

## **ATTACHMENT IV**

### **Closure Plan**

## Closure Plan

Virginia Electric and Power Company  
Possum Point Power Station  
Coal Combustion Residual Surface Impoundment Closures  
Dumfries, Virginia

GAI Project Number: C150132.00

December 2015



Prepared by: GAI Consultants, Inc.  
Richmond Office  
4198 Cox Road, Suite 114  
Glen Allen, Virginia 23060

Prepared for: Virginia Electric and Power Company  
5000 Dominion Boulevard  
Glen Allen, Virginia 23060-3308

# Closure Plan

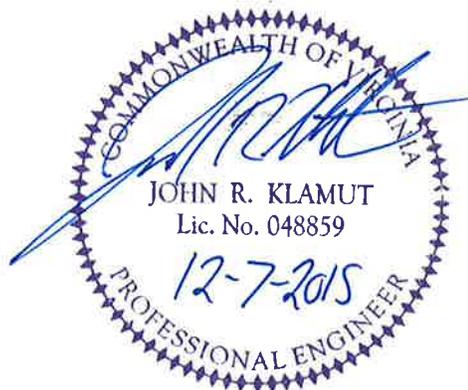
Virginia Electric and Power Company  
Possum Point Power Station  
Coal Combustion Residual Surface Impoundment Closures  
Dumfries, Virginia

GAI Project Number: C150132.00

December 2015

Prepared for:  
Virginia Electric and Power Company  
5000 Dominion Boulevard  
Glen Allen, Virginia 23060-3308

Prepared by:  
GAI Consultants, Inc.  
Richmond Office  
4198 Cox Road Suite 114  
Glen Allen, Virginia 23060



# Table of Contents

Acronyms.....	2
A. Introduction.....	3
A.1 Regulatory Background.....	3
A.2 Site Description.....	3
A.3 Closure Description.....	3
B. Closure Timeframes.....	4
C. Preparation for Closure of Surface Impoundments.....	5
C.1 Removal.....	5
C.2 Stabilization and Free Liquid Considerations.....	6
C.3 Structures and Equipment.....	6
D. Closure of Surface Impoundments.....	6
D.1 Surface Impoundment D Final Cover Design.....	6
D.2 Final Slopes.....	7
D.3 Run-Off Controls.....	8
D.4 Settlement, Subsidence, Displacement.....	8
E. Closure Implementation.....	8
E.1 Notification.....	8
E.2 Certification.....	9
F. Closure Cost Estimate.....	9
F.1 Closure Cost Estimate.....	9
F.2 Financial Assurance.....	9
G. References.....	10
Table 1	Closure Construction Summary
Table 2	Surface Impoundments A, B, C, D, and E Construction Milestones
Table 3	Summary of Closure/ Post-Closure Costs
Attachment 1	Site Life and Cell/Phase/Area Capacity Calculations (not applicable)
Attachment 2	Closure Design Plans
Attachment 3	CQA Plan and Technical Specifications
Attachment 4	Universal Soil Loss Demonstration
Attachment 5	Slope Stability
Attachment 6	Stormwater Calculations
Attachment 7	Settlement, Subsidence, and Displacement
Attachment 8	Closure Cost Estimate
Attachment 9	Additional Geosynthetic and Drainage Calculations

## Acronyms

CCR	Coal Combustion Residual
CFR	Code of Federal Regulations
CQA	Construction Quality Assurance
DCR	Department of Conservation and Recreation
Dominion	Virginia Electric and Power Company d/b/a Dominion Virginia Power
EPA	Environmental Protection Agency
GDN	Geocomposite Drainage Net
H	horizontal
LLDPE	Linear Low-Density Polyethylene
PMF	Probable Maximum Flood
Station	Dominion Possum Point Power Station
V	vertical
VA	Virginia
VAC	Virginia Administrative Code
VDEQ	Virginia Department of Environmental Quality
VPDES	Virginia Pollutant Discharge Elimination System
VSWMR	Virginia Solid Waste Management Regulations

## A. Introduction

This Plan was prepared on behalf of Virginia Electric and Power Company d/b/a Dominion Virginia Power (Dominion) by GAI Consultants, Inc. The purpose of this Plan is to provide a Closure Plan for the Dominion Possum Point Power Station (Station) Coal Combustion Residual (CCR) Surface Impoundments A, B, C, D, and E.

### A.1 Regulatory Background

The CCR impoundments are currently regulated by the Virginia (VA) Department of Conservation and Recreation (DCR) Dam Safety Program and by the VA Department of Environmental Quality (VDEQ) under VA Pollutant Discharge Elimination System (VPDES) Permit No. VA0002071.

The impoundments are being closed as inactive CCR surface impoundments under the new Environmental Protection Agency (EPA) CCR regulations provided in 40 Code of Federal Regulations (CFR), Part 257.100, Subpart D, dated April 17, 2015. Inactive CCR Surface Impoundments that complete closure by April 17, 2018 and meet the requirements of §257.100 (b) (1) through (4) or (b) (5) are exempt from all other requirements of the Final CCR Rule. These sections allow for closure of surface impoundments by construction of a final cover system or through removal of CCR. Section A.3 of this plan outlines the closure description for the CCR units at the Station.

Closed inactive CCR surface impoundments are subject to the Virginia Solid Waste Management Regulations (VSWMR). This Closure Plan has been prepared in accordance with the VSWMR; however, it also incorporates several of the measures described in the CCR rule.

This Plan follows the format guidelines for Solid Waste Disposal Facilities as described in Submission Instruction No. 6, issued by the VDEQ in 2012.

### A.2 Site Description

The Station is located near Dumfries in Prince William County, VA. The Station is accessed by Possum Point Road (Route 633) and is adjacent to the Potomac River and Quantico Creek. There are currently five inactive CCR impoundments located at the Station: Surface Impoundments A, B, C, D, and E. The CCR impoundments cover a total area of approximately 120 acres as shown on the design plans in **Attachment 2**. The Station stopped using coal as a fuel in 2003 and no new CCR has been placed in Surface Impoundments A, B, C, D, or E since that date. The CCR surface impoundment areas are described below.

- Surface Impoundments A, B, and C cover a total area of approximately 18 acres. They were constructed in 1955.
- Surface Impoundment D covers an area of approximately 64 acres. It was constructed in 1988 to replace a pre-existing impoundment in the same location.
- Surface Impoundment E covers an area of approximately 38 acres. Surface Impoundment E was constructed in 1967.

### A.3 Closure Description

Surface Impoundments A, B, C, and E will be closed through the removal of CCR in the impoundments, thus meeting the requirements of 40 CFR §257.100 (b)(5) of the Final CCR Rule. To accomplish this, Dominion mechanically dredged the CCR from Surface Impoundment A, B, C, and E and placed it in Surface Impoundment D with consent of VADEQ and per the requirements of VPDES Permit No. VA0002071. Dredging of Surface Impoundment E to Surface Impoundment D began in June 2015. Dredging from Surface Impoundments A, B, and C to Surface Impoundment D began in August 2015, also in accordance with the station's VPDES permit. A majority of the CCR was removed from the

Surface Impoundments A, B, C, and E prior to October 19, 2015. Remaining CCR material in these surface impoundments is being removed and disposed offsite at an authorized disposal facility permitted to receive the material. After closure by removal of CCR in Surface Impoundments A, B, C, and E, Dominion will recontour these areas back into the existing landscape and stabilize with natural vegetation.

Surface Impoundment D will be closed in place, with a cover system over the CCR surface that will be constructed in accordance with 40 CFR §257.100 (b) (1) through (4) of the Final CCR Rule. To prepare for closure, the upper portion of the CCR in Surface Impoundment D will be dewatered and graded to stabilize the CCR and create a slope for proper drainage. 40 CFR §257.100 (b) (2) (i) requires that free liquids be eliminated by removing liquid wastes or solidifying the remaining wastes and waste residues. Water ponded on the surface of the CCR impoundment will be removed and the CCR dewatered to a depth determined by a qualified professional engineer to provide a stable surface for the installation of the final cover system. 40 CFR §257.100 (b) (2) (ii) requires the remaining CCR be stabilized sufficient to support the final cover system. Earth fill from onsite or offsite borrow areas and the Surface Impoundment D embankment will be placed in the impoundment area to help raise the grade of the impoundment for drainage and create a slope for proper drainage. Water that comes in contact with CCR during closure activities or is generated by dewatering activities will be discharged in accordance with the Station's VPDES Permit No. VA0002071.

Closure will be accomplished by placing an engineered cover system consisting of geosynthetic and soil layers over the CCR surface to prevent infiltration of water into the CCR. Protective cover and vegetative support layers consisting of embankment soil material will be part of the final cover system. An erosion resistant channel will also be constructed to prevent future impoundment of run-on waters.

The CCR impoundments will be closed as inactive CCR impoundments. The impoundments will be closed in accordance with the VSWMR; however, additional measures from the CCR Final Rule have been adopted in this Closure Plan.

## B. Closure Timeframes

**Table 1** below includes a summary of the capping or closure construction at the Possum Point Power Station. Surface Impoundments A, B, C, and E no longer receive any new CCR generated by the station. Surface Impoundment D ceased accepting CCR prior to October 19, 2015. Therefore, site life calculations are not provided in this section because they are not applicable to the closure of these facilities. Closure of Surface Impoundment D is considered to begin in March 2016 when soil may begin to be hauled to Surface Impoundment D in order to establish the proposed subgrade required for the final cover system.

**Table 2** below provides a list of milestone dates to allow for the tracking and progress of closure.

**Table 1.**  
**Closure Construction Summary**

Closure Phase	Size (acres)	Closure Construction Timeframe
Surface Impoundments A, B, and C	Approx. 18	August 2015 through April 17, 2018
Surface Impoundment E	Approx. 38	June 2015 through April 17, 2018
Surface Impoundment D	Approx. 64	March 2016 through April 17, 2018
<b>Total</b>	<b>Approx. 120</b>	

**Table 2.**  
**Surface Impoundments A, B, C, D, and E Construction Milestones**

Milestone	Approximate Start Date	Approximate End Date
Dispose of any remaining CCR in Surface Impoundments A, B, C and E at an offsite disposal facility.	November 2015	April 2018 <sup>1</sup>
Lower the A, B, C, and E dam embankments, decommission dams, and construct temporary sediment basins in the former Surface Impoundments A, B, C, and E to control stormwater.	March 2016	September 2016 <sup>2</sup>
Grade and fill impoundment areas and establish Vegetation in former Surface Impoundments A, B, C, and E after CCR is removed.	March 2016	April 2018
Grade CCR and import fill in Surface Impoundment D to establish subgrade (entire Surface Impoundment D)	March 2016	June 2017
Construct final cover system and surface water drainage channels. This includes lowering the dam embankment to provide fill for the final cover system.	April 2017	September 2017
Construct new spillway through dam embankment to prevent future impoundment of water.	May 2017	August 2017
Incorporate soil amendments into Surface Impoundment D cover soil and seed.	September 2017	December 2017
Closure of all surface impoundments complete	-	April 17, 2018

## C. Preparation for Closure of Surface Impoundments

Surface Impoundments A, B, C, D, and E are considered inactive CCR surface impoundments under the federal CCR regulations (CCR rule). The closure process for the impoundments is discussed below. This Plan is consistent with the requirements of the VSWMR and the VDEQ Submission Instructions No. 6 for Solid Waste Facilities. The Plan also incorporates some of the provisions of the CCR rule found at 40 CFR §257.100.

### C.1 Removal

Prior to October 19, 2015, Dominion plans to mechanically dredge the CCR from Surface Impoundments A, B, C, and E and place the dredged CCR in Surface Impoundment D. After October 19, 2015, CCR that is remaining in Surface Impoundments A, B, C, and/or E will be excavated and hauled to an offsite authorized disposal facility. The CCR in Surface impoundments A, B, C, and E will be removed no later than April 17, 2018.

<sup>1</sup> Majority of CCR is scheduled to be removed by April 2016.

<sup>2</sup> Temporary Sediment Basins shall be removed once vegetation is fully established in accordance with Prince William County Sediment and Erosion Control requirements. Anticipated removal of temporary sediment basins is one year after permanent seeding of the closed impoundment areas.

After removal of the CCRs from the impoundments, a registered professional engineer will visually inspect the bottom of Surface Impoundments A, B, C, and E to verify that all CCR in surface impoundments A, B, C, and E is effectively removed.

Wastewater management during closure of the impoundments will be accomplished in accordance with the Station's VPDES Permit No. VA0002071.

## C.2 Stabilization and Free Liquid Considerations

Stabilization of the remaining waste is only applicable to Surface Impoundment D because the CCR in Surface Impoundments A, B, C, and E will be removed. Surface Impoundment D will be stabilized in preparation for the closure process. The CCR in the Surface impoundment D will be stabilized and made suitable for construction of an engineered cover system by dewatering the upper portion of the CCR surface.

40 CFR §257.53 defines "free liquids" as liquids that readily separate from the solid portion of a waste under ambient temperature and pressure. 40 CFR §257.100 (b) (2) (i) requires that free liquids be eliminated by removing liquid wastes or solidifying the remaining wastes and waste residues. 40 CFR §257.100 (b)(2)(ii) requires the remaining CCR be stabilized sufficient to support the final cover system.

For this Closure Plan, "free liquids" are considered to include ponded water or water that separates from the CCR through processes such as rim ditching or compaction during closure activities. Water ponded on the surface of the CCR impoundment will be removed and the CCR dewatered to a depth determined by a qualified professional engineer to provide a stable surface for the installation of the final cover system.

A geotechnical investigation of the CCRs in Surface impoundment D was completed to support the dewatering plan and design of the Surface impoundment D cover system. The required/existing bearing strength of the CCR surface was estimated to be 5,800 psf to provide for a stable final cover system. The bearing strength calculations are summarized in the Geotechnical Report, which is provided in **Attachment 7**.

## C.3 Structures and Equipment

Structures and equipment located in Surface Impoundments A, B, C, D, and E consist of the existing concrete riser structures and outlet pipes. The riser structures and outlet pipes will be removed and disposed of at an offsite disposal facility that is permitted to accept demolition debris and CCRs. Alternatively, the structures and pipes will be demolished, cleaned, and the material disposed of at an offsite sanitary or construction/demolition/debris disposal facility permitted to accept the construction debris.

## D. Closure of Surface Impoundments

After removal of CCRs, areas around Surface Impoundments A, B, C, and E will be filled and graded to drain and the subsoils and fill will be amended to establish vegetation.

The final cover system for Surface Impoundment D is described in more detail below.

### D.1 Surface Impoundment D Final Cover Design

The final cover design will be in accordance with the pre-approved alternate final cover systems described in 9 Virginia Administrative Code (VAC) 20-81-160.D.2.e and in accordance with the relevant provisions of the CCR Final Rule for closure of inactive impoundments. Additional layers consisting of a cushion geotextile (as needed) below the 40 mil geomembrane and a Geocomposite Drainage Net

(GDN) were added to the alternate cover system to enhance the puncture resistance of the geomembrane and drainage of stormwater, which will infiltrate through the soil above the 40-mil geomembrane cap.

The layers of the final cover system to be installed are described below (from top to bottom) and shown in the details provided in the closure design plans (**Attachment 2**). The Earthwork, Cushion Geotextile, Textured Linear Low-Density Polyethylene (LLDPE) Geomembrane, and GDN Technical Specifications included in **Attachment 3** provide more detail for each component.

- **Vegetation.** Consists of combination of quick-cover vegetation, such as annual ryegrass, and easily maintained perennial grasses and legumes, such as Kentucky 31 Fescue and clover. The seed mix for the cap will be selected in accordance with the Virginia Erosion and Sediment Control Handbook recommendations.
- **Vegetative Support Layer.** Consists of six inches of soil that can sustain vegetation. This layer will consist of topsoil or site soil amended with appropriate nutrients to facilitate vegetative growth. The vegetative support layer will be spread by low-ground-pressure equipment and will be compacted only as required for access and stability.
- **Protective Cover Soil Layer.** Consists of an 18-inch-thick soil layer. The protective cover soil layer will store moisture and support vegetation. It will also act as a protective layer for the drainage and barrier layers. The calculations provided in **Attachment 4** demonstrate that the soil loss of the stabilized final cover system is less than 2 tons per acre per year. The analyses show that the final slopes will not cause significant cover erosion throughout the closure and post-closure periods.
- **Drainage Layer.** Consists of a GDN, which is a synthetic drainage net sandwiched between two pieces of geotextile fabric. This layer provides lateral drainage over the barrier layer. Calculations provided in **Attachment 9** show that the selected drainage net will provide adequate flow capacity to handle water that will infiltrate through the vegetative support layer and protective cover soil layer. The geotextile filter fabric on the top of the GDN will allow the flow into the net while filtering out fine soil particles from the cover soil layer. The nonwoven geotextile fabric on the bottom of the GDN will act as a cushion to protect the 40-mil LLDPE geomembrane.
- **Barrier Layer.** This layer prevents water from infiltrating into the CCRs. The barrier layer will consist of a 40-mil LLDPE geomembrane.
- **Cushion Geotextile (as needed).** Consists of nonwoven geotextile that will act as a cushion to protect the 40-mil LLDPE geomembrane. This layer will be constructed directly on top of a prepared subgrade layer which may be CCR or soil from an on-site borrow area or the existing Surface Impoundment D Embankment. Cushion geotextile will not be needed where the prepared subgrade surface is smooth.

## D.2 Final Slopes

The maximum overall side slope of the final cover system is 4 horizontal (H):1 vertical (V) and is 120 feet long. The minimum constructed slope of the final cover over the geosynthetic cap will be 2.5 percent. Major channels over the geosynthetic cap system will be constructed to a minimum slope of 1.5 percent, minor roadside channels located around the perimeter of the final cover system may be graded at a minimum slope of one percent. Areas outside the cap system on native grades or earthen fill will be graded to drain. Channel side slopes within the final cover system are designed at 5H: 1V. These slopes allow the final cover system to drain properly, even after potential differential settlement of the underlying CCRs. In addition, the drainage and erosion control system, described below, will be constructed for proper drainage of the water without allowing excessive erosion.

The intent is that by designing the cover system overland slopes to a grade of 2.5 percent and the major channel slopes to a grade of 1.5 percent, the final post settlement slopes will be a minimum of one percent for channels and two percent for overland areas. The veneer and deep seated slope stability analyses of the final cover system were evaluated as part of this Closure Plan for both static and seismic conditions. The calculations for these analyses are presented in **Attachment 5** and **Attachment 7** and demonstrate the final design slopes are stable.

### **D.3 Run-Off Controls**

All stormwater features and facilities have been designed in accordance with the VSWMRs, which require that runoff from a 25-year, 24-hour storm event be controlled. The Surface Impoundment D cover system will be graded to drain surface water runoff into channels that will be graded into the cover system and its subgrade. The drainage channels in the impoundment area are designed with erosion control controls to prevent erosion from a minimum of the 25-year, 24-hour storm. The run-off controls are also designed to meet Virginia Stormwater Requirements and Prince William County Requirements for stormwater quality and quantity.

Perforated subsurface drainage pipes will be installed above the geomembrane at the bottom of the drainage channels to collect stormwater runoff that infiltrates through the cover soils and drains into the GDN.

**Attachment 6** of this Report includes hydrologic and hydraulic calculations which estimate the run-off flow values from the final cover system. The appendix also includes calculations for the sizing of the temporary sediment basins, which collect the final cover run-off until the vegetation layer is established and sediment control is no longer required.

Surface Impoundment D will remain a jurisdictional dam regulated by the DCR after the cover system is installed and the impoundment area is closed. Because the embankment that forms Surface Impoundment D is a dam, it must meet the required DCR dam safety criteria. For dam safety purposes, the Surface Impoundment D embankment is designed to prevent overtopping during the Probable Maximum Flood (PMF) event, and the spillway that will be constructed through the embankment is designed to pass the PMF event without significant erosion. A separate dam modification permit will be obtained from the DCR for permitting of the spillway and embankment modifications.

### **D.4 Settlement, Subsidence, Displacement**

The waste was analyzed to evaluate the stability of the final cover system and assess that positive slopes will be maintained on the final cover. Settlement was evaluated at stationing (every 100-ft) along the alignment of each of the three main surface water channels that drain the cap system; these channel alignments include the maximum fill depth of CCR subject to settlement. Settlement and stability calculations are provided in the geotechnical calculation completed for the closure design provided in **Attachment 7**. Based on the results of the geotechnical investigation and settlement the total settlement of the geosynthetic cap system was estimated to be approximately 1 to 4 inches. The final slopes should remain at a minimum of two percent after settlement for overland areas and 1 percent for channels.

## **E. Closure Implementation**

### **E.1 Notification**

Within 90 days following completion of closure of Surface Impoundment D, a survey plat will be submitted to the local land-recording authority (Prince William County General District Court) prepared by a professional land surveyor licensed by the Commonwealth or a person qualified in accordance

with Title 54.1 of the Code of VA, indicating the location and dimensions of disposal areas. Monitoring well locations will be included and identified by their numbers on the survey plat.

Upon completion of closure activities, Dominion will record a restriction on the property deed stating that the property has been used to manage CCR, and that the property's use is restricted in accordance with 9VAC20-81-170. A copy of the deed restriction will be submitted to the DEQ.

## E.2 Certification

After construction of the final closure sequence is completed, certification of closure prepared by a professional engineer licensed in the Commonwealth of VA will be submitted to the VDEQ. A copy will remain at the Station throughout post-closure.

## F. Closure Cost Estimate

The closure costs estimates are provided in **Attachment 8**. A summary of the cost estimates is provided in the **Table 3** below.

**Table 3.**  
**Summary of Closure/Post-Closure Costs**

Description of Activity	Estimated One Time Costs	Estimated Annual Costs
Surface impoundments A, B, and C	\$16,100,000	-
Surface impoundment D	\$44,800,000	\$450,000
Surface impoundment E	\$26,200,000	-
<b>Total</b>	<b>\$87,100,000</b>	<b>\$450,000</b>

### F.1 Closure Cost Estimate

Closure cost estimates have been prepared for Surface Impoundments A, B, C, D, and E. Surface Impoundments A, B, C, and E will be closed through removal of CCRs; therefore, only capital costs associated with closure activities are included. Surface Impoundment D will be closed with CCR materials remaining in place.

### F.2 Financial Assurance

The Financial Assurance documents will be updated and submitted annually to VDEQ, in accordance with the VA Financial Assurance Regulations for Solid Waste Facilities. The future annual financial assurance documents will be provided according to the cost estimates provided in this permit application or updated accordingly.

## **G. References**

40 CFR Parts 257 and 261, Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities, April 17, 2015.

Solid Waste Permitting Submission Instruction No. 6, Virginia Department of Environmental Quality, Office of Waste Permitting and Compliance, January 2012.

Virginia Administrative Code, 9VAC20-81.

Virginia Erosion and Sediment Control Handbook, Virginia Department of Environmental Quality, Third Edition, 1992.

# **ATTACHMENT 1**

## **Site Life and Cell/Phase/Area Capacity Calculations (Not Applicable)**