Closure Plan

CLOSURE PLAN

Chesterfield Power Station FFCP Management Facility – Permit #609

Submitted To: Dominion Energy – Chesterfield Power Station
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Table of Contents

1.0 PLAN CERTIFICATION

This Closure Plan for the Chesterfield Power Station FFCP Management Facility located in Chesterfield County, Virginia was prepared by Golder Associates Inc. (Golder). The document and Certification/Statement of Professional Opinion are based on and limited to information that Golder has relied on from Dominion and others, but not independently verified, as well as work products produced by Golder.

On the basis of and subject to the foregoing, it is my professional opinion as a Professional Engineer licensed in the Commonwealth of Virginia that this Closure Plan has been prepared in accordance with good and accepted engineering practices as exercised by other engineers practicing in the same discipline(s), under similar circumstances, at the same time, and in the same locale. It is my professional opinion that this Closure Plan was prepared consistent with the requirements of the United States Environmental Protection Agency's "Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments," published in the Federal Register on April 17, 2015, with an effective date of October 19, 2015, 40 CFR §257.102.

The use of the word "certification" and/or "certify" in this document shall be interpreted and construed as a Statement of Professional Opinion, and is not and shall not be interpreted or construed as a guarantee, warranty, or legal opinion.

Daniel McGrath
Print Name

Associate and Senior Consultant
Title

Daniel McGrath
Signature

8/7/17
Date

2.0 PURPOSE

This Closure Plan (Plan) is for the Chesterfield Power Station Fossil Fuel Combustion Products (FFCP) Management Facility (Facility) at the Chesterfield Power Station (Station), Chesterfield County, Virginia. This Facility is a captive industrial landfill and at final capacity, will contain approximately 9,360,000 cubic yards of FFCP (including CCR) material. The landfill closure cap, approximately 66 acres, will be constructed as described this plan.

This Closure Plan was prepared in accordance with 40 CFR Part §257, Subpart D and is consistent with the requirements of 40 CFR §257.102(b) for the development of a written closure plan for a CCR Landfill.

2.1 Closure Plan Implementation

The goals of the closure plan design at the Facility are to provide a low maintenance cover system with adequate stormwater run off controls to prevent erosion and exposure of the FFCPs. The maximum facility sideslope is 3 Horizontal to 1 Vertical (3H:1V), and stormwater benches are located to intercept sheet flow before it can concentrate into an erosive flow. The final cover soil will have a vigorous stand of vegetation established to minimize soil erosion. A 40-mil HDPE geomembrane liner serves as the infiltration barrier to prevent water percolation into the FFCP. FFCPs by their nature are non-putrescible, and do not decompose or produce landfill gas. Gas migration and odor is not anticipated to be a concern. Leachate will continue to be collected and transported by the existing leachate collection and conveyance system for treatment and disposal.

3.0 CLOSURE ACTIVITIES

3.1 Closure Plan Time Frame

With an anticipated in-service date of late 2017, the estimated life of the Facility is approximately 20 years. It is anticipated the Facility will cease accepting FFCP in approximately 2038. Progressive closure construction is anticipated to be in accordance with the table below. The final closure date may vary depending on the ash generation and beneficial use rate. Virginia Electric and Power Company d/b/a Dominion Energy Virginia ("Dominion Energy") intends to market a portion of FFCP generated at the Station for beneficial reuse projects. Construction of the final closure cap of the facility will take place in three interim stages:

Closure Stage	Approximate Area, Ac.	Approximate Closure Year
1	21	2025
2	14	2030
3	32	2038
Final		2038

Selection of the interim closure stage is based on the landfill fill sequence and when an area of approximately 15 to 20 acres is at final grades and can be closed.

3.2 Inventory Removal and Disposal

All facility equipment and temporary structures used during normal operations will be removed after their usefulness ends. All lubricants, fuel, waste oil, and other residues used or generated as part of Facility operations will be managed and disposed of appropriately. Operational equipment should not require decontamination, and all routine equipment maintenance will be performed to minimize the risk of contamination from lubricants or fuel oil used at the Facility.

3.3 Closure of Sediment Basins

The two sediment basins serving the Facility will have accumulated sediment removed and the basins will be transitioned into permanent stormwater management ponds. The ponds will be left in place to manage stormwater flow from the site.

The lined contact stormwater basin will have the accumulated sediments removed and placed in the active landfill area as part of final closure activities. The pond liner will be removed and the subgrade inspected for contamination. If contaminated soil is found, it will be excavated and placed in the active landfill area as part of final closure activities. The principal spillway intake structure will be removed and the outlet pipe permanently closed. The auxiliary spillway will be deepened to allow flow into the adjacent unlined stormwater pond. The inside sideslopes and other disturbed areas of the pond will then be seeded to establish vegetation above the normal pool level.

4.0 FINAL COVER DESIGN

Final closure will be performed progressively as significant portions (approximately 15- to 20- acre areas) of the Facility are filled to design grades. The Final Cover Design is a pre-approved alternate as described in 9VAC20-81-160.D.2.e. Final closure will be conducted to fulfill requirements of the permit and the construction plan as described below:

- The closure side slopes are designed for a maximum 3H:1V (Horizontal to Vertical) slope, and the crown is designed with a minimum five percent slope.
- The final cover design consists of (from the bottom up):
  - Compacted subgrade (soil or FFCP);
  - 40-mil textured high-density polyethylene (HDPE) geomembrane;
  - 250-mil double-sided geocomposite;
  - A minimum 18-inch infiltration layer of compacted soil; and,
  - A minimum 6-inch layer of vegetative support soil that is subsequently seeded.
- The final closure grading is sloped so that runoff will be directed to the sedimentation basin located at the east end of the Facility.

The final cover system is designed in accordance with 40 CFR §257.102(d)(3)(i), including the use of a geomembrane liner to minimize the infiltration of liquids into the FFCP. The final cover system is designed to prevent the future impoundment of water, and includes measures to prevent sloughing, minimize erosion, and prevent excessive hydraulic head build-up. The final cover system is designed to minimize the need for maintenance after closure. The largest area requiring a final cover is estimated at approximately 66 acres.

4.1 Components of the Final Cover System

The proposed Final Cover for the Chesterfield FFCP Facility is a pre-approved alternate final cover system as described in 9VAC20-81-160.D.2.e. This section presents a discussion of the components of the Final Cover System.

4.1.1 Liner Subgrade

The subgrade for the barrier layer geomembrane will consist of compacted soil or FFCP material that meets the liner subgrade requirements as specified in Sections 02200 (Earthwork) and 02597 (Polyethylene Geomembrane) of the Technical Specifications. The liner subgrade will contain particles no larger than 3/8” and will be rolled with a smooth-drum roller to flatten out wheel ruts and protrusions that may damage the overlying geosynthetics.

4.1.2 Barrier Layer

The proposed barrier layer for the Facility is 40 mil High Density Polyethylene (HDPE) geomembrane. HDPE was selected due to its combination of being a physically “tough” barrier composed of a highly

chemically resistant material. Long term settlement of the in-place FFCP is anticipated to be negligible due to the rapid consolidation properties of the FFCP, so liner strain is not expected to occur.

4.1.3 Cover Drainage Layer

A drainage layer, consisting of 250-mil double-sided geocomposite, will be installed on top of the barrier layer to provide drainage for the cover soil. The geocomposite will prevent the cover soils from becoming saturated and potentially subject to downward movement. Collected drainage from within the geocomposite will be discharged at the toe of the cap into the perimeter drainage system. This collected water will not have come in contact with the FFCP and can be treated as ordinary stormwater.

4.1.4 Erosion Control / Protective Cover Layer

The 18-inch protective cover layer will be constructed of on-site soils. The protective cover layer will be placed and compacted to at least 90% of its Standard Proctor Density.

4.1.5 Vegetative Support Layer

The top six inches of the Final Cover System will be the vegetative support layer soil. This soil will be placed, but not compacted, and then seeded with a site-specific mixture based on recommendations from a soils report and will consist mainly of turf-type grasses and nurse crops that will lend themselves to quickly establishing a healthy stand of grass. Woody vegetation is not allowed on the Final Cover System.

4.1.6 Cover System Performance

The 24-inch thickness of the cover system soils is sufficiently thick to protect the underlying geosynthetics from freezing. The maximum anticipated depth of frost penetration for central Virginia is approximately 20 inches (0.5 meters).

The cover system soils will consist of on-site soils that are fine-grained loamy soils that generally exhibit some degree of plasticity and are classified as low to moderately erodible by wind and water. The calculated soil loss by the Revised Universal Soil Loss Equation (RUSLE) is 1.79 tons per year.

4.1.7 Erosion and Sediment Control

Erosion and sediment control is discussed in the Erosion and Sediment Control Plan (ESC Plan) as part of the Design Drawings and the Design Report for the Facility's Virginia DEQ Solid Waste Part B Permit Application. To prevent soil erosion while vegetation is being established, the Facility will use techniques chosen from the Virginia Erosion and Sediment Control Handbook, Third Edition, dated 1992, as well as other design features. The primary defense against soil erosion is to protect the soil from direct raindrop erosion. This will be accomplished by the application of mulch or erosion control matting after seeding, depending on the area of the design plans. Prior to seeding, the top surface of the vegetative support

layer will be roughened using the tracks of a bulldozer running parallel to the slope to create a surface of small depressions that aid in establishment of vegetative cover and reduce runoff velocity.

4.2 Final Slopes

The final slopes for the Facility will be a maximum of 3:1 on the sideslopes and 5% on the top. To protect from erosion, diversion berms will be constructed at a maximum vertical spacing of 30 feet to collect surface runoff into a protected channel before it has time to concentrate into small rivulets and cause erosion. The diversion berms are protected with appropriate lining to minimize erosion.

The materials and slopes of the final cover system layers are such that a factor of safety of at least 1.5 is calculated for each interface. The site is not located in a seismic impact zone as defined by the EPA. The maximum horizontal ground acceleration (2% probability of occurrence in 50 years based on USGS mapping) is 0.09g. Further discussion of the seismic impact zone is included in the Facility's Part A permit application.

4.3 Runoff Controls

The features described in the ESC Plan are designed to manage the peak flow for the 25-year, 24-hour storm event. The stormwater system is designed as a series of diversion berms, slope drain pipes, engineered stormwater channels and stormwater basins. The system is designed to adequately convey to 25-year, 24-hour storm event. The system was also checked for overtopping during the 100-year storm event. Runoff from a typical non-contact area of the landfill would be as follows: sheet flow to a sideslope diversion berm, channel flow to a slope drain pipe, slope drain pipe to perimeter channel, perimeter channel to stormwater basin.

4.3.1 Drainage Structure Maintenance

Maintenance of the site's drainage structures will include routine inspections as per the *Operations Plan* to identify areas of erosion, undercutting, or other maintenance needs. Additional inspections may be required after large storm events to check for damage. Specific items to be inspected include:

- Culvert inlets for accumulated sediment or debris;
- Diversion berms for erosion and establishment of vegetation;
- Slope drain pipes for proper anchorage, leaking joints, undercutting;
- Vegetation in other areas for proper establishment, need of mowing;
- Perimeter channels for erosion and establishment of vegetation;
- Energy dissipation and drop inlet structures for integrity and accumulated sediment; and,
- Other temporary controls (e.g. silt fence) for proper function and sediment control.

4.4 Settlement, Subsidence, and Displacement

The final cover system is not expected to experience settlement due to potential consolidation of the FFCPs. Since FFCPs are inorganic in nature and are compacted to at least 92 percent of the standard Proctor (ASTM D698) during placement, the majority of the settlement will occur during placement and compaction. In the event that non-uniform settlement occurs, minor regrading and repair of the final cover system soils may be required.

The proposed exterior sideslopes of the landfill are to be 3H:1V. The stability of the final cover system was evaluated under static conditions by examining potential rotational failure through the exterior slopes and veneer failure of the sideslopes. The analyses indicate that the final cover system will be stable under design static conditions. Certain minimum physical properties were assumed, including interface friction angles and soil properties (i.e., internal friction angles and cohesion). Laboratory testing of materials proposed for use in final closure construction will be completed prior to use to verify that the material provides equivalent performance.

5.0 SCHEDULE FOR CLOSURE

The FFCP disposal units will be developed in a staged manner and final closure construction will be conducted as significant areas (approximately 15- to 20-acres) of the Facility reach final closure grades. The final closure schedule is dependent on the beneficial use market demand for FFCPs. Beneficial use of the FFCPs could extend the life of the Facility until the closure of the Station. Should beneficial reuse not occur, the Facility is anticipated to close in approximately 2038. The erosion and sedimentation controls will remain part of the Facility closure, and the groundwater monitoring system will remain in place during the closure and post-closure periods.

The closure construction activity for each cycle of closure is anticipated to take approximately nine to twelve months to complete, based on Dominion's construction experience of similar size landfill closure projects. Minimizing the FFCP exposure during closure cap construction to prevent erosion from rain and wind will be accomplished by methods such as:

- Installation of stormwater runoff and run-on controls such as temporary diversion berms, silt fencing, slope drains, and sediment trapping measures as required by the specific construction activity;
- Sequencing the stripping of soil and fine grading for cap construction such that it occurs during periods of favorable weather; and,
- Limiting exposing areas to those that can be covered with geosynthetics in a short amount of time.

6.0 CLOSURE IMPLEMENTATION

6.1 Closure Posting

One sign will be posted at the site entrance to the Facility notifying all persons of the final closure of the Facility and prohibition against further receipt of FFCPs. Unauthorized access to the site will be controlled by fencing (as needed) and lockable gates across the access roads.

6.2 Notification

The County of Chesterfield, Virginia will be notified upon the completion of closure of the Facility. The survey plat will be prepared showing the final closure grades and the locations of the groundwater monitoring wells. The survey plat and deed will have the following notification language:

> **This property has been used for the management and disposal of solid waste. Any future use of the site shall not disturb the integrity of the final cover, liners, or any other components of the containment systems, or the function of the monitoring system unless necessary to comply with the Virginia Solid Waste Management Regulations or approved by the Department of Environmental Quality.**

Within 30 days of recording a notation on the deed to the property, a notification indicating the notation has been recorded will be sent to DEQ, posted on Dominion Energy's publicly accessible internet site, and placed in the Facility's operating record.

6.3 Closure Certification

Upon completion of closure construction, a certification statement, signed by a licensed professional engineer, will be submitted to the DEQ along with the results of the CQA plan. The certification statement shall read as follows:

> **I certify that closure has been completed in accordance with the Closure Plan dated [DATE] for permit number 609 issued to Dominion, with the exception of the following discrepancies:**
>
> **In addition, a sign(s) was(were) posted on [DATE] at the landfill entrance notifying all persons of the closing [and state other notification procedures if applicable] and barriers [indicate type] were installed at [location] to prevent new waste from being deposited.**
>
> **A survey plat prepared by [NAME] was submitted to the County of Chesterfield, Virginia on [DATE]. A copy of the survey plat is included with this certification.**

A notation was recorded on the deed to the landfill property on [DATE]. A copy of the revised deed is attached to this certification.

[Signature, date and stamp of Professional Engineer]

7.0 CLOSURE COST ESTIMATE

The estimated cost for closure of the 66-acre landfill is $10,400,000. Dominion will hire a construction contractor to provide closure construction services.