Tennessee Valley Authority
Kingston Fossil Plant

OPERATIONS MANUAL

COAL COMBUSTION BYPRODUCT DISPOSAL FACILITY - PENINSULA SITE

KIF450

Prepared By:

Tennessee Valley Authority
Fossil Engineering Services
1101 Market Street
Chattanooga, TN 37401-2801

May 2006

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Applicable Design Documents	REV	EDMS NUMBER	DESCRIPTION
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References	R1		
	R2		

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

	Revision 0	R1	R2
Date	May 2006		
Prepared	R.N. Davies		
Checked	T.Y. Elkady		
Supervised	Harold L. Petty		

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Note:

(1) The hydrogeological report was submitted under separate cover to TDEC on November 29, 2005. A Notice of Completeness was received from TDEC on December 16, 2005. Appendix B only includes supplemental data used in the design that was not included in the previous submittal.

1 SITE INFORMATION

1.1 Overview and Introduction

This Operations Manual has been prepared in support of a Part II Permit application for a coal-combustion byproduct (CCB) disposal facility to be located at Tennessee Valley Authority's (TVA's) Kingston Fossil Plant (KIF), located near Harriman, Tennessee. The proposed disposal facility is to be located on lands currently owned by TVA located within the KIF reservation. The CCB disposal facility is an integral part of a project to install a flue gas desulfurization (FGD) system at KIF. When operational, the FGD system will reduce sulfur dioxide emissions through the use of wet limestone forced oxidation technology. Gypsum will be produced as a byproduct of the FGD operations. TVA intends to market the resulting gypsum for beneficial re-use by private companies. However, the proposed CCB disposal facility described herein is needed for the on-site disposal of gypsum materials that cannot be marketed.

This Operations Manual has been developed in accordance with rules published by the Tennessee Department of Environment and Conservation (TDEC), specifically Rule 1200-1-.04. TVA is requesting that TDEC issue a permit for the construction and operation of the CCB disposal facility as a Class II facility. TVA also requests that TDEC issue certain waivers, as specifically identified in this O&M Plan, that are needed to address TVA's operational needs and the inert nature of the materials to be disposed.

Information presented in this document has been organized and presented consistent with the permit application requirements presented in Rule 1200-1-.04 (9). Sections within this application have been titled and enumerated consistent with the regulations to facilitate the review process. Additional information developed in support of this Operations Manual and the permit application has been presented as Appendices or attachments as listed below:

Appendix A	Hydrogeologic Report
Appendix B	Design Calculations
Appendix C	Gypsum Testing and Physical Properties
Appendix D	Groundwater Monitoring Plan

Appendix E	Closure and Post-Closure Plan
Appendix F	Material Specifications and Construction Quality Assurance and Quality Control Plan
Appendix G	DSWM Policy Memorandum dated September 7, 2001

1.2 Hydrogeological Report (ref. 1200-1-7-.04 (9) (a))

The Hydrogeological Report supporting this application is titled *"Kingston Fossil Plant – Peninsula Site, Hydrogeologic Evaluation of Coal-Combustion Byproduct Disposal Facility"* (October 2005) and is presented as Appendix A. This document was submitted to TDEC as a stand alone document on November 29, 2005. Based on TDEC's review, a Notice of Completeness was received by TVA on December 16, 2005. No changes have been made to this document since its submittal to TDEC.

1.3 Engineering Plans (ref. 1200-1-7-.04 (9) (b))

The Engineering Drawings that support this application are presented as Attachment 1 to this Operations Manual. The drawing set is titled, *"Coal-Combustion By-product (Gypsum) Disposal Facility, Kingston Fossil Plant – Peninsula Site"*. The following drawings are included:

Table 1
List of Drawings

Drawing No.	Title
10W427-1	Cover Sheet
10W427-2	Existing Site Conditions and Boring Locations
10W427-3	Site Development Plan
10W427-4	Phase I Initial Grading Plan and Soil Dikes
10W427-5	Phase I Top of Geologic Buffer
10W427-6	Phase I, Stage 1A
10W427-7	Phase I, Stage 1B
10W427-8	Phase II Initial Grading Plan and Soil Dikes
10W427-9	Phase II Top of Geologic Buffer
10W427-10	Phase II Stage 1A
10W427-11	Phase I and II Final Cover Grading Plan (Wet Stack)
10W427-12	Phase I and II Final Cover Grading Plan (Dry Stack)
10W427-13	Surface Water Management Plan
10W427-14	Cross Section I
10W427-15	Cross Section II
10W427-16	Operational and Typical Details I
10W427-17	Operational and Typical Details II
10W427-18	Drainage System Details I
10W427-19	Drainage System Details II
10W427-20	Final Cover System Details
10W427-21	Surface Water Management System Details I (Downdrain Channel Option)
10W427-22	Surface Water Management System Details II (Downdrain Pipe Option)
10W427-23	Surface Water Management System Details III
10W427-24	Underdrain Lift Station
10W427-25	Stormwater Lift Station

2. NARRATIVE DESCRIPTION OF FACILITY OPERATIONS

The following section of this Operations Manual presents a narrative description of the development and operation of the planned CCB disposal facility. To facilitate the review of this document, regulatory requirements are cited in italics at the start of each section followed by a text description indicating how the specific requirement has been addressed. Where appropriate, the text also references engineering drawings or other supporting information that has been developed in support of the Operations Manual and permit application.

2.1 Site Information

2.1.1 Responsible Officials (ref. 1200-1-7-.04 (9) (c) 1)

Regulatory requirement:

1. Identifies the name of the individual responsible for operation and maintenance of the facility;

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.

2.1.2 Site Location (ref. 1200-1-7-.04 (9) (c) 2)

Regulatory requirement:

2. Describes the location of the facility using roads and highways;

The Site is located on land currently owned by TVA at the Kingston Fossil Plant (KIF). The specific area proposed for the disposal facility is commonly referred to as the "Peninsula Site". 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. A site location map is provided on Drawing No. 10W427-1 (Cover Sheet).

2.1.3 Site Description (ref. 1200-1-7-.04 (9) (c) 3)

Regulatory requirement:

3. Describes its compliance with all applicable buffer zone standards listed in paragraph (3) of this Rule. Each buffer zone standard must be specifically addressed referencing the closest property lines, residences, wells, and bodies of water as appropriate, and maps may be attached for easy descriptions and reference or otherwise demonstrate compliance.

KIF is located at the base of a peninsula formed by the Clinch and Emory River embayments of Watts Bar Lake. Construction of KIF began in 1951 and commercial operation began in 1955. Land acquisition for KIF included approximately 550 acres east of the current plant operational area, commonly referred to as the KIF Peninsula Site. The area was originally devoted to agricultural and residential use. These cultivated fields are currently used by the Tennessee Wildlife Resources Agency (TWRA) to support an onsite wildlife management program (i.e., hunting).

The proposed CCB facility will be located on a peninsula landform at the confluence of the Clinch and Emory Rivers in Roane County, Tennessee. The Emory River enters the Clinch River at Clinch River Mile (CRM) 4.36 along the eastern margin of the peninsula. Existing ground surface across the proposed disposal site

ranges from approximately elevation 735 to 860 ft. msl, and the 100-year flood stage elevation is 747.6 ft. Modern day floods near the mouth of the Clinch River (CRM 0.7) suggest that the highest modern (1903) flood stage was near 746 ft. msl.

The CCB disposal facility proposed at KIF will occur in two separate phases. Both phases would involve disposal of gypsum derived from flue-gas desulfurization (FGD). Phase I would be constructed pending successful marketing of the FGD derived gypsum. The footprint for Phase I includes an area of approximately 51 acres. If efforts to market the gypsum are unsuccessful, the disposal facility will be expanded laterally under Phase II. Phase II includes additional area adjacent to the site and encompasses an additional area of approximately 41 acres (note: areas are measured to limits of waste).

2.1.4 Compliance with Buffer Zones (ref. 1200-1-7-.04 (3) (a)

Regulatory requirement:

Disposal facilities must be located, designed, constructed, operated, and maintained such that the fill areas are, at a minimum:

1. *100 feet from all property lines*

The proposed CCB disposal facility is located on the KIF reservation. No property lines are within 100 ft.

2. *500 feet from all residences, unless the owner of the residential property agrees in writing to a shorter distance*

There are no residences within 500 ft. of the proposed CCB disposal facility.

3. *500 feet from all wells determined to be down gradient and used as a source of drinking water by humans or livestock*

There are no wells downgradient of the site that are used as a source of drinking water by humans or livestock.

4. *200 feet from normal boundaries of springs, streams, lakes (except that this standard shall not apply to any wet weather conveyance nor to bodies of water constructed and designed to be part of the facility)*

The disturbance footprint of the disposal facility is located within 200 ft. of the normal boundary of Watts Bar Lake-Clinch River. However, as indicated on Drawing No. 10W427-3 (Site Development Plan), waste limits shall be maintained beyond the required 200 ft. buffer zone. Only soil starter dikes will be located within the buffer. Prior to construction, TVA will obtain permits required under Section 404 of the Clean Water Act and an Aquatic Resource Alteration Permit (ARAP) to address construction activities within the buffer area.

TVA requests that TDEC issue a waiver of the 200 ft. buffer requirement to allow construction of the soil starter dikes within the buffer zone as indicated on the engineering drawings.

2.1.5 Compliance with Siting Requirements for Fault Areas (ref. 1200-1-7-.04 (9) (c) 4)

Regulatory requirement:

4. Describes its compliance with applicable siting requirements for fault areas.

   Rule 1200-1-7-.04 (u) New Class I and II SWLF units and lateral extensions shall not be located within 200 feet (60 meters) of a fault that has had displacement in Holocene time unless the owner or operator demonstrates in the Narrative Description of the Facility and Operations Manual that an alternative setback distance of less than 200 feet (60 meters) will prevent damage to the structural integrity of the SWLF unit and will be protective to human health and the environment.

As part of the planning and design of the proposed facility, TVA has completed an extensive hydrogeologic evaluation of the site. Based on the investigations performed to date, there is no evidence of Holocene-age faulting within the 200 ft. facility exclusion zone although the Kingston fault (a thrust fault) crosses the southeastern

margin of the site. The Kingston fault is an ancient structure that, along with associated faults, were formed approximately 300 million years ago and further movement along these faults is highly improbable (Julian and Boggs, 2005).

2.1.6 Compliance with Siting Requirements for Seismic Impact Zones (ref. 1200-1-7-.04 (9) (c) 5)

Regulatory requirement:

5. *Describes its compliance with applicable siting requirements for seismic impact zones.*

   Rule 1200-1-7-.04 (v) New Class I and II SWLF units and lateral extensions shall not be located in seismic impact zones unless the owner or operator demonstrates that all containment structures including liners, leachate collection systems and surface water control systems are designed to resist the maximum acceleration in lithified earth material for the site. The owner or operator must place the demonstration in the Narrative Description of the Facility and Operations Manual.

The Site lies within a seismic impact zone, defined by TDEC Rule 1200-1-7-.04 as being an area with a 10 percent or greater probability of being subject to an earthquake ground acceleration of at least 0.10g within 250 years. The Site falls within an area characterized by a maximum horizontal acceleration of 0.25g within 250 years. In accordance with TDEC regulations, "*all containment structures including liners, leachate collection systems, and surface water control systems are to be designed to resist the maximum horizontal acceleration in lithified earth material for the site*".

In accordance with the TDEC regulations, engineering analyses were performed for critical components of the facility considering both static and seismic conditions. Seismic evaluations were performed using a maximum horizontal ground acceleration of 0.25g in 250 years. Calculation packages detailing assumptions and procedures, analyzed cross sections, and material properties for the aforementioned analyses are presented in Appendix B. Results indicate that the proposed facility has adequate factors of safety under both operational and final facility configurations.

2.1.7 Compliance with Siting Requirements for Unstable Areas (ref. 1200-1-7-.04 (9) (c) 6)

Regulatory requirement:

4. *Describes its compliance with applicable siting requirements for unstable areas.*

   Rule 1200-1-7-.04 (2) (w) Owners or operators of new Class I and II SWLF units, existing Class I and lateral expansions located in an unstable area must demonstrate that engineering measures have been incorporated into the SWLF units designed to ensure that the integrity of the structural components of the SWLF unit will not be disrupted. The owner or operator must place the demonstration in the Description of the Facility and Operations Manual operating record. The owner or operator must consider the following factors at a minimum, when determining whether an area is unstable:

1. *On-site local soil conditions that may result in significant differential settlement.*

2. *On-site or local geologic or geomorphologic features; and*

3. *On-site or local human-made features or event (both surface and subsurface).*

Topographic depressions or dolines are exhibited at the site. These features do not possess open throats or avenues for reception of incipient recharge. Rather, the dolines are thickly mantled by soil thicknesses ranging from about 35 to 75 ft. Visual and laboratory classifications of these soils indicate that they are of residual origin except in the area of the site pond where alluvial deposition has occurred. Based on the hydrogeologic evaluation, there were no voids detected immediately above bedrock that would indicate staging of soil into the deeper bedrock system. There are no natural karst features (i.e., sinkholes, sinking streams, and springs) directly integrated into the subsurface. Coring of the bedrock at the site exhibits slight to highly fractured

conditions. Most cavities and joints were also observed to be completely or partially filled with clays and sand. Some topographic depressions coincide with bedrock depressions but no active karst features were observed at these locations.

The only man made feature is the former farm pond located in the center of the site. This feature will be filled in during construction of the facility and therefore will not affect the integrity of the facility. TVA will obtain the necessary permits for this work in advance of proceeding with the work.

A central drainage corridor (150 ft. wide drainage blanket) is included in the design to remove liquids from lower portions of the CCB disposal facility during normal operations and during the post-closure period. As part of the engineering design, differential settlements were estimated along the axis of the corridor to ensure that positive drainage would be maintained under post-settlement conditions. This evaluation is presented in Appendix B and illustrates that positive gravity drainage will be maintained after settlement under the final configuration of the disposal facility.

2.1.8 Access Control (ref. 1200-1-7-.04 (9) (c) 7)

Regulatory requirement:

7. *Describes the barriers, signs, procedures and other measures to be used to control access to and use of the facility;*

Phases I and II of the proposed CCB facility are located within the TVA KIF Reservation. Access to this facility is via the plant entrance and internal plant roads. During normal operations, plant personnel will be at the site performing disposal operations, inspections and maintenance as required. TVA also maintains 24-hour security at the plant.

Temporary signage and barriers will be erected on an as-required basis during construction operations to route construction-related traffic to designated areas.

3 FACILITY OPERATIONS

3.1 Overview

This Section of the Operations Manual provides a description of the normal operations anticipated for the planned CCB facility. Section 3 provides a description of operational procedures and specifically addresses the required elements of Rule 1200-1-7-.04 (9) (c) parts 8 through 18.

3.2 General Sequence of Operations (ref. 1200-1-7-.04 (9) (c) 8)

Regulatory Requirement

8. Describes the methods and sequence of operation;

The proposed CCB disposal facility is intended for the disposal of gypsum derived from flue-gas desulfurization (FGD). While it is TVA's intent to market the resulting gypsum materials for beneficial re-use, the disposal facility is required as a back-up to normal operations. At a minimum, it is anticipated that the facility will be used to dispose of materials resulting from periodic by-passes that will occur during routine maintenance of equipment that will be used as part of the planned marketing activities. In addition, periodic disposal of gypsum materials may be required if market conditions or other external factors result in reduced demand for gypsum materials. Accordingly, the proposed CCB disposal facility has been conservatively sized and designed to handle 100 percent of the anticipated gypsum production once the FGD project is brought on-line.

Figure 1 presents an overall site plan identifying key elements of the proposed CCB disposal facility. Initial activities (prior to waste disposal) will involve construction of the stormwater pond, geologic buffer, central drainage corridor, initial soil dikes, and associated stormwater diversion features associated with development of the Phase I area of the Site.

The disposal footprint of Phase I is approximately 51 acres. The initial soil dikes will be constructed as indicated on Drawing No. 10W427-4 (Phase I Initial Grading

Plan and Soil Dikes). The geologic buffer consisting of a three-foot thickness of re-compacted soil with a specified hydraulic conductivity of no more than 1 x 10^{-7} cm/sec will be constructed and the central drainage corridor will be added as depicted on Drawing No. 10W427-5 (Phase I Top of Geologic Buffer). The soil dikes will form the boundary of an initial wet pond operation and will also provide a means of access for construction equipment around the initial pond perimeter. It is TVA's intent that this layer will meet or exceed the regulatory requirements of a geologic buffer, as defined in the TDEC regulations.

The geologic buffer will be graded towards the center of the disposal area with the central channel graded towards the low point of the Phase I area at the southwest corner of the site. The central drainage corridor consists of a 150 ft. wide drainage blanket constructed of crushed stone wrapped in a geotextile filter fabric with interior perforated pipes. This drainage corridor will be used to collect internal drainage resulting from the consolidation of the disposed gypsum and will convey this water to a sump (underdrain lift station). The contents will be pumped to the stormwater pond and will subsequently be pumped to the plant's discharge channel for discharge in accordance with the plant's NPDES permit.

Phase I will be initially operated as a wet pond, as subsequently described. It is anticipated that operations will transition from a wet pond operation to a Rim Ditch operation if the volume of material being disposed becomes significant. TVA may construct the Phase II area at any time during the operation of Phase I. It is anticipated that TVA will review the timing for the implementation of Phase II once sufficient operational experience has been gathered regarding the efficiency of gypsum byproduct marketing activities. Other external factors such as market demand for gypsum materials may also factor into the need for, and timing of construction of Phase II.

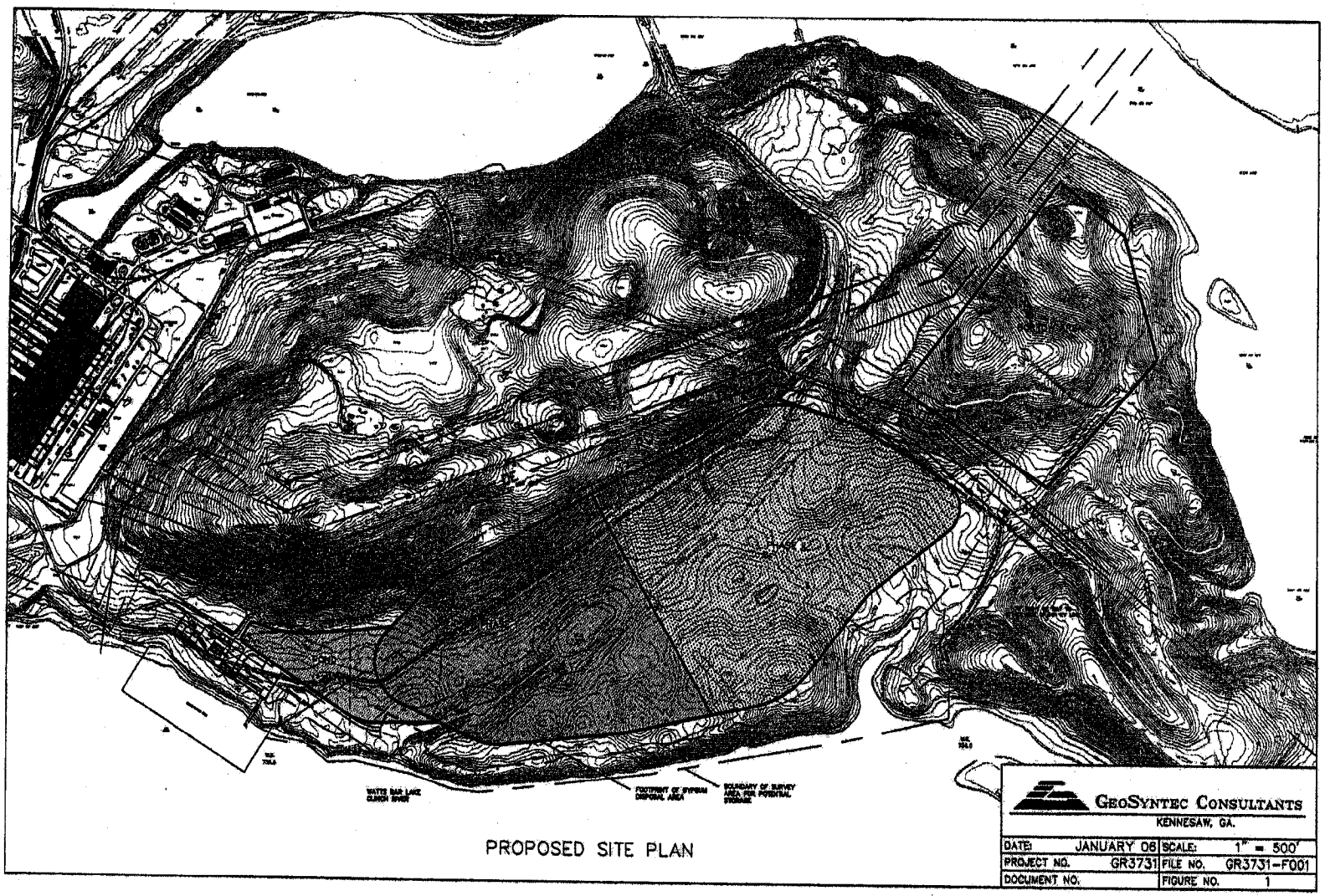

Figure 1 – Site Plan

After completion of initial construction activities to prepare the Phase I area, gypsum will be sluiced to the upper (northern) end of the Phase I wet pond. The wet pond will be decanted at the lower end using a conventional pond decant structure (See Drawing No. 10W427-19, Drainage System Details II) located adjacent to the stormwater pond, with decant water being discharged into the stormwater pond. Temporary diversion berms may be required to promote settling of the coarser gypsum particles. The number and location of these berms (if used) will be field determined based on operational needs. Coarser material will be removed from the pond area and used to progressively raise the elevation of the outer dikes using a conventional wet cast operation.

The outer dikes will be raised progressively during the operation of the wet pond. The dike construction procedure is depicted on Drawing No. 10W427-16 (Operational and Typical Details I). It is estimated that the disposal facility can be operated in this manner for a period of approximately 2 years prior to transitioning to a Rim Ditch operation. However, the actual time period will be highly dependant upon the efficiency of planned marketing operations. Transition to a Rim Ditch operation can occur once sufficient pond capacity is provided to allow for efficient operations.

Once the disposal operation has transitioned to a Rim Ditch operation, gypsum will be sluiced to a Rim Ditch located around the interior of the perimeter dikes rather than directly to the wet pond. The Rim Ditch would discharge to the central pond, with coarser gypsum particles being deposited in the Rim Ditch. The general procedure for raising the elevation of the dikes using a Rim Ditch operation is depicted on Drawing No. 10W427-17 (Operational and Typical Details II). As sufficient materials are deposited, the outer dikes will be raised in elevation using the upstream method of construction. Decant water will continue to be discharged from the central pond to the stormwater pond. Stormwater and decant water collected in the stormwater pond will be pumped to TVA's existing NPDES permitted discharge located at the plant discharge channel.

Once sufficient operational experience has been gained, TVA may elect to expand into the Phase II area. This may be done at any point during the operation of Phase I. The disposal footprint of Phase II is approximately 41 acres. If expansion into Phase II occurs early in the operation of Phase I, it may be possible to operate Phases I and II simultaneously. If expansion into Phase II occurs at a later time, the Phase II area would lean into and "piggyback" the previously constructed sideslope of Phase I that is common to the two areas.

Phase II of the disposal area will be developed in a similar manner to Phase I, i.e., first as a wet pond operation, raising the dikes by a wet casting operation; then as a Rim Ditch operation with a central pond.

The CCB disposal facility design has been developed assuming wet disposal up to an approximate elevation of 900 ft. msl. Dry stack disposal can be performed above this elevation. The estimated airspace available for disposal of gypsum is as follows:

- Phase I – 6,513,000 cubic yards (cy) for wet stack operation (i.e., up to approximate elevation 900 ft. msl);
- Phase I and II – 13,371,000 cy for combined wet stack (i.e., up to elevation 900 ft. msl); and an additional 2,634,000 cy capacity for dry stack operations.

3.3 Type and Volume of Waste (ref. 1200-1-7-.04 (9) (c) 9)

Regulatory requirement:

> 9. *Describes the types and anticipated volumes of solid wastes to be disposed of and the sources which generate the waste, and for special wastes, the physical and chemical characteristics of the wastes and any special handling procedures to be utilized;*

TVA is proposing to construct and operate a wet scrubber system to reduce sulfate (SO_3) emissions from the flue gas emissions at the Kingston Plant. The system is expected to become operational in FY2009. The only wastes that will be disposed of in this facility will be gypsum resulting from the operation of the proposed FGD system. Relatively small quantities of fly ash and/or bottom ash may be used from time to time as construction materials (e.g., road base) during operation of the facility.

Wet gypsum will be pumped from the power generation area to the marketing area, to be located just west of the proposed disposal facility (Figure 1). A by-pass valve will be located at this location. Depending on market conditions, TVA may be able to market up to 90 percent or more of the gypsum generated at KIF to private companies involved in the manufacture of various products. Since there are a variety of uncertainties associated with the actual percentage of gypsum that can be marketed, all life projections included in this Operations Manual have been developed based on worst case (i.e., no marketing) projections.

The design has been developed assuming that gypsum will be wet sluiced or slurried to the CCB disposal facility. Wet disposal operations will continue until approximate elevation 900 feet above mean sea level (msl) has been attained. Above this elevation, it is assumed that any further disposal will be performed as a dry stacking operation since the footprint of the wet pond will be significantly reduced at this point. Drawing No. 10W427-11 illustrates the grades upon completion of wet disposal operations and

Drawing No. 10W427-12 illustrates the final cover grades upon completion of both wet disposal and dry stacking activities.

Gypsum is an inert, non-combustible material and does not decay biologically. It is primarily utilized in the manufacture of gypsum wallboard, but can also be used as a soil amendment and in other products. When slurried, the gypsum slurry will have a pH in the range 6.7 to 7.8 (Law, 1995). Additional data regarding the typical characteristics of gypsum and the typical chemical composition (based on data from TVA's Cumberland Fossil Plant) is included in Appendix C.

Since wet sluicing of gypsum is integral to TVA's gypsum disposal practices, TVA requests a waiver of Rule 1200-1-7-.04 (2), regarding disposal of bulk non-containerized liquids in a landfill.

TVA estimates that approximately 547,500 cy of settled gypsum will be produced each year. Under worst case conditions (i.e., no marketing), TVA has developed the stage-storage capacity estimates presented in Table 2.

Table 2
Stage-Storage Capacity Estimates

Description	Disposal Volume (cy)	Highest Elevation (ft. msl)	Minimum Anticipated Life (1) (years)
Phase 1 – completion of wet stacking	6,513,000	900	12
Phase I and II combined – completion of wet stacking	13,371,000	900	24.5
Phase I and II combined – completion of wet and dry stacking	16,005,000	984	29.25

Notes:
(1) – assumes no marketing

3.4 Areas to be Filled and Permitted (ref. 1200-1-7-.04 (9) (c) 10)

Regulatory requirement:

10. Identifies the number of acres to be filled and the total number of acres to be permitted, including buffer zone acreage (Note: If the site is to be developed in accordance with a phased development plan, each parcel must be separately addressed. If minimum closure areas are to be utilized such proposal must be described here and delineated in the closure plans)

Table 3 provides a summary of the areas to be filled and permitted. The Phases of work and major areas of the site are illustrated on Figure 1 and on Drawing No. 10W427-3 (Site Development Plan).

Table 3
Areas to be Filled and Permitted

Description	Area to Limit of Waste	Area to Limit of Disturbance
Phase I (including Stormwater Pond)	51.24	83.36
Phase I and II (including Stormwater Pond)	92.7	153.74

3.5 Waste Handling and Covering (ref. 1200-1-7-.04 (9) (c) 11)

Regulatory requirement:

11. Describes the waste handling and covering program, to include but not necessarily be limited to, descriptions of:

(i) Unloading, spreading, and compacting operations;
(ii) The frequencies and depths of initial, intermediate, and final cover; and
(iii) The cover material(s) to be utilized, including the estimated volumes to be needed (show initial, intermediate, and final earthwork calculations) and their sources and availability.

3.5.1 Waste Handling Operations

Phase I will be ready to receive waste following completion of the construction activities illustrated on Drawing No. 10W427-4 (Phase I – Initial Grading Plan and Soil Dikes) and Drawing No. 10W427-5 (Phase I – Top of Geologic Buffer). At this point, the disposal area will be bounded around the perimeter with soil dikes; and a geologic buffer consisting of a 3 ft. thick layer of compacted clay having a hydraulic conductivity of not greater than 1×10^{-7} cm/sec. The central internal drainage corridor will also be in place consisting of a 150 ft. wide blanket drain running along the axis of the disposal facility. The central drainage corridor will provide internal drainage to lower portions of the disposal area during operation of the facility and throughout the post-closure period. Drainage collected by the central drainage corridor will be discharged by gravity to the underdrain lift station illustrated on Drawing No. 10W427-24. Further details of the design and operation of the central drainage corridor are provided in Appendix B.

After completion of initial construction activities to prepare the Phase I area, gypsum will be sluiced to the upper (northern) end of the Phase I wet pond. The discharge point may be moved periodically to facilitate distribution of the gypsum materials. The wet pond will be decanted at the lower end using a pond decant structure (see Drawing No. 10W427-19) located adjacent to the stormwater pond, with decant water being discharged into the stormwater pond. Temporary diversion berms may be required to promote settling of the coarser gypsum particles. The number and location of these berms (if used) will be field determined based on operational needs.

The outer dikes will be raised progressively using the upstream method of construction, commencing at the downgradient end (west end) of the Phase I area. The dikes will be raised using settled gypsum that will be excavated from the pond using a long-reach backhoe, drag-line or other conventional earthmoving equipment. The stages of construction are illustrated on Drawing No. 10W427-6 (Phase I Stage 1A) and Drawing No. 10W427-7 (Phase I Stage 1B). Operational details are also illustrated on Drawing No. 10W427-16 and 10W427-17 (Operational Details). Depending on the rate of filling and other operational considerations, TVA may transition to a Rim Ditch operation to facilitate raising of the outer dikes. Operational details for a Rim Ditch operation are illustrated on Drawing No. 10W427-17.

Once the disposal operation has transitioned to a Rim Ditch operation, gypsum will be sluiced to a Rim Ditch located around the interior of the perimeter of the stack rather than directly to the wet pond. The Rim Ditch will discharge to the central pond, with coarser gypsum particles being deposited in the Rim Ditch. As sufficient materials are deposited, the outer dikes will be raised in elevation using the upstream method of construction. Decant water will continue to be discharged from the central pond to the stormwater pond. Stormwater and decant water collected in the stormwater pond will be pumped to TVA's existing NPDES permitted discharge located at the plant discharge channel.

Settled gypsum in the interior of the disposal facility will consolidate as a result of the decanting operations and drainage of free liquids through the perimeter drains and central drainage corridor. Coarse gypsum materials used for the construction of the outer dikes of the disposal facility will be spread in uniform layers and compacted.

Internal drainage features and surface water conveyance ditches will be constructed concurrently as the outer dikes are raised in elevation. Perimeter drains will be installed each time the dike is raised by approximately 10 ft. in elevation. Details are indicated on Drawing Nos. 10W427-18 and -19 (Drainage System Details) and Drawing Nos. 10W427-21 through -23 (Surface Water Management system Details).

An intermediate soil cover will be constructed progressively over the outer dikes as they are raised in elevation. The intermediate soil cover consists of one foot thickness of soil capable of sustaining vegetation. Intermediate cover soils for Phase I will be obtained from either the footprint of Phase II or from the designated borrow area.

Depending on operational needs, TVA may elect to expand the disposal area by implementing Phase II. The decision to implement Phase II will be made based on operational needs and the success of gypsum marketing activities. Prior to placement of waste in Phase II, construction activities illustrated on Drawing Nos. 10W427-8 (Initial Grading Plan and Soil Dikes) and Drawing No. 10W427-9 (Phase II – Top of Geologic Buffer) will be implemented. Waste placement activities in Phase II will be essentially similar to Phase I operations, i.e., the area will initially be operated as a wet pond; outer dikes will be raised in elevation using wet-cast gypsum; and operations may transition to a Rim Ditch operation once sufficient pond capacity has been developed. If TVA elects to expand into Phase II early in the life of the facility, it will be possible to operate Phase I and II as a single cell. However, if Phase II lags Phase I, operations within Phase I may be suspended temporarily until Phase II reaches a similar elevation to Phase I.

3.5.2 Daily and Intermediate Cover

No daily or intermediate cover (other than intermediate cover soil placed on the outer dikes) will be required for this facility. Since gypsum is inert, physically stable, does not biodegrade, and does not attract animals, vector control is not needed. Intermediate soil cover and vegetation will be established progressively on the outer sideslopes as the disposal facility is developed. Water spraying or other dust suppression techniques will be used as needed to control fugitive dust in periods of dry weather.

Due to the physical properties of gypsum and the nature of the proposed operations, TVA requests a waiver to the typical initial and intermediate cover requirements of Rule 1200-1-7-.04 (6) (b) since this requirement typically applies to municipal solid waste facilities where vector control is required.

3.5.3 Final cover

Final closure of the CCB disposal facility will be undertaken as described in the Closure Plan for this facility. Drawing Nos. 10W427-11 and 10W427-12 depict the final closure contours (including the thickness of the final cover). Final cover grades shown on Drawing No. 10W427-12 will be used in the event that TVA elects to use a dry stacking process above elevation 900 ft. msl. If TVA elects to close the facility upon completion of wet stacking operations, the grades shown on Drawing No. 10W427-11 will be the final cover grades.

The final cover will be constructed once disposal activities have been completed. Drawing No. 10W427-20 (Final Cover System Details) depicts details of two alternative cover systems. Soils for the construction of the low permeability soil layer of the final cover system will be obtained from the designated on-site borrow area. Soil balance estimates indicate that sufficient materials will be available from on-site sources. The vegetative soil layer will also be constructed using locally available soils from the KIF reservation, or from off-reservation sources provided the soil meets the requirements contained on the drawings and in the specifications. Following placement of the vegetative soil layer, the soil will be prepared and seeded using appropriate methods outlined in the specifications. Additional provisions for quality assurance and quality control are also contained in the Material Specifications and Quality Assurance and Quality Control (QA/QC) plan for this facility included as Appendix F of this permit application.

The design of the final cover system meets or exceeds the requirements contained in TDEC Policy Memorandum dated September 7, 2001 item 4 for coal ash facilities (see Appendix G).

3.6 Operating Equipment (ref. 1200-1-7-.04 (9) (c) 12)

Regulatory requirement

12. Describes the operating equipment to be utilized (including back-up equipment), and their source and availability

TVA will utilize equipment and resources of its Heavy Equipment Division (HED) for the construction and operation of the CCB disposal facility. It is likely that the following pieces of equipment will be used at this facility:

- Long-reach track-hoes or draglines (hydraulic excavators);
- Bulldozers;
- Compactors;
- Scrapers;
- Water pumps;
- Solids handling pumps;
- Water trucks; and

- Other conventional earthmoving equipment.

TVA can provide additional equipment within 24 hours for construction or disposal operations in the event of a breakdown.

3.7 Control and collection of Litter (ref. 1200-1-7-.04 (9) (c) 13)

Regulatory requirement

13. Describes the structures and procedures to be used in controlling and collecting litter

Litter control is not applicable to this facility. During normal operations, gypsum will be slurried to the disposal facility as previously described.

3.8 Stormwater Run-on and Run-off Control (ref. 1200-1-7-.04 (9) (c) 14)

Regulatory requirement

14. Describes how run-on and run-off collection and holding and erosion control facilities will be managed, including the disposition of collected waters and residues and a comparison of before and after flows in drainageways leaving the site

Also Rule 1200-1-7-.04 (2) (i) Run-on, Run-off, and Erosion Control

1. The operator must design, construct, and maintain a run-on control system capable of plow onto the active portion of the facility for all flow up to and including peak discharge from a 24-hour, 25-year storm.

Soil starter dikes will be used to form the initial footprint of both phases of construction and effectively isolate the waste disposal areas from stormwater run-on. Run-on diversion ditches and associated culverts are provided to intercept and divert stormwater from upgradient slopes along the north side of Phase I and Phase II. The locations of drainage features are shown on Drawing Nos. 10W427-4 (Phase I Initial Grading Plan and Soil Dikes) and 10W427-8 (Phase II Initial Grading Plan and Soil Dikes). Run-on conveyance structures have been designed to handle the peak discharge from a 24-hour, 25-year storm event. Supporting calculations are presented in Appendix B.

2. *The operator must design, construct, and maintain a run-off management system to collect and control at least the peak flow volume resulting from a 24-hour, 25-year storm.*

The run-off management system for the site includes stormwater drainage control structures and features designed to minimize erosion, minimize the conveyance of sediment laden stormwater, and minimize the potential for water pollution. The outer slopes of the CCB disposal facility have been designed with terraces spaced every 90 ft. of slope length (30 ft. vertical spacing) that will be constructed progressively as the elevation of the disposal facility is raised. A network of conveyance channels and downchutes will convey surface water run-off by gravity to a single stormwater pond, located at the west of the facility. The stormwater pond has been designed to collect and control the peak flow volume resulting from a 24-hour, 25-year storm. A stormwater lift station is provided to convey stormwater from the stormwater pond to KIF's plant discharge channel where it will be discharged under the plants existing NPDES permit. The surface water management system is depicted on Drawing No. 10W427-13 (Surface Water Management Plan), and the lift station is depicted on Drawing No. 10W427-25 (Stormwater Lift Station). Calculations supporting the design of the stormwater management systems are presented in Appendix B.

3. *Holding facilities (e.g., sediment basins) associated with run-on and run-off control systems must be designed to detain at least the water volume resulting from a 24-hour, 25-year storm and to divert through emergency spillways at least the peak flow resulting from a 24-hour, 100-year storm.*

The stormwater pond will accommodate a flow volume greater than that resulting from a 24-hour, 25-year storm event. The emergency overflow for the stormwater pond has been sized to convey at least the peak flow from a 24-hour, 100-year storm event without overtopping of the stormwater pond. Two alternative details of the emergency overflow are presented on Drawing No. 10W427-23 (Surface Water Management Details III). Calculations supporting the design of the holding facility and emergency overflow are presented in Appendix B.

4. *Collection and holding facilities associated with run-on and run-off control systems must be emptied or otherwise managed expeditiously after storms to maintain design capacity of the system*

Three vertical turbine pumps will be installed to remove water from the stormwater pond during and after a storm event. The pumps have been sized such that the volume of water resulting from a 24-hour, 10-year storm event can be removed within a 24-hour period. The stormwater lift station is depicted on Drawing No. 10W427-25 (Stormwater Lift Station). Supporting calculations are presented in Appendix B.

5. *Run-on and run-off must be managed separately from leachate unless otherwise approved by the Commissioner.*

As described above, stormwater run-on will be diverted around the footprint of the disposal facility prior to discharge to the river. 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.

Both consolidation water and decant water will have been in contact with gypsum due to the nature of the anticipated disposal operations. Contact water is expected to contain trace levels of inorganic constituents and exhibit a pH value in the range 5.5 to 7.5. However, the anticipated levels are not considered problematic and should be within allowable discharge limits.

Due to the nature of the disposal operations, TVA requests that TDEC issue a waiver of the requirement to manage run-off separately from leachate.

6. *The operator must take other erosion control measures (e.g., temporary mulching or seeding, silt barriers) as necessary to control erosion at the site.*

Prior to any grubbing or land disturbance activities, silt fences (Filtrex ® SiltSoxx, or equivalent), cut-off trenches, and other erosion control measures will be implemented. Other erosion control measures may include temporary sedimentation ponds, surface water ditches, and establishment of temporary and permanent vegetation on exposed soil slopes. If the length of exposed area exceeds 150 ft., a series of barriers at no more than 100 ft. spacing may be required. Erosion control measures will meet or exceed those prescribed within the Tennessee Erosion and Sediment Control Handbook.

3.9 Leachate Collection and Management (ref. 1200-1-7-.04 (9) (c) 15)

Regulatory requirement

15. *Describes how leachate collection and holding facilities will be managed, including the disposition of collected leachate*

A mantle of predominantly residual soil of relatively low permeability is present above bedrock at the location of the proposed CCB disposal facility. The soil thickness is variable, but ranges from 8.5 to 120 ft. averaging 40.5 ft. based on available data. The residuum primarily consists of clay and silt with variable chert gravel content. The base of the disposal facility will consist of a geologic buffer constructed of a three-foot thick layer of re-compacted soil having a hydraulic permeability of not more than 1×10^{-7} cm/sec. A central drainage corridor consisting of a 150 ft. wide drainage blanket running along the axis of the facility will be constructed above the geologic buffer to collect and remove free liquids from the base of the facility. The floor of the disposal area will be graded toward the central drainage corridor to promote removal of free liquids. The drainage corridor will operate under gravity flow and will convey collected liquids to an underdrain lift station, depicted on Drawing No. 10W427-24 (Underdrain Lift Station). Calculations were performed to demonstrate that the drainage corridor would maintain gravity flow conditions without grade reversal under anticipated post-settlement conditions. These calculations are presented in Appendix B. Water collected in the underdrain lift station will be pumped to the stormwater management pond and subsequently discharged at the KIF discharge channel under an existing NPDES permit as described in Section 3.8.

TDEC regulations require that the leachate collection system is designed, constructed, operated, and maintained such that the leachate depth over the liner does not exceed one foot as calculated referencing the infiltration volume of the 25-year, 24-hour storm through the intermediate cover. Since this requirement is intended for solid waste facilities and does not contemplate the operation of wet disposal (sluice) operation, TVA requests a waiver of this requirement for this facility.

In support of this request, TVA has performed the following analyses (presented in Appendix B):

- SEEP/W analyses have been performed to illustrate the effectiveness of the central drainage corridor in terms of reducing water levels in the stack during and after of disposal operations. The analyses indicate that the rate at which water levels within the stack will be lowered will be considerably enhanced through the use of the central drainage corridor (when compared to no internal drainage).

- Slope stability analyses have been performed to demonstrate that the stack will attain acceptable factors of safety with regard to slope stability under anticipated short-term and long-term conditions. Stability analyses evaluated both static stability and seismic stability.

TVA representatives met with Mr. Rick Brown of TDEC on March 7, 2006 to discuss this issue. TVA is requesting this waiver consistent with these discussions.

3.10 Dust Control (ref. 1200-1-7-.04 (9) (c) 16)

Regulatory requirement

16. Describes the dust control measures to be taken and when they would be implemented

During wet stacking operations a significant portion of the facility footprint will consist of a wet pond, minimizing the need for dust suppression. Dust control measures will consist of water spraying on access roads and exposed gypsum surfaces and will be implemented on an as needed basis during periods of dry weather. Dust and erosion control for the outer sideslopes will be addressed by the installation of the intermediate cover described in Section 2.5.2.

3.11 Fire Safety (ref. 1200-1-7-.04 (9) (c) 17)

Regulatory requirement

17. Describes the fire safety precautions and procedures to be taken, the types and availability of on-site fire suppression equipment, and/or the arrangements made with the local fire protection agency.

Gypsum material is an inert material derived from limestone, is not combustible, and therefore poses no threat as a potential fire hazard. However, properly maintained fire suppression equipment will be provided for disposal equipment and vehicles. This will consist of fire extinguishers of the appropriate size and type.

3.12 Personnel facilities and Services (ref. 1200-1-7-.04 (9) (c) 18)

Regulatory requirement

18. Describes the facilities and services available to facility personnel, including shelter, drinking water, handwashing and toilet facilities, and communications equipment

Facilities and services that are available and readily accessible to personnel at the KIF plant site, include the following:

- A utility building is on-site for equipment maintenance and yard operations personnel that is accessible by any facility personnel and has adequate screening, heating facilities, and lighting.
- Safe drinking water.
- Sanitary hand-washing facilities.
- Toilet facilities.
- A two-way radio and/or telephone for communications.
- A first aid kit.

3.13 Quality Assurance Plan (ref. 1200-1-7-.04 (9) (c) 19)

Regulatory requirement

19. Describes in a construction quality assurance plan:

(i) How each new "as built" solid waste landfill unit(s) and/or lateral expansion liner(s) and cover system(s) will be inspected and/or tested by a registered engineer as required at rule 1200-1-7-.04(1)(c) during construction or installation for uniformity, damage, and imperfections, and

(ii) How each constructed section of the liner system or final cover system will be certified by a registered engineer.

Procedures for the construction of components of the proposed disposal facility are presented in QA/QC Plan included as Appendix F of this permit application. This QA/QC plan also outlines procedures to verify that proper materials, construction techniques, and installation procedures are used by the constructor and the design intent is met.

3.14 Control of Gas Migration (ref. 1200-1-7-.04 (9) (c) 20)

Regulatory requirement

20. Describes how the migration of explosive gases will be controlled and monitored

Since gypsum is an inert, non-combustible material and does not decay biologically, no gas migration controls are needed. TVA requests a waiver to this requirement consistent with DSWM Policy dated September 7, 2001, item 3 (presented as Appendix G).

3.15 Groundwater Monitoring Program (ref. 1200-1-7-.04 (9) (c) 21)

Regulatory requirement:

> *21. Describes the planned ground water monitoring program, to include but not necessarily be limited to, descriptions of:*
>
> *(i) The number and location of wells or other monitoring points;*
> *(ii) Monitoring well construction;*
> *(iii) The parameters to be monitored for and the frequency they will be checked.*

The Groundwater Monitoring Plan is included as Appendix D of this permit application.

3.16 Location in Floodplains (ref. 1200-1-7-.04 (9) (c) 22)

Regulatory requirement:

> *22. Include an engineering statement of the site flood frequency exposure and describes flood protection measures to be taken.*

Filling operations will be required within the 100-year floodplain. TVA will obtain the appropriate permits required for this work (e.g., Aquatic Resource Alteration Permit (ARAP) under Section 404 of the Clean Water Act) and will provide mitigation measures for impacts to wetland areas. The 100-year flood elevation taken from TVA data is 747.6 ft. msl. Once site preparation activities have been completed, waste limits will be above the 100-year flood elevation. The lower elevations of the soil starter dike in localized areas will be slightly below the 100-year flood elevation. However, these are minor and the impact of a flood event on the facility would be negligible.

3.17 Other Environmental Impacts (ref. 1200-1-7-.04 (9) (c) 23)

Regulatory requirement:

> *23. Describes the impact the facility will have on endangered or threatened species of plants, fish, or wildlife or their habitat.*

As part of the planning process for the FGD project, TVA conducted an Environmental Assessment (TVA, 2006). The EA concluded that the FGD project (which includes the CCB disposal facility) will have no significant impacts on animals, plants, or aquatic life. In addition, no state or federally protected species were identified during the field investigations of the project area. These field investigations were conducted in 2005.

3.18 Random Inspection Program

Regulatory requirement:

24. Describes the random inspection program required under rule 1200-1-7-.04-(2)(s)

A random inspection program for this facility is not required. This disposal facility will only dispose of gypsum from TVA facilities. In addition, minor quantities of bottom ash and fly ash (for use in construction) may be co-disposed. Therefore, a random inspection program for unauthorized wastes is not required. See DSWM Policy, September 7, 2001 Item 5 (Appendix G).

4 CLOSURE/POST-CLOSURE PLAN

A Closure/Post-Closure (C/PC) Plan for this facility is presented as Appendix E. The C/PC plan was prepared to meet the requirements of Rule 1200-1-7-.03 (2).

5. REFERENCES

Julian, Hank E. and Boggs, Mark J 2005, *Kingston Fossil Plant Peninsula Site – Hydrogeologic Evaluation of Coal-Combustion Byproduct Disposal Facility,* October 2005

TVA, 2005, Environmental Assessment – *Installation of Flue Gas Desulfurization System at Kingston Fossil Plant, Roane County, Tennessee,* February 2006

Law, 1995, *Use of Coal Combustion Byproducts as Engineered Fills,* November 10, 1995