



AECOM
1600 Perimeter Park Drive
Suite 400
Morrisville, NC 27560
www.aecom.com

919 461 1100 tel
919 461 1123 fax

October 12,2016

Tennessee Valley Authority
1101 Market Street
Chattanooga, Tennessee 37402

**Closure and Post Closure Plan
North Rail Loop Landfill
EPA Final Coal Combustion Residuals (CCR) Rule
TVA Gallatin Fossil Plant
Sumner County, Tennessee**

1.0 PURPOSE

This letter documents AECOM's certification of the EPA Final CCR Rule closure and post-closure plan for the TVA Gallatin Fossil Plant's North Rail Loop Landfill.

2.0 CLOSURE AND POST-CLOSURE PLAN

The closure plan describes the steps necessary to close the CCR unit at any time during the life of the unit, and is subject to the requirements described in 40 CFR 257.102(b). The post-closure plan describes the monitoring and maintenance activities to be performed during the post-closure period of the unit, and is subject to the requirements of 40 CFR 257.104(d).

The EPA Final CCR Rule closure and post-closure plan is conceptual and subject to change at any time. The attached closure and post-closure plan demonstrates compliance with the requirements set forth in 40 CFR 257.102(b) and 257.104(d).

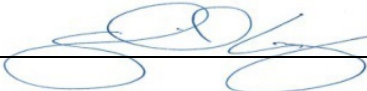
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3.0 QUALIFIED PROFESSIONAL ENGINEER CERTIFICATION

I, Gabe W. Lang, being a Professional Engineer in good standing in the State of Tennessee, 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 my signature below;
3. that the closure plan for the TVA Gallatin Fossil Plant's North Rail Loop Landfill meet(s) the requirements described in 40 CFR 257.102(b) and
4. that the post-closure plan for the TVA Gallatin Fossil Plant's North Rail Loop Landfill meet(s) the requirements of 40 CFR 257.104(d).

SIGNATURE _____

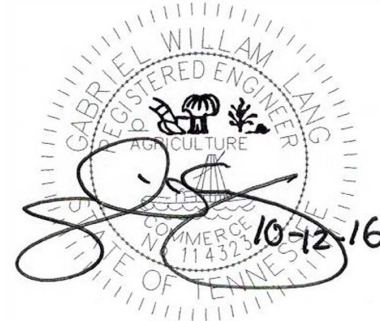


DATE ____10/12/16____

ADDRESS: AECOM
1600 Perimeter Park Dr. Ste. 400
Morrisville, NC 27560

TELEPHONE: (919) 461 1100

ATTACHMENTS: Closure [40 CFR 257.102(b)(1)] and Post-Closure Plan [40 CFR 257.104(d)(1)] For Coal Combustion Residuals.



COAL COMBUSTION PRODUCT DISPOSAL PROGRAM

Tennessee Valley Authority – North Rail Loop Landfill
Sumner County, Tennessee

Closure [40 CFR 257.102(b)(1)] and Post-Closure Plan [40 CFR 257.104(d)(1)] for Coal Combustion Residuals (CCR) Existing Landfill TVA Gallatin Fossil Plant

Prepared for



Tennessee Valley Authority
1101 Market Street
Chattanooga, TN 37402-2801

October 12, 2016 – Rev0

Prepared by

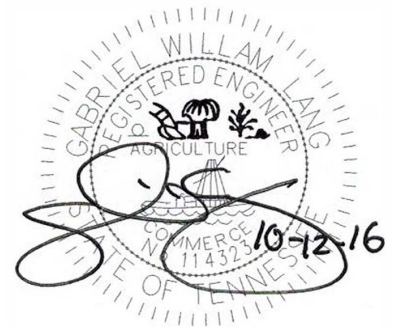




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1.0 Introduction

This U.S. Environmental Protection Agency Final Coal Combustion Residual Rule (EPA Final CCR Rule) closure and post-closure plan is conceptual and is subject to change. It describes the CCR closure and post-closure activities at the TVA Gallatin Fossil Plant (GAF) to demonstrate that the North Rail Loop (NRL) Landfill will be closed and maintained in accordance with the CCR closure and post-closure requirements of 40 CFR §§257.102 and 104, respectively.

2.0 Written Closure Plan - 40 CFR 257.102(b)(1)

40 CFR 257.102(b)(1). *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 CCR unit will be completed. The 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 estimate timeframes to complete each step or phase of CCR unit closure.*



2.1 Closure Activities- §257.102(b)(1)(i)

The NRL Landfill is being developed in a series of three cells. Cells 1, 2, and 3 will be constructed sequentially moving east to west as additional disposal capacity is needed. Cell 1 is currently operational. An interim cover layer will be provided on areas that are filled as they approach the final grades. This interim cover will be in place throughout the life of Cells 1, 2, and 3, and final cover placement will occur once Cell 3 has reached design capacity.

2.2 Closure Type/Closure in Place - §257.102(b)(1)(iii)

The closure of the NRL Landfill will be accomplished by leaving the CCR in place, thus requiring a final cover system and closure design elements enabling it to meet the CCR closure in-place performance standards outlined in 40 CFR 257.102(d)(1) and described in Section 2.8.

2.3 Maximum CCR Inventory - §257.102(b)(1)(iv)

The estimated future maximum inventory of CCR ever on-site over the active life of the NRL Landfill is approximately 6,765,800 cubic yards (CCY).

2.4 Largest Area Requiring Final Cover - §257.102(b)(1)(v)

The estimated largest future area of the NRL Landfill ever requiring a final cover at any time during the active life of the CCR unit is approximately 52.4 acres.

2.5 Schedule of Closure Activities - §257.102(b)(1)(vi)

The following sequential steps necessary for completing the closure activities of 40 CFR 257.102 and their estimated scheduled completion dates are provided below.

Table 1: Schedule of Closure Activities

	Closure Activity	Estimated Date
1.	Cell 1 Operation Completion	2018
2.	Cell 2 Operation Completion	2026
3.	Cell 3 Operation Completion	2031
5.	Installation of final cover system	2031
6.	Completion of closure	2032

Notes:

- (1) The schedule reflected above is based upon TVA's operational plan as of the date of this document. Operational needs may arise that may require this schedule to be adjusted.

2.6 Estimated year of Closure Completion- §257.102(b)(1)(vi)

The estimated year for completion of all closure activities is 2032.

2.7 Request for Time Extension

If it is estimated that the time required to complete closure will exceed the regulatory timeframes, site-specific information, factors and considerations will be provided to support any time extensions.

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

40 CFR 257.102(d)(1). *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.*

2.8.1 Control of Infiltration and Releases - §257.102(d)(1)(i)

TVA will 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.

The cover system slopes promote precipitation run-off by maintaining positive grading to minimize the ponding of water. Surface water benches will intercept surface water run-off from the cover slopes, which will be conveyed to letdown channels, and then to one of two perimeter drainage ditches located at the toe of the cover system. Each perimeter drainage ditch is sloped to convey run-off to one of two sediment basins, one of which is located to the northwest of the facility, the other to the northeast of the facility. The sediment basins discharge into Ash Pond A, which in turn discharges to Cumberland River via a National Pollutant Discharge Elimination System (NPDES) permitted outfall.

All drainage structures have been designed to accommodate at least a 25-year, 24-hour storm event. Additional details of the run-on/run-off controls are provided in the drawings listed below, which are included in the *Part II Permit Application*, Part E, Engineering Plans (URS, 2014).



Item	Drawing No.
Final Grades	10W275-10
Stormwater Management Plan	10W275-14
Surface Water Management Details I	10W275-22
Surface Water Management Details II	10W275-23
Roadway and Sediment Basin Details	10W275-24
Stormwater Terrace Discharge Details	10W275-25

2.8.2 Prevention of Future Impoundment of Water, Sediment, or Slurry - §257.102(d)(1)(ii)

TVA will preclude the probability of future impoundment of water, sediment, or slurry at the NRL Landfill. The cover system slopes promote precipitation run-off by maintaining positive grading to minimize the ponding of water.

As soon as practicable after final grading, TVA will take necessary steps to establish a protective vegetative cover of acceptable grasses over disturbed areas of the site. These steps shall include seeding, mulching, and any necessary fertilization at a minimum, and may include additional activities such as sodding or the use of reinforcement matting on steeper slopes and drainage ways if necessary. Temporary erosion control blankets may be used if necessary to provide seedbed protection and prevent wash-out of seed and fertilizer during vegetation establishment.

2.8.3 Slope Stability Measures - §257.102(d)(1)(iii)

TVA will 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 period. Preconstruction testing of the cover materials will be conducted to verify that all materials meet the minimum interface strength requirements established by the stability analysis in Part F of the *Part II Permit Application* (URS, 2014). Furthermore, each layer of the final cover system will be placed such that it meets applicable specifications established by the slope stability analysis.

2.8.4 CCR Unit Maintenance - §257.102(d)(1)(iv)

TVA will minimize the need for further maintenance of the CCR unit by:

- Adequately maintaining the leachate collection system;
- Constructing the final cover in accordance with site-specific design requirements;
- Grading surfaces to promote proper surface water management;

- Implementing erosion and sediment control measures; and
- Maintaining the groundwater monitoring network.

2.8.5 Completion of Closure - §257.102(d)(1)(v)

Completion of closure will be completed in the shortest amount of time consistent with recognized and generally accepted good engineering practices.

2.9 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.*

- (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 1×10^{-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 (d)(3)(ii)(A) through (C) 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.*

2.9.1 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 elements:

- Cap Cover Soil: A minimum 18-inch infiltration layer of earthen materials with permeability no greater than 1×10^{-5} cm/sec;
- Top Soil: A minimum 6-inch erosion layer that contains earthen material that is capable of sustaining native plant growth; and

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

The final cover system for the NRL Landfill will consist of an alternative cover design, as described in Section 2.9.2 below.

2.9.2 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 to Section 2.9.1 for the following:

- An infiltration layer that achieves an equivalent reduction in infiltration as the infiltration layer specified in Section 2.9.1.
- An erosion layer that provides equivalent protection from wind or water erosion as the erosion layer specified in Section 2.9.1.
- The minimization of any disruption of the integrity of the final cover system through a design that accommodates settling and subsidence.

An alternative final cover system was selected for the NRL Landfill. Details of the final cover system are illustrated on the Engineering Plans (Drawing 10W275-18), in Part E of the *Part II Permit Application*, (URS, 2014). The final cover system (see **Figure 1**) consists of (from top to bottom):

- A 12-inch thick vegetative cover soil capable of sustaining native vegetation;
- A 12-inch thick protective soil layer;
- A double-sided geocomposite drainage layer; and
- A 40-mil linear low density polyethylene (LLDPE) flexible membrane liner barrier layer which has permeability much less than 1×10^{-7} cm/sec.

The alternative final cover system will be installed upon a subgrade layer consisting of compacted intermediate cover soil or compacted CCR material. A settlement analysis, included in Part F of the *Part II Permit Application*, (URS, 2014), showed that the minimum grades for the landfill are capable of maintaining positive flow.

TVA will obtain 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.

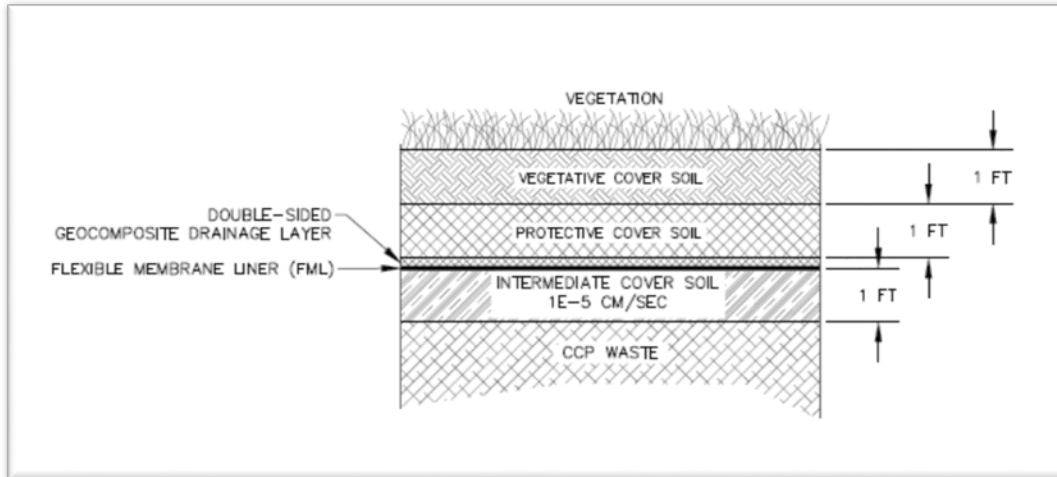


Figure 1: Alternative Final Cover System

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

As required by 40 CFR 257.102(b)(1)(iii), the following methods and procedures will be used in the installation of the final cover.

The final cover system may be constructed in phases as large areas of each cell are brought to final grade. Initially, the lower elevations of outer side slopes will receive a final cover, to be followed later by upper side slopes and finally the crest of the landfill. In this manner, the maximum area requiring final cover upon closure can be reduced.

The sequence of final cover construction will begin by compacting the intermediate cover soil or CCR subgrade layer in a controlled manner. It is noted that intermediate cover may not be required in areas where final cover will be constructed within 180 days of final placement of CCR. The 40-mil LLDPE geomembrane barrier layer and double-sided geocomposite will be installed above the compacted soil or CCR subgrade layer. The protective cover soil and vegetative cover soil layers will be installed above the geocomposite drainage layer and moderately compacted to aid in root development and prevent damage to the underlying geosynthetics. Finally, the surface of the cover will be seeded and vegetated.

2.9.4 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.*

A professional engineer will provide a written certification stating that the design of the final cover system meets the requirements of 40 CFR 257.102. The certification will be included in the facility's notification of intent to close the NRL Landfill, as per 40 CFR 257.102(g).

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

40 CFR 257.104(d)(1). *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 paragraph (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;*
- (i) 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 system 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.*

3.1 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*

(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 for the NRL Landfill 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;
- Leachate collection and removal system; and
- Groundwater monitoring system.

3.1.1 Final Cover System - § 257.104(b)(1)

Following closure of the NRL Landfill, visual inspections of the site will be completed for the duration of the post-closure period. Inspections will be completed on a quarterly basis for the initial year following closure and on an annual basis thereafter. Maintenance or other corrective measures needed to prevent the deterioration of the closure system will be identified during the inspections.

The cap system will be maintained for a minimum of 30 years following final closure of the NRL Landfill. The integrity and effectiveness of the cap system will be maintained by making repairs to the cover as necessary to correct the potential effects of subsidence and erosion, as well as preventing run-on and run-off from eroding or otherwise significantly damaging the cap system. If settlement or other structural problems occur in the final cover system, the cover will be re-graded. In addition, the vegetative cover will be inspected to maintain a healthy stand of vegetation. Until vegetation of the final cover is fully established, sediment transport will be retarded by temporary silt fences. Other temporary sediment control measures will be installed as needed to reduce the sediment load until the vegetative cover is fully established.

3.1.2 Leachate Collection and Removal System - §257.104(b)(2)

TVA will maintain the integrity and effectiveness of the leachate collection and removal system, and properly operate it in accordance with 40 CFR 257.70.

Maintenance and monitoring of the leachate collection system during the post-closure period will include inspecting the leachate collection and underdrain pump systems and side slope risers, removing sediment and debris (if needed), verifying operation of pumps, and ensuring that outlets are clear and unobstructed. Inspections will be completed on a quarterly basis for the initial year following closure and on an annual basis thereafter.

3.1.3 Groundwater Monitoring System - §257.104(b)(3).

The groundwater monitoring system will be designed and maintained in accordance with the EPA Final CCR Rule, 40 CFR §§257.90 through 98. Groundwater monitoring locations will be



inspected quarterly during the first year of post-closure, and annually thereafter. Repairs will be made as needed.

3.2 Contact Information - §257.104(d)(1)(ii)

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

Owner: Tennessee Valley Authority, as agent for the United States of America

Contact: Civil Projects & CCP Management, Strategy and Engineering

1101 Market St.

Chattanooga, TN 37402

Phone: 844-342-0012

Email: tvainfo@tva.com

3.3 Planned Uses - §257.104(d)(1)(iii)

It is anticipated that following development and closure of the NRL Landfill, the property will be not be used and it will not be accessible to the public.

Post-closure use of the property will 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 of the EPA Final CCR Rule under 40 CFR Part 257.

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.

4.0 References

[1] URS Corporation. (2014). Part II Permit Application, CCP Disposal Facility, North Rail Loop, Vol 2, Part E, Engineering Plans, Drawings 10W275-10, 10W275-14, 10W275-18, and 10W275-22 through 10W275-25.

[2] URS Corporation. (2014). Part II Permit Application, CCP Disposal Facility, North Rail Loop, Vol 3, Part F, Geotechnical Calculations.