Proposed New/Modified Treatment Facility: New Waste Processing Facility

As an alternative to modifying T Plant and using commercial contracts for MLLW and TRU waste treatment, a new facility would be constructed to process/treat the same waste streams and have all of the capabilities identified above for the modified T Plant Complex and for commercial treatment.

CH MLLW in standard containers, non-conforming LLW, elemental lead, and elemental mercury would also be treated in this new facility. Specific capabilities provided by the new facility to treat these waste streams could include stabilization, macroencapsulation, thermal desorption, mercury amalgamation, deactivation, sorting, sampling, repackaging, NDE, and NDA.

The new facility location is assumed to be in the 200 West Area near WRAP, consistent with previous DOE proposals for a modular complex to process MLLW and TRU waste. The new facility would be expected to be larger than WRAP (FH 2003).

MLLW would be treated to meet applicable regulatory requirements so that it can be disposed of in the MLLW trenches. TRU waste would be processed and shipped to WIPP.

2.2.3 Disposal Facilities

Facilities used for LLW and MLLW disposal at Hanford consist of the LLBGs and the Environmental Restoration Disposal Facility (ERDF). New or modified facilities would be developed for LLW, MLLW, ILAW, and WTP melters. Each of the existing and proposed new facilities considered in the alternatives is described in this section.

TRU wastes are disposed of in New Mexico at WIPP, which is the DOE repository for TRU wastes. Hanford began shipping TRU waste to WIPP in the summer of 2000 and would continue shipping TRU waste to WIPP for disposal.

LLW has been buried on the Hanford Site since the start of the defense materials production mission. Six LLBGs are located in the 200 West Area (218-W-3A, 218-W-3AE, 218-W-4B, 218-W-4C, 218-W-5, and 218-W-6) and two LLBGs are in the 200 East Area (218-E-10 and 218-E-12B). These eight disposal facilities are collectively referred to as the LLBGs. See Appendix D for additional information about each LLBG. The LLBGs have historically been used for temporary storage of some waste (these functions were previously described). Figure 2.12 shows a picture of a burial ground with both open and covered trenches.

Disposal Facilities

Existing Facilities

- LLBGs
  - LLW Trenches
  - MLLW Trenches
- ERDF

Proposed New/Modified Facilities

- Existing Design Unlined LLW Trenches
- Deeper, Wider Unlined LLW Trenches
- Single Expandable Unlined LLW Trench
- Deeper, Wider Lined LLW Trenches
- Existing Design MLLW Trenches
- Deeper, Wider Lined MLLW Trenches
- Single Expandable Lined Trench
- Melter Trench
- ILAW Multiple Trenches
- ILAW Disposal Vaults
- ILAW Expandable Trench
- Modular Lined Combined Use Disposal Trenches
- Closure Caps

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Figure 2.12. Aerial View of a Low Level Burial Ground

The total volume of LLW placed in the LLBGs between 1962 and 1999 was about 283,000 m^3 (10,000,000 ft^3). The waste occupies an area of 141 ha (348 ac). The LLBGs occupy a total area of 425 ha (1050 ac); thus, approximately two-thirds of the LLBGs would be available for future waste disposal.

Within the LLBGs, several techniques can be used to provide extra confinement for Cat 3 LLW and approved GTC3 LLW. These techniques include placement of higher-activity LLW deep within the trench, burial in HICs, and in-trench grouting. The higher-activity LLW is usually placed in the bottom of the trenches with Cat 1 wastes placed on top of the Cat 3 and GTC3 LLW. This is intended to reduce the risk of intrusion into the higher-hazard wastes.

HICs are large cement boxes or cylinders into which the Cat 3 LLW and approved GTC3 LLW are placed for burial. The HIC is first placed within the burial trench and the waste is loaded into the HIC. Figure 2.13 shows four HICs in the bottom of a burial trench. The HIC is then sealed with a lid and buried with other LLW placed around it. The HIC provides additional containment for higher-activity waste while the radioactivity decays. The concrete used to construct the HICs also changes the chemistry of the soil in the immediate vicinity of the waste, which reduces the mobility of certain radionuclides.

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Figure 2.13. High-Integrity Containers in a Low-Level Waste Disposal Trench

In-trench grouting involves placing the CH Cat 3 LLW and approved CH GTC3 LLW on a cement pad or on spacers, installing reinforcement steel and forms around the waste, and covering the waste with fresh concrete to encapsulate the waste within a concrete barrier. The process is limited to CH wastes because of the need for workers to be in close contact with the waste to place cement forms around them. Steel fibers are incorporated into the concrete to increase its strength. The resulting monoliths, such as the one shown in Figure 2.14, have a maximum size of 6.4 m (21 ft) long, 4 m (13 ft) high, and 2.7 m (9 ft) wide with a minimum wall thickness of 0.15 m (0.5 ft). After curing, the encased waste is covered with at least 2.4 m (8 ft) of soil. As with the HICs, in-trench grouting provides additional containment for the waste and retards migration of some radionuclides from the LLBGs. In-trench grouting is a more economical method for encapsulation of Cat 3 and GTC3 LLW than using the HIC.

The use of HICs versus in-trench grouting for CH waste is determined on a case-by-case basis. Generally, HICs are used for RH wastes while CH wastes are in-trench grouted. However, HICs can be used for either RH or CH waste.

The amount of waste that can be disposed of in a trench varies depending on the specific characteristics of the waste (e.g., CH vs. RH, Cat 1 vs. Cat 3) and how much cover soil is placed on the waste. Typically, about 30 percent to 50 percent of the total trench volume is filled with waste.

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Figure 2.14. Trench Grouted Wastes

2.2.3.1 LLW Disposal Trenches

The existing LLW trenches currently comprise a series of relatively long, unlined, narrow trenches for disposal of LLW. The dimensions of existing trenches in the LLBGs vary with location. Typically, trenches are about 12 m (40 ft) wide at the base; however, some are "V" shaped and some are wider with flat bottoms. The trenches are excavated to a depth of approximately 6 m (20 ft). The waste is placed within the trenches and the location of each waste package is recorded in waste management records. Periodically the waste may be covered with dirt for interim periods before adding additional wastes. After the trenches are filled with waste to the desired level, a 2.6-m (8-ft) layer of soil is placed over the waste so the surface is near the original grade. The trenches are inspected weekly to note any areas of subsidence and when necessary corrective actions are taken in a timely manner. Layouts of the trenches within each LLBG are shown in Appendix D.

Proposed New/Modified Disposal Facility: Existing Design Unlined LLW Trenches

Trenches of the current design would be used to expand LLBG disposal capacity. Dimensions are nominally 12 m (39 ft) wide at the base, 6.1 m (20 ft) deep, 20 m (66 ft) wide on top, and 350 m (1150 ft) long. However, the dimensions of each trench are modified to fit within the available space of each specific burial ground. The number of new trenches would depend on the amount and category of LLW received.

Proposed New/Modified Disposal Facility: Deeper, Wider Unlined LLW Trenches

Deeper, wider LLW trenches would be used to expand LLBG disposal capacity. The reference design for deeper, wider LLW trenches was assumed to be 67 m (220 ft) wide at the top, 7 m (23 ft) wide at the bottom, about 18 m (60 ft) deep, and 350 m (1150 ft) long. However, the dimensions of each trench are modified to fit within the available space of each specific burial ground. The number of new trenches would depend on the amount and category of LLW received.

Proposed New/Modified Disposal Facility: Single Expandable Unlined LLW Trench

A single expandable unlined LLW trench would be used to expand disposal capacity for LLW. The trench would be similar to those for ERDF (see Section 2.2.3.3), except they would not contain any liners for leachate collection. It would also be constructed in the 200 W Area so that they could be expanded as needed for future wastes. The design of such a facility is in the earliest stage of conceptual design. The potential benefit of such a facility is economy of scale for construction and land use. The size of the trench would depend on the amount and category of LLW received. The trench would be about 18 to 21 m (60 to 70 ft) deep and would require 3.8 to 8.9 ha (1.5 to 3.6 ac).

2.2.3.2 MLLW Trenches

The two existing MLLW trenches (218-W-5, trenches 31 and 34) are located within a LLBG but, for the HSW EIS, they are considered separately from the other LLW disposal trenches. The trenches are permitted for MLLW disposal (DOE-RL 1997). One trench (see Figure 2.15) is currently being used as a MLLW disposal unit. The floor dimensions of the trenches are about 30.5 m (100 ft) wide by 76.2 m (250 ft) long and 9.1-10.7 m (30-35 ft) deep. The floor slopes to allow collection of leachate (rain or snow melt that has permeated through the waste). The surface dimensions are approximately 91 m (300 ft) wide by 137 m (450 ft) long and encompass approximately 1.3 ha (3.2 ac) of land.

Applicable regulations (WAC 173-303) require that waste trenches contain liners to collect any leachate that contacts the waste during the operating period. All liquids collected in the leachate collection system would be treated before disposal as discussed in Section 2.2.2.3. The existing MLLW trenches would be capped in accordance with applicable regulations.

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Figure 2.15. Mixed Low-Level Waste Disposal Trench

Proposed New/Modified Disposal Facility: Existing Design MLLW Trenches

Additional trenches of the existing design would be needed. New MLLW trenches would be the same as those described above for the existing MLLW trenches. They would also be constructed in the 200 East Area to provide better access to ETF for leachate treatment. Regulations require that waste trenches contain liners to collect any leachate that contacts the waste during the operating period. All liquids collected in the leachate collection system would be treated before disposal. The trenches would be capped in accordance with applicable regulations.

Proposed New/Modified Disposal Facility: Deeper, Wider Lined MLLW Trenches

Deeper, wider trenches would be constructed to increase the efficiency and reduce the cost of future MLLW disposal at Hanford. They would also be constructed in the 200 East Area to provide better access to ETF for leachate treatment. The deeper, wider MLLW trench would be about 80 m (262 ft) wide as the base and 188 m (617 ft) wide at the top, with a depth of 18 m (60 ft). The length of the trench would be 170 m (558 ft) long for the Lower Bound volume and 340 m (1115 ft) long for the Upper Bound volume. Regulations require that waste trenches contain liners to collect any leachate that contacts the waste during the operating period. All liquids collected in the leachate collection system would be treated before disposal. The trenches would be capped in accordance with applicable regulations.

Proposed New/Modified Disposal Facility: Single Expandable Lined MLLW Trench

A single expandable lined trench would be used to expand disposal capacity for MLLW. It would also be constructed in the 200 East Area so that it could be expanded as needed for future wastes and have better access to ETF for leachate treatment. The design of such a trench is in the earliest stage of conceptualization. The potential benefit of such a trench is economy of scale for construction and land use. The size of the trench would depend on the future volume of MLLW to be disposed of. The trench would be about 18 to 21 m (60 to 70 ft) deep and would require 3.8 to 8.9 ha (1.5 to 3.6 ac).

Proposed New/Modified Disposal Facility: Lined Melter Trench

The vitrification of tank waste on the Hanford Site would result in the need to dispose of WTP melters. These items would be treated at the vitrification facility to ready them for disposal. The large melters would be taken to a lined trench designed for them. The dimensions for the melter trench would be about: 270 m (886 ft) long, 120 m (165 ft) wide, and 21 m (70 ft) deep. To place the melters into the trench a ramp with a 6 percent grade into the trench is planned. Leachate from the melter trench would be treated along with other MLLW trench leachate. The trench would be capped in accordance with applicable regulations.

2.2.3.3 ILAW Disposal Facilities

See the following text boxes for a description of the proposed ILAW disposal facilities.

Proposed New/Modified Disposal Facility: ILAW Disposal in an Expandable Trench

ILAW would be disposed in a single expandable trench located in the 200 East Area just southwest of the PUREX facility. A single trench 183 m wide by 365 m long by 10 m deep could accommodate the total mission quantity of ILAW (Aromi and Freeberg 2002). The bottom of the trench would contain a double leachate collection system similar to a RCRA Subtitle C landfill.

Initially two cells, each 62 m wide by 76 m long, would be installed. These cells could accommodate about 22,000 ILAW packages (Aromi and Freeberg 2002). Additional cells would be installed as necessary to accommodate the ILAW.

The canisters would be emplaced by a crane. The crane would be equipped with instrumentation and controls to allow the logging of each canisters position, serial number, and date using a GPS.

After several canisters are emplaced, the crane operator, using a material-handling bucket, will place fill between and over the canisters, thereby minimizing the overall radiation exposure to the crane operator.

Proposed New/Modified Disposal Facility: ILAW Disposal in Multiple Trenches

The current design for each monolithic ILAW canister disposal trench is for a bottom dimension of 20 m (66 ft) by 210 m (690 ft). The trenches would be 10 m (33 ft) in depth with a top dimension of 80 (300 ft) by 280 m (920 ft) with 3:1 side slopes. The bottom of the trench would contain a double leachate collection system similar to a RCRA Subtitle C landfill (Burbank 2002).

The monolithic ILAW canisters would be removed from the transport vehicles using a large crane with a 90-m (300-ft) boom and a 22-metric ton (25-ton) capacity at 85 m (280 ft). The crane would be equipped with instrumentation and controls to allow the logging of each canister's position, serial number, and date using a global positioning system (GPS). This information would be relayed to the support facility for real-time readout and tracking of all canisters placed.

After several canisters are emplaced, the crane operator, using a material handling bucket, would place fill between and over the canisters, thereby minimizing the overall radiation exposure to the crane operator. Final cover of each layer to provide 1 m (3 ft) compacted cover would be completed by standard heavy earthmoving equipment.

Three layers of canisters would be placed into each trench with the first layer containing approximately 1,900 canisters; the second layer containing approximately 4,500 canisters; and the third layer containing approximately 7,300 canisters. The total capacity of each trench would be approximately 13,700 canisters (Burbank 2002).

An interim barrier would be placed atop each trench as it is filled. The first layer is backfill, which would vary in thickness with a minimum depth of 1.3 m (4.3 ft) and would provide a slope of not greater than 2 percent from the center of the trench to the outer edges. To minimize leachate collection, a temporary weather barrier, 'rain cover' or surface liner would be placed on top of this slope as part of operations activities. As the final closure activities would not occur for several years following filling of a trench, an interim cover consisting of two layers of sand and gravel would be placed as part of the operations activities. This interim cover would be a minimum of 2 m (7 ft) in thickness to provide additional protection from water intrusion. The trenches would be capped in accordance with applicable regulations.

Proposed New/Modified Disposal Facility: ILAW Disposal Vaults

Under the No Action Alternative 66 new vaults would be constructed onsite for the disposal of the ILAW cullet. Each vault would be an estimated 37 m (120 ft) long by 10 m (33 ft) wide by 15 m (50 ft) deep with a capacity to hold 5,300 m^3 (7,000 yd^3) of ILAW (DOE 2001c). These vaults would contain a leachate collection system and an array of monitoring wells. The canisters would be emplaced by a gantry crane. The crane would be equipped with instrumentation and controls to allow the logging of each canisters position, serial number, and date using a GPS. An interim barrier would be placed atop each vault as they are filled. The interim barrier would consist of backfill of variable thickness but a minimum depth of 1.3 m (4.3 ft). The interim barrier would also contain a temporary surface liner and an interim cover of sand and gravel atop the backfill. The total thickness of the interim barrier would be at least 3.3 m (11 ft).

2.2.3.4 Environmental Restoration Disposal Facility

ERDF, which began operation in 1996, is located in the center of the Hanford Site between the 200 East and 200 West Areas. ERDF is a large-scale, evolving landfill, complete with ancillary facilities as shown in Figure 2.16. It is designed to receive and isolate low-level radioactive, hazardous and mixed wastes. ERDF is a RCRA- and TSCA-compliant landfill authorized under CERCLA. The facility complies with all substantive elements of applicable or relevant and appropriate requirements identified through the CERCLA process, including Washington State and EPA codes, standards, and regulations, as well as with DOE orders. Administrative requirements such as RCRA permitting are not required for disposal of CERCLA waste from Hanford cleanup actions.

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Figure 2.16. Environmental Restoration Disposal Facility (ERDF)

Four disposal cells currently make up ERDF. The first two cells are each 21 m (70 ft) deep, 152 m (500 ft) long, and 152 m (500 ft) wide at the bottom and were completed in 1996. Construction of two additional cells of the same size was completed in 2000. Two additional cells are currently under construction. An interim cover was placed over the filled portions of the first two cells. Design and construction of the final cover will not begin until cells #3 and #4 are filled. ERDF can be expanded further if necessary. It is authorized to be expanded up to eight cells. Capacity of the current four-cell configuration is 4.7 billion kg (5.2 million tons).

The cells are lined with a RCRA Subtitle C-type liner, and have a leachate collection system. The facility is monitored regularly and when closed will continue to be monitored to ensure that human health and the environment are protected.

ERDF is designed to provide disposal capacity, as needed, to accommodate projected Hanford waste volumes over the next 20 to 30 years. It is being included in this EIS as an alternative disposal site to the LLBGs.

Proposed New/Modified Disposal Facility: Modular Lined Combined Use Disposal Facility

A Modular Lined Combined Use Disposal Facility is similar in configuration and size to ERDF. The facility could involve three different configurations. The first and most comprehensive would include LLW, MLLW, melters, and ILAW (Aromi and Freeberg 2002). The second would include only LLW and MLLW, and the third would include only melters and ILAW. Several locations have been considered for the facility including near PUREX, so as to be close to the WTP, near the existing LLBGs in 200 East, and at ERDF. As with other disposal facilities, it would be capped in accordance with applicable regulations.

2.2.3.5 Liners for Waste Disposal Facilities

DOE currently has three double-lined facilities on the Hanford Site: ERDF, two RCRA-permitted mixed waste trenches, and three RCRA-permitted, liquid waste surface impoundments called the Liquid Effluent Retention Facility (not part of the HSW EIS scope). The RCRA-compliant waste disposal cells liner system consists of series of layers as shown in Figure 2.17. Additional liner technologies are discussed in Appendix D.

The geotextile layers provide a filtration/separation medium when placed adjacent to the sub-grade and between the geomembrane and the leachate collection system's layers. The geomembrane is to prevent the downward movement of contaminants. During liner installation, great care is taken to avoid mechanical tearing of the liner material and generally, a very comprehensive onsite liner system installation Quality Assurance Program is followed to ensure the integrity and longevity of the liner system.

Polyethylene geomembranes provide a highly impermeable barrier to gasses and liquids in order to mitigate or eliminate ground water contamination. The high-density polyethylene (HDPE) geomembranes are resistant to corrosion and most chemicals, resistant to biological degradation, and resistant to ultra-violet light degradation. They are also flexible, thereby permitting ground movement and contraction and swelling due to temperature fluctuations without cracking and unaffected by wet/dry cycle (unlike bentonite clays).

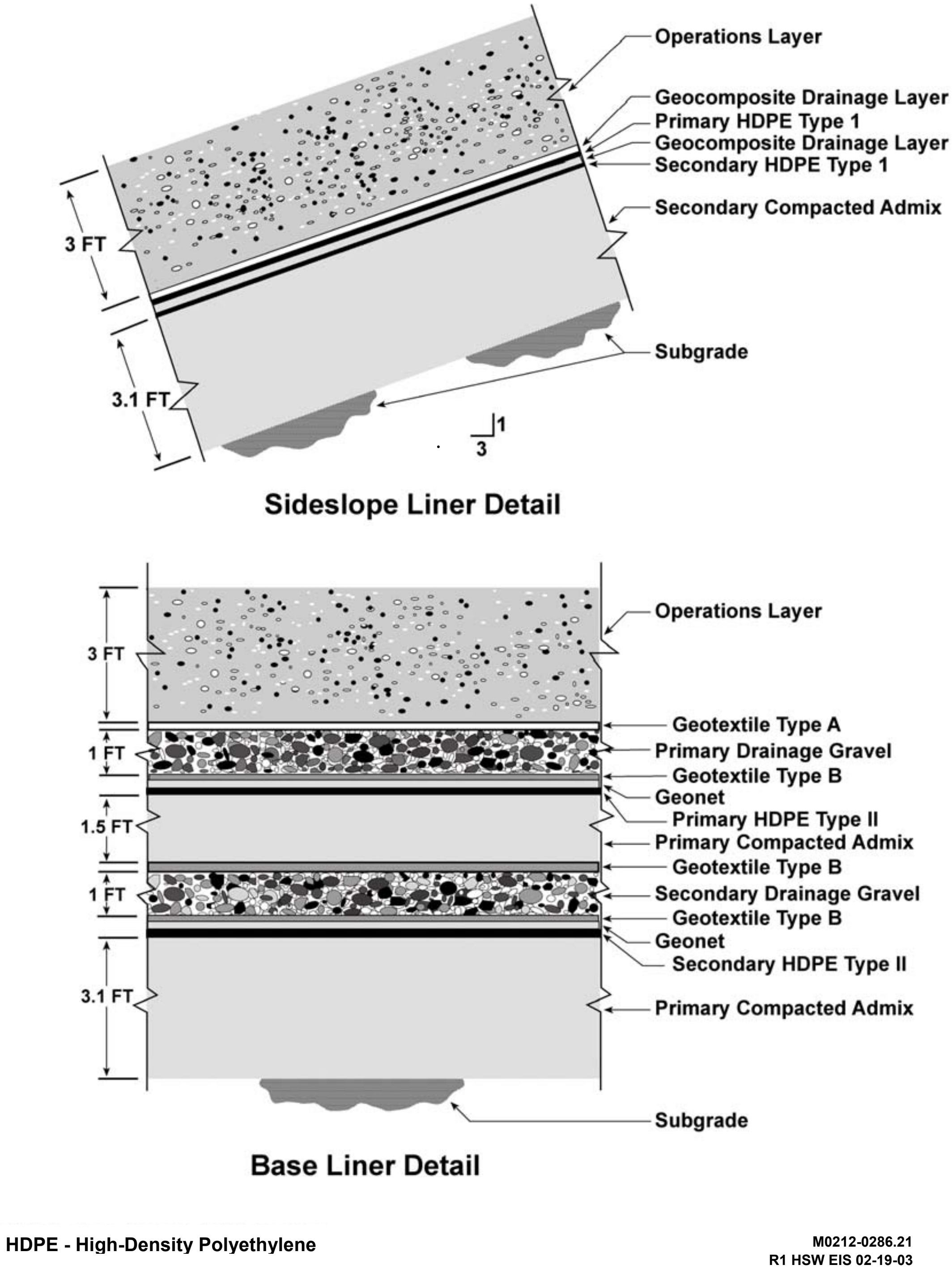

Figure 2.17. Typical Liner System

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HDPE is chemically resistant because it is essentially inert, and because of its high density and resultant low permeability, it resists penetration by chemicals. Chemicals that do react with HDPE are primarily oxidizing agents like nitric acid and hydrogen peroxide. Oxidation will only occur under two conditions: 1) the oxidizer must be in high concentrations, and 2) the material must receive a sufficient supply of energy to activate the reaction (Tisinger and Giroud 1993). If oxidation does occur, the HDPE material becomes soft and brittle and therefore becomes subject to stress cracking. Under anaerobic conditions or conditions devoid of energy, oxidation cannot occur. Because most waste facilities are typically anaerobic and the liner is buried and therefore not directly exposed to the sunlight, the process of oxidative degradation of HDPE liners is highly unlikely. Furthermore, most HDPE liners contain antioxidants that further mitigate the impacts of oxidation on liner degradation.

2.2.3.6 Closure Barriers

Closure barriers (also know as "caps") are planned for the disposal trenches in accordance with applicable regulations. Because the design and timing of the barriers is still being decided, the various design options are still being considered. For the EIS analysis the Modified RCRA Subtitle C barrier was selected. Other closure barrier designs are described in Appendix D.

The Modified RCRA Subtitle C barrier is designed to provide long-term containment and hydrologic protection for a performance period of 500 years with no maintenance being conducted after an assumed 100-year institutional control period. The performance period is based on radionuclide concentration and activity limits for Cat 3 LLW. The Modified RCRA Subtitle C Barrier, shown in Figure 2.18, is composed of eight layers of durable material with a combined minimum thickness of 1.7 m (5.5 ft) excluding the grading fill layer. This design incorporates *Resource Conservation and Recovery Act of* 1976 "minimum technology guidance" (MTG) (EPA 1989), with modifications for extended performance. One major change is the elimination of the clay layer, which may desiccate and crack over time in an arid environment. The geo-membrane component has also been eliminated because of its uncertain long-term durability. The design also incorporates provisions for bio-intrusion and human intrusion control.

A borrow pit to supply the local materials for the barriers would be developed at Areas B and C in accordance with the discussion in Appendix D.

Proposed New/Modified Disposal Facility: LLBG Closure Barrier or Cap

MLLW trenches are capped in accordance with applicable regulations. The LLBGs would be closed and capped beginning in 2046. While the final design for the closure cap or barrier has not yet been decided, the RCRA modified Subtitle C Barrier illustrated in Figure 2.18 has been used for the HSW EIS analysis. Alternative barrier designs are discussed in Appendix D. A discussion of the borrow pits in Areas B and C that are assumed to be used to derive some of the capping material is contained in Appendix D.

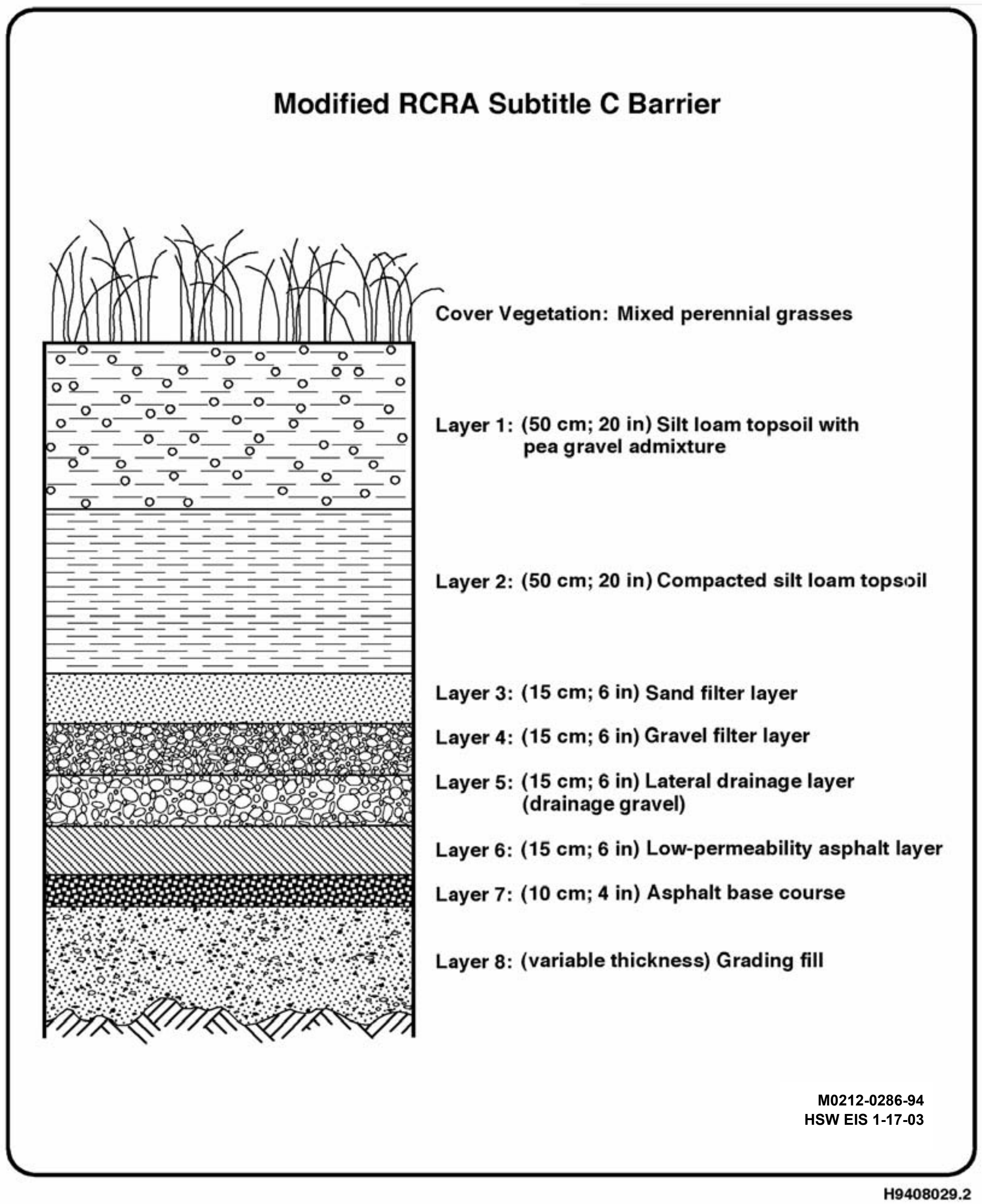

Figure 2.18. Modified RCRA Subtitle C Barrier for Mixed Low-Level Waste Trenches and the Low Level Burial Grounds