Tennessee Valley Authority
Kingston Fossil Plant

CLOSURE AND POST-CLOSURE PLAN

COAL COMBUSTION BYPRODUCT DISPOSAL FACILITY - PENINSULA SITE

KIF450

Prepared By:

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1101 Market Street
Chattanooga, TN 37401-2801

May 2006

Title: CLOSURE AND POST-CLOSURE PLAN COAL-COMBUSTION BYPRODUCT DISPOSAL FACILITY – PENINSULA SITE.			DCN#
			Plant/Unit: Kingston Fossil Plant
Vendor	Contract No.	Key Nouns:	

Applicable Design Documents	REV	EDMS NUMBER	DESCRIPTION
	R0		
References	R1		
	R2		

TENNESSEE VALLEY AUTHORITY
FOSSIL POWER GROUP
FOSSIL ENGINEERING SERVICES
SITE AND ENVIRONMENTAL ENGINEERING

	Revision 0	R1	R2
Date	May 2006		
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1 INTRODUCTION

1.1 Purpose

The following Closure and Post-Closure Plan (C/PC Plan) has been developed for the proposed Coal Combustion Byproduct (CCB) Disposal Facility located at Tennessee Valley Authority's (TVA's) Kingston Fossil Plant (KIF). This plan is submitted in accordance with the Tennessee Department of Environment and Conservation's Division of Solid Waste Management (TDSWM), Rule 1200-1-7-.03 (2). Closure and post closure activities will be conducted in accordance with the current Subtitle D regulations adopted by the Tennessee Department of Environment and Conservation (TDEC). The purpose of this document is to: (i) describe necessary activities associated with the closure of the disposal facility; and (ii) describe the monitoring and maintenance activities for the facility during the post-closure period. A copy of this C/PC Plan will be kept at the facility, or another approved location.

1.2 Site Location and Description

The CCB disposal facility is located on land currently owned by TVA at the Kingston Fossil Plant (KIF). KIF is located near the city of Harriman in Roane County, TN. Access to the Site is via the plant main entrance which is located on Swan Pond Road. Swan Pond Road is located off Highway 70 between the cities of Kingston and Harriman.

The proposed CCB disposal facility will be located on a peninsula landform at the confluence of the Clinch and Emory Rivers. The CCB disposal facility will extend from the central portion of the peninsula to its southern margin adjacent to the Clinch River. Existing ground surface elevation across the proposed disposal site ranges from approximately 735 ft. to 860 ft. Mean Sea Level (msl).

1.3 Expected Year of Closure

TVA estimates that approximately 547,500 cy of settled gypsum will be produced each year. Under worst case conditions (i.e., no marketing of gypsum), TVA estimates the facility life expectancy indicated in the following sections of the plan. Facility life expectance should be considerably greater than these worst case projections, but is subject to external factors (e.g., demand for gypsum) that are beyond TVA's control.

1.3.1 Phase I

Drawing No. 10W427-8 (Phase II Initial Grading Plan and Soil Dikes) depicts the final grades for Phase I at the end of wet cast operation. Based on this design, there are 6,513,000 cy of disposal capacity available. Assuming a disposal rate of 547,500 cy annually gypsum, Phase I will provide 12 years of disposal capacity under worst case conditions. Completion of disposal operations in Phase I is expected by 2021.

1.3.2 Phase II

Depending on the success of gypsum marketing, TVA may construct Phase II. The final grading plan for Phase I and II at the end of wet cast operation is shown in Drawing No. 10W427-11 (Phase I and Phase II Final Cover Grading Plan (Wet Stack)). Phase I and Phase II combined have an estimated disposal capacity of 13,371,000 cy. Therefore, under worst case conditions, and assuming a disposal rate of 547,500 cy annually, the combined life of Phase I and Phase II wet stack is approximately 24.5 years.

1.3.3 Dry Stack

The CCB disposal facility has been designed to allow dry stacking of gypsum above elevation 900 ft. msl. The additional dry stacking capacity of Phase I and Phase II combined is approximately 2,634,000 cy. With this additional capacity, the estimated life of the facility under worst case conditions is 29 years.

1.4 Facility Contact Information

The following is a list of responsible parties involved in the permitting, design, operation, maintenance, quality control and quality assurance of the CCB disposal facility at TVA's Kingston Fossil Plant.

1. Owner: Tennessee Valley Authority (TVA)
   Contact: Plant Manager
   Tennessee Valley Authority
   Kingston Fossil Plant
   714 Swan Pond Road
   Harriman, Tennessee 37748
   Phone (865) 717-2501

As of the date of this revision, the plant manager is Mr. Michael T. Beckham.

Please direct any correspondence in regards to this document to the designated Solid Waste Specialist. The Solid Waste Specialist for Kingston Fossil Plant is:

Larry C. Bowers
1101 Market Street, LP 5D-C
Chattanooga, Tennessee 37402-2801
Phone: (423)751-4947
Fax: (423)751-7011

2. State: Tennessee Department of Environment and Conservation
   Division of Solid Waste Management
   Tennessee Department of Environment and Conservation
   2700 Middlebrook Pike, Suite 220
   Knoxville, Tennessee 37921-5602
   Phone: (865) 594-6035
   Fax: (865) 594-6115
   Contact as of the date of this manual is Mr. Larry Cook, Environmental Field Office Manager.

Tennessee Department of Conservation
Division of Solid Waste Management
Central Office
401 Church Street
5th Floor, L&C Tower
Nashville, TN 37243-1533
Phone: (615) 532-0780
Fax: (615) 532-0886

Contact as of the date of this manual is Mr. Mike Apple, Division Director.

2 CLOSURE PLAN

Information presented in this document has been organized and presented consistent with the permit application requirements presented in Rule 1200-1-7-.04 (9) (d) and Rule 1200-1.-:03 (2). Sections within this document have been titled and enumerated consistent with the regulations to facilitate the review process. The regulatory requirements are cited in italics at the start of each section followed by a text description indicating how the specific requirement has been or will be addressed.

2.1 Closure Requirements (ref. 1200-1-7-.04 (8))

Regulatory requirement:

(a) General Performance Standard

1. *The operator must close the disposal facility or disposal facility parcel in a manner that:*

   (i) Minimizes the need for further maintenance; and
   (ii) Controls, minimizes, or eliminates, to the extent necessary to prevent threats to public health and the environment, post-closure escape of solid waste, solid waste constituents, leachate, contaminated rainfall, or waste decomposition products to the ground or surface waters or to the atmosphere.

2. *The operator must care for a disposal facility or disposal facility parcel for the period of time after closure, specified in subparagraph (d) of this Rule, in a manner that assures that the performance objectives of part 1 of this subparagraph are continuously met.*

This Closure Plan provides direction to close the disposal facility in a manner that will minimize the need for further maintenance of the facility. It further specifies

measures to control, minimize, or eliminate threats to public health and the environment.

(a) Adherence to plan - The operator must initiate and complete closure activities and conduct post-closure care activities in accordance with the approved closure/post-closure care plan, if such plan has been prepared and approved for the disposal facility or disposal facility parcel being closed.

The operator will initiate and complete closure activities and conduct post-closure activities in accordance with the approved closure and post-closure plan at the time of closure of the facility.

(b) Closure Requirements - The following requirements apply to active portions of the facility:

1. The operator must notify the Division Director of his intent to close at least 60 days prior to the date he expects to begin final closure of the disposal facility or disposal facility parcel.

2. The operator must complete closure activities including grading and establishing vegetative cover in the shortest practicable time, not to exceed 180 days, after any fill areas or any portion of the fill areas have achieved final grade, unless the Commissioner allows otherwise in the permit. Permits may provide, or be modified to provide, minimum areas for closure which will be shown in closure plans. Such modifications of closure plans, for the sole purpose of identifying minimum closure areas, shall be deemed minor modifications. When these complete closure areas reach final grade, these areas shall be closed as otherwise provided in this part and within the 180 day time frame provided herein.

TVA will notify the Director of the Tennessee Division of Solid Waste Management of its intent to close the facility at least 60 days prior to closure. Closure activities will begin within 30 days, after the date on which the disposal unit receives the known final receipt of waste, and the closure activities (including final cover placement, grading, drainage, and establishment of vegetative cover) of each unit will

be completed within 180 days following the beginning of closure as previously mentioned, except where an extension is requested and approved by the Tennessee Division of Solid Waste Management.

2.2 Final Cover and Alternative Final Cover Systems (ref. 1200-1-7-.04 (8) (c))

Regulatory requirement:

3. *Unless otherwise noted in the permit a depth of compacted final cover material (e.g., soil) shall be placed on the disposal facility or disposal facility parcel in the shortest practicable time, not to exceed 90 days, after achieving final grade of any fill area or any portion of a fill area. At least the top twelve inches of this cover material shall be soil which will support the growth of suitable vegetation (e.g., topsoil).*

   (i) At Class I and Class II facilities the depth of final cover system shall be at least 36 inches of soil of which a minimum of 12 inches shall be for the support of vegetative cover.

   The design of the final cover system shall be such that the infiltration volume of water will be equal to or less than the percolation volume through the bottom liner system or a design which includes a compacted soil layer of at least 24 inches which has a permeability no greater than 1×10^{-7} cm/sec, whichever is less. This design shall be supported by the use of the HELP model or other equivalent method approved by the Commissioner.

   An alternate final cover system may be used provided that it is demonstrated to the satisfaction of the Commissioner that the final cover system provides equivalent or superior performance to the minimum performance standard in this subpart.

   (ii) At Class III and Class IV facilities, unless the Commissioner determines that a greater depth is needed to achieve the general

performance standard of subparagraph (a) of this paragraph, the depth of final cover shall be at least 30 inches of compacted soil. The final cover consists of an 18 inch low permeability layer overlain by a 12 inch protective layer.

(iii) At Class I, II, III, and IV facilities, with approval of the Commissioner any other low permeability layer construction techniques or materials may be used to provide the final cover, provided that it provides equivalent or superior performance to the requirements of this part.

Final cover will be placed over the disposal facility or disposal facility parcel in the shortest time practical, not to exceed 90 days, after achieving final grade.

Details of the final cover system are illustrated on Drawing No. 10W427-20 (Final Cover System Details). As shown in the drawing, the final cover system will consist of the following profile, from top to bottom:

- a 12-inch thick protective cover soil (vegetative cover) that is capable of sustaining native plant growth;
- a 24-inch thick compacted clay layer exhibiting hydraulic conductivity of less than or equal to 1×10^{-7} cm/sec; and
- a 6-inch thick intermediate cover soil.

The final cover grading plan is presented in Drawing No. 10W427-12 (Phase I and II Final Cover Grading Plan (Wet and Dry Stack)). As shown in this drawing, the final cover will be graded to a minimum slope of 4 percent and a maximum slope of 33.3 percent.

Consistent with the regulations, the use of alternative final cover systems are acceptable if it can be demonstrated that the alternative system provides equivalent or superior performance to the minimum performance standard. An alternative final cover has been developed for this facility and may be substituted as an alternative. The proposed alternative final cover consists of (from top to bottom):

- a 12-inch thick vegetative layer that is capable of sustaining native plant growth;
- a geocomposite drainage layer, consisting of a High-Density PolyEthylene (HDPE) geonet with geotextile filters heat bonded to both sides of the geonet;
- a 40-mil thick HDPE geomembrane; and
- a 12-inch thick compacted soil layer.

The calculation package titled "*Final Cover System Demonstration*", included in this permit application demonstrates, using the Hydraulic Evaluation of Landfill Performance (HELP) model, that the alternative final cover system provides equivalent or superior performance, (in terms of equivalent reduction in infiltration) to the minimum requirements of the prescribed final cover system. The alternative final cover system will be implemented only after approval of the Commissioner of the Tennessee Division of Solid Waste Management.

2.3 Drainage System (ref. 1200-1-7-.04 (8) (c))

Regulatory requirement:

4. *The final surface of the disposal facility or disposal facility parcel shall be graded and/or provided with drainage facilities in a manner that:*

   (i) Minimizes precipitation run-on from adjacent areas onto the disposal facility or disposal facility parcel;
   (ii) Minimizes erosion of cover material (e.g., no steep slopes);
   (iii) Optimizes drainage of precipitation falling on the disposal facility or disposal facility parcel (e.g., prevent pooling); and
   (iv) Provides a surface drainage system which is consistent with the surrounding area and in no way significantly adversely affects proper drainage from these adjacent lands.

The proposed grading plan of the drainage system (surface water management system) for the TVA Kingston Fossil Plant disposal facility is provided in Drawing No. 10W427-13 (Surface Water Management Plan). Runoff from primarily undisturbed areas to the north of the disposal area (referred to as "run-on") will be intercepted by a system of drainage channels to prevent from "running-on" to the active portion of the disposal area. This system of drainage channels will collect and convey run-on to Watts Bar Lake Clinch River to the south of the disposal area, through a drop inlet and culvert system which will be located underneath the bottom of the stormwater pond. The stormwater management system for this facility is designed such that run-on from undisturbed areas (i.e., outside the limits of the disposal area) will bypass the stormwater pond located to the south-west of the disposal area.

Erosion of soil material on the final cover system will be minimized through slope stabilization techniques. The final cover slope will not exceed a 33 percent (i.e., 3 horizontal: 1 vertical) slope. The maximum slope length of the steepest slope (between drainage benches) is 90 feet. The cover system optimizes drainage and precipitation run-off by maintaining minimum top slopes of 4 percent to prevent ponding of water on top of the cover. Benches will intercept surface water runoff from the cover slopes and convey the runoff to downdrain pipes, which will convey the runoff to the perimeter drainage channels located at the toe of the cover system. The perimeter drainage channels are sloped towards the south-west corner of the disposal area and will connect to a drop-inlet and twin 36-inch diameter culvert system under the perimeter access road conveying runoff to the stormwater pond. All drainage structures have been designed to accommodate at least a 25-year, 24-hour storm event. The surface water management system has been designed to be consistent with the surrounding area and does not significantly affect proper drainage from or to adjacent lands.

In addition, vegetation will be established on the final cover system surface as the fill progresses to prevent erosion of final cover material.

2.4 Vegetative Cover (ref. 1200-1-7-.04 (8) (c))

Regulatory requirement:

5. *In order to minimize soil erosion, as soon as practicable after final grading, the operator shall take steps as necessary to establish a protective vegetative cover of acceptable grasses over disturbed areas of the site. These steps shall include seeding, mulching, and any necessary fertilization at a minimum, and may include additional activities such as sodding of steeper slopes and drainage ways if such are necessary.*

As soon as practical after final grading, the operator will take necessary steps to establish a protective vegetative cover of acceptable grasses over disturbed areas of the site. These steps shall include seeding, mulching, and any necessary fertilization at a minimum, and may include additional activities such as sodding of steeper slopes and drainage ways if necessary. Application rates for seeding and fertilizing of indigenous grass/vegetation are provided in the *Material* Specifications and Construction Quality Assurance and Quality Control (QA/QC) Plan included as Appendix F in this permit application. Temporary erosion control blankets may be used if necessary to provide seedbed protection and prevent wash-out of seed and fertilizer during vegetation establishment. The closure will be scheduled to ensure at least one month remains in the growing season to establish a grass cover, or alternatively the entire cover will be re-seeded at the start of the next growing season, after confirming that the grades of the cover and the condition of the cover soil are in accordance with the QA/QC plan.

2.5 Other Erosion and Sediment Control Measures (ref. 1200-1-7-.04 (8) (c))

Regulatory requirement:

6. *In addition to the drainage and grading requirements and vegetative cover requirements, the operator shall take other measures as may be necessary to minimize and control erosion and sedimentation (e.g., soil stabilization, sediment ponds) at the site.*

In addition to the drainage, grading, and vegetative cover requirements, other measures such as soil stabilization through riprap protection, and sediment ponds will be implemented to minimize and control erosion and sedimentation at the site. The perimeter ditches, drainage benches, and culvert outlet areas will be lined with riprap. The stormwater pond located to the south-west of the disposal area was sized to accept

sediment of 67 cubic yards per acre of disturbed area. Additional erosion control problems will be addressed with appropriate structural and non-structural sediment and erosion control practices as prescribed within the plans or the most recent edition of the Tennessee Erosion and Sediment Control Handbook.

2.6 Leachate Collection System (ref. 1200-1-7-.04 (8) (c))

Regulatory requirement:

7. *As required in his permit, or as otherwise necessary to prevent threats to human health and the environment, the operator shall establish and/or complete a system for collecting, removing, and treating leachate generated by the disposal facility or disposal facility parcel.*

Leachate from this facility will consist of consolidation water resulting from the self-weight consolidation of the gypsum material. Consolidation water will be collected using the perimeter drains depicted on Drawing No. 10W427-16 (Operational and Typical Details I) and the central drainage corridor depicted on Drawing No. 10W427-18 (Drainage System Details I). Consolidation water will be managed together with stormwater run-off and will be routed through the stormwater pond prior to being pumped (with stormwater) to the plant's discharge channel for discharge under KIF's existing NPDES permit. In addition, decant water from the sluicing operations will also be routed to the stormwater pond.

2.7 Gas Collection System (ref. 1200-1-7-.04 (8) (c))

Regulatory requirement:

8. *As required in his permit, or as otherwise necessary to prevent threats to human health and the environment, the operator shall establish and/or complete a system for collecting and venting or otherwise controlling the vertical and horizontal escape of gases generated in the disposal facility or disposal facility parcel.*

Since this disposal facility accepts only gypsum waste, and no gas is expected to be generated from the waste, Rule 1200-1-7-.04 (8) (c) 8 is not applicable to this facility.

2.8 Borrow Area Reclamation

Borrow areas which are used for excavation and construction of final cover soil will be reclaimed by regrading, stabilizing, and establishing permanent vegetation, within 30 days of ceasing borrow activities. Borrow and stockpile areas will be graded to allow positive drainage off-site. Additional erosion controls will be addressed with appropriate structural and non-structural sediment and erosion control practices as prescribed within the plans or the most recent edition of the Tennessee Erosion and Sediment Control Handbook.

2.9 Closure Sequence

Upon achieving the appropriate final grades for the gypsum waste, the disposal facility will be closed in the following sequence (for clarity, this closure sequence refers only to the proposed final cover system, rather than the alternative final cover system):

1) Prior to construction of the final cover system, an on-site or off-site borrow source for soil material will be identified, and both field and laboratory tests will be performed to ensure that the properties of the soil from the proposed borrow area satisfy material acceptance criteria provided in the QA/QC plan.

2) Closure will then begin by installing the compacted soil layer in a controlled manner in lifts using materials from the designated borrow source. The QA/QC plan will be followed to monitor the consistency of the compacted soil layer as it is placed.

3) The vegetative soil cover will be installed on top of the compacted soil layer under the supervision of the TVA site construction manager and a professional engineer registered in the State of Tennessee. To aid in root development, this layer will be moderately compacted.

4) Finally, the surface of the cover will be seeded and/or vegetated, and fertilizer will be added to promote germination and growth. Application rates for seeding and fertilizing are provided in the QA/QC plan.

In case of contingent closure, the disposal facility shall be re-graded to prevent the ponding of water. The grade of the final cover surface of the facility may not be less than 4 percent and no greater than 33.3 percent.

2.10 Closure Certification and Notification (ref. 1200-1-7-.04 (8) (c))

Regulatory requirement:

9. *The operator must notify the Division Director in writing within 60 days of his completion of closure of the disposal facility or disposal facility parcel. Such notification must include a certification by the operator that the disposal facility or disposal facility parcel has been closed in accordance with the approved closure/post-closure care plan. Within 21 days of the receipt of such notice the Division Director shall inspect the facility to verify that closure has been completed and in accordance with the approved plan. Within 10 days of such verification, the Commissioner shall approve the closure in writing to the operator. Closure shall not be considered final and complete until such approval has been made.*

TVA will close the Kingston Fossil Plant Disposal Facility in accordance with the closure plan approved by TDEC Division of Solid Waste Management. Upon completing all the requirements outlined in the closure plan, TVA will provide the Division of Solid Waste Management with certification, signed by an independent professional engineer registered in the State of Tennessee, verifying compliance with closure requirements within 60 days after completing the closure requirements.

3 POST-CLOSURE PLAN

3.1 Post-Closure Care Period (ref. 1200-1-7-.04 (8) (a) and (d))

Regulatory requirement:

(a) General Performance Standard

(ii) The operator must care for a disposal facility or disposal facility parcel for the period of time after closure, specified in subparagraph (d) of this Rule, in a manner that assures that the performance objectives of part 1 of this subparagraph are continuously met.

(d) Post-Closure Care Period - For Class I and Class II disposal facilities, post-closure care must continue for 30 years after the date of final completion of closure of the disposal facility or disposal facility or parcel unless a shorter period is established in the approved closure/post-closure care plan. For Class III and IV disposal facilities, post-closure care must continue for 2 years after the date of final completion of closure of the facility or facility parcel. The postclosure care period may be reduced or extended based on cause by amendment of the approved closure/post-closure care plan as provided in rule 1200-1-7-.03(2)(e).

TVA will provide post-closure care for the disposal facility for a period of thirty (30) years after completion of disposal facility closure activities, in accordance with this Post-Closure Plan.

3.2 Post-Closure Care Activities

3.2.1 Final Contours and Drainage System (ref. 1200-7-.04 (8) (e))

Regulatory requirement:

(e) Post-Closure Care Activities - During the post-closure care period, the operator must, at a minimum, perform the following activities on closed portions of his facility:

1. Maintain the approved final contours and drainage system of the site such that the objectives of part (c) 4 of this paragraph are continuously met;

The approved final contours and drainage system will be maintained at the site. The effectiveness of the final cover will be maintained by making repairs to the cover as necessary to correct the effects of subsidence and erosion, as well as preventing run-on and run-off from eroding/damaging the final cover system. If settlement or other structural problems occur in the final cover system, the cover will be regraded. The problem area will be stripped of the vegetation layer and fill dirt will be applied to the area. The disturbed area will be covered with soil and reseeded as specified in the design. If excessive surface cracks appear on the soil cover, the cracks will be properly graded with suitable soil and appropriate vegetative cover will be re established to prevent the infiltration of surface water.

The disposal area final cover has been designed with a series of benches and downdrains to provide for positive, non-erosive drainage of run-off into the perimeter ditches located along the toe of the disposal area cover. The ditches convey water and sediment to a stormwater pond located on the south-west portion of the site as shown on Drawing No. 10W427-13 (Surface Water Management Plan). The pond is designed to control run-on and run-off from all storms up to the 100-year, 24-hour storm event. Based on the analyses included in Appendix B in this permit application, additional storage volume has been reserved in these ponds to provide sediment storage of at least 67 cubic yards per acre of site area.

The sediment will be removed when the sediment level reaches the specified sediment cleanout elevation of the silt gauge, or when the specified elevation is obscured by water for a long period of time. The sediment cleanout elevation has been specified for the stormwater pond in the *Surface Water Management* analyses package. The sediment ponds will be cleaned using a dragline, clamshell or dredge, or drained and excavated using a backhoe, front-end loader, dozer, or other equipment. The outlet

and inlet structures of the stormwater pond will be maintained by the operator throughout the life of the disposal facility and during the post-closure period.

3.2.2 Vegetative Cover (ref. 1200-7-.04 (8) (e))

Regulatory requirement:

> 2. *Ensure that a healthy vegetative cover is established and maintained over the site.*

The vegetative cover will be inspected on a monthly basis so as to maintain a healthy stand of vegetation. Areas containing distressed vegetation will be reseeded. The vegetative cover over the site will be maintained by mowing on a regular schedule. Initially the grass will be cut quarterly; however, once the grass is established, it will be cut twice a year. The mowing schedule is intended to limit the growth of weeds or rooting of brush species that could undermine the final cover. If an area has less than 25 percent coverage by grass, the area will be reworked and reseeded. Fertilizer may be applied to promote the re-establishment of a self-sustaining vegetative cover. Significant depressions or gullies that develop will be promptly repaired by filling with soil and seeding. The details of the vegetative cover are provided in the QA/QC plan.

Regulatory requirement:

> 3. *Maintain the drainage facilities, sediment ponds, and other erosion/sedimentation control measures (if such are present at the landfill), at least until the vegetative cover is established sufficiently enough to render such maintenance unnecessary.*

Until vegetation of the final cover is fully established, sediment transport will be retarded by temporary silt fences. Sediment transported from the cover before vegetation is fully established will be conveyed to the stormwater pond. Should excessive cleaning and maintenance of the stormwater pond be needed due to erosion of soil from the cover, temporary sediment control measures will be installed to reduce the sediment load until the vegetative cover is fully established. Stormwater channels will be lined to prevent erosion. The channels will be inspected monthly and after major

storm events for structural and erosion problems. If damage to the channel is discovered, it will be repaired as appropriate.

3.2.3 Leachate Collection System (ref. 1200-7-.04 (8) (e))

Regulatory requirement:

> 4. *Maintain and monitor the leachate collection, removal, and treatment system (if such is present at the facility);*

Leachate from this facility will consist of consolidation water resulting from the self-weight consolidation of the gypsum material. Maintenance of the collection system will include inspecting the underdrain lift station, removing sediment and debris (if needed), verifying operation of pumps, inspecting perimeter drains on outer sideslopes, ensuring that outlets are clear and unobstructed.

3.2.4 Gas Collection System (ref. 1200-7-.04 (8) (e))

Regulatory requirement:

> 5. *Maintain and monitor the gas collection and control system (if such is present at the facility);*

Since this disposal facility accepts only gypsum waste, and no gas is expected to be generated from the waste, Rule 1200-1-7-.04 (8) (e) 5 is not applicable to this facility.

3.2.5 Groundwater Monitoring Plan (ref. 1200-7-.04 (8) (e))

Regulatory requirement:

> 6. *Maintain and monitor the ground and/or surface water monitoring system (if such is present at the facility). The monitoring system and sampling and analysis program established in the permit shall be*

> *continued during the post-closure care period, unless the permit is modified to establish a different system or program. Monitoring data must be reported in writing to the Division Director within 30 days after the completion of the analyses.*

The groundwater monitoring during the post-closure care period will be performed in conformance with the Groundwater Monitoring Plan presented in Appendix D of this permit application. The locations of existing and proposed groundwater monitoring wells are shown on Drawing No. 10W427-3 (Site Development Plan). Monitoring data will be reported in writing to the Division Director within 30 days after the completion of the analyses.

3.2.6 Inspections

Personnel from TVA will make visual inspections of the site on a regular basis, at least quarterly, for the duration of the post-closure care period. Maintenance or other corrective measures needed to prevent the deterioration of the closure system will be identified during the inspections.

Features to be inspected include the disposal site, surface-water and ground-water monitoring points, security devices, and storm-water control features. Each inspection will be documented and will include, at a minimum, the following information: date and time of inspection, name of inspector, notation of observations made, nature of any remedial actions to be taken, and recommendation for corrective measures.

3.2.7 Post-Closure Certification (ref. 1200-7-.04 (8) (e))

Regulatory requirement:

> 7. *Following completion of the post-closure care period for each SWLF unit, the owner or operator must file with the Department a certification verifying that post-closure has been completed in accordance with the post-closure plan.*

The operator will notify the Division Director in writing of its completion of the post-closure care period of the disposal facility within 60 days of completion of the post-closure care period. An independent professional engineer in the State of Tennessee will certify that the post-closure activities were completed in accordance with the post-closure care plan.

4 NOTICE IN DEED TO PROPERTY (ref. 1200-7-.04 (8) (f))

Regulatory requirement:

(f) Notice in Deed to Property - the operator must ensure that, within 90 days of completion of final closure of the facility and prior to sale or lease of the property on which the facility is located, there is recorded, in accordance with State law, a notation on the deed of property or on some other instrument which is normally examined during a title search that will in perpetuity notify any person conducting a title search that the land has been used as a disposal facility and its use is restricted in accordance with the approved closure/post-closure plan.

Within 90 days of completion of final closure activities of the facility and prior to final sale or lease of the property on which the facility is located, TVA will ensure that there is recorded, in accordance with State law, a notation on the deed to the property or some other instrument, which is normally examined during a title search that will in perpetuity notify any person conducting a title search that the land has been used as a disposal facility, and the use of the property is restricted in accordance with the approved closure/post-closure plan.

CLOSURE AND POST-CLOSURE COST ESTIMATE

Cost Estimate
Work Sheet A
Closure Activities - Compacted Clay Final Cover Option

Notes:

1) This worksheet is to be submitted as part of the C/PC Plan.
2) Provide a cost for all activities that apply.
3) Additional cost information may be attached as needed.
4) All soils used for final cover construction are from on-site sources.

I. Establishing Final Cover		
A. Top Soil		
1.	Quantity Needed (cu.yd.)	179,147.05
2.	Excavation Unit Cost ($/cu.yd.)	$3.95
3.	Excavation Cost (1. * 2.)	$707,630.85
4.	Placement/Spreading Unit Cost ($/cu.yd.)	$9.21
5.	Placement Cost (1. * 4.)	$1,649,944.33
	TOTAL Top Soil (3. + 5.)	$2,357,575.18
B. Landfill Cap		
1. On-Site Clay		
a.	Quantity Needed (cu.yd.)	394,123.51
b.	Excavation Unit Cost ($/cu.yd.)	$3.95
c.	Excavation Cost (a. * b.)	$1,556,787.86
d.	Placement/Spreading Unit Cost ($/cu.yd.)	$9.21
e.	Placement Cost (a. * d.)	$3,629,877.53
f.	Compaction Unit Cost ($/cu.yd.)	$1.32
g.	Compaction Cost (a. * f.)	$520,243.03
	TOTAL On-site Clay (c. + e. + g.)	$5,706,908.42
2. Off-Site Clay		
a.	Quantity Needed (cu.yd.)	
b.	Purchase Unit Cost ($/cu.yd.)	
c.	Purchase Cost (a. * b.)	$0.00
d.	Delivery Unit Cost ($/cu.yd.)	
e.	Delivery Cost (a. * d.)	$0.00
f.	Placement/Spreading Unit Cost ($/cu.yd.)	
g.	Placement Cost (a. * f.)	$0.00
h.	Compaction Unit Cost ($/cu.yd.)	
i.	Compaction Cost (a. * h.)	$0.00
	TOTAL Off-Site Clay (c. + e. + g. + i.)	$0.00

3.	Quality Control/Testing of Clay	
	a.	
	b.	
	c.	
	TOTAL Clay Testing (LS)	$26,318.64
	TOTAL Landfill Cap	$5,733,227.06
C.	Synthetic Membrane	
1.	Quantity Needed (sq.yd.)	
2.	Purchase Unit Cost ($/sq.yd.)	
3.	Purchase Cost (1. * 2.)	$0.00
4.	Installation Unit Cost ($/sq.yd.)	
5.	Installation Cost (1. * 4.)	$0.00
	TOTAL Synthetic Membrane (3. + 5.)	$0.00
D.	Geotextile Filter Fabric	
1.	Quantity Needed (sq.yd.)	
2.	Purchase Unit Cost ($/sq.yd.)	
3.	Purchase Cost (1. * 2.)	$0.00
4.	Installation Unit Cost ($/sq.yd.)	
5.	Installation Cost (1. * 4.)	$0.00
	TOTAL Geotextile Filter Fabric (3. + 5.)	$0.00
	TOTAL for Establishing Final Cover (A. + B. + C. + D.)	$8,090,802.24

II. Establishing Vegetative Cover

A.	Labor ($/acre)	$460.58
B.	Seeding ($/acre)	$460.58
C.	Fertilizing ($/acre)	$328.97
D.	Erosion Control Matting ($/acre)	$65.80
E.	Number of Acres	101
	TOTAL for Establishing Vegetative Cover (A. + B. + C. + D.) * E.	$132,839.20

III. Establishing/Completing a System to Minimize & Control Erosion/Sedimentation

A. Sedimentation Pond

1. Excavation/Construction ($)

2.	Materials (e.g. pipe. Riprap) ($)	
	TOTAL for Sedimentation Pond (1. + 2.)	$0.00
B.	Diversion Ditch	
1.	Construction ($)	
2.	Materials ($)	
	TOTAL for Diversion Ditch (1. + 2.)	$0.00
C.	Temporary Structures (Filtrexx Siltsoxx)	
1.	Quantity needed (ft)	6550.36
2.	Materials unit cost ($/ft)	$2.00
3.	Materials cost ($)	$13,100.72
4.	Construction unit cost ($/ft)	$1.50
5.	Construction cost ($)	$9,825.54
	TOTAL for Temporary Structures (3. + 5.)	$22,926.26
TOTAL	for establishing or completing a system to minimize & control erosion & sedimentation (A. + B. + C.)	$22,926.26

IV. Establishing or Completing Leachate Collection Removal, & Treatment System

A.	Installation	
1.	Number of Feet	
2.	Piping System Unit Cost ($/ft)	
3.	Piping System Cost (1. * 2.)	$0.00
4.	Storage Tanks ($)	
5.	Pumps ($)	
TOTAL	for Establishing or Completing Leachate System (3. + 4. + 5.)	$0.00

V. Establishing or Completing a System to Collect or Vent Gases

A.	Installation	
1.	Materials (e.g. piping)	
2.	Equipment (e.g. pumps)	
3.	Labor (e.g. drilling)	
TOTAL	for Establishing or Completing a System to Collect or Vent Gases (1. + 2. + 3.)	$0.00

VI. Establishing or Completing Groundwater/Surface Water Monitoring System

A.	Installation	
1.	Number of Wells	
2.	Drilling Unit Cost ($/Well)	
3.	Drilling Cost (1. * 2.)	$0.00
4.	Materials Unit Cost ($/Well)	
5.	Materials (1. * 4.)	$0.00
6.	Equipment (e.g. pumps)	
7.	Labor	
TOTAL	for Establishing or Completing Groundwater Monitoring System (3. + 5. + 6. + 7.)	$0.00

TOTAL CLOSURE COSTS (SUM OF TOTALS FOR SECTIONS I. THOUGH VI.)	$8,246,567.70

Cost Estimate
Work Sheet A
Closure Activities - Composite Final Cover Option

Notes:
1) This worksheet is to be submitted as part of the C/PC Plan.
2) Provide a cost for all activities that apply.
3) Additional cost information may be attached as needed.

I. Establishing Final Cover		
A. Top Soil		
1.	Quantity Needed (cu.yd.)	179,149.05
2.	Excavation Unit Cost ($/cu.yd.)	$3.95
3.	Excavation Cost (1. * 2.)	$707,638.75
4.	Placement/Spreading Unit Cost ($/cu.yd.)	$9.21
5.	Placement Cost (1. * 4.)	$1,649,962.75
	TOTAL Top Soil (3. + 5.)	$2,357,601.50
B. Landfill Cap		
1. On-Site Clay		
a.	Quantity Needed (cu.yd.)	179,149.05
b.	Excavation Unit Cost ($/cu.yd.)	$3.95
c.	Excavation Cost (a. * b.)	$707,638.75
d.	Placement/Spreading Unit Cost ($/cu.yd.)	$9.21
e.	Placement Cost (a. * d.)	$1,649,962.75
f.	Compaction Unit Cost ($/cu.yd.)	$1.32
g.	Compaction Cost (a. * f.)	$236,476.75
	TOTAL On-site Clay (c. + e. + g.)	$2,594,078.24
2. Off-Site Clay		
a.	Quantity Needed (cu.yd.)	
b.	Purchase Unit Cost ($/cu.yd.)	
c.	Purchase Cost (a. * b.)	$0.00
d.	Delivery Unit Cost ($/cu.yd.)	
e.	Delivery Cost (a. * d.)	$0.00
f.	Placement/Spreading Unit Cost ($/cu.yd.)	
g.	Placement Cost (a. * f.)	$0.00
h.	Compaction Unit Cost ($/cu.yd.)	
i.	Compaction Cost (a. * h.)	$0.00
	TOTAL Off-Site Clay (c. + e. + g. + i.)	$0.00

3.	Quality Control/Testing of Clay	
	a.	
	b.	
	c.	
	TOTAL Clay Testing (LS)	$26,318.64
	TOTAL Landfill Cap	$2,620,396.88
C.	Synthetic Membrane	
1.	Quantity Needed (sq.yd.)	488,583
2.	Purchase Unit Cost ($/sq.yd.)	$4.50
3.	Purchase Cost (1. * 2.)	$2,198,622.86
4.	Installation Unit Cost ($/sq.yd.)	$0.10
5.	Installation Cost (1. * 4.)	$48,858.29
	TOTAL Synthetic Membrane (3. + 5.)	$2,247,481.15
D.	Geotextile Filter Fabric	
1.	Quantity Needed (sq.yd.)	488,583
2.	Purchase Unit Cost ($/sq.yd.)	$4.50
3.	Purchase Cost (1. * 2.)	$2,198,622.86
4.	Installation Unit Cost ($/sq.yd.)	$0.10
5.	Installation Cost (1. * 4.)	$48,858.29
	TOTAL Geotextile Filter Fabric (3. + 5.)	$2,247,481.15
TOTAL	for Establishing Final Cover (A. + B. + C. + D.)	$9,472,960.67

II. Establishing Vegetative Cover

A.	Labor ($/acre)	$460.58
B.	Seeding ($/acre)	$460.58
C.	Fertilizing ($/acre)	$328.97
D.	Erosion Control Matting ($/acre)	$65.80
E.	Number of Acres	101
TOTAL	for Establishing Vegetative Cover (A. + B. + C. + D.) * E.	$132,839.20

III. Establishing/Completing a System to Minimize & Control Erosion/Sedimentation

A.	Sedimentation Pond	
1.	Excavation/Construction ($)	
2.	Materials (e.g. pipe. Riprap) ($)	

TOTAL	for Sedimentation Pond (1. + 2.)	$0.00

B. Diversion Ditch

1.	Construction ($)	
2.	Materials ($)	
TOTAL	for Diversion Ditch (1. + 2.)	$0.00

C. Temporary Structures (Filtrexx Siltsoxx)

1.	Quantity needed (ft)	6550.36
2.	Materials unit cost ($/ft)	$2.00
3.	Materials cost ($)	$13,100.72
4.	Construction unit cost ($/ft)	$1.50
5.	Construction cost ($)	$9,825.54
TOTAL	for Temporary Structures (3. + 5.)	$22,926.26

TOTAL for establishing or completing a system to minimize & control erosion & sedimentation (A. + B. + C.) $22,926.26

IV. Establishing or Completing Leachate Collection Removal, & Treatment System

A. Installation

1.	Number of Feet	
2.	Piping System Unit Cost ($/ft)	
3.	Piping System Cost (1. * 2.)	$0.00
4.	Storage Tanks ($)	
5.	Pumps ($)	

TOTAL for Establishing or Completing Leachate System (3. + 4. + 5.) $0.00

V. Establishing or Completing a System to Collect or Vent Gases

A. Installation

1.	Materials (e.g. piping)	
2.	Equipment (e.g. pumps)	
3.	Labor (e.g. drilling)	

TOTAL for Establishing or Completing a System to Collect or Vent Gases (1. + 2. + 3.) $0.00

VI. Establishing or Completing Groundwater/Surface Water Monitoring System

A.	Installation	
1.	Number of Wells	
2.	Drilling Unit Cost ($/Well)	
3.	Drilling Cost (1. * 2.)	$0.00
4.	Materials Unit Cost ($/Well)	
5.	Materials (1. * 4.)	$0.00
6.	Equipment (e.g. pumps)	
7.	Labor	
TOTAL	for Establishing or Completing Groundwater Monitoring System (3. + 5. + 6. + 7.)	$0.00

TOTAL CLOSURE COSTS (SUM OF TOTALS FOR SECTIONS I. THOUGH VI.)	$9,628,726.14

Cost Estimate
Work Sheet B
Post Closure Activities

Notes:

1) This worksheet is to be submitted as part of the C/PC Plan.
2) This facility will be maintained and monitored for 30 years after final closure of Class I and II landfills and 2 years after final closure of Class III and IV landfills.
3) Fill in blanks for all activities which apply.
4) All costs are to be calculated on an ANNUAL BASIS

I. Survey Inspections to Confirm Final Grade and Drainage are Maintained	
A. Transportation	INCLUSIVE
B. Labor	INCLUSIVE
TOTAL for Surveying Inspections (A. + B.)	$15,791.18
II. Maintain Healthy Vegetation	
A. Transportation	INCLUSIVE
B. Labor	$3,947.80
C. Seeding	$3,947.80
D. Fertilizing	$2,763.46
E. Mulching	$657.97
F. Rodent Control	
G. Mowing	$15,791.18
TOTAL for Maintaining Healthy Vegetation (A. + B. + C. + D. + E. + F. + G.)	$27,108.21
III. Maintain Drainage Facilities, Sediment Ponds, & Erosion/Sediment Control Measures	
A. Transportation	N/A
B. Labor	$7,895.59
C. Cleaning out of Systems	$0.00
D. Repair of Gullies or Rills	
1. Soil Acquisition	
a. Quantity	1,000.00
b. Purchase Unit Cost ($/cu.yd.)	$1.32
c. Purchase Cost (a. * b.)	$1,320.00
d. Delivery Unit Cost ($/cu.yd.)	$5.26

e. Delivery Cost (a. * d.)	$5,260.00
2. Placement/Spreading/Compaction	$5,000.00
3. Revegetation	$3,000.00
TOTAL D.	$14,580.00
TOTAL for Maintaining Drainage (A. + B. + C. + D.)	$22,475.59

IV. Maintain and Monitor Leachate Collection, Removal, & Treatment System

A. Treatment of Leachate	
1. On-Site	
a. Quantity (cu.yd.)	
b. Treatment Unit Cost ($/cu.yd.)	
c. Treatment Costs (a. * b.)	$0.00
d. Sewer Discharge Unit Cost	
e. Discharge Costs (a. * d.)	$0.00
TOTAL 1. On-Site (c. + e.)	$0.00
2. Off-Site	
a. Quantity (cu.yd.)	
b. Hauling Unit Cost ($/cu.yd.)	
c. Hauling Costs (a. * b.)	$0.00
d. Treatment Unit Cost ($/cu.yd.)	
e. Treatment Costs (a. * d.)	$0.00
TOTAL 2. Off-Site (c. + e.)	$0.00
TOTAL for Treatment of Leachate (A.) (1. or 2. TOTAL)	$0.00
B. Maintenance of Leachate Collection System	
1. Transportation	
2. Labor	
3. Repairs/Materials	
a. Pumps	$3,000.00
b. Cleaning out System	$3,000.00
c. Leak Detection	
d. Lift station	$4,000.00
TOTAL 3. (a. + b. + c. + d.)	$10,000.00
TOTAL B. (1. + 2. + 3.)	$10,000.00
TOTAL for Monitoring and Maintaining Leachate System (A. + B.)	$10,000.00

V. Maintain and Monitor Gas Collection or Venting System

A.	Transportation	
B.	Labor	
C.	Repairs/Materials	
1.	Cleaning	
2.	Caps	
3.	Other	
TOTAL C.	(1. + 2. + 3.)	$0.00
TOTAL for Maintaining & Monitoring Gas Control Systems (A. + B. + C.)		$0.00

VI. Maintain and Monitor Groundwater and/or Surface Water Monitoring System

A.	Installation	
1.	Number of Wells/Springs	20.00
2.	Number of Samples/Well	2.00
3.	Unit Costs of Analysis	$1,315.93
4.	Cost of Sampling + Analysis (1. * 2. * 3.)	$52,637.28
5.	Labor Cost/Well	
6.	Labor Costs (1. * 5.)	
TOTAL A.	(4. + 6.)	$52,637.28
B.	Inspection & Maintenance of System	
1.	Transportation	
2.	Labor	5,263.73
3.	Repairs/Materials	
a.	Caps	$526.37
b.	Tubing	$526.37
c.	Pumps	$526.37
d.	Well Replacement	$526.37
e.	Other	$526.37
TOTAL 3.	(a. + b. + c. + d. + e.)	$2,631.86
TOTAL B.	(1. + 2. + 3.)	$7,895.59
TOTAL for Maintaining & Monitoring Groundwater Systems (A. + B.)		$60,532.87

TOTAL CLOSURE COSTS, ANNUAL BASIS (SUM OF TOTALS FOR SECTIONS I. THOUGH VI.)	**$135,907.85**
INFLATION RATE UTILIZED	**5.00%**
30 YR BASIS (Annual Cost * Inflation Rate Over 30 Years)	**$9,481,039**

SUMMARY OF ANNUAL COST, 30 YEAR BASIS

Annual Cost	Year	Inflation Rate	Annual Cost with Inflation
$135,907.85	1	5.0%	$142,703
	2	5.0%	$149,838
	3	5.0%	$157,330
	4	5.0%	$165,197
	5	5.0%	$173,457
	6	5.0%	$182,130
	7	5.0%	$191,236
	8	5.0%	$200,798
	9	5.0%	$210,838
	10	5.0%	$221,380
	11	5.0%	$232,449
	12	5.0%	$244,071
	13	5.0%	$256,275
	14	5.0%	$269,088
	15	5.0%	$282,543
	16	5.0%	$296,670
	17	5.0%	$311,503
	18	5.0%	$327,078
	19	5.0%	$343,432
	20	5.0%	$360,604
	21	5.0%	$378,634
	22	5.0%	$397,566
	23	5.0%	$417,444
	24	5.0%	$438,316
	25	5.0%	$460,232
	26	5.0%	$483,244
	27	5.0%	$507,406
	28	5.0%	$532,776
	29	5.0%	$559,415
	30	5.0%	$587,386
	TOTAL, 30 YR BASIS		**$9,481,039**