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3052 Beaumont Centre Circle, Lexington KY 40513

November 3, 2022  
Revision 1

Tennessee Valley Authority  
1101 Market Street  
Chattanooga, Tennessee 37402

**RE: Closure and Post-Closure Plan  
Ash Pond 2 and Consolidated Waste Dry Stack (CCR Unit)  
EPA Final Coal Combustion Residuals (CCR) Rule  
TVA Shawnee Fossil Plant  
Paducah, McCracken County, Kentucky**

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## **1.0 PURPOSE**

As described in 40 CFR § 257.102 and § 257.104, an owner or operator of a CCR unit is required to demonstrate that certain measures will be adopted to close and maintain the facility. This letter documents Stantec's certification that the Closure and Post-Closure Plan for the TVA Shawnee Fossil Plant's (SHF) Ash Pond 2 and Consolidated Waste Dry Stack (CCR unit) complies with requirements in the EPA Final CCR Rule 40 CFR § 257.102(b) and § 257.104(d).

## **2.0 SUMMARY OF FINDINGS**

The attached plan documents the closure and post-closure measures that meet the requirements specified in 40 CFR § 257.102(b) and § 257.104(d).

## **3.0 QUALIFIED PROFESSIONAL ENGINEER CERTIFICATION**

I, Don W. Fuller II, being a Professional Engineer in good standing in the Commonwealth of Kentucky, do hereby certify, to the best of my knowledge, information, and belief:

1. that the information contained in this certification is prepared in accordance with the accepted practice of engineering;
2. that the information contained herein is accurate as of the date of the attached plan and the date of my signature below; and
3. that the Closure and Post-Closure Plan for the TVA Shawnee Fossil Plant's CCR Unit meets the requirements specified in 40 CFR § 257.102(b) and § 257.104(d).



November 3, 2022  
Page 2 of 2

**RE: Closure and Post-Closure Plan  
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EPA Final Coal Combustion Residuals (CCR) Rule  
TVA Shawnee Fossil Plant  
Paducah, McCracken County, Kentucky**



SIGNATURE



DATE 11/3/2022

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ATTACHMENTS: Closure and Post-Closure Plan



## **Closure and Post-Closure Plan**

Ash Pond 2 and Consolidated Waste  
Dry Stack Final Closure Project

TVA Shawnee Fossil Plant  
Paducah, McCracken County, Kentucky

March 26, 2021

Revision 1

Prepared for:

Tennessee Valley Authority  
Chattanooga, Tennessee



Prepared by:

Stantec Consulting Services  
Louisville, Kentucky

## CLOSURE AND POST-CLOSURE PLAN

<b>REVISION DATE</b>	<b>DESCRIPTION OF REVISION</b>
October 12, 2016	Revision 0 – Initial Submittal
March 26, 2021	Revision 1 – Revised Closure Activities

## Table of Contents

<b>1.0</b>	<b>INTRODUCTION</b> .....	<b>1</b>
<b>2.0</b>	<b>WRITTEN CLOSURE PLAN – 40 CFR 257.102(B)(1)</b> .....	<b>1</b>
2.1	CLOSURE ACTIVITIES - §257.102(B)(1)(I).....	2
2.2	CLOSURE TYPE/CLOSURE IN PLACE – §257.102(B)(1)(III).....	3
2.3	MAXIMUM CCR INVENTORY - §257.102(B)(1)(IV) .....	3
2.4	LARGEST AREA REQUIRING FINAL COVER - §257.102(B)(1)(V) .....	3
2.5	SCHEDULE OF CLOSURE ACTIVITIES - §257.102(B)(1)(VI) .....	3
2.6	ESTIMATED YEAR OF CLOSURE COMPLETION - §257.102(B)(1)(VI) .....	4
2.7	REQUEST FOR TIME EXTENSION.....	4
2.8	AMENDMENT OF CLOSURE PLAN - §257.102(B)(3) .....	4
<b>3.0</b>	<b>CCR CLOSURE IN-PLACE PERFORMANCE STANDARDS – 40 CFR 257.102(D)(1)</b> .....	<b>5</b>
3.1	CONTROL OF INFILTRATION AND RELEASES - §257.102(D)(1)(I) .....	5
3.2	PREVENTION OF FUTURE IMPOUNDMENT OF WATER, SEDIMENT, OR SLURRY - §257.102(D)(1)(II) .....	6
3.3	SLOPE STABILITY MEASURES - §257.102(D)(1)(III) .....	6
3.4	CCR UNIT MAINTENANCE - §257.102(D)(1)(IV).....	7
3.5	COMPLETION OF CLOSURE - §257.102(D)(1)(V) .....	7
3.6	DRAINAGE AND STABILIZATION OF SURFACE IMPOUNDMENTS - §257.102(D)(2) .....	7
3.7	FINAL COVER SYSTEM DESIGN (OR ALTERNATIVE) - §257.102(D)(3).....	7
3.7.1	Final Cover System Design Standards - §257.102(d)(3)(i) .....	8
3.7.2	Alternative Final Cover System Design - §257.102(d)(3)(ii) .....	9
3.7.3	Methods and Procedures for Installation of Final Cover - §257.102(b)(1)(iii).....	10
3.7.4	Professional Engineer Certification - §257.102(d)(3)(iii) .....	11
<b>4.0</b>	<b>WRITTEN POST-CLOSURE PLAN – 40 CFR 257.104(D)(1)</b> .....	<b>11</b>
4.1	MONITORING AND MAINTENANCE ACTIVITIES - §257.104(D)(1)(I) .....	11
4.1.1	Final Cover System - §257.104(b)(1) .....	12
4.1.2	Leachate Collection and Removal System - §257.104(b)(2).....	13
4.1.3	Groundwater Monitoring System - §257.104(b)(3).....	13
4.2	CONTACT INFORMATION - §257.104(D)(1)(II) .....	13
4.3	PLANNED USES - §257.104(D)(1)(III) .....	13
4.4	AMENDMENT OF POST CLOSURE PLAN - §257.104(D)(3) .....	14

## LIST OF APPENDICES

Appendix A Closure and Post-Closure Cost Estimate

## CLOSURE AND POST-CLOSURE PLAN

### Introduction

## 1.0 INTRODUCTION

This EPA Final Coal Combustion Residuals (CCR) Rule closure and post-closure plan contains the current plan and is subject to change. This document describes the CCR closure and post-closure activities at the TVA Shawnee Fossil Plant to ensure that Ash Pond 2 and the Consolidated Waste Dry Stack (also referred to as the Existing CCR Landfill and the Special Waste Landfill)<sup>1</sup> will be closed and maintained in accordance with the CCR closure and post-closure requirements of 40 CFR § 257.102 and § 257.104, respectively. These units are immediately adjacent to each other, exist within the area where CCR has been historically managed and stored, and are monitored by a certified multiunit groundwater monitoring well system. Accordingly, this area will be closed as one CCR unit in accordance with this closure and post-closure plan.

## 2.0 WRITTEN CLOSURE PLAN – 40 CFR 257.102(b)(1)

**40 CFR 257.102(b).** *Written Closure Plan – (1) Content of the Plan. The owner or operator of a CCR unit must prepare a written closure plan that describes the steps necessary to close the CCR unit at any point during the active life of the CCR unit consistent with recognized and generally accepted good engineering practices. The written closure plan must include, at a minimum, the information specified in paragraphs (b)(1)(i) through (vi) of this section.*

- (i) A narrative description of how the CCR unit will be closed in accordance with this section.*
- (ii) If closure of the CCR unit will be accomplished through the removal of CCR from the CCR unit, a description of the procedures to remove the CCR and decontaminate the CCR unit in accordance with paragraph (c) of this section.*
- (iii) If closure of the CCR unit will be accomplished by leaving CCR in place, a description of the final cover system, designed in accordance with paragraph (d) of this section, and the methods and procedures to be used to install the final cover. The closure plan must also discuss how the final cover system will achieve the performance standards specified in paragraph (d) of this section.*
- (iv) An estimate of the maximum inventory of CCR ever on-site over the active life of the CCR unit.*
- (v) An estimate of the largest area of the CCR unit ever requiring a final cover as required by paragraph (d) of this section at any time during the CCR unit's active life.*
- (vi) A schedule for completing all activities necessary to satisfy the closure criteria in this section, including an estimate of the year in which all closure activities for the CRR unit will be completed. The*

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<sup>1</sup> Historically, the Kentucky Division of Waste Management (KDWM) has permitted and regulated an area known as the Inactive Dredge Cell as a non-CCR unit under Chapter 45 of its solid waste regulations. For purposes of this closure plan under the federal CCR Rule, the Inactive Dredge Cell is included within the boundaries of the Consolidated Waste Dry Stack.



## CLOSURE AND POST-CLOSURE PLAN

Written Closure Plan – 40 CFR 257.102(b)(1)

*schedule should provide sufficient information to describe the sequential steps that will be taken to close the CCR unit, including identification of major milestones such as coordinating and obtaining necessary approvals and permits from other agencies, the dewatering and stabilization phase of CCR surface impoundment closure, or installation of the final cover system, and the estimated timeframes to complete each step or phase of CCR unit closure..*

### 2.1 CLOSURE ACTIVITIES - §257.102(b)(1)(i)

The Ash Pond 2 and Consolidated Waste Dry Stack will be closed in place as one CCR unit. The closure construction will be completed in accordance with the Construction Quality Management Plan.

Ash Pond 2 will undergo dewatering and CCR stabilization to allow for equipment access to perform grading. Following stabilization in Ash Pond 2, CCR will be moved from a portion of the Consolidated Waste Dry Stack to contour and create closure grades in Ash Pond 2 and the portion of the Consolidated Waste Dry Stack regulated by KDWM as the Inactive Dredge Cell. The Consolidated Waste Dry Stack slopes will be flattened to 4H:1V and the top of the landfill will be lowered to obtain the required grades for the single closure. Compaction Quality Verification (CQV) mapping performed using smooth drum vibratory rollers enable with XMV roller technology may potentially be used where fill is being placed over CCR materials. Prior to use, TVA will coordinate with KDWM regarding equipment and technology to be used.

Once grading is complete, in-place closure will be performed. This work includes installation of a final cap system encompassing the entire area. The final cap system area is approximately 305 acres in size and will consist of a geosynthetics–engineered turf matrix, as described in Section 3.7.2.

Stormwater drainage improvements will be implemented during final closure. Prior to installation of the cap system, minor grading of existing ditches and construction of new ditches will be completed to improve drainage of the closed facility. Following installation of the final cap system, new stormwater outfalls will be installed to convey stormwater to Little Bayou Creek or the Ohio River via the plant discharge channel.

Closure activities will also incorporate improvements to the original Ash Pond 1 dike along the southwest side of the Consolidated Waste Dry Stack. This work will include flattening the steeper portions of the dike to 2.5H:1V and relocating the access road where dike flattening has occurred. Installation of the final cap system is planned over the existing and regraded Ash Pond 1 dike slopes.

Installation of a sheet pile erosion protection wall at the toe of the Ash Pond 1 dike throughout the length of the dike will be completed in the area prior to closure construction. The sheet pile wall is planned as a long-term preventative maintenance project to protect the dike from current and future erosion along the Little Bayou Creek bank. While not a requirement under the CCR Rule for a CCR landfill, stability analyses performed for static and seismic conditions of the Consolidated Waste Dry Stack indicate results above the target factors of safety based on existing conditions. The sheet pile erosion protection wall installation is not expected to impact the stability of the Consolidated Waste Dry Stack since the critical failure surfaces for the existing conditions of the landfill daylight before the Ash Pond 1 dike and would be contained within the unit. Additionally, the sheet pile erosion protection wall is not anticipated to affect the groundwater



## **CLOSURE AND POST-CLOSURE PLAN**

Written Closure Plan – 40 CFR 257.102(b)(1)

monitoring system in the area. Following completion of the sheet pile erosion protection wall installation, a Construction Progress Report will be prepared and submitted to document the as-built conditions.

### **2.2 CLOSURE TYPE/CLOSURE IN PLACE – §257.102(b)(1)(iii)**

The Consolidated Waste Dry Stack will be regraded and CCR will be moved within Ash Pond 2 and a portion of the Consolidated Waste Dry Stack, regulated by KDWM as the Inactive Dredge Cell, for contouring and to create final closure grades to support the final cover system. A final cover system will be placed over the remaining CCR creating one closed CCR unit. The closure will be accomplished by leaving the CCR in place, thus requiring a final cover system and closure design elements enabling the closed unit to meet the CCR closure in-place performance standards outlined in 40 CFR 257.102(d)(1) and described in Section 3.0.

### **2.3 MAXIMUM CCR INVENTORY - §257.102(b)(1)(iv)**

Based on available records, the estimated maximum inventory of CCR ever on-site is consistent with the current volumes and is approximately 6.0 million cubic yards at the Ash Pond 2 and is approximately 21.5 million cubic yards at the Consolidated Waste Dry Stack.

### **2.4 LARGEST AREA REQUIRING FINAL COVER - §257.102(b)(1)(v)**

Based on available records, the estimated largest area requiring a final cover during the active life is consistent with the current disposal area and is approximately 305 acres.

### **2.5 SCHEDULE OF CLOSURE ACTIVITIES - §257.102(b)(1)(vi)**

The following closure schedule for completing the activities stipulated by 40 CFR 257.102 and the related completion timeframes are subject to change based on plant operations, KDWM regulatory permitting approvals, EPA Final CCR Rule requirements, and other related factors. During the closure process, opportunities to improve upon the schedule will be considered. Table 1 provides the estimated schedule of closure activities.





## CLOSURE AND POST-CLOSURE PLAN

Written Closure Plan – 40 CFR 257.102(b)(1)

**Table 1 Estimated Schedule of Closure Activities**

	<b>Closure Activity</b>	<b>Start Date (day)</b>
1.	Coordinating with and obtaining necessary approvals and permits from regulatory agencies; provide notice of intent to close	1
2.	Dewatering, stabilization, and regrading of surface impoundment(s)	61
3.	Installation of final cover	1160
4.	Completion of closure	1410
5.	Completion of post-closure care period	Add 30 years to completion of closure

### **2.6 ESTIMATED YEAR OF CLOSURE COMPLETION - §257.102(b)(1)(vi)**

The estimated year for completion of closure activities is 2025. The estimated year of closure is subject to change based on plant operations, KDWM regulatory permitting approvals, EPA Final CCR Rule requirements, and other factors.

### **2.7 REQUEST FOR TIME EXTENSION**

If it is estimated that the time required to complete closure will exceed the regulatory timeframes allowed under 40 CFR § 257.102(f), site-specific information, factors and considerations will be provided to support any time extensions.

### **2.8 AMENDMENT OF CLOSURE PLAN - §257.102(b)(3)**

The owner or operator may amend the closure plan at any time, and must do so at least 60 days prior to any planned change in the operation of the CCR unit that would substantially affect the written closure plan in effect. The closure plan must also be amended no later than 60 days after unanticipated events necessitate a revision of the written closure plan (30 days after if the triggering event takes place after closure activities have commenced). The amended closure plan requires a new certification from a qualified professional engineer that it meets the requirements of 40 CFR 257.102.



## CLOSURE AND POST-CLOSURE PLAN

CCR Closure In-Place Performance Standards – 40 CFR 257.102(d)(1)

### 3.0 CCR CLOSURE IN-PLACE PERFORMANCE STANDARDS – 40 CFR 257.102(d)(1)

**40 CFR 257.102(d).** Closure performance standard when leaving CCR in place —

- (1) *The owner or operator of a CCR unit must ensure that, at a minimum, the CCR unit is closed in a manner that will:*
- (i) *Control, minimize or eliminate, to the maximum extent feasible, post-closure infiltration of liquids into the waste and releases of CCR, leachate, or contaminated run-off to the ground or surface waters or to the atmosphere;*
  - (ii) *Preclude the probability of future impoundment of water, sediment, or slurry;*
  - (iii) *Include measures that provide for major slope stability to prevent the sloughing or movement of the final cover system during the closure and post-closure care period;*
  - (iv) *Minimize the need for further maintenance of the CCR unit; and*
  - (v) *Be completed in the shortest amount of time consistent with recognized and generally accepted good engineering practices.*

#### 3.1 CONTROL OF INFILTRATION AND RELEASES - §257.102(d)(1)(i)

TVA will control, minimize, or eliminate, to the maximum extent possible, post-closure infiltration of liquids into the waste and releases of CCR, leachate, or contaminated run-off to the ground or surface waters or to the atmosphere, through the design of a site grading plan, construction of an engineered cap system, and the establishment of a stormwater management system in accordance with accepted engineering practices and the CCR regulations.

The cap system will be designed to control the infiltration of precipitation into the closed unit according to acceptable, permeability compliance limits. The cap system will also act to cover, control, and prevent the release of CCR material from the closed unit, into surface waters and the atmosphere. The designed grading plan and stormwater management system promotes positive drainage and controls infiltration into the CCR materials. The cap cover is designed to prevent the exposure of CCR material to the atmosphere.

Following installation of the cap system, new stormwater outfalls will be installed to convey stormwater to Little Bayou Creek or the Ohio River via the plant discharge channel. The perimeter ditches will be graded at 1 to 2 percent to promote drainage to each stormwater outfall. A total of 24 new outfalls are planned around the perimeter of the closed facility. Twenty-two of the new outfalls will be KPDES permitted outfalls, while the remaining two will be stormwater outfalls discharging to the Coal Yard Drainage Basin. All drainage structures have been designed to accommodate at least a 25-year, 24-hour storm event.



## CLOSURE AND POST-CLOSURE PLAN

CCR Closure In-Place Performance Standards – 40 CFR 257.102(d)(1)

To prevent “contact” water from leaving the site, new outfalls will not be made available for use until the drainage area for that outfall has the final cap completed.

Where pipes penetrate the geosynthetic cover system, the geosynthetics will be battened to concrete collars around the pipes to prevent “contact” water from entering the perimeter ditches and outfalls.

### **3.2 PREVENTION OF FUTURE IMPOUNDMENT OF WATER, SEDIMENT, OR SLURRY - §257.102(d)(1)(ii)**

TVA will control the future impoundment of water or sediment at the closed CCR unit through the design and construction of a site grading plan and an engineered cap system, and the establishment of a stormwater management system in accordance with accepted engineering practices. The designed grading plan and stormwater management system will promote positive surface drainage on the site to minimize the ponding of water.

During construction, magnetic extensometers within Ash Pond 2 will be monitored and correlations will be developed between actual settlement magnitude and time rate readings. Actual readings will be compared and correlated with settlement magnitudes and time rates established during design settlement analyses. The readings and evaluation will be used to establish criteria for determining when sufficient settlement has occurred to begin cap construction in a given area to reduce the potential for significant settlement and future impoundment of water on the cap system.

### **3.3 SLOPE STABILITY MEASURES - §257.102(d)(1)(iii)**

TVA has evaluated the static and seismic slope stability of the final cover system to assess the potential for sliding in the closure cap system and determine the minimum required interface strength for use in performance-based specifications. The analyses also accounted for a potential solar panel system to be installed on top of the cap system. Preconstruction testing of the cover materials will be conducted to verify that all materials meet the minimum interface strength requirements established by stability analyses. Maintenance of the cover system sand infill during the construction and post-construction periods will further aid in the prevention of erosion and sloughing.

TVA has performed an evaluation of the expected static and seismic performance of the Consolidated Waste Dry Stack and Ash Pond 2. The resulting factors of safety meet the requirements outlined in the CCR Rule. Seismic evaluation of existing CCR landfills is not required by the CCR Rule but was performed to document acceptable safety factors, using the CCR Rule guidance for existing CCR impoundments as the target value criteria. Stability analyses performed for Ash Pond 2 for static conditions, seismic conditions, and sudden drawdown conditions indicate factors of safety that meet the requirements outlined in the CCR Rule. The static evaluations of Ash Pond 2 are documented in the CCR Rule Demonstration *Safety Factor Assessment, Ash Pond 2, Shawnee Fossil Plant* by Stantec dated October 2016. The seismic evaluations for Ash Pond 2 are documented in the CCR Rule Demonstration *Seismic Impact Zone Demonstration, Ash Pond 2, Shawnee Fossil Plant* by Stantec dated October 2018. Additionally, sudden drawdown slope stability analyses for Ash Pond 2 are documented in the CCR Rule Demonstration *Initial Structural Stability Assessment, Ash Pond 2, Shawnee Fossil Plant* by Stantec dated October 2016.



## CLOSURE AND POST-CLOSURE PLAN

CCR Closure In-Place Performance Standards – 40 CFR 257.102(d)(1)

### 3.4 CCR UNIT MAINTENANCE - §257.102(d)(1)(iv)

TVA will mitigate against the need for further maintenance of the CCR unit through compliance with post-closure care activities, in addition to the preemptive project for the installation of a sheet pile erosion protection wall to prevent erosion of the toe of the dike along Little Bayou Creek. Regularly scheduled inspections to evaluate post-closure conditions and to verify preventive maintenance activities of the unit will reduce the need for additional maintenance. Post-closure monitoring and maintenance activities are addressed in Section 4.1.

### 3.5 COMPLETION OF CLOSURE - §257.102(d)(1)(v)

Closure will be completed in the shortest amount of time practical, consistent with recognized and generally accepted good engineering practices.

### 3.6 DRAINAGE AND STABILIZATION OF SURFACE IMPOUNDMENTS - §257.102(d)(2)

**40 CFR 257.102(d)(2).** *Drainage and stabilization of CCR surface impoundments.*

*The owner or operator of a CCR surface impoundment or any lateral expansion of a CCR surface impoundment must meet the requirements of paragraphs (d)(2)(i) and (ii) of this section prior to installing the final cover system required under paragraph (d)(3) of this section.*

(i) *Free liquids must be eliminated by removing liquid wastes or solidifying the remaining wastes and waste residues.*

(ii) *Remaining wastes must be stabilized sufficient to support the final cover system.*

The operational drawdown of Ash Pond 2 will be performed in accordance with the KPDES Permit and the Drawdown and Dewatering Plan prepared for the closure project. The plan provides guidance for facilitating the removal of the water within the surface impoundment and water quality testing activities to confirm the dewatering effluent meets current KPDES permit requirements. Following drawdown, the CCR material in Ash Pond 2 will be stabilized to allow for equipment access to perform grading and to support the final cover system. Settlement monitoring will be completed to support these activities.

### 3.7 FINAL COVER SYSTEM DESIGN (OR ALTERNATIVE) - §257.102(d)(3)

**40 CFR 257.102(d)(3).** *Final cover system. If a CCR unit is closed by leaving CCR in place, the owner or operator must install a final cover system that is designed to minimize infiltration and erosion, and at a minimum, meets the requirements of paragraph (d)(3)(i) of this section, or the requirements of the alternative final cover system specified in paragraph (d)(3)(ii) of this section.*



## CLOSURE AND POST-CLOSURE PLAN

### CCR Closure In-Place Performance Standards – 40 CFR 257.102(d)(1)

(i) *The final cover system must be designed and constructed to meet the criteria in paragraphs (d)(3)(i)(A) through (D) of this section. The design of the final cover system must be included in the written closure plan required by paragraph (b) of this section.*

- (A) *The permeability of the final cover system must be less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than  $1 \times 10^{-5}$  cm/sec, whichever is less.*
- (B) *The infiltration of liquids through the closed CCR unit must be minimized by the use of an infiltration layer that contains a minimum of 18 inches of earthen material.*
- (C) *The erosion of the final cover system must be minimized by the use of an erosion layer that contains a minimum of six inches of earthen material that is capable of sustaining native plant growth.*
- (D) *The disruption of the integrity of the final cover system must be minimized through a design that accommodates settling and subsidence.*

(ii) *The owner or operator may select an alternative final cover system design, provided the alternative final cover system is designed and constructed to meet the criteria in paragraphs (f)(3)(ii)(A) through (D) of this section. The design of the final cover system must be included in the written closure plan required by paragraph (b) of this section.*

- (A) *The design of the final cover system must include an infiltration layer that provides an equivalent reduction in infiltration as the infiltration layer specified in paragraphs (d)(3)(i)(A) and (B) of this section.*
- (B) *The design of the final cover system must include an erosion layer that provides equivalent protection from wind or water erosion as the erosion layer specified in paragraph (d)(3)(i)(C) of this section.*
- (C) *The disruption of the integrity of the final cover system must be minimized through a design that accommodates settling and subsidence.*

### 3.7.1 Final Cover System Design Standards - §257.102(d)(3)(i)

The final cover system must be designed to minimize infiltration and erosion, consisting of the following minimum elements:

- Cap Cover Soil: A minimum 18-inch infiltration layer of earthen materials with permeability less than or equal to the permeability of any natural subsoils present, or a permeability no greater than  $1 \times 10^{-5}$  cm/sec, whichever is less;
- Top Soil: A minimum 6-inch erosion layer that contains earthen material that is capable of sustaining native plant growth; and



## CLOSURE AND POST-CLOSURE PLAN

CCR Closure In-Place Performance Standards – 40 CFR 257.102(d)(1)

- Disruption of the integrity of the final cover system will be minimized through a design that accommodates settling or subsidence.

The final cover system for the closure of the CCR unit will consist of an alternative final cover system as described in Section 3.7.2.

### 3.7.2 Alternative Final Cover System Design - §257.102(d)(3)(ii)

An alternative final cover system design may be selected provided it achieves an equivalent standard as that stated in Section 3.7.1 for the following:

- An infiltration layer that achieves an equivalent reduction in infiltration as the infiltration layer specified in Section 3.7.1.
- An erosion layer that provides equivalent protection from wind or water erosion as the erosion layer specified in Section 3.7.1.
- The minimization of disruptions of the integrity of the final cover system through a design that accommodates settling and subsidence.

An alternative final cover system will be installed over the CCR unit and includes the following components (from bottom to top):

- Structured geomembrane
- Engineered turf (comprised of polyethylene fibers tufted through double layer of woven polypropylene geotextiles manufactured for high UV and heat resistance)
- Sand infill (1/2-inch minimum)

The geomembrane will extend to the Consolidated Waste Dry Stack permitted waste boundary, 10 feet beyond the outer edge of the perimeter dike in areas of the Ash Pond 2 that remain beyond the landfill boundary, and to the toe of the dike on the southwest side of the Consolidated Waste Dry Stack. The geomembrane will be placed directly on CCR material in active areas and on CCR material or remaining interim cover soil (once topsoil is removed) in the original landfill area to the south scheduled for slope regrading. The CCR materials will be placed and compacted prior to geomembrane deployment in a manner to minimize settling and subsidence that could disrupt the integrity of the final cover system. The engineered turf will be placed above the geomembrane. The geosynthetic materials will be installed and tested as required by the manufacturer. Sand infill will be placed to the minimum thickness recommended by the turf manufacturer (typically a ½-inch minimum thickness, not to exceed ¾-inch thick), and will be worked into the engineered turf as infill between the synthetic yarn blades.

Preliminary Hydrologic Evaluation of Landfill Performance (HELP) model analyses were performed to compare the percolation/leakage rate through the alternative final cover system and a CCR Rule-compliant final cover system. Based on the results of historic permeability testing, the average in-situ permeability for the native clays and silts is approximately  $6 \times 10^{-7}$  cm/sec. For purposes of evaluation, the proposed



## CLOSURE AND POST-CLOSURE PLAN

### CCR Closure In-Place Performance Standards – 40 CFR 257.102(d)(1)

alternative final cover system was compared to a CCR rule-compliant cap system consisting of 18 inches of low permeability  $6 \times 10^{-7}$  cm/sec cover soil and 6 inches of  $1 \times 10^{-5}$  cm/sec permeability vegetative cover soil.

For comparison, the cap systems were analyzed using typical soil/geomembrane properties to determine the percolation/leakage rate of water (in inches per year) through each system. For purposes of these analyses, a ClosureTurf cap system consisting of a 50-mil structured LLDPE geomembrane, high-density engineered turf, and ½-inch of sand infill was assumed to be installed as the final cover system. If a cap system with differing material properties is approved for installation, these analyses will be revised and this Closure Plan will be updated accordingly. Based on the results of these preliminary analyses for the flattest anticipated grade, the soil cap resulted in 3.1 inches per year and the engineered turf cap system resulted in 0.033 inches per year. By comparison, the results indicate the percolation/leakage rate through the engineered turf cap will be lower when compared to the soil cap system.

The alternative final cover system achieves an equivalent reduction in infiltration as the infiltration layer specified in Section 3.7.1, as it includes geomembrane with typical permeability values ranging from  $10^{-13}$  to  $10^{-14}$  cm/sec. The engineered turf and sand infill components of the alternative final cover system also satisfy the erosion protection requirements stated in Section 3.7.1. The CCR materials will be compacted in a manner to minimize settling and subsidence that could disrupt the integrity of the final cover system. Settlement monitoring will be completed to support these activities. The alternative final cover system is expected to result in a shortened construction schedule and to provide a better and more consistent moisture barrier when compared to a CCR Rule-compliant soil cover system.

TVA has obtained a written certification from a qualified professional engineer verifying that the design of the final cover system meets the requirements of the EPA Final CCR Rule.

### **3.7.3 Methods and Procedures for Installation of Final Cover - §257.102(b)(1)(iii)**

40 CFR 257.102(b)(1)(iii) requires a description of the methods and procedures used in the installation of the final cover. Section 3.1.1 describes the details regarding the construction procedures for cover installation.

The final cover system will be installed once CCR and soil is graded to the subgrade lines indicated on the construction plans. The CCR materials will be compacted in a manner to minimize settling and subsidence that could disrupt the integrity of the final cover system. Settlement monitoring will be completed to support these activities. As subgrade is reached in individual drainage areas, the final cover system installation will progress to minimize areas of CCR exposure. Cover system installation will be performed working from upstream to downstream to minimize the potential of “contact” water on the cover materials.

The geomembrane layer will be placed above the compacted CCR or soil subgrade layer. The engineered turf layer will be placed directly over the geomembrane. Sand infill will be installed above the engineered turf layer and worked into the turf between the synthetic yarn blades to ballast the material in place. The geosynthetic materials will be installed and tested as required by the manufacturer.



## CLOSURE AND POST-CLOSURE PLAN

Written Post-Closure Plan – 40 CFR 257.104(d)(1)

### 3.7.4 Professional Engineer Certification - §257.102(d)(3)(iii)

**40 CFR 257.102(d)(3)(iii).** *The owner or operator of the CCR unit must obtain a written certification from a qualified professional engineer that the design of the final cover system meets the requirements of this section.*

TVA has obtained a written certification from a qualified professional engineer verifying that the design of the final cover system meets the requirements of 40 CFR 257.102.

## 4.0 WRITTEN POST-CLOSURE PLAN – 40 CFR 257.104(d)(1)

**40 CFR 257.104(d).** *Written Post-Closure Plan – (1) Content of the Plan. The owner or operator of a CCR unit must prepare a written post-closure plan that includes, at a minimum, the information specified in paragraphs (d)(1)(i) through (iii) of this section.*

(i) *A description of the monitoring and maintenance activities required in paragraph (b) of this section for the CCR unit, and the frequency at which these activities will be performed;*

(ii) *The name, address, telephone number, and email address of the person or office to contact about the facility during the post-closure care period; and*

(iii) *A description of the planned uses of the property during the post-closure period. Post-closure use of the property shall not disturb the integrity of the final cover, liner(s), or any other component of the containment system, or the function of the monitoring systems unless necessary to comply with the requirements in this subpart. Any other disturbance is allowed if the owner or operator of the CCR unit demonstrates that disturbance of the final cover, liner, or other component of the containment system, including any removal of CCR, will not increase the potential threat to human health or the environment. The demonstration must be certified by a qualified professional engineer, and notification shall be provided to the State Director that the demonstration has been placed in the operating record and on the owner's or operator's publicly accessible internet site.*

### 4.1 MONITORING AND MAINTENANCE ACTIVITIES - §257.104(d)(1)(i)

**40 CFR 257.104(b).** *Post-closure care maintenance requirements. Following closure of the CCR unit, the owner or operator must conduct post-closure care for the CCR unit, which must consist of at least the following:*

(1) *Maintaining the integrity and effectiveness of the final cover system, including making repairs to the final cover as necessary to correct the effects of settlement, subsidence, erosion, or other events, and preventing run-on and run-off from eroding or otherwise damaging the final cover;*

(2) *If the CCR unit is subject to the design criteria under §257.70, maintaining the integrity and effectiveness of the leachate collection and removal system and operating the leachate collection and removal system in accordance with the requirements of §257.70; and*





## CLOSURE AND POST-CLOSURE PLAN

Written Post-Closure Plan – 40 CFR 257.104(d)(1)

(3) *Maintaining the groundwater monitoring system and monitoring the groundwater in accordance with the requirements of §§257.90 through 257.98.*

In accordance with 40 CFR 257.104(d)(1)(i), post-closure care for the closed CCR unit will address the following systems as required under 40 CFR 257.104(b), along with the frequencies for the identified monitoring and maintenance activities:

- Final cover system; and
- Groundwater monitoring system.

### 4.1.1 Final Cover System - §257.104(b)(1)

TVA will maintain the integrity and effectiveness of the final cover system, and make repairs as necessary to correct the effects of settlement, subsidence, erosion, and other events, and control run-on and run-off from eroding or otherwise damaging the final cover, in accordance with accepted engineering practices. Regularly scheduled inspections, developed specifically for the conditions at the Shawnee Fossil Plant, will be conducted at a minimum annually on the final cover system, and will include observations of the dike slopes, crest, and toe. Inspections will monitor for sand infill erosion, pooling, sloughing, wet areas, seeps, bare areas, and other structural issues.

The cap system will be maintained for a minimum of 30 years following final closure of Ash Pond 2 and the Consolidated Waste Dry Stack. The estimated 30-year post-closure maintenance costs are included in Appendix A. Repairs will be conducted as deemed necessary to correct the effects of settlement, subsidence, erosion, and other surface defects encountered during inspections, and to prevent run-on and run-off from eroding or otherwise damaging the final cover. Repairs may consist of grading activities to correct erosion and poor surface runoff conditions, and sand infill replacement in isolated areas.

Regular maintenance events will include inspection of the cap system, review of sand infill coverage and replacement of sand infill or cap in isolated areas as needed.

During the post-closure care period, the following activities will be performed:

- Maintain the approved final contours and drainage systems of the site such that sand infill movement and unintended ponding is controlled, and precipitation on the closed area is controlled and directed off the closure area.
- Maintain sand infill coverage across the site for sediment and erosion control.
- Maintain and monitor the surface water drainage features. Maintenance of the surface water drainage system will continue throughout the post-closure period to prevent sand infill movement and to promote positive drainage and acceptable performance of the drainage system.
- Instrumentation Monitoring, Liner Integrity Evaluations, and applicable inspections/assessments.



## **CLOSURE AND POST-CLOSURE PLAN**

Written Post-Closure Plan – 40 CFR 257.104(d)(1)

During post-closure, instrumentation will be monitored quarterly for two years. After two years, if data shows that slope inclinometer movement has become stable, monitoring can be reduced to once every six months. If data shows that conditions have not stabilized, then monitoring will continue at least quarterly unless a higher frequency of monitoring is deemed necessary.

### **4.1.2 Leachate Collection and Removal System - §257.104(b)(2)**

Since the units are not new CCR landfills or new lateral expansions of CCR landfills, they are not subject to the requirements of 40 CFR 257.70. Therefore, this section is not applicable.

### **4.1.3 Groundwater Monitoring System - §257.104(b)(3)**

The groundwater monitoring system has been designed and will be maintained in accordance with the EPA Final CCR Rule, 40 CFR §257.90 through 98. Regularly scheduled inspections and preventive maintenance activities will be conducted on the groundwater monitoring system, subject to specific groundwater monitoring compliance conditions and frequencies stipulated by the EPA Final CCR Rule.

The groundwater monitoring system will be maintained and monitored in accordance with the CCR Rule Groundwater Monitoring Plan. The monitoring system, sampling and analysis program will be continued during the post-closure period, in accordance with the EPA Final CCR Rule.

## **4.2 CONTACT INFORMATION - §257.104(d)(1)(ii)**

The following contact information is provided for the post-closure period:

Owner: Tennessee Valley Authority (TVA)  
Contact: Civil Projects & CCP Management, Strategy and Engineering  
Tennessee Valley Authority  
1101 Market Street  
Chattanooga, Tennessee 37402  
Phone: 844-342-0012  
Email: tvainfo@tva.com

## **4.3 PLANNED USES - §257.104(d)(1)(iii)**

TVA is evaluating the potential to install a solar panel system over the engineered turf cap system following closure construction. The solar panel system would be designed to be installed directly over the turf without causing damage to the cap system components. The veneer stability analyses performed for the cap system include the potential for the solar system installed over the engineered turf cap.



## **CLOSURE AND POST-CLOSURE PLAN**

Written Post-Closure Plan – 40 CFR 257.104(d)(1)

### **4.4 AMENDMENT OF POST CLOSURE PLAN - §257.104(d)(3)**

The owner or operator may amend the post closure plan at any time, and must do so at least 60 days prior to any planned change in the operation of the CCR unit that would substantially affect the written closure plan in effect. The post closure plan must also be amended no later than 60 days after an unanticipated event requires the need to revise the existing written post closure plan. If a written post closure plan is revised after post closure activities have commenced for a CCR unit, the owner or operator must amend the written post closure plan no later than 30 days following the triggering event. The amended post closure plan requires a new certification from a qualified professional engineer that it meets the requirements of 40 CFR 257.104.



# APPENDIX A

## Closure and Post-Closure Cost Estimate

TVA CONFIDENTIAL - COMMERCIAL BUSINESS INFORMATION

