gaiconsultants.com | transforming ideas into reality®

gai consultants

Coal Combustion Residuals Structural Stability Assessment

Virginia Electric and Power Company
Possum Point Power Station
Surface Impoundment D Dumfries, Virginia

GAI Project Number: C150132.00

October 2016

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

Table of Contents -

Certification/Statement of Professional Opinion

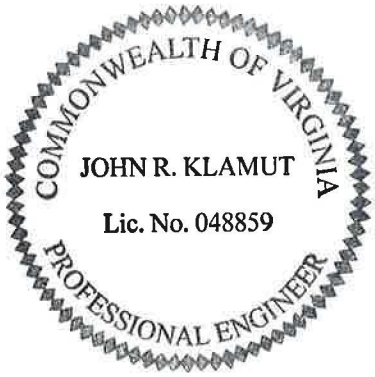
The Coal Combustion Residuals Structural Stability Assessment (Assessment) for the Possum Point Power Station Surface Impoundment D was prepared by GAI Consultants, Inc. (GAI). The Assessment was based on certain information that, other than for information GAI originally prepared, GAI has relied on, but not independently verified. This Certification/Statement of Professional Opinion is therefore limited to the information available to GAI at the time the Assessment 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 Assessment 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 the Assessment was prepared consistent with the requirements of section 257.73 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 Subpart D).

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, Inc.

John R. Klamut, PE
Engineering Manager

Date 10/13/2016



gai consultants
transforming ideas into reality

Acronyms

Assessment	Coal Combustion Residuals Structural Stability Assessment
CCR	Coal Combustion Residuals
CCR Rule	"Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments" 40 CFR 257 Subpart D (2015)
CFR	Code of Federal Regulations
DCR	Virginia Department of Conservation and Recreation
DCR Dam Permit	Virginia Department of Conservation and Recreation Dam Permit for Dam Inventory No. 15320
Dominion	Virginia Electric and Power Company d/b/a Dominion
EPA	United States Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
GAI	GAI Consultants, Inc.
IDFCSP	Inflow Design Flood Control System Plan
MSL	Mean Sea Level
Station	Dominion Possum Point Power Station
VPDES	Virginia Pollutant Discharge Elimination System
VPDES Permit	Virginia Pollutant Discharge Elimination System Permit No. VA0002071

1.0 Introduction

The Possum Point Power Station (Station) is owned by Virginia Electric and Power Company d/b/a Dominion Virginia Power (Dominion) and is located in Prince William County, Virginia. The Station includes Surface Impoundment D, which will be used for the long-term storage of coal combustion residuals (CCR).

Surface Impoundment D is located on Dominion property at the Possum Point Power Station in Prince William County, Virginia (coordinates 38° 32′ 05″ North and 77° 16′ 57″ West).

Surface Impoundment D is regulated as an existing CCR surface impoundment under the Environmental Protection Agency's "Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments" [40 CFR 257 Subpart D] published in the Federal Register on April 17, 2015 with an effective date of October 19, 2015 (CCR Rule). Surface Impoundment D is also regulated as a dam by the Virginia Department of Conservation and Recreation (DCR) with Inventory Number 15320 (DCR Dam Permit).

2.0 Purpose

This Structural Stability Assessment is prepared pursuant to the requirements in 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 (CCR Rule), § 257.73(d)(1) [40 CFR § 257.73(d)(1)].

3.0 Structural Stability Assessment Requirements

In accordance with § 257.73(d)(1), a CCR surface impoundment owner or operator is required to conduct initial and periodic structural stability assessments to establish whether the CCR unit can safely store the maximum volume of CCR and CCR wastewater. The assessment must, at a minimum, document whether the CCR unit has been designed, constructed, operated, and maintained with:

- Stable foundations and abutments;
- Adequate slope protection to protect against surface erosion, wave action, and adverse effects of sudden drawdown;
- [Embankments] mechanically compacted to a density sufficient to withstand the range of loading conditions in the CCR unit;
- Vegetated slopes of [embankments] and surrounding areas not to exceed a height of six inches above the slope of the [embankment], except for slopes which have an alternate form or forms of slope protection;
- A single spillway or a combination of spillways designed, constructed, operated, and maintained to adequately manage flow during and following the peak discharge from the 1000-year flood for a significant hazard potential CCR surface impoundment.
- Hydraulic structures underlying the base of the CCR unit or passing through the [embankment] of the CCR unit that maintain structural integrity and are free of significant deterioration, deformation, distortion, bending deficiencies, sedimentation, and debris which may negatively affect the operation of the hydraulic structure; and

- For CCR units with downstream slopes which can be inundated by the pool of an adjacent water body, such as a river, stream or lake, downstream slopes that maintain structural stability during low pool of the adjacent water body or sudden drawdown of the adjacent water body.

4.0 Structural Stability Assessment

This Assessment is based on a review of material as noted, and on additional analyses performed for this Assessment.

4.1 Stable Foundations

Material underlying Surface Impoundment D, comprising the embankment foundation, is discussed in the Surface Impoundment D *History of Construction* (GAI, 2016a). GAI analyses of embankment stability (GAI, 2016b) show that the Surface Impoundment D meets the minimum factor of safety requirements in CCR Rule § 257.73(e)(1)(equal or exceed: 1.50 for the long-term, maximum storage pool loading condition; 1.40 for the maximum surcharge pool loading condition; and 1.00 for the seismic factor of safety). Surface Impoundment D foundation material is not subject to liquefaction.

Additionally, the Surface Impoundment D has been routinely inspected and monitored by Station personnel and Dominion personnel (Virginia Power, 2014a), in accordance with the requirements in the DCR Dam Permit, and no foundation or abutment instability has been reported. It is GAI's opinion that foundations are currently stable, and that the foundations and abutments were designed, constructed, and maintained to be stable.

4.2 Slope Protection

The internal Surface Impoundment D embankment slopes are vegetated to protect against erosion. The downstream embankment slopes are vegetated and utilize stormwater control benches to control the flow of stormwater down the embankment. A riprap channel located on the east side of the embankment is used to convey stormwater flows from the stormwater control benches down the embankment to a drainage inlet located beyond the toe of the embankment (O'Brien & Gere, 2010).

The design determined that wave heights would not be expected to exceed 1.5-feet, and that due to the low normal pool maintained by the valves, high wave activity near the crest was not likely (Virginia Power, 1986). Dominion performed an annual inspection in accordance with the requirements of the DCR Dam Permit on October 2, 2015 (Virginia Power, 2015a). As part of this inspection, Dominion evaluated the vegetation on the slopes of the impoundment embankment. The downstream slope of the embankment was observed to be stable, well vegetated, and well maintained. The inspection states that a surficial slough was observed on the upstream embankment slope with no current indications of structural deficiencies. Currently, the embankment and the upstream slope display no cracking or sloughing (GAI, 2016c).

It is GAI's opinion that the embankment slope protection is stable, and signifies that the embankment slope protection was designed, constructed, and maintained to be stable.

4.3 Embankment Compaction

The technical specifications implemented as part of the original design report (Virginia Power, 1986) contain the compaction requirements for the construction of the embankment. Embankment fills were to be placed in lifts not to exceed 12-inches and compacted to a minimum of 95 percent of the maximum dry density as defined by the ASTM D698 standard compaction test. The technical specifications also indicate that "any deviations from the compaction requirements shall only be allowed by the Engineer after a review of test results, construction procedures, and field conditions". As-built drawings showing completion of construction of Surface Impoundment D were prepared in 1988 (Virginia Power, 1988). Dominion employed a third party QA/QC firm to monitor all aspects of embankment construction and perform all testing and inspections required by the technical specifications. The as-built drawings indicate that the embankments were constructed per the technical specifications set forth by the original design report (Virginia Power, 1986a).

It is GAI's opinion that the embankment compaction was designed, constructed, operated, and maintained to be stable.

4.4 Vegetated Slopes

As required by § 257.73(d)(1)(iv), vegetation on slopes and surrounding areas must be maintained to promote visible inspections. Current operations at the Surface Impoundment D, as regulated by the DCR Dam Permit, call for grass to be mowed 2-3 times per year to control vegetation height (Virginia Power, 2014a). The vegetated slopes are operated and maintained to be stable and to provide visual observation of instability.

4.5 Spillway Capacity and Underlying Hydraulic Structures

The principal spillway consists of a reinforced concrete intake tower connected to a 30-inch reinforced concrete pipe (RCP), which is designed to discharge through a 30-inch diameter, 320-foot long pipe that runs below the embankment and into a concrete stilling basin located near the western toe (Virginia Power, 1986b). As designed, the flow then discharges via a 580-foot long concrete lined channel into Surface Impoundment E which is located west of Surface Impoundment D (GAI, 2016c). The outlet structure utilizes a series of manually operated valves from elevation 116 to 142-feet that can be used to control water elevation. When reaching the maximum design elevation (Virginia Power, 2014a), water enters the tower through a 5-foot wide intake weir with a crest elevation of 142-feet (Golder, 2012). Currently, water from Surface ImpoundmentD is being routed through a dewatering water treatment system prior to discharge to Outfall 503 and not through Surface Impoundment E.

The emergency spillway crest is a 120-foot wide earthen spillway sized to safely convey the full PMF storm event while maintaining a minimum freeboard of 2-feet. The emergency spillway crest elevation is 144-feet (Virginia Power, 1986a). Water discharging from the emergency spillway flows into a natural channel to the west and eventually outfalls into Quantico Creek (Golder, 2012).

The "2015 Annual Inspection Report" (Virginia Power, 2015a) indicates that the principle spillway system is in good condition and is free of debris that would prevent the system from functioning as designed.

The Inflow Design Flood Control System Plan (IDFCSP) (GAI, 2016d) contains routing calculations as part of a hydraulic capacity assessment, and demonstrates that the principle and emergency spillway can adequately manage the Probable Maximum Flood (PMF), which is greater than the 1,000-year flood.

It is GAI's opinion that the spillway system was designed, constructed, operated, and maintained to be stable.

4.6 Adjacent Water Bodies

The downstream slope of the Surface Impoundment D embankment is approximately ¼ of a mile north of Quantico Creek. Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) No. 51153C0316E (revised August 3, 2015) shows that the Surface Impoundment D embankment is not bordering the inundation area for the 100-year (1% annual recurrence) flood. The 100-year water elevation (Base Flood Elevation) shown on the FIRM map for Quantico Creek is approximately 8-feet mean sea level (MSL). The toe of the Surface Impoundment D embankment is approximately 300 linear feet and 24-feet above the 100-year flood inundation zone.

5.0 Corrective Measures

Based on a review of available material and additional analyses performed for this Assessment, at this time no deficiencies were detected in the structural stability analysis for Surface Impoundment D and no corrective measures are required.

6.0 Conclusion

It is GAI's opinion, based on a review of available material and additional analyses performed for this Assessment, that the Surface Impoundment D design, construction, and operations and maintenance procedures are consistent with good engineering practices for the maximum volume of CCR and CCR wastewater which can be impounded and meet the requirements of 40 CFR 257.73(d).

7.0 References

GAI. 2016a. Coal Combustion Residuals History of Construction Report, Possum Point Power Station, Dumfries, Virginia. October.

GAI. 2016b. Coal Combustion Residuals Factor of Safety Assessment, Possum Point Power Station, Dumfries, Virginia. October.

GAI. 2016c. Coal Combustion Residuals Annual Inspection Report, Possum Point Power Station, Dumfries, Virginia. October.

GAI. 2016d. Coal Combustion Residuals Inflow Design Flood Control System Plan, Possum Point Power Station, Dumfries, Virginia. October.

Golder Associates Inc. (Golder), 2012. Inundation Study, Possum Point Power Station, Ash Pond 'D' Dam, DCR Inventory #15320, December.

O'Brien & Gere. 2010. *Dam Safety Assessment of CCW Impoundments, Possum Point Power Station;* September 8.

United States Environmental Protection Agency, 2015. 40 CFR Parts 257 and 261 Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule. April 17, 2015.

Virginia Department of Conservation and Recreation (DCR), Soil and Water Conservation Board. 2016. Dam Safety Alteration Permit 15320. Effective April 30, 2016; Expires April 30, 2018. May 3.

Virginia Power (Dominion). 2014a. Operating Plan and Schedule, Ash Pond 'D' Dam and Impoundment, Possum Point Power Station, Prince William County, Virginia. April.

Virginia Power (Dominion). 2015a. Annual Inspection Report, Possum Point Power Station, Ash Pond D, DCR Inventory No. 15320. October.

Virginia Power (Dominion). 1988. As-Built Drawings, Possum Point Power Station, Ash Pond "D" Expansion Project, Possum Point Power Station. October.

Virginia Power (Dominion). 1986a. Final Design Report, Possum Point Power Station, Ash Pond 'D' Dam, DCR Inventory #15320, October.

Virginia Power (Dominion). 1986b. Final Design Drawings, Possum Point, Ash Pond "D" Expansion Project, Possum Point Power Station.