

Energy Systems Environmental Restoration Program
Y-12 Environmental Restoration Program

**Closure Certification Report for the Bear Creek
Burial Grounds B Area and Walk-In Pits
at the Oak Ridge Y-12 Plant,
Oak Ridge, Tennessee**

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ACRONYMS

ARAP	Aquatic Resource Application Permit
BCBG	Bear Creek Burial Ground
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
RCRA	Resource Conservation and Recovery Act
TDEC	Tennessee Department of Environment and Conservation
WIP	Walk-In Pits

1. INTRODUCTION

On July 5, 1993, the revised *RCRA Closure Plan for the Bear Creek Burial Grounds B Area and Walk-In Pits at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee*, DOE/OR/01-1100&D3 and Y/ER-53&D3, was approved by the Tennessee Department of Environment and Conservation (TDEC). The closure activities described in that closure plan have been performed. The purpose of this document is to summarize the closure activities for B Area and Walk-In Pits (WIPs), including placement of the Kerr Hollow Quarry debris at the WIPs.

2. FACILITY DESCRIPTION

The Bear Creek Burial Grounds (BCBGs) are located on the southwest flank of Pine Ridge ~1.5 miles west of the Oak Ridge Y-12 Plant in Bear Creek Valley. The BCBGs consist of several contiguous disposal sites identified as Burial Grounds A, B, C, and D. Each burial site consists of a series of trenches used for disposal of solid wastes and, in some cases, liquid wastes. Trench bottoms are reported to be a maximum of 20 ft below the original grade.

The B Area and the WIPs are located adjacent to each other in the BCBG. The B Area consists of a series of trenches located on the crest of a hill in the center of the BCBG. The WIPs are located on the side of a hill on the north and south sides of Area B and are designated as north and south WIPs.

The B Area was first used in 1962 for the disposal of depleted uranium chips, metals, and oxides. Because the chips were pyrophoric, chip fires were common. For a period of time in 1968, chips were deliberately burned upon delivery to prevent unpredicted and unattended fires later. This practice was stopped soon after it was initiated and unoxidized chips may currently remain in the covered trenches.

The WIPs were first used in 1966 for the disposal of uranium and thorium saw fines and other pyrophoric and shock sensitive materials. From 1968 until 1980, the area also was used for the above-grade burial of acids, bases, and organics. Packaging of these wastes included drums, cardboard boxes, and buckets. The explosion hazard of the waste buried in the WIPs limited the types of closure activities that could be safely undertaken and was the main cause for changes in closure activities from those at the other parts of the BCBG.

The Kerr Hollow Quarry debris was dispositioned adjacent to the BCBG south WIP, and the Area B WIP cap was extended to cover the debris. This debris is considered a nonhazardous residue from treatment operations at the quarry and is contaminated with low levels of uranium.

3. CLOSURE PLAN APPROVAL

Revised RCRA Closure Plan for the Bear Creek Burial Grounds, Y/TS-395, was initially intended to apply to A Area, C-West, B Area, and the WIPs of BCBG. However, because of safety concerns and the typography of the WIPs, a separate approach had to be developed. Consequently, the closure plan for B Area and WIPs was prepared separately from that of the other burial grounds and was presented in DOE/OR/01-1100&D1.

In January 1993, the closure plan (DOE/OR/01-1100&D2) was revised to include inspection and maintenance criteria and to reflect that future monitoring and remediation would be conducted as part of the ongoing Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) activities at the Oak Ridge Y-12 Plant.

This closure plan revision (DOE/OR/01-1100&D3) was approved by TDEC on July 5, 1993. It is intended to reflect the placement of the Kerr Hollow Quarry debris adjacent to the WIPs, revise the closure dates, and acknowledge that the disposition of a monitoring well cannot be verified because of its location inside the boundaries of the north WIP.

4. CLOSURE PERFORMANCE STANDARD

The BCBG B Area, the WIPs, and the Kerr Hollow Quarry debris were covered with an engineered cap that minimizes migration of liquids, promotes drainage around the capped areas, and minimizes erosion, subsidence, and maintenance. These areas were closed in place such that postclosure maintenance will be reduced.

Before construction, 10 of 11 groundwater sampling wells within the perimeter of the cap were plugged and abandoned. One well, GW-033, was not investigated to verify its disposition, as it is located on the boundary of the north WIP. However, based on known depth and construction of the well, and the geology of the subsurface strata, the potential is very low that the well will act as a conduit for contaminants into groundwater or present a health and safety concern.

4.1 WASTE INVENTORY

The waste inventory in the B Area and WIPs (which includes solid wastes, shock-sensitive materials, depleted uranium chips, acids, bases, and organics) was left in place because attempts to remove these materials would pose harm to health and environment.

The Kerr Hollow Quarry debris (nonhazardous solid waste) was placed in dumpsters and B-25 boxes and overpacked in concrete vaults. The vaults were placed on a prepared (engineered) pad, located south of the south WIP, and back-filled with coarse sand. A minimum thickness of 2 ft of compacted clay was placed on the sand.

4.2 EQUIPMENT DECONTAMINATION

Except for three instances, equipment decontamination was not necessary because of the manner by which the B Area and WIPs were closed. During construction, recontouring fill was pushed in front of the equipment such that the equipment only had contact with clean soil.

On three separate occasions, after coming into contact with contaminated soil adjacent to the WIPs, equipment had to be decontaminated using the following procedure. The remaining soil was scraped off the equipment and placed beneath the cap. The equipment was triple steam cleaned and radiation monitoring was performed before the equipment exited the controlled/exclusion area. The wash and rinse water used to clean the contaminated equipment was processed according to Y-12 Plant procedures.

4.3 DESIGN ELEMENTS OF CLOSURE

The site was cleared and backfilled with clean clay to form a continuous, relatively smooth contour. Because of site topography, the thickness of this clay layer varies. However, the minimum thickness of the layer is 2 ft. The north and south WIPs, which contain pyrophoric and shock sensitive materials, had clay fill placed and compacted following safety restrictions.

A gas collection vent system was installed by placing vent pipes across the hilltop and side slopes. A geotextile fabric and geonet overlay the site to act as a gas collection system and to connect to the gas vents. A geomembrane liner, placed on top of the fabric and geonet, prevents rainwater from infiltrating the waste. A mortar-filled fabric envelope blankets the entire surface to secure the cap. The gas vents were constructed through this layer.

5. INSTALLATION PROCEDURES

This chapter describes the construction of an engineered multilayered cap.

5.1 COVER PLACEMENT

5.1.1 Recontouring Fill

The existing site had areas of very steep slopes, benches, depressions, and other topographic features that precluded the placement of a flexible geomembrane liner. The site contouring produced a smooth topography without depressions or humps and provided for positive surface drainage. The fill was hand-raked prior to placement of the geosynthetic layers.

A minimum of 2 ft of clay was placed over the WIPs as blast shielding for construction personnel. The explosion potential of the waste materials is very small, and the 2-ft layer was

placed as a precautionary measure. Extensive safety analysis and documentation have been conducted on this project. B Area also was covered with a minimum of 2 ft of clay.

5.1.2 Geotextile Fabric and Geonet

Geonet, sandwiched between two layers of flexible geotextile fabric, was placed over the recontouring fill. The geonet allows gases to migrate to a header that is connected to a series of vents. The geotextile fabric serves as a cushion to protect the geomembrane above it from puncture and as a separator to prevent the intrusion of soil from below. The geotextile and geonet also serve as a pathway for condensate to migrate to the bottom of the hill.

5.1.3 Geomembrane

A flexible reinforced polypropylene geomembrane liner was placed over the geonet to prevent rainwater from infiltrating into the waste. A layer of fabric was placed over the geomembrane to protect it from the cover system above.

5.1.4 Cover System

A "fabriform" revetment mat was placed over the geomembrane to provide protection for the geomembrane from wind damage, ultraviolet light (which degrades plastic), and animals (which may perforate the geomembrane with their hooves or burrows). The revetment mat consists of a double-layer fabric into which grout was pumped. The grout hardened into a concrete layer ~4 in. thick. Reinforcing tendons run in each direction within the mat.

Storm-water runoff was directed to ditches along the perimeter of the site and at the foot of the hill. The fabriform cover was placed in the ditches to serve as a paved channel for runoff to contain storm water, dissipate energy, and prevent erosion.

5.2 DRAINAGE AND EROSION

The cover system and the geomembrane are intended to prevent infiltration of rainfall and to control the flow of storm water across the site. Storm runoff will sheet flow over the cover to ditches outside the waste perimeter. The ditches were lined with fabriform and are continuous with the cap cover. Where the drainage ditches exit the site, energy dissipators have been provided to control erosion. The edge of the fabriform also was doubled back on to itself in those locations where runoff could cause erosion problems.

6. ADDITIONAL CLOSURE ACTIVITIES

6.1 CONSTRUCTION QUALITY ASSURANCE

The closure was designed and constructed to protect human health and the environment. To ensure that the completed closure meets or exceeds all project plans and specifications,

construction quality assurance plans were prepared. The construction quality control procedures for cap construction are documented in the *Cap Construction Quality Control Procedures for Geosynthetics, Burial Ground B and Walk-In Pits Site Closure, Y-12 Plant Rev. 1*, dated December 22, 1992, and *Construction Quality Control Procedures for Geosynthetics, Burial Ground B and Walk-In Pits Site Closure, Y-12 Plant Rev. 1*, dated December 22, 1992, both prepared by Lockwood Greene Engineers, Inc.

These plans were used in monitoring and documenting the quality of the materials used and the conditions and manner of their placement. The plans were monitored by Lockwood Greene Technologies (formerly Lockwood Greene Engineers, Inc.).

After completion of construction, a final documentation report, *Summary Report, Bear Creek Burial Ground and the Walk-In-Pits*, Job No. 63301.01, was prepared by Lockwood Greene Technologies. This report includes summaries of all construction activities, observations, test data sheets, deviations from design and material specifications, and as-built drawings.

6.2 CONSTRUCTION DRAWINGS

Construction drawings were prepared and submitted to the TDEC Commissioner. These drawings depicted the proposed final contours after cap placement, cross sections showing each layer of the cap, including slopes, and run-on and runoff control structures. As-built drawings and the summary report, *Bear Creek Burial Ground and the Walk-In-Pits*, Job No. 63301.01, will be issued with the certification package.

6.3 TRAFFIC CONTROL

The access roads in the vicinity of this site have been routed so that no road crosses any portion of the Walk-In Pits and B Area. Traffic is restricted from leaving the roadways by an existing 6-ft high chain link fence.

6.4 CLOSURE SCHEDULE

The actual dates for closure activities of WIPs and BCBG Area B are listed below in Table 1.

Table 1. Closure activities of Walk-In Pits and Bear Creek Burial Grounds Area B

Date	Closure activities
June 15, 1993	Began transporting West Borrow Area clay to WIPs site for work outside the regulated unit, and closed Bear Creek Road for specific time periods to haul materials.
July 5, 1993	Received notice that closure plan was approved.
July 12, 1993	Packaged Kerr Hollow Quarry debris in concrete vaults and began moving to the WIPs site.

Table 1 (continued)

Date	Closure activities
July 16, 1993	Began tree removal southeast of the south WIP.
July 27, 1993	Installed the four remotely operated cameras and prepared to tape work on the WIPs during regulated times.
July 27, 1993	Suspended construction activity on Tributary 7 of Bear Creek.
August 19, 1983	Submitted [U.S. Department of Energy (DOE)] the Aquatic Resource Application Permit (ARAP) application to TDEC.
September 13, 1993	Began regulated work on the WIPs.
November 5, 1993	Received approval from the Justification for Continuing Operations Committee to allow foot traffic on the WIPs.
December 13, 1993	Began installation of the liner.
January 20, 1994	Received notice that the ARAP for the construction of a concrete energy dissipator adjacent to Tributary 7 (#93-586) was approved.
May 24, 1994	Completed construction at the WIPs.

6.5 NOTICE TO LOCAL LAND AUTHORITY

Within 90 days after final closure is completed, a survey plat indicating the location and dimensions of landfill pits, trenches, and disposal areas with respect to permanently surveyed benchmarks will be submitted to the local land authority and to TDEC's Commissioner. The plat will be prepared and certified by a professional land surveyor. The survey plat will contain the following prominently displayed note or a similarly worded note to comply with Tennessee Rule 1200-1-11-.05(7)(i):

The owner or operator of the property containing the Bear Creek Burial Grounds as shown on this plat is obligated to restrict disturbance of the site in accordance with *Rules Governing Hazardous Waste Management in Tennessee*. Postclosure use of the property on or in which hazardous wastes remain must never be allowed to disturb the integrity of the final cover, liner(s), or any other components of any containment system or the function of the facility's monitoring systems unless the owner or operator receives approval from the Commissioner of the Tennessee Department of Environment and Conservation under the previously referenced rules.

To comply with Tennessee Rule 1200-1-11-.05(7)(i), a record and identification of the type, location, and quantity of hazardous wastes disposed of within the pits, trenches, and disposal areas of the facility shall be submitted to the Commissioner and local land authority. The record and identification of the type, location, and quantity of waste shall be based upon best available knowledge and records.

6.6 NOTICE IN DEED TO PROPERTY

The notice presented in the previous section (Sect. 6.5), Notice to Local Land Authority, or a similarly worded note complying with Tennessee Rule 1200-1-11-.05(7)(j) will be recorded on the facility property deed or on some instrument normally examined during title search.

6.7 CLOSURE CERTIFICATION

This report certifies that closure was completed according to the latest approved closure plan. Within 60 days after closure is completed, this report will be submitted to DOE who, in turn, will submit it to TDEC's Commissioner.

7. POSTCLOSURE INSPECTION

Although the design has incorporated features that address most of the potential postconstruction problems, a postclosure inspection program will be implemented. The postclosure inspection program will focus on two areas of concern: settlement/subsidence monitoring and growth of undesirable vegetation. Inspection will be performed by a combination of visual, analytical, and measurement techniques.

7.1 VISUAL INSPECTION

Monthly visual inspections will be performed on the BCBG B and WIPs cap for the first 6 months following construction completion and quarterly thereafter. The following cap components will be included in the visual inspections:

- The perimeter of the cap and the perimeter drainage ditches will be inspected for any damage, especially due to animals burrowing under the edge of the cap.
- The inspector will walk the cap and visually inspect for damage or degradation. The inspector will evaluate the general condition of the protective cover mat. Special emphasis will be given to visually inspecting for signs of differential settlement and subsidence and the presence of unwanted vegetation.

Inspections will be documented by completion of a Postclosure Inspection Checklist (see Figure 1).

7.2 SUBSIDENCE MONITORING

Site topographic surveys will be employed to monitor the site for subsidence. A baseline survey of the site was performed at the completion of construction and the results are reflected in the as-built drawings. Monitoring surveys of cap elevations will be performed annually. Results of these surveys will be compared to the baseline survey to determine if

Inspector: Name _____

Inspection: Date _____

Title _____

Time _____

Date Next Topo Survey is Due: _____

Inspector's Signature _____

Supervisor's Signature _____

INSPECTION ITEM	TYPE OF PROBLEM	ACCEPT/ REJECT	OBSERVATIONS	CORRECTIVE ACTION	DATE ACTION REQUEST
Erosion of Cap Perimeter	Gullies, rills, bare soil around perimeter or in drainage ditches			Restore areas to design grade and reseed	
Protective Cover Mat	Damage or degradation, vegetation over six inches			Repair damaged or degraded mat sections, treat with herbicides	
Subsidence or Settlement	Any areas where visual observations detect subsidence or settlement of the cover			Report condition to management for investigation	
Run-on and Run-off Control System	Ponding, blockage, erosion			Regrade and seed/rip-rap low or eroded areas, remove blockage	
Rodent Damage	Burrowing and other damage from rodents			Repair damage and implement animal control measures	
Bench Marks	Damaged, dislocated, or missing survey benchmarks			Replace or repair monuments, resurvey	
Signage	Damaged, deteriorated, or missing signs			Repair or replace signs	
Unauthorized Materials	Unauthorized materials placed in area			Obtain management instructions for removal of materials	

(Photograph and/or sketch deteriorated areas)

Fig. 1. Example of a Postclosure Inspection Checklist.

subsidence has occurred and the extent of subsidence. If an area of subsidence is found and the cover is 6 in. lower than the baseline topographic elevation at that location, a formal investigation of the subsidence incident will be initiated.

7.3 UNWANTED VEGETATION

The presence of limited vegetation on the cap will have no adverse effect on cap performance or cap integrity. However, unlimited growth of vegetation over a long period of time could pose a problem for the cap.

To control growth of unwanted vegetation, the area will be treated with a suitable herbicide such as Round-up on an as-needed basis. Herbicide will be applied when the vegetation growth exceeds a height of 6 in. above the revetment mat.

7.4 WELL MONITORING

The groundwater shall be monitored under the terms of the Bear Creek Hydrogeologic Regime RCRA Post Closure Permit modification for Burial Ground B and the WIPs. Point of compliance and background wells specific to Area B and the WIPs will be cited by TDEC in the post closure permit modification. Additionally, western most exit pathway transect wells (GW-710, GW-711, GW-712, GW-713, GW-714, and GW-715) will be monitored.

Comprehensive valley-wide sampling of surface water and groundwater will be integrated with CERCLA activities and with the attributes of the geologic and hydrogeologic environment to evaluate the effectiveness of the closure activities and evaluate additional actions required to ensure the resources of the valley are acceptable for the intended uses.

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