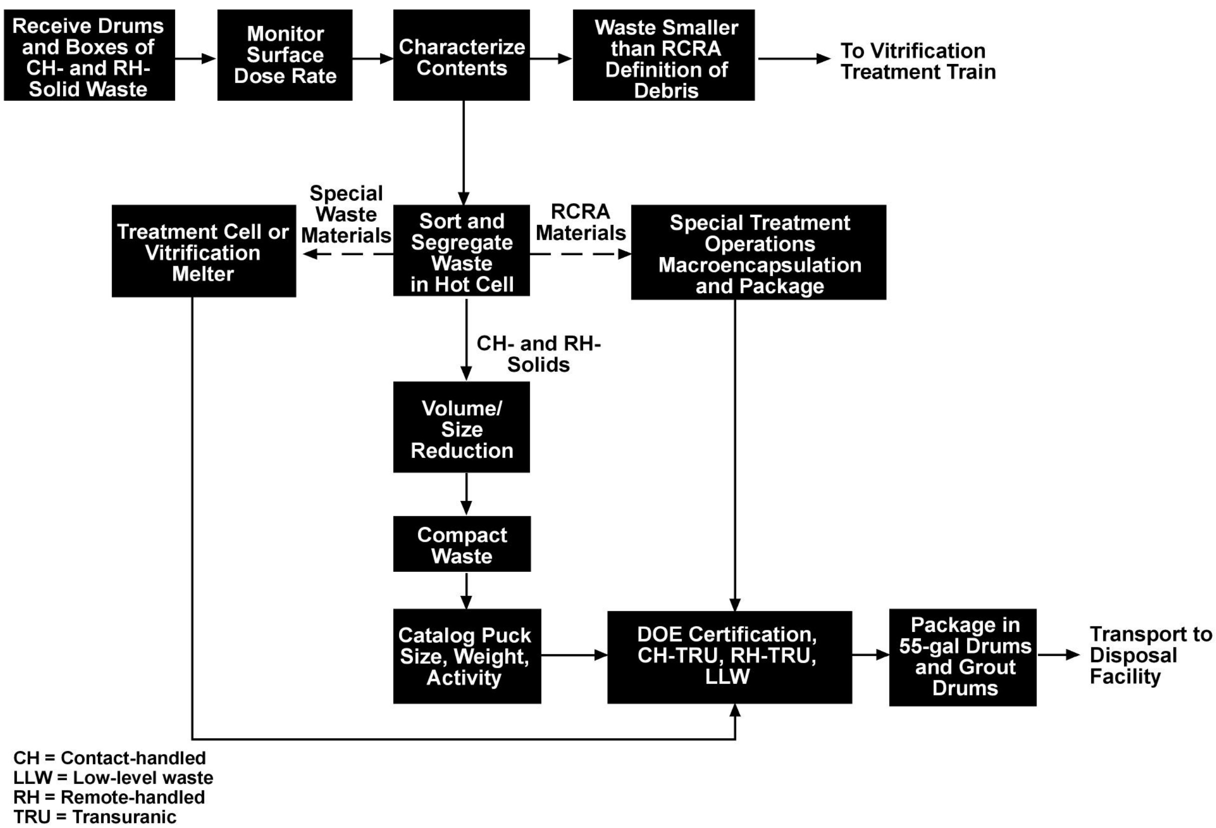

Figure 2-9. Vitrification Alternative flow diagram for solid waste treatment.

2.5.3 Schedule of Activities

The total project duration of the Vitrification Alternative would be approximately 10 years, with about 3 years of waste treatment. Following 3 months of cold commissioning after construction of the facility, hot operations would be conducted for a period of 2.75 years. This treatment schedule combines the tank and solid waste treatment timelines and adjusts shift requirements to balance the life cycle of operations while minimizing duplication of treatment unit operations and treatment equipment. This approach would allow for reduction in peak personnel loading (except during construction activities) and related personnel support facilities. Contact-handled solids would be treated first and would normally proceed at a rate of approximately 13 drum equivalents per day on a 2-shift, 5-day basis. The remote-handled solids treatment would proceed at a rate of approximately 0.7 casks per shift on a 2-shift, 5-day basis. Contact-handled solid waste treatment would require approximately 1.25 years of operations, and remote-handled solid waste treatment would require 1.5 years. The overall project schedule is depicted in Figure 2-10, and details of the waste treatment schedule are provided in Figure 2-11.

Vitrification Alternative Schedule

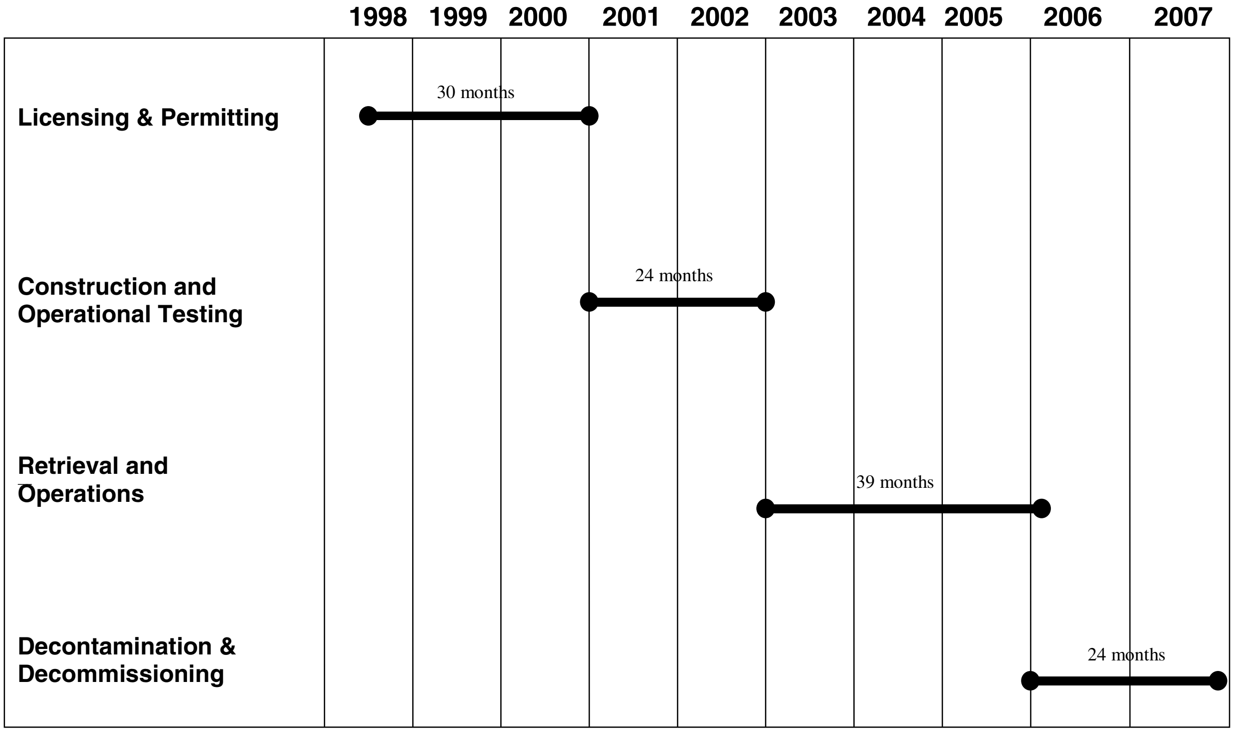

Figure 2-10. Vitrification Alternative project schedule.

Vitrification Alternative Waste Treatment Schedule

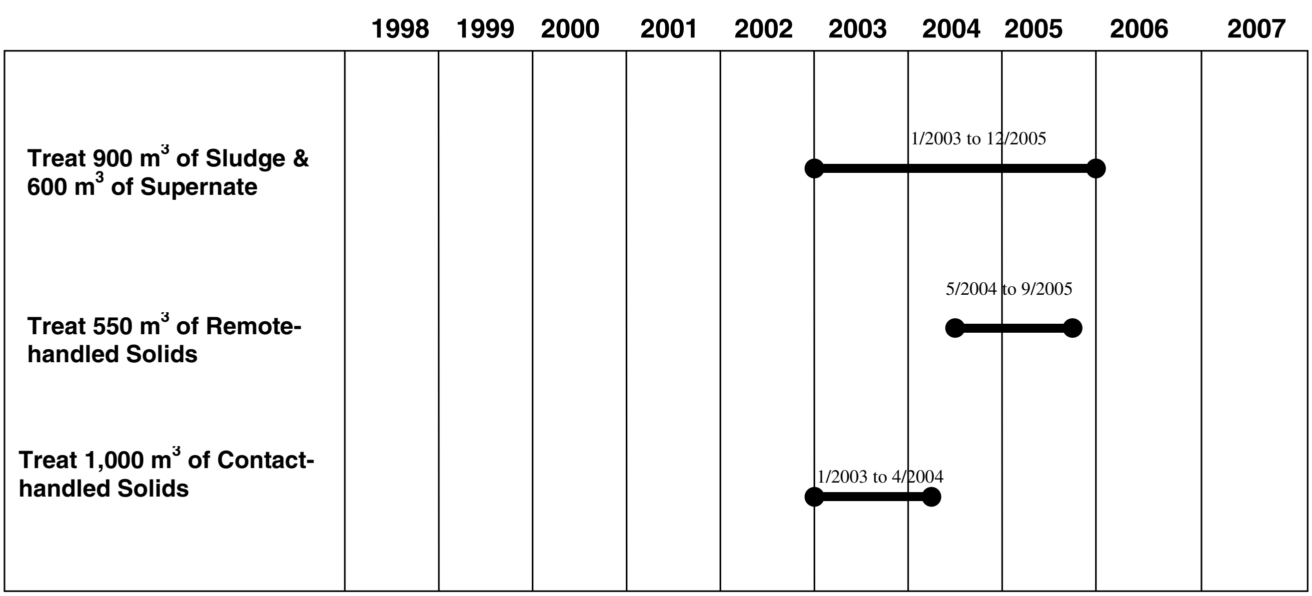

Figure 2-11. Vitrification Alternative waste treatment schedule.

2.6 CEMENTATION ALTERNATIVE

The Cementation Alternative consists of sludge and supernate separation by hydrocyclone/centrifuge pre-treatment and subsequent cementation for the tank wastes, and segregation and supercompaction for the contact-handled and remote-handled solid wastes.

2.1.1 Facility Description

The facility for the Cementation Alternative would be located within an approximate 2-ha (5-acre) plot of land located immediately west of the Melton Valley Storage Tanks. The process building would be a three-and-one-half-story structure. The facility would be a 3.7 m × 61 m × 14 m (120 ft × 200 ft × 45 ft) steel-framed structure with concrete and steel shielding. The total floor area of the cementation facility would be approximately 5,575 m^2 (60,000 ft^2), with an estimated 1,860 m^2 (20,000 ft^2) for the process area and 3,720 m^3 (40,000 ft^2) for the process support area. Doublewide trailers would be brought onto the site to provide approximately 560 m^2 (6,000 ft^2) for the administration area that would be detached from the process building.

2.6.1 Waste Treatment Description

The cementation technology is based on operations conducted at DOE's Hanford facility near Richland, Washington, and information provided in a feasibility study (Parallax 1995). As pollution prevention measures, storm water would be diverted around the facility and gate valves would be installed in the diversion basins to retain spills. The off-gas system would minimize air emissions, and liquid used for the decontamination of the cementation treatment system would be transferred back into the cementation treatment system as waste minimization measures. A summary of volumes of primary, secondary, and decontamination and decommissioning waste is included in Table 2-3.

2.6.1.1 Tank waste treatment (sludge and supernate)

The Cementation Alternative would use hydrocyclone and centrifuge waste pre-treatment to separate the supernate from the sludge. The majority of the liquids would be recycled through the Melton Valley Storage Tanks for sludge mobilization. After separation, the pretreated sludges would be treated by cementation (Figure 2-12). The facility would oscillate between treatment for supernate and treatment for sludge.

The initial step would be pretreatment to remove excess liquid from the sludge/supernate mixture following sludge retrieval. The pretreatment process would include storage tanks for the sludge/supernate, feed tanks for the cement mixer, metering equipment for pH adjustment additives, and associated pumps and instrumentation. A hydrocyclone in series with a centrifuge would separate the sludge from the supernate. The hydrocyclone is a centrifugal device with no moving parts. Solids from the hydrocyclone would gravity drain into the feed tank. The centrifuge would receive the effluent from the hydrocyclone and then provide a sufficiently high gravity force to effectively remove suspended solids ranging from 1 to 20% weight, with particle sizes ranging from 2 to 150 µm, at a flow rate up to 60 gallons per minute (actual flow rate would be dependent on the rate of sludge and supernate retrieval from the Melton Valley Storage Tanks). A back-drive system would be included with the centrifuge design to maintain a desired slurry discharge of 25% weight total suspended solids. A supernate collection tank would temporarily hold the liquid streams from the hydrocyclone and centrifuge before the supernate is pumped back for sludge mobilization.

Table 2-3. Summary of projected waste volumes for the Cementation Alternative

Waste Stream	Category	Projected Volume Out[a]	Treatment Requirement
Primary Waste Streams			
Sludge	TRU	1,287 m^3	Cementation
Supernate	remote-handled low-level waste	2,453 m^3	Cementation
Contact-handled solids	TRU	260 m^3	Various
Remote-handled solids	TRU	116 m^3	Various
Remote-handled solids	remote-handled low-level waste	87 m^3	Various
Secondary Waste Streams			
Primary waste containers			
Remote-handled casks	Low-level waste	946 m^3	Volume reduction
Contact-handled drums and boxes	Low-level waste	36 m^3	Volume reduction
Construction debris	Sanitary	200 m^3	None
PPE (gloves, booties, etc.)[b]	Low-level waste	384 m^3	Volume reduction
HEPA filters [b]	Low-level waste	83 m^3	Volume reduction
Consumables (rags, towels, etc.) [b]	Low-level waste	257 m^3	Volume reduction
Mechanical/maintenance items	Low-level waste/TRU	130 m^3	Volume reduction
Laboratory solvents and residues	Low-level waste/ mixed waste/TRU	2 m^3	Vitrification, stabilization
Sanitary solids	Sanitary	2,217 m^3	Capture
Sanitary wastewater	Sanitary	5,020 m^3	Capture
Decontamination and Decommissioning Waste Streams			
Concrete rubble	Construction debris	14,111 m^3	None
Free release metals	Recycle, reuse	77 m^3	None
Non-contaminated metals	Construction debris	32 m^3	None
Contaminated materials	Low-level waste	1,127 m^3	Volume reduction
Special materials	Low-level waste/ mixed waste	1 m^3	Stabilize, special treatment

[a]Volumes are waste product volumes in the final disposal containers.
[b]If the waste is determined to be hazardous, the waste would also be macroencapsulated .
HEPA - High-Efficiency Particulate Air. TRU - transuranic.
PPE - personal protective equipment.

The stainless steel feed tanks would be sized to allow continuous transfer of the sludge and supernate to the cementation facility. The feed tanks would be filled by the bottoms discharge of the hydrocyclone and centrifuge, and would contain approximately 25% weight total suspended solids. The feed tanks could also perform as settling tanks, if maintenance downtime is required for the centrifuge or hydrocyclone. Agitators would provide the required continuous mixing of the sludge, and a decant pump would remove any excess effluent. The feed tanks would be plumbed for metering the pH adjustment solution (e.g., HCl and NaOH). The metered waste slurry would be transferred from the feed tanks to the cementation batch process system using positive displacement pumps (Figure 2-12).

A dry blend storage tank assembly would store the premixed cementation/stabilization agents, and would consist of feed input, storage, and feed transfer systems. Premixed cementation/stabilization blends would be conveyed pneumatically to the storage bin. In-line sampling capability would be provided for the pneumatic feed conveyance system to verify the premix chemistry. Storage of the stabilization mixture would be provided by a vibrating bottom hopper fitted with mechanically activated level switches, and air pulse mixing that would be ducted to a baghouse and eventually to HEPA filters for air discharge. The feed transfer system would include a weigh belt feeder, transfer conveyor, transport

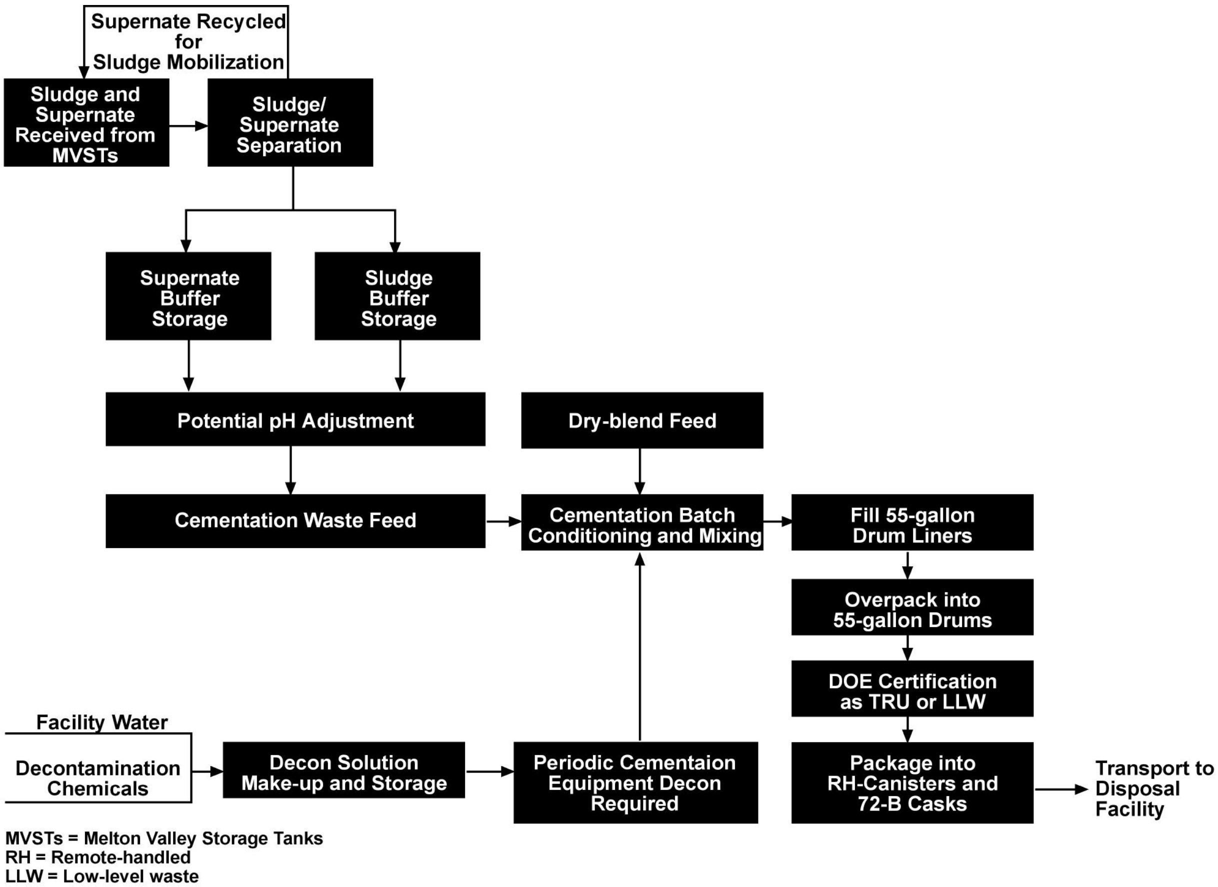

Figure 2-12. Flow diagram for tank waste treatment for the Cementation Alternative.

blower, and tramp screen that feeds stabilization mixtures through a rotary valve. A truck would deliver the dry blend to the treatment facility, for deposit into the dry blend storage tank, which would contain enough premixed blend to process sludge for 5 to 7 days. Approximately 7 lbs of dry blend consisting of 33, 20, 19, 20, and 20% weight of slag, cement, fly ash, perlite, and Indian Red Pottery Clay, respectively (Spence and Gilliam 1998), would be added per gallon of sludge to obtain a stable treated waste product. Approximately 11 lbs of dry blend would be added per gallon of supernate, and would consist of 40, 40, 16, and 4% weight of slag, cement, fly ash, and perlite, respectively.

The dry blend premix would be transferred through the vibrating bin bottom and injected with air for fluidization, then through a rotary airlock to a weigh belt feeder into the cementation mixer. The feed tank metering pump would transfer the waste slurry to the mixer. The cementation mixer is a high-energy, low-shear, twin-screw device that gravity discharges the cement blend into a conical surge tank. The surge tank includes an agitator, and an integral pump controls its level. A grout pump would discharge the waste slurry mixture into 50-gallon drum liners. The drum liners would be filled by weighing and float control instrumentation. Approximately three 50-gallon carbon steel liners could be filled on an hourly basis. The filled liners would remain on the conveyor system for a minimum of 4 hours to allow the cement to harden, then the liners would be placed inside 55-gallon carbon steel overpack drums. A remote manual manipulator would perform external surface contamination analysis of the overpack drums. After passing the analysis, the drums would be transferred to the interim storage area before placement into remote-handled canisters and, ultimately, 72-B casks. It is anticipated that operations would oscillate between cementation of sludge and cementation of supernate on a weekly basis. The treated supernate would be remote-handled low-level waste and would be disposed of at the Nevada Test Site or another facility designated in the WM PEIS Record of Decision for low-level waste.

In addition to the dust collection and filtration (i.e., a baghouse and HEPA filters) for the grout dry blending mixture, particulate emissions would be collected using HEPA filters. The cementation mixing process would contain several spray nozzles to clean the mixer, conveyors, surge tank, and the liquid collection tank. Decontamination chemicals would be used with a cementation pipeline-clearing pump to flush the lines each time the process is stopped, with discharge routed to a liquid collection tank. The contents of the liquid collection tank would be pumped to the pretreatment process for separation and transfer to the supernate collection tank for cementation treatment.

2.6.1.2 Solid waste treatment (remote-handled and contact-handled solids)

In general, treatment of the remote-handled and contact-handled solid waste would include: waste receipt, assaying, opening, sorting, treatment, repacking, compaction, overpacking, grouting, DOE certification, packing in transport containers, and transport to the appropriate disposal facility. The solids treatment for the Cementation Alternative is identical to the Vitrification Alternative. Please refer to Section 2.4.2.2 for detailed information about this process.

2.6.2 Schedule of Activities

The total project duration of the Cementation Alternative is approximately 12.5 years, with 6 years involving waste treatment. The Cementation Alternative would require a longer waste treatment time, which would reduce the radiochemical and particulate emissions in a given year. The longer treatment time is due to the availability of shipments to the Waste Isolation Pilot Plant. The longer treatment time is a result of the shipment capacity allotment given by Waste Isolation Pilot Plant to each approved shipper of certified TRU waste. (If the allocated shipment allotment from Waste Isolation Pilot Plant were not a limiting factor, the sludge and supernate could be treated by this alternative treatment method in 1 or 2 years. The Cementation Alternative's treatment schedule for the waste streams was developed to keep the same number of operating shifts as required for sludge treatment to minimize operating the equipment. This approach would also allow for reduction in peak personnel loading and related personnel support facilities. The overall project schedule is depicted in Figure 2-13. Further schedule detail for the tank and solid waste treatment is provided in Figure 2-14.

Waste treatment would be conducted in the cementation facility for a period of 6 years with a designed treatment rate of 1.25 gallons per minute of sludge/supernate. In order to process the sludge and supernate in 6 years, the cementation facility would need to be operational at least 70% of the year and would require one 8-hour shift per day for 5 days a week. Contact-handled solids would be treated first and would normally proceed at a rate of approximately 6.5 drum equivalents per day on a 1-shift, 5-day basis. Contact-handled solid waste treatment would require approximately 2.5 years of operations. The remote-handled solid wastes would be treated after the contact-handled solids and would proceed at a rate of approximately 0.7 casks per shift on an 8-hour shift per day, 5-day basis. Remote-handled solid waste treatment would require 3 years, based on the facility being operational 80% of the year.

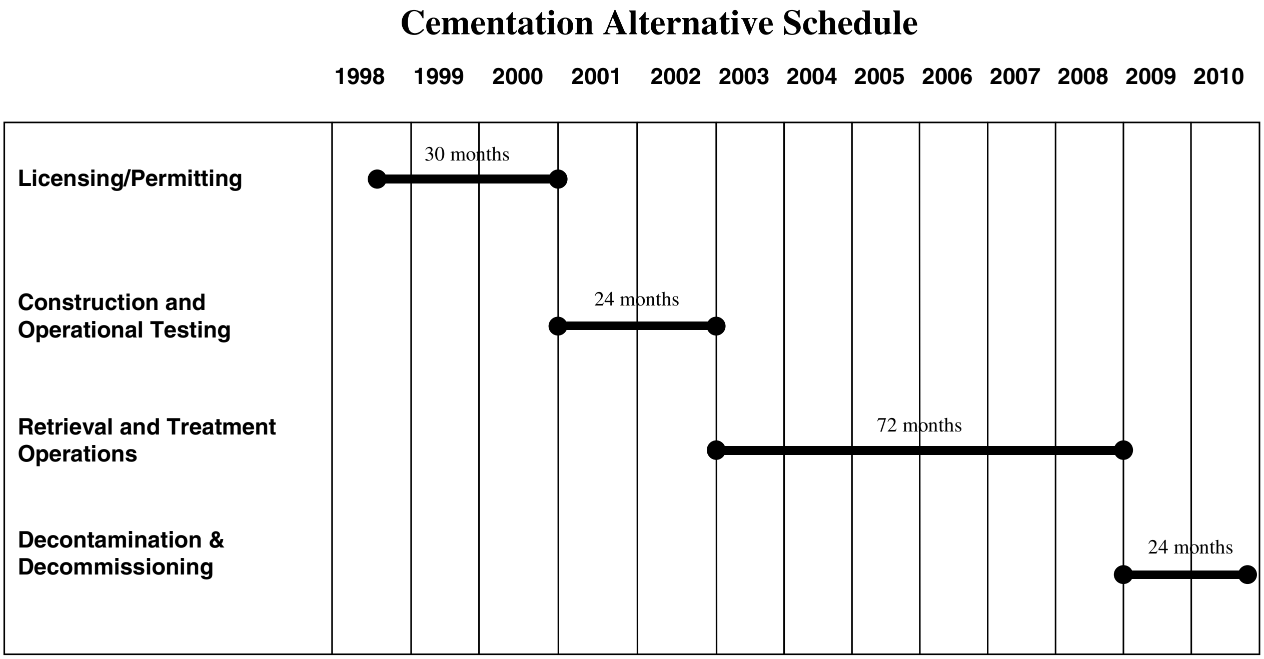

Figure 2-13. The Cementation Alternative Schedule shows the project would take approximately 12.5 years to complete.

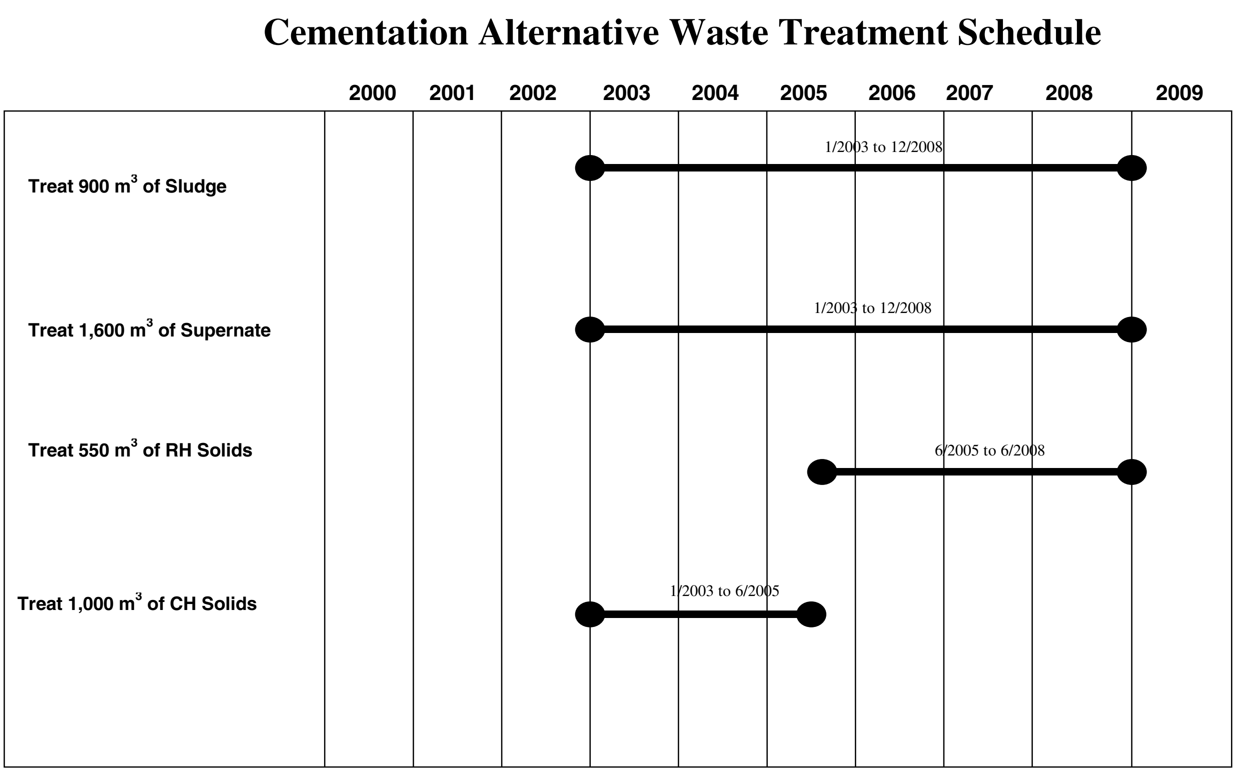

Figure 2-14. The Cementation Alternative waste treatment schedule would take approximately 6 years.

2.7 TREATMENT AND WASTE STORAGE AT ORNL ALTERNATIVE

This alternative would entail waste treatment by any of the three previous treatment alternatives (low-temperature drying, vitrification, or cementation) and indefinite waste storage at ORNL rather than shipment to an off-site disposal facility (e.g., the Waste Isolation Pilot plant for TRU waste, and the Nevada Test Site or another designated facility in the WM PEIS for low-level waste). Treated remote-handled wastes would require remote handling during on-site storage at ORNL because of the associated doses. Implementation of this alternative would result in noncompliance with the milestone established in the Commissioner's Order from Tennessee requiring the submittal of a Project Management Plan (which includes schedules for treatment and shipment) by September 30, 2001. In addition, this alternative would jeopardize the existing "target date" established in the Order for initiation of shipment of the stabilized remote-handled-TRU sludges to the Waste Isolation Pilot Plant by January 2003.

2.7.1 Facility Description

2.7.1.1 Waste treatment facility

Since this alternative would include waste treatment by any of the three treatment alternatives previously described, please refer to these previous sections for a description of the waste treatment facilities for low-temperature drying, vitrification, and cementation.

Waste Treatment Facility Description	Section
Low-Temperature Drying	Section 2.4.1
Vitrification	Section 2.5.1
Cementation	Section 2.6.1

2.7.1.2 Waste storage facilities

On-site waste treatment would result in primary, secondary, and D&D waste streams that would consist of remote-handled TRU waste; contact-handled TRU wastes; low-level waste; remote-handled low-level waste; and mixed waste, which would require on-site storage at ORNL. This alternative would require the construction of new waste storage facilities. Several assumptions were made to determine the storage space required for the waste streams resulting from waste treatment.

1. It was assumed that a required engineering analysis would indicate that the existing storage bunkers for remote-handled and mixed waste (Buildings 7855 and 7883) could be used to store treated remote-handled TRU and remote-handled low-level wastes. These bunkers would provide 320 m^3 of storage capacity.
2. It was assumed that the existing metal buildings that store contact-handled TRU waste (Buildings 7572, 7574, 7842, 7878, and 7879) would be used for treated low-level waste storage. These buildings would provide 1,631 m^3 (57,632 ft^3) of storage capacity for low-level waste.
3. It was assumed that the new storage facilities would have similar waste storage capacities [approximately 150 m^3 for each remote-handle waste bunker, and approximately 300 m^3 (11,318 ft^3) for each metal building].
4. It was assumed that the building footprints (area) for the new storage facilities, and for their construction, would be similar to the existing storage facilities (234 m^2 remote-handled waste storage bunkers and 375 m^2 metal storage buildings for low-level waste).

5. It was assumed that the new waste storage facilities would be located in the Melton Valley area of ORNL, preferably near the waste treatment facility or the existing TRU waste storage facilities.

Tables 2-4a, -b, and -c provide a summary of the resulting waste volumes of the three waste treatment alternatives and the new storage space required for the resulting waste streams. The construction of new waste storage facilities would need to coincide with the construction of the selected waste treatment facility in order to be ready for the receipt of the treated waste streams. The number of new storage facilities needed for the treated wastes would be dependent on the treatment method chosen.

Table 2-4. Summary of the TRU, mixed low-level, remote-handled low-level, and low-level waste volumes, the resulting new storage space required for each treatment alternative, and the land area required for additional storage facilities

	Low-Temperature Drying	Vitrification	Cementation
Table 2-4a. Summary of the TRU, mixed low-level, and remote-handled low-level waste volumes and new storage space required			
Treated TRU waste volume (m^3)	607	1,060	1,793
Mixed low-level waste volume (m^3)	23	4	3
Treated remote-handled low-level waste volume (m^3)	–	–	2,540[a]
Total TRU, mixed, and remote-handled low-level waste requiring on-site storage **(m^3)**	630	1,064	4,336
Existing waste bunkers storage capacity (m^3)	320	320	320
New storage capacity needed **(m^3)[b]**	310	744	4,016
Assumed capacity of single new waste bunker (m^3)	150	150	150
Number of new waste bunkers needed	3	5	27
Assumed area of new waste bunker (m^2)	234	234	234
Total Storage Facility Area required for TRU, mixed, and remote-handled low-level wastes **(m^2)**	702	1,161	6,265
Table 2-4b. Summary of low-level waste volumes and new storage space required			
Total low-level waste requiring on-site storage **(m^3)**	2,778[a]	4,983[a]	2,833[a]
Existing storage capacity (metal building)	1,631	1,631	1,631
New storage capacity needed **(m^3)[b]**	1,147	3,352	1,202
Assumed capacity of single new metal building (m^3)	300	300	300
Number of new metal buildings needed	4	11	4
Area of new metal buildings (m^2)	375	375	375
Total area required for low-level wastes **(m^2)**	1,434	4,190	1,503
Table 2-4c. Total area required for all waste types and the associated land requirements for the new storage facilities			
TOTAL FACILITY SPACE REQUIRED FOR ALL WASTE TYPES (m^2)	**2,136**	**5,351**	**7,768**
TOTAL HECTARES REQUIRED FOR NEW WASTE STORAGE FACILITIES[c]	**0.3**	**0.6**	**0.8**

[a]Total waste volumes include alpha-low-level waste.
[b]Determined by subtracting available capacity from resulting waste volume and dividing by assumed storage capacity of new facility (150 m^3 for TRU, mixed, and remote-handle low-level wastes, and 300 m^3 for low-level wastes).
[c]Determined by summing storage space required for all waste types, for each treatment method, and converting to hectares.

2.7.2 Waste Treatment Description

This alternative would include waste treatment by any of the three treatment approaches previously described (low-temperature drying, vitrification, or cementation), and then indefinite storage onsite at ORNL. Please refer to these previous sections for the descriptions of the waste treatments that would be implemented if this alternative were selected.

Waste Treatment Description	Section
Low-Temperature Drying	Section 2.4.2
Vitrification	Section 2.5.2
Cementation	Section 2.6.2

2.7.3 Schedule of Activities

This alternative would include indefinite storage of the waste at ORNL following waste treatment. It is assumed that storage would be for a minimum of 100 years. The schedules for waste treatment were discussed in previous sections, as noted below. Construction of additional waste storage facilities would need to coincide with the construction of the waste treatment facility in order to have facilities available to store the treated wastes following waste treatment and repackaging. It is assumed that the schedules would be similar to the facility construction schedule, which would allow for about 2 years for construction.

Waste Treatment and D&D Schedule	Section
Low-Temperature Drying Alternative	Section 2.4.3
Vitrification Alternative	Section 2.5.3
Cementation Alternative	Section 2.6.3

2.8 ALTERNATIVES CONSIDERED BUT NOT EVALUATED IN DETAIL

2.8.1 Off-site Waste Treatment

Currently there is no facility available or planned at any DOE site that could treat remote-handled TRU mixed waste sludge and associated low-level waste supernate stored at ORNL. The Idaho National Engineering and Environmental Laboratory (INEEL) is planning to process its contact-handled TRU on-site waste at the planned Advanced Mixed Waste Treatment Project facility; however, using the planned INEEL facility to treat ORNL TRU waste would be difficult for the following reasons:

- Because the planned INEEL facility is being constructed to process the contact-handled TRU waste at INEEL, the ORNL remote-handled TRU waste may not meet the planned facility's waste acceptance criteria.

- Most of the ORNL remote-handled and contact-handled TRU/alpha low-level solid waste containers do not meet DOT standards (49 *CFR* 173). These containers would require repackaging prior to transport offsite; therefore, it would be safer and more economical for the treatment of solid waste to be conducted at ORNL, and for the treated waste to be shipped directly to the WIPP or the low-level waste disposal sites.

- After treatment at INEEL, the ORNL treated waste would require a second redundant step of repackaging and DOE certification before the waste could be transported to the WIPP or low-level waste disposal site for disposal, resulting in additional worker exposures and cost.

- Treatment of the ORNL TRU wastes at INEEL is unreasonable because of the increased costs and risks associated with preparing the tank waste for shipment, repackaging and certifying the waste twice, transporting the waste to INEEL for treatment, and then transporting the treated waste to the WIPP or the low-level waste disposal sites.

2.8.2 Alternate On-site Treatment Facility Locations

Several factors were considered in selecting the site of the proposed on-site treatment facility. These factors are discussed in Section 2.1 and include minimizing the length of any sludge/supernate waste transfer line from the Melton Hill Valley Storage Tanks to the proposed treatment facility, using the terrain to provide natural shielding for the proposed facility, and considering recommendations made in a feasibility study that focused on dealing with the tank wastes.

The proposed site is directly west of the Melton Valley Storage Tanks, which is the current storage area for the TRU mixed waste sludge and associated low-level supernate. This location reduces the potential risks associated with transporting the liquid and sludge tank wastes from the Melton Valley Storage Tanks to the proposed treatment facility over public or laboratory roads. Since the solid waste storage facilities are also located in Melton Valley, the transportation of the solid wastes would only occur on laboratory roads, also reducing the risk to the public. Melton Valley, while considered part of ORNL, is separated from the ORNL main plant area by the Haw Ridge (Figure 2-1), thus reducing potential risks to the main body of workers at ORNL from accidental releases. Alternative site locations were not evaluated in detail because other on-site locations did not meet the siting factors.

2.8.3 Alternative Disposal Locations

TRU waste will be disposed of at the WIPP in accordance with the WIPP SEIS-II Record of Decision (DOE 1998) for TRU waste. The analysis in this EIS assumes that all low-level waste resulting from the ORNL TRU Waste Treatment Facility will be disposed of at the Nevada Test Site. The Nevada Test Site waste acceptance criteria would allow disposal of alpha low-level waste; however, the disposal of any low-level waste generated from this action will be consistent with the pending Record of Decision for low-level waste from the WM PEIS. The WM PEIS Record of Decision for low-level waste is expected to be issued before completion of the final EIS for the TRU Waste Treatment Project at ORNL. Because the project would generate small quantities of low-level waste in comparison to the 1.5 million m^3 of low-level waste analyzed for the entire DOE complex in the WM PEIS, the assumption of disposal of low-level waste at the Nevada Test Site does not prejudice the WM PEIS Record of Decision for low-level waste.

2.8.4 Alternative Treatment Technologies

Sixteen stabilization and solidification technologies were identified and evaluated as candidates for processing TRU waste sludge in the *Feasibility Study for Processing ORNL Transuranic Waste at Existing and Modified Facilities* (Parallax 1995), but were not analyzed further because they were not considered reasonable (Table 2-5). One of the technologies, plasma arc vitrification, was also identified as potentially useful for solid remote-handled and contact-handled TRU/alpha low-level waste. However, it would not be feasible to use a technology for the solid wastes unless it was also used for the sludge and supernate. Because of cost, scaling, and permitting issues, this technology was eliminated from further consideration.

Table 2-5. Summary of alternatives considered but not evaluated for sludge and supernate waste treatment

Treatment name	Summary description	Rationale for not evaluating
Aquaset II-H®	A non-thermal process that utilizes a powdered solidification agent developed for the immobilization of sludge through the action of complex bonding mechanisms and ion exchange reactions.	Not a proven technology, inability to treat multiple waste streams, its lack of ease with retreatment capabilities, and the excess amount of water used during the process.
Catalytic extraction	A thermal process that introduces sludge into a molten metal bath which acts as a catalyst to break down the waste into its elemental constituents.	Extensive chemical formulation is required for each changing waste stream.
Glass-ceramic vitrification	A thermal process that combines sludge with a ceramic feed material, then calcines in a spray calciner.	Not a proven technology for this type of waste and has a low tolerance to feed variations.
Bitumen solidification	A non-thermal process that uses either bitumen or asphalt as a high molecular weight hydrocarbon to encapsulate the sludge.	Gas generation from the degradation of the hydrocarbon material by alpha-emitting radionuclides.
Ceramic vitrification	A thermal process that combines sludge with ceramic powder and glass frits and then forms and heats into bricks in a brick former.	Not a proven technology for this type of waste and has a lower flexibility with treatment various wastes.
Microwave vitrification	A thermal process that combines glass frits and sludge, places the mixture into a microwave cavity, and melts.	Not proven at large scale; lower flexibility with treatment various waste.
In-can glass melting	A thermal process that first dries the sludge to a fine powder in a spray calciner, then combines the fine powder with glass frits and feeds it into a drum for heating.	Lacks multiple waste stream capabilities, lacks retreatment capabilities, and is not a proven technology for ORNL's waste stream.
Titanate	A thermal process that involves mixing supercalcine (a silicate-based material) with sludge and then calcining.	Increased waste loading, sensitivity to sodium waste streams, lack of multiple waste stream capabilities, lack of retreatment capabilities, and not being a proven technology for ORNL's waste stream.

Synroc hot-isostatic pressing	A thermal process that involves calcination of the sludge and then mixing it with synroc additives. Synroc is an acronym for a synthetic, igneous rock system that consists of thermodynamic-compatible minerals having the ability to capture radioactive waste elements in their crystal lattices.	Similar to the Titanate process.
Supercalcine hot-isostatic pressing	A thermal process that involves mixing supercalcine (a silicate-based material) with sludge and then calcining.	Similar to the Titanate process.
Cermet	A thermal process that involves dissolving and mixing sludge and cermet-forming additives in molten urea.	Similar to the Titanate process.
Fluetap concrete	This process combines the sludge with water, cement, fly ash, and clay in a mixer, then transfers the mix into a drum, and places it into an autoclave for 64 hours to accelerate hardening. The drum is then placed in an air-storage for several years to remove the free water from the concrete.	Failed to meet the schedule constraints.
Molten salts	A thermal process that introduces air to the sludge under a surface of a sodium carbonate-containing melt.	Failed to meet Resource Conservation and Recovery Act (RCRA) Land Disposal Restrictions (LDR) standards.
Supercalcine pellets-in-metal	A thermal process that combines supercalcine with sludge. Binders are added and the material is pelletized. The pellets are sintered to form the desired mineral phase, placed in drums, and encapsulated in lead.	Failed to meet RCRA LDR standards.
Marbles-in-lead matrix	A thermal process that creates marbles from a joule-heated molten glass/sludge mixture and then casts the marbles in lead.	Failed to meet RCRA LDR standards.
Polymer encapsulation	A non-thermal process that involves mixing vinyl ester styrene with sludge and then allows to cure in an in-drum mixer.	Failed to meet the Waste Isolation Pilot Plant waste acceptance criteria.

2.9 SUMMARY OF ENVIRONMENTAL IMPACTS

Table 2-6 is a summary of the potential environmental impacts associated with implementing the various alternatives considered in the EIS. These impacts are discussed in detail in Chapter 4, but are summarized here to allow comparison of the alternatives.

Table 2-6. Comparison of impacts among alternatives

	No Action Alternative	Low-Temperature Drying Alternative (Preferred)	Vitrification Alternative	Cementation Alternative	Treatment and Waste Storage at ORNL Alternative
Land use (Chapter 4, Section 4.1)	• No change in land use, land use classifications, or impacts to visual resources	• No change in land use classification • 2 hectares (ha) (5 acres) would change from underdeveloped to industrial use • Buildings and other structures would be visible to workers but not the public	• No change in land use classification • 2 to 2.8 ha (5 to 7 acres) would change from underdeveloped to industrial use • Buildings and other structures would be visible to workers but not the public	• No change in land use classification • 2 ha (5 acres) would change from underdeveloped to industrial use • Buildings and other structures would be visible to workers but not the public	• No change in land use classification • 2 to 2.8 ha (5 to 7 acres) would change from underdeveloped to industrial use • For waste storage after treatment, an additional 0.3 ha (0.75 acre) of land would be required if treatment was by low-temperature drying, 0.6 ha (1.5 acres) of land if by vitrification, or 0.8 ha (2.0 acres) of land if by cementation • Buildings and other structures would be visible to workers but not the public
Cultural and historic resources (Chapter 4, Section 4.2)	• No cultural, archeological, or historic resources in project area	• Same as No Action Alternative	• Same as No Action Alternative	• Same as No Action Alternative	• Same as No Action Alternative

Table 2-6. Comparison of impacts among alternatives (continued)

	No Action Alternative	Low-Temperature Drying Alternative (Preferred)	Vitrification Alternative	Cementation Alternative	Treatment and Waste Storage at ORNL Alternative
Ecological resources (Chapter 4, Section 4.3)	• Continued release of waste constituents from SWSA 5 North trenches to soils and groundwater affecting biota • No habitat destruction under normal operations	• 2 ha (5 acres) of forested habitat lost and converted to industrial use (revegetated after facility D&D) • Reduction of soil and water contamination because treatment would be available for waste to be removed from trenches under CERCLA	• 2 to 2.8 ha (5 to 7 acres) of forested habitat lost and converted to industrial use (revegetated after facility D&D) • Reduction of soil and water contamination because treatment would be available for waste to be removed from trenches under CERCLA	• 2 ha (5 acres) of forested habitat lost and converted to industrial use (revegetated after facility D&D) • Reduction of soil and water contamination because treatment would be available for waste to be removed from trenches under CERCLA	• 2 to 2.8 ha (5 to 7 acres) of forested habitat lost and converted to industrial use • Low-quality habitat indefinitely lost for on-site waste storage facility construction; 0.3 ha (0.75 acre) of land required if treatment by low-temperature drying, 0.6 ha (1.5 acres) of land if by vitrification, and 0.8 ha (2.0 acres) of land if by cementation • Reduction of soil and water contamination because treatment would be available for waste to be removed from trenches under CERCLA

Table 2-6. Comparison of impacts among alternatives (continued)

	No Action Alternative	Low-Temperature Drying Alternative (Preferred)	Vitrification Alternative	Cementation Alternative	Treatment and Waste Storage at ORNL Alternative
Geology and seismicity (Chapter 4, Section 4.4)	• No impact to geology or regional seismicity • No construction-related impacts to soils or geology • Continued release of waste constituents from the SWSA 5 North trenches to soils	• No impact to geology or regional seismicity • 2 ha of soil disturbed • Reduction of soil and water contamination because treatment would be available for waste to be removed from trenches under CERCLA	• No impact to geology or regional seismicity • 2.8 ha of soil disturbed • Reduction of soil and water contamination because treatment would be available for waste to be removed from trenches under CERCLA	• No impact to geology or regional seismicity • 2 ha of soil disturbed • Reduction of soil and water contamination because treatment would be available for waste to be removed from trenches under CERCLA	• No impact to geology or regional seismicity • 2 to 2.8 ha of soil disturbed • Reduction of soil and water contamination because treatment would be available for waste to be removed from trenches under CERCLA
Surface water (Chapter 4, Section 4.5.1)	• Continued release of waste constituents from the SWSA 5 North trenches to surface water	• Potential for increased siltation in White Oak Creek, Melton Branch, and an unnamed tributary • Reduction of soil and water contamination because treatment would be available for waste to be removed from trenches under CERCLA	• Same as Low-Temperature Drying Alternative	• Same as Low-Temperature Drying Alternative	• Same as Low-Temperature Drying Alternative
Groundwater (Chapter 4, Section 4.5.2)	• No groundwater use • Continued release of waste constituents from SWSA 5 North trenches	• No groundwater use • Positively impacts groundwater due to waste removal and treatment of waste from SWSA 5 North trenches	• Same as Low-Temperature Drying Alternative	• Same as Low-Temperature Drying Alternative	• Same as Low-Temperature Drying Alternative

Table 2-6. Comparison of impacts among alternatives (continued)

	No Action Alternative	Low-Temperature Drying Alternative (Preferred)	Vitrification Alternative	Cementation Alternative	Treatment and Waste Storage at ORNL Alternative
Wetlands & Floodplains (Chapter 4, Section 4.5.3)	• Continued impacts to White Oak Creek floodplain due to SWSA 5 North contamination • No impact to wetlands	• Small impact to the 100-year or 500-year floodplains during construction phase • Wetland B (0.012 ha or 0.03 acres) would be eliminated by construction	• Same as Low-Temperature Drying Alternative	• Same as Low-Temperature Drying Alternative	• Same as Low-Temperature Drying Alternative
Waste Management (Chapter 4, Section 4.6)	• TRU sludge wastes and associated low-level supernate in the Melton Valley Storage Tanks, solid wastes in SWSA 5 North trenches, and solid waste in storage facilities would remain untreated • Would require continued surveillance and maintenance of untreated legacy waste inventory and associated on-site facilities indefinitely at ORNL • Would result in violation of legal mandate due to continued waste storage, potentially resulting in fines	• All legacy wastes in proposed action would be treated • Approximately 10,833 m^3 of total generated waste, including: – 607 m^3 contact-handled and remote-handled TRU waste; – 2,778 m^3 low-level waste; – 23 m^3 of low-level mixed waste; – 1,560 m^3 of sanitary wastewater; and – 5,550 m^3 debris from D&D activities	• Same as Low-Temperature Drying Alternative • Approximately 34,128 m^3 of total waste generated, including: – 1,060 m^3 contact-handled and remote-handled TRU waste; – 4,980 m^3 low-level waste; – 4 m^3 of low-level mixed waste; – 7,201 m^3 of sanitary wastewater; and – 20,760 m^3 debris from D&D activities	• Same as Low-Temperature Drying Alternative – Approximately 28,826 m^3 of total waste generated, including: – 1,793 m^3 contact-handled and remote-handled TRU waste; – 2,833 m^3 low-level waste; – 2,540 m^3 of remote-handled low-level waste; – 3 m^3 of low-level mixed waste; – 7,437 m^3 of sanitary wastewater; and – 14,143 m^3 debris from D&D activities	• Same as Low-Temperature Drying Alternative • 10,833 to 34,128 m^3 of waste generated, depending on the treatment selected, and stored on-site • Would require continued surveillance and maintenance of waste inventory indefinitely onsite at ORNL • Would require construction of additional waste storage facilities—using 0.3 to 0.8 ha of land depending upon treatment process selected

Table 2-6. Comparison of impacts among alternatives (continued)

	No Action Alternative	Low-Temperature Drying Alternative (Preferred)	Vitrification Alternative	Cementation Alternative	Treatment and Waste Storage at ORNL Alternative
Climate and Air Quality (Chapter 4, Section 4.7)	• No impact to air quality	• Minor emissions during normal operations	• Same as Low-Temperature Drying Alternative	• Same as Low-Temperature Drying Alternative	• Same as Low-Temperature Drying Alternative
Transportation (Chapter 4, Section 4.8)	• No off-site shipments	• 397 shipments of TRU waste with 3.2E-01 accidents and 4.4E-02 fatalities predicted • Non-accident latent cancer fatalities (LCFs) of 8.7E-02 for CH TRU and 3.1E-02 for RH TRU waste • 277 low-level waste shipments with 2.6E-01 accidents and 3.6E-02 accident fatalities predicted • 2.1E-09 non-accident LCFs predicted	• 987 shipments of TRU waste with 8.0E-01 accidents and 1.1E-01 fatalities predicted • Non-accident LCFs of 5.3E-03 for CH TRU and 9.3E-02 for RH TRU waste • 281 low-level waste shipments with 2.6E-01 accidents and 3.6E-02 accident fatalities • 2.1E-09 non-accident LCFs predicted	• 2,425 shipments of TRU waste with 2.2 accidents and 3.0E-01 fatalities predicted • Non-accident LCFs of 5.3E-02 for CH TRU and 2.7E-01 for RH TRU waste • 914 low-level waste shipments with 8.8E-01 accidents and 1.2E-01 accident fatalities predicted • 7.5E-09 non-accident LCFs predicted	• No off-site shipment of TRU waste or low-level waste • Requires on-site transportation of processed waste to on-site waste storage facilities

Table 2-6. Comparison of impacts among alternatives (continued)

	No Action Alternative	Low-Temperature Drying Alternative (Preferred)	Vitrification Alternative	Cementation Alternative	Treatment and Waste Storage at ORNL Alternative
Utility Requirements (Chapter 4, Section 4.9)	• Total estimated power usage 2,200 MW • 5 million gallons of water use projected over 100-year institutional control period	• About 15,000 MW of total electricity usage • 5 million gallons of water use during project life	• About 45,000 MW of total electricity usage • 7 million gallons of water use during project life	• About 11,250 MW of total electricity usage • 15 million gallons of water use during project life	• Electricity use varies by alternative from 13,450 MW to 47,200 MW total, which includes electricity use for long-term storage • Water use varies by alternative (10 million to 20 million gallons), which includes water use for long-term storage
Human Health (Chapter 4, Section 4.10)	• LCF for involved worker population estimated to be 2E-02 • Risk to public and non-involved worker would be negligible	• Probability of cancer fatalities (PCF) from radiological releases to involved worker estimated to be 3.0E-05; non-involved worker estimated to be 2.0E-05; and off-site MEI estimated to be 1.0E-05 • Collective dose to the affected off-site pubic population would be 1.2E-01 person-rem, resulting in 6.0E-05 LCFs	• PCF from radiological releases to involved worker estimated to be 9.0E-05; non-involved workers estimated to be 7.0E-05; off-site MEI estimated to be 5.0E-05 • Collective dose to the affected off-site pubic population would be 6.8E-01 person-rem, resulting in 3.0E-04 LCFs	• PCF from radiological releases to involved worker estimated to be 6.0E-06; non-involved workers estimated to be 5.0E-06; and off-site MEI estimated at 3.0E-06 • Collective dose to the affected off-site pubic population would be 2.8E-02 person-rem, resulting in 1.0E-06 LCFs	• LCF for involved worker population estimated to be 2E-02 • PCF for the non-involved worker and off-site MEI would be equal to that estimated for the treatment technology selected • Collective dose and number of fatalities for the affected off-site population would be equal to that for the treatment technology selected

Table 2-6. Comparison of impacts among alternatives (continued)

	No Action Alternative	**Low-Temperature Drying Alternative (Preferred)**	**Vitrification Alternative**	**Cementation Alternative**	**Treatment and Waste Storage at ORNL Alternative**
Noise (Chapter 4, Section 4.12)	• Noise levels should decrease to 50 to 60 dBA when the High Flux Isotope Reactor access road construction is complete	• Site construction and D&D noise up to 70 dBA • Noise levels during operations at 50 to 60 dBA • Noise increases are temporary and minor	• Same as Low-Temperature Drying Alternative	• Same as Low-Temperature Drying Alternative	• Same as Low-Temperature Drying Alternative during treatment and would decrease, similar to the levels of No Action, during long-term storage

Table 2-6. Comparison of impacts among alternatives (continued)

	No Action Alternative	**Low-Temperature Drying Alternative (Preferred)**	**Vitrification Alternative**	**Cementation Alternative**	**Treatment and Waste Storage at ORNL Alternative**
Accidents (Chapter 4, Section 4.11)	• **Melton Valley Storage Tank (MVST) Breach** – MEI – 1.1E-05 PCF – Population – 1.1 LCF – Non-involved workers – 9.2E-04 PCF • **Vehicle impact (CH TRU and RH TRU waste)** – MEI – 1.6E-06 PCF – Population – 0.024 LCF – Non-involved workers – 1.3E-04 PCF • **Earthquake** – MEI – 1.6E-05 PCF – Population – 0.24 LCF – Non-involved workers – 1.4E-03 PCF • **Vehicle impact/fire (CH TRU and RH TRU waste)** – MEI – 1.4E-07 PCF – Population – 2.1E-03 LCF – Non-involved workers – 1.2E-05 PCF	• **MVST Breach** - NA • **MVST transfer line failure** – MEI – 3.2E-06 PCF – Population – 0.16 LCF – Non-involved workers – 2.8E-04 PCF • **Vehicle impact** - negligible • **Earthquake** – MEI – 4.8E-07 PCF – Population – 7.2E-03 LCF – Non-involved workers – 4.2E-05 PCF • **Vehicle impact/fire** - negligible	• Same as Low-Temperature Drying Alternative	• **MVST Breach** - NA • **MVST transfer line** failure – MEI – 6.3E-06 PCF – Population – 0.31 LCF – Non-involved workers – 5.5E-04 PCF • **Vehicle impact** - negligible • **Earthquake** – MEI – 9.6E-07 PCF – Population – 0.014 LCF – Non-involved workers – 8.4E-05 PCF	• **MVST transfer line failure** – MEI – 3.2E-06 to 6.6E-06 PCF – Population – 0.16 to 0.31 LCF – Non-involved workers – 2.8E-04 to 5.5E-04 PCF • **Vehicle impact** - negligible • **Earthquake (CH TRU and RH TRU waste)** – MEI – 4.8E-07 to 9.6E-07 PCF – Population – 7.2E-03 to 1.4E-02 LCF – Non-involved workers – 4.2E-05 to 8.4E-05 PCF • **Vehicle impact/fire (after processing)** – MEI – 1.4E-07 PCF – Population – 2.1E-03 LCF – Non-involved workers – 1.2E-05 PCF

Table 2-6. Comparison of impacts among alternatives (continued)

	No Action Alternative	Low-Temperature Drying Alternative (Preferred)	Vitrification Alternative	Cementation Alternative	Treatment and Waste Storage at ORNL Alternative
Socioeconomic (Chapter 4, Section 4.13)	• No change in economic activity	• No significant impacts • Earnings represent 0.1% of the income for the region	• No significant impacts • Earnings represent 0.2% of the income for the region	• No significant impacts • Earnings represent 0.1% of the income for the region	• No significant impacts • Earnings represent 0.1% of the income for the region
Environmental Justice (Chapter 4, Section 4.14)	• No environmental justice impacts expected	• Same as No Action Alternative	• Same as No Action Alternative	• Same as No Action Alternative	• Same as No Action Alternative

CH TRU = contact-handled transuranic waste.
D&D = decontamination and decommissioning.
HFIR = High Flux Isotope Reactor.
LCF = latent cancer fatality.
MEI = maximally exposed individual.
NA = Not applicable.
ORNL = Oak Ridge National Laboratory.
PCF = probability of cancer fatality.
RH TRU = remote-handled transuranic waste.
TRU = transuranic.

2.10 REFERENCES

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