



CCR Rule Closure Plan

Dominion Virginia Power
Curley Hollow Solid Waste Management Facility
To Support the Virginia City Hybrid Energy Center
Wise County, Virginia

GAI Project Number: C160523.00

October 2016



Prepared by: GAI Consultants
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Prepared for: Dominion Virginia Power
5000 Dominion Boulevard
Glen Allen, Virginia 23060

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Certification/Statement of Professional Opinion

The Coal Combustion Residuals Closure and Post-Closure (Plan) for the Curley Hollow Solid Waste Management Facility was prepared by GAI Consultants (GAI). The Plan was based on certain information that, other than for information GAI originally prepared, GAI has relied on but not independently verified. This Certification/Statement of Professional Opinion is therefore limited to the information available to GAI at the time the Plan was written. 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 the 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, and at the same time and in the same locale. It is my professional opinion that the Plan meets the requirements of the United States Environmental Protection Agency's "Disposal of Coal Combustion Residuals From Electric Utilities," published in the Federal Register on April 17, 2015 with an effective date of October 19, 2015.

The use of the words "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.

GAI Consultants



James F. Shields, P.E.
Assistant Manager, Engineering

Date 9/29/16



Acronyms

CCR	Coal Combustion Residuals
CCR Rule	"Disposal of Coal Combustion Residuals From Electric Utilities" 40 CFR § 257 (2015)
CFR	Code of Federal Regulations
CHSWMF	Curley Hollow Solid Waste Management Facility
Dominion	Virginia Electric and Power Company d/b/a Dominion Virginia Power
EPA	Environmental Protection Agency
FFP	Fossil Fuel Combustion Product
GAI	GAI Consultants
HDPE	High Density Polyethylene
Plan	Closure Plan
PVC	Poly Vinyl Chloride
VCHEC	Virginia City Hybrid Energy Center
VDEQ	Virginia Department of Environmental Quality

1.0 Closure Plan

Virginia Electric and Power Company d/b/a Dominion Virginia Power (Dominion) operates the Curley Hollow Solid Waste Management Facility (CHSWMF) in support of the operation of the Virginia City Hybrid Energy Center (VCHC) in Wise County, Virginia. Dominion is permitted to develop approximately 160 acres for the disposal of approximately 35 million cubic yards of fossil fuel combustion products (FFPs) produced at the VCHC. The significant aspects of landfill design, operation and closure, waste composition, leachate management, and the details of the site liner and cap systems will reasonably conform to the lines and grades illustrated on the drawings provided with the Virginia Department of Environmental Quality (VDEQ) Part B Application (Part B Permit). The selection of either a 40-mil Polyvinyl Chloride (PVC) or a 60-mil Textured High Density Polyethylene (HDPE) Flexible Membrane Liner (FML) cap will be made based on the economy of the materials at the time of closure.

The proposed final topography for the landfill is shown on Part B Permit Drawing "Part B Drawing 7." The following discussion, based on VDEQ submission instructions, provides a description of the elements of the closure appurtenants.

This Closure Plan fulfills the requirements for the Code of Federal Regulations (CFR) Title 40 Part 257 Subpart D, "Disposal of Coal Combustion Residuals From Electric Utilities," published in the Federal Register on April 17, 2015 with an effective date of October 19, 2015 (CCR Rule), § 257.102.

1.1 Closure Activities

1.1.1 Closure Plan Time Frames

This Closure Plan describes the operation of the CHSWMF for a period of 20 years. The final closure date is estimated as January 2034, but could change due to variance in FFP production, unscheduled plant maintenance outages, and potential off-site beneficial use of FFPs, which affect the disposal rate of FFPs placed in the landfill. The site development will be performed in stages as shown on Part B Permit Drawings "Part B Drawings 8, 9, 10, 11, and 12," and the final topography is shown on "Part B Drawing 7." The final "outside" benches and slopes of each stage's development will receive the final cap system. Dominion may develop, operate, and close partial sections within each stage.

1.1.2 Closure Performance Standard

The site will be covered with a low-permeability geomembrane cover system, including soil cover to minimize releases of waste and production of leachate. The majority of waste is FFP from the operation of an atmospheric fluidized bed combustor. FFP has relatively inert characteristics. The other wastes which have a potential for decomposition and the potential produced gases from these wastes are of negligible quantity.

Post-closure maintenance will be minimized by implementation of actions as described in the CHSWMF Post-closure care plan.

1.1.3 Inventory Removal and Disposal

Once the post-closure care period (30 years) has concluded, the final leachate pond will be decommissioned, and the leachate, if continuing to flow, will be channeled (or piped, as appropriate) directly to a leachate pumping station for pumping back to the Station. Additional discussions on leachate handling are presented in the Part B Permit, Module XV: Leachate Handling. Pond decommissioning will be accomplished by excavating or removing the liner system and protective cover and any solid waste residues, and regrading the earthen dikes to

conform to the surrounding contours and to provide positive drainage. The liner components, protective cover, and solid waste residues will be disposed of at an approved landfill.

The sedimentation pond will remain and be converted to a storm water management pond.

1.1.4 Closure

The final site topography plan for the landfill is shown on Part B Permit Drawing "Part B Drawing 7." The final cover design, installation requirements, and maintenance requirements for the landfill are shown on Part B Permit Drawing "Part B Drawing 23" and in the Part B Permit, Module V: Design Report, Attachment 5. Cover soil will be obtained both from onsite and offsite sources, as allowed under the permit. Currently, the existing site is covered with soil. It is anticipated that some of this soil will be excavated and stockpiled for use in the vegetative final soil cover layer. Dominion owns approximately 1,700 acres of the VCHEC site, which will be used to obtain borrow soils for the final cover. Off-site borrow soils may also be procured to obtain soil for the final cover. Possible locations for laydown, soil stockpile, soil borrow and soil spoil areas are shown on the Part B Permit, Drawing "Part B Drawing 6."

1.1.4.1 Cover Design – Landfill Closure

Inactive areas, areas that will not be receiving waste for more than 30 days, will receive a crusting agent or 12 inches of intermediate cover soil within 30 days of the last FFP placement activity.

Final closure activities will begin within 30 days of receipt of the last volume of waste and be completed within six months unless a request for extension is made to and approved by the VDEQ.

The liner portion of the final cover will be a FML consisting of 40-mil PVC or 60-mil textured HDPE. The FML will be obtained from an approved manufacturer who has demonstrated their material to be compatible with the site-specific conditions. This FML is being specified in lieu of a two-foot layer of clay soil with a coefficient of permeability less than 1×10^{-7} cm/sec. The FML will have a permeability equal to or less than the landfill liner. A Geocomposite Drainage Net (GDN) will provide drainage and permeability, and a 24-inch soil cover (18-inch soil protective layer and six-inch erosion layer) will provide protection for the FML and support vegetative cover.

Each capping operation will use either 40-mil PVC or 60-mil HDPE for the closure cap FML for the entire closure area [estimated at 160 acres]. Intermixing of geomembrane material types within an active capping operation will not be permitted. Seaming of different types of geomembranes will only be permitted at the tie-in location of a previously-capped area to an active capping area. For seaming different types of geomembranes peel and shear requirements will be provided for test seams and destructive testing.

A general cover material construction plan is summarized below; cover will be placed within 30 days of FFP being placed to final grade.

- Excavate and stockpile the existing (partial) site's soil cover. This will be completed in phases as individual areas are developed, and will help to reduce erosion.
- Regrade the intermediate cover and install the FML, GDN, and soil cover according to the requirements of the Technical Specifications and Drawings.

1.1.4.2 Drainage and Erosion

Calculations have been performed to estimate erosion rates during closure and throughout the post-closure period (see the Part B Permit, Module II: Closure Plan, Appendix A).

The estimated rate of cover erosion was calculated by using the Universal Soil Loss Equation. The calculation considered the surface as being vegetated with the proposed grasses and low growing birdsfoot trefoil. This condition would occur on completed areas throughout the post-closure period.

The area with the longest and steepest slope between benches (75 feet at 33 percent) would be susceptible to the most severe erosion rates. This identified area has an estimated erosion rate of 1.8 tons per acre per year for the vegetated surface. The estimated erosion rate for the vegetated surface is less than the accepted maximum soil loss rate (2.0 tons per acre per year).

Seeding and mulching will occur immediately after grading as erosion of unprotected surfaces is more severe. Soil material that erodes during construction will be intercepted and channeled to the onsite sedimentation pond. Any eroded areas will be repaired. The GDN and bench drain pipes will be installed as shown on Part B Permit drawings "Part B Drawing 7" and "Part B Drawing 23." Prior to installation, aggregate used in the aggregate envelope shall be tested to verify the coefficient of permeability meets requirements for a typical aggregate envelope.

The GDN drainage layer will consist of a synthetic geonet with a transmissivity of at least $1.5 \times 10^{-3} \text{ M}^2/\text{sec}$ at 100 psi. SKAPS Industries TN 250 meets this specification.

Calculations have been performed using the Hydrologic Evaluation of Landfill Performance (HELP) Model Computer Program to estimate drainage layer flow for the final cover system.

The HELP Model calculations show that collector drains are needed at the benches due to the reverse grade of the benches. The collector drains are required to prevent the build-up of peak water head in the drainage layer greater than the drainage layer's thickness, which would cause uplift pressure on the vegetative layer.

The bench drains discussed above and the final cover drainage layer will drain infiltrated precipitation without significant head accumulating on the FML.

A surface water drainage system has been designed to provide run-on and run-off control at the facility. The diversion channels along the southern boundary of the site will be used, and improved as necessary, to divert run-on away from the fill. The leachate channels will be converted to sediment channels, which collect and convey surface run-off from the closed landfill into the sedimentation pond west of the site, ultimately draining into Meade Creek. The channels are designed to control at least the 25-year, 24-hour storm during and after construction. The channel design has "freeboard" so the actual hydraulic capacity is greater. Slope drains will be lined as specified on Part B Permit Drawing "Part B Drawing 24."

Benches will be fertilized, seeded, and mulched the same way as the final cover. Sediment channels will have channel lining according to the channel schedule on Part B Permit Drawing "Part B Drawing 24." Details of the channel stabilization and vegetation design are provided on the drawings. Site access by vehicle is through the facility haul road. The culverts in the perimeter sediment channels underneath the entrance and at the "Final Leachate Pond" are sized to handle at least the 25-year, 24-hour storm. The layout and details of the surface water drainage system are shown on the drawings. Calculations are provided in the Part B Permit, Module V: Design Report, Attachment 2.

1.1.4.3 Final Slopes

Basegrade elevations will be attained by installing engineered soil or rock fill in the valley floor and excavating the side slopes. The basic geometry for proposed landfill is:

- Basegrade side slopes: 3 horizontal to 1 vertical (3H:1V) or flatter;
- Final Landfill side slopes: 3H:1V between benches; with
- Final Benches: 20-foot wide spaced every 25 vertical feet.

1.1.4.4 Maintenance Needs

The cover system is designed to function with minimum maintenance needs. The top surface of the fill will be graded to provide positive drainage while minimizing ponding. Embankment side slopes will be graded at 3H:1V or flatter to minimize erosion. The vegetative cover specified will be monitored after major storm events. Vegetative cover will be reseeded and mulched as necessary. The vegetation species were chosen to minimize maintenance fertilizing. Biological nitrogen fixation (by Birdsfoot Trefoil) will maintain and build fertility levels. Large woody plants will be cut down and the stumps treated as necessary.

1.1.4.5 Construction Quality Assurance Plan

The Construction Quality Assurance Plan provided in the Part B Permit, Module V: Design Report, will be implemented for the closure of the CHSWMF.

1.1.5 Schedule for Closure

The schedule for closure is presented in general terms in Table 1. A more definitive schedule with specific milestones will be presented to the VDEQ upon notification of intent to close.

Table 1: Milestones and Schedules for Closure

Milestone	Approximate Date
Final Receipt of FFP	January 2034
Commence Closure	February 2034
Complete Closure	August 2034

1.1.6 Posting

Access to the CHSWMF is through a secured entrance to the VCHEC. Signs will be posted at the facility access points in accordance with 9 VAC 20-81-160(D)(5)(a). These signs will indicate that the site is closed and no longer accepting waste and unauthorized entrance is prohibited.

1.1.7 Notification

Within 90 days following completion of closure of the CHSWMF, a survey plat will be submitted to the local land-recording authority (Wise 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 and CCR Rule § 257.104(d)(1)(iii). A copy of the deed restriction will be submitted to the VDEQ.

Sections 257.102 of the CCR Rule and 9 VAC20-81-800 of the VSWMR require the owner or operator of a CCR surface impoundment to place the following on the owner or operator's publicly accessible internet site: a notification of intent to initiate closure, annual progress reports, notification of closure completion, and notification of deed notation. These closure-related notifications will be provided in accordance with the CCR Rule and VSWMR.

1.1.8 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 be placed in the facility's operating record and a copy will remain at the Station throughout post-closure.

1.2 Closure Calculations

The CHSWMF will use the cover system detailed on Part B Permit Drawing "Part B Drawing 23" as approved in the Part B Permit. The CHSWMF final cover system was designed with the requirements of 9 VAC 20-90-270 E and meets the requirements of the CCR Rule, refer to the Part B Permit for information and calculations on:

- Cover system stability and liquids management; and
- Settlement, subsidence, and displacement.

1.3 Freeze and Thaw Effects

The depth of maximum frost penetration is expected to be approximately 18 to 30 inches. Since a synthetic FML will be used in the final cover, freeze/thaw cycles would not affect the integrity of the FML. Also, frost heave of the soil materials above the FML should not be a problem, since the FML will stop the upward migration of moisture and, therefore, stop ice lenses from forming and expanding to cause frost heave.

During maximum frost penetration, nearly the entire thickness of cover materials above the FML could freeze. At the onset of winter, these materials would start to freeze from the surface down to the maximum frost depth, during which time the drainage layer would continue functioning until the maximum frost depth is reached. But, during spring thaw, materials in the upper part of the vegetated layer would thaw before the drainage material, leaving a variable thickness of possibly saturated "topsoil" with a limited drainage layer. During the first few years after closure, inspections will pay close attention to local "sloughing" in the vegetated layer and promptly repair any erosion. Because the finished slopes are relatively mild (33 percent), local "sloughing" is not expected to be severe or long term. After a good stand of vegetation has been established, "sloughing" should be significantly reduced or stopped.

1.4 Construction Specifications

The site and cap system construction technical specifications and drawings are included in the Part B Permit, Module V: Design Report.

1.5 Groundwater Monitoring System

Information regarding the Groundwater Monitoring System is provided in the Part B Permit, Module X: Groundwater Monitoring and Sampling and Analysis Plan. The groundwater monitoring system will be maintained according to 40 CFR §§ 257.90 through 257.98.

1.6 Leachate Collection System

Details regarding the leachate control system design and operation are presented in the Part B Permit, Module V: Design Report.

1.7 Gas Collection System

Not applicable, as there is negligible potential for gases formed at FFP landfills.

1.8 Closure Cost Estimate

A summary of the cost estimates is provided in Table 2.

Table 2: Summary of Closure Costs

Description of Activity	Estimate Area to Cover	Estimated One Time Costs
Maximum CHSWMF Closure Cost	145 acres	\$21,750,000
End-of-life CHSWMF Closure Cost	10 acres	\$1,500,000

1.9 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 and updated accordingly.

2.0 References

GAI Consultants. *Module X - Groundwater Monitoring and Sampling and Analysis Plan, Part B Permit Application*, December 2014.

GAI Consultants. *Module XII - Closure Plan, Part B Permit Application*, September 2008.

GAI Consultants. *Module II - Operations Plan, Part B Permit Application*, February 2009.

GAI Consultants. *Construction Stormwater Pollution Prevention and Erosion and Sediment Control Plan*, April 2016.