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11687 Lebanon Road, Cincinnati OH 45241

October 17, 2016
File: 175534017
Revision 0

Ohio Valley Electric Corporation
3932 U.S. Route 23
P.O. Box 468
Piketon, Ohio 45661

RE: Initial Structural Stability Assessment
South Fly Ash Pond
EPA Final Coal Combustion Residuals (CCR) Rule
Kyger Creek Station
Cheshire, Gallia County, Ohio

1.0 PURPOSE

This letter documents Stantec's certification of the initial structural stability assessment for the Ohio Valley Electric Corporation (OVEC) Kyger Creek Station's South Fly Ash Pond. Based on this assessment, the South Fly Ash Pond is in compliance with the structural stability requirements in the EPA Final CCR Rule at 40 CFR 257.73(d).

2.0 INITIAL STRUCTURAL STABILITY ASSESSMENT

As described in 40 CFR 257.73(d), documentation is required on how the South Fly Ash Pond has been designed, constructed, operated, and maintained according to the structural stability requirements listed in the section. The combined capacity of all spillways must also be designed, constructed, operated, and maintained to adequately manage flow from the 1,000-year storm event based upon a hazard potential classification of "significant."

3.0 SUMMARY OF FINDINGS

The attached report presents the initial structural stability assessment of the South Fly Ash Pond. The results show that the impoundment meets the structural stability requirements set forth in 40 CFR 257.73(d)(1)-(2).

4.0 QUALIFIED PROFESSIONAL ENGINEER CERTIFICATION

I, Stan A. Harris, being a Professional Engineer in good standing in the State of Ohio, 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;

Re: **Initial Structural Stability Assessment**
South Fly Ash Pond
EPA Final Coal Combustion Residuals (CCR) Rule
Kyger Creek Station
Cheshire, Gallia County, Ohio

2. that the information contained herein is accurate as of the date of my signature below; and

3. that the initial structural stability assessment for the OVEC Kyger Creek Station's South Fly Ash Pond meets the requirements specified in 40 CFR 257.73(d)(1)-(2).

SIGNATURE _____ DATE 10/17/16

ADDRESS: Stantec Consulting Services Inc.
11687 Lebanon Road
Cincinnati, Ohio 45241

TELEPHONE: (513) 842-8200

ATTACHMENTS: Kyger Creek South Fly Ash Pond Initial Structural Stability Assessment Report

Initial Structural Stability Assessment

Kyger Creek Station
South Fly Ash Pond
Cheshire, Gallia County, Ohio

Prepared for:
Ohio Valley Electric Corporation
Piketon, Ohio

Prepared by:
Stantec Consulting Services Inc.
Cincinnati, Ohio

October 17, 2016

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1.0 PROJECT BACKGROUND

On April 17, 2015 the "Disposal of Coal Combustion Residuals (CCR) from Electric Utilities" (EPA Final CCR Rule) was published in the Federal Register. Stantec Consulting Services, Inc. (Stantec) was contracted by the Ohio Valley Electric Corporation (OVEC) to analyze the structural stability of the Kyger Creek Station's South Fly Ash Pond (SFAP) evaluate its compliance with §257.73 of the EPA Final CCR Rule.

As required by §257.73 of the EPA Final CCR Rule, an initial structural integrity evaluation is required by October 17, 2016 and must include an initial structural stability assessment for each existing CCR surface impoundment that meets the conditions of paragraph (b) as follows:

1. Has a height of five feet or more and a storage volume of 20 acre-feet or more or
2. Has a height of 20 feet or more.

2.0 UNIT DESCRIPTION

The Kyger Creek Station is located on the north shore of the Ohio River downstream of Cheshire, Ohio. The station consists of five coal-fired electric generating units, each nominally rated at 217 megawatts. The Kyger Creek Station is directly accessible from State Route 7.

The South Fly Ash Pond is located west of the station across State Route 7. Upon commencing operations in 1955, the station sluiced CCRs into the South Fly Ash Pond for storage. Originally the pond received bottom ash, but is now currently used to storage fly ash. The South Fly Ash Pond was created by building a perimeter dike to enclose an area of approximately 68 acres. It is bounded by State Route 7 to the east, the closed North Ash Pond to the north, a railroad line and plant road to the west, and a plant road and flue gas desulfurization (FGD) wastewater treatment plant to the south.

The subsections under §257.73(d) address conditions of appurtenances categorized as embankments, spillways, or hydraulic structures. Sections 2.1 to 2.3 below provide descriptions of the individual unit elements that fall within these appurtenance categories. Appendix A includes a plan view of the Kyger Creek Station.

Note that all elevations included in this document and appendices are referenced to the National Geodetic Vertical Datum of 1929 (NGVD29).

2.1 EMBANKMENTS

2.1.1 SFAP Perimeter Dike

The SFAP Perimeter Dike was built between 1954 and 1955 during construction of the Kyger Creek Station. The dike encompasses the entire surface impoundment. To the north, the South Fly Ash Pond abuts the closed North Fly Ash Pond facility. The rolled earth dike is approximately 6,750 feet long with a maximum height of 40 feet. The crest wide is estimated as 12 feet with an elevation of 590 feet. The interior embankment has a slope of 2H:1V, while the exterior slope is 2.25H:1V to 3H:1V. As designed, the bottom of the South Fly Ash Pond is elevation 550 feet (Terracon, 2014).

2.2 SPILLWAYS

2.2.1 Primary Spillway System

The configuration of the primary spillway system for the South Fly Ash Pond is documented by CHA (2009) and by construction drawings (AEPSC, 2016). The SFAP primary intake structure is a 36-inch steel-reinforced concrete pipe with a 42-inch by 39-inch steel-reinforced concrete riser. The elevation of the spillway is 582 feet. Concrete stop logs are used to raise the spillway elevation to 587 feet (CHA, 2009).

2.3 HYDRAULIC STRUCTURES

Other than the primary spillway described above, no hydraulic structures are located at the SFAP.

3.0 FOUNDATIONS AND ABUTMENTS (§257.73(d)(1)(i))

Per §257.73(d)(1)(i), the initial structural stability assessment must document whether the unit has been designed, constructed, operated, and maintained with stable foundations and abutments. The South Fly Ash Pond has the following features that fall within this requirement:

- SFAP Perimeter Dike

Assessment of the foundations and abutments associated with these features was completed considering the following criteria related to the EPA Final CCR Rule:

- Review inspection reports of the facility, considering frequency of inspections, and if the inspections included review and/or assessment of features including cracking, settlement, deformation, or erosion of the foundations/abutments. Inspections should

indicate that there are no significant signs of tension cracking, settlement, depressions, erosion, and/or deformations at the crest, slope, and toe of the structure.

- Confirm that an assessment of seepage conditions of the foundation, with considerations of heave and vertical exit gradient, has been performed. Verify that the seepage assessment follows appropriate methodologies (such as USACE EM 1110-2-1901) and that the foundations exhibit acceptable performance (e.g. FS for piping greater than or equal to 3.0).

3.1 SFAP PERIMETER DIKE

3.1.1 Background

The South Fly Ash Pond is formed by a perimeter dike system; therefore, there are no natural abutments. The station is in an unglaciated area of Ohio on the Marietta Plateau. Alluvium covers the site with a thickness of 16 to 40 feet. It is clay interbedded with sand lenses. Glacial outwash deposits of variable thickness lie between the alluvium and bedrock. Bedrock is estimated at elevation 494 to 497 feet. It is a shale and sandstone of Pennsylvanian-age Conemaugh Group (Terracon, 2014).

DLZ (2011) encountered bedrock refusal at elevation 499 feet, noting a soft to medium hard gray siltstone interbedded with shale. Foundation soils were a soft to medium stiff lean clay from the ground surface to approximately elevation 530 feet. The clay layer had lenses of silt and varying amounts of fine to medium sand. A medium dense to dense granular layer was encountered from elevation 531.2 to 513.8 feet.

3.1.2 Assessment

A qualified person performs inspections of the South Fly Ash Pond weekly, monthly, quarterly, and annually. Regular site inspections have been conducted and documented from 1985 to 2016. These inspections include observations related to foundation conditions with respect to observable cracking, settlement, depressions, erosion, and deformation.

AEPSC (2015) noted no signs of settlement, deformation, or cracks on the north dike. A few minor shoreline sloughing on the interior slope were observed. No signs of settlement, deformation, or cracks were observed on the crest, interior, or exterior slopes of the east, west, and south dike. A small depression was observed above the outlet pipe of the principal spillway. It was attributed to minor ground surface undulations.

CHA (2009) observed no changes in horizontal alignment or evidence of patchwork/failures on the dikes. An isolated small slump, an isolated grassed-over slough, and an isolated abandoned vector hole were noted on the exterior slope of the dike.

A seepage analysis for the original dike construction is not available. As part of the geotechnical exploration in 2011, DLZ noted that the piezometer data indicates very low phreatic surfaces through the perimeter dike and at the downstream toe. Groundwater levels were generally 12 to 24 feet below the impounded water level below the perimeter dike of the surface impoundments. This was assumed to be based on rapid hydraulic head dissipation in the clay soil consistent with very low permeability laboratory test results. At the downstream toes of the perimeter dikes, groundwater was typically 5 to 22 feet below the ground surface. Two piezometers indicated groundwater levels at or slightly below the ground surface. DLZ concluded that seepage of water through or under the dams should not be a concern (2011).

AEPSC (2015) monitored existing seepage repairs on the face of the east dike, the south side of the west dike, and the north side of the west dike. Flow was monitored to compare to previous annual inspections. The repairs performed since the 2014 inspection included sand and gravel drainage blankets to prevent piping and erosion of the seep.

3.1.1 Conclusion

Based on the assessment of the foundation for the SFAP Perimeter Dike, the EPA Final CCR Rule-related criteria listed above have been met.

4.0 SLOPE PROTECTION (§257.73(d)(1)(ii))

Per §257.73(d)(1)(ii), the initial structural stability assessment must document whether the unit has been designed, constructed, operated, and maintained with adequate slope protection to protect against surface erosion, wave action, and adverse effects of sudden drawdown. The South Fly Ash Pond has the following features that fall within this requirement:

- SFAP Perimeter Dike

Assessment of the slope protection associated with these features was completed considering the following criteria related to the EPA Final CCR Rule:

1. *Regular (weekly) inspections for erosion. Inspections should show there are no significant signs of deterioration in the slope protection configuration of the Item.*

2. *Appropriate slope protection shall be provided based on anticipated flow velocities. [Hydrologic/hydraulic calculations of flow velocities on the slope of the Item for the appropriate erosive forces. Some common slope protection measures include: riprap, gabions, paving (concrete or asphalt), or appropriate vegetative cover.]*

3. *If slope protection is riprap, filter layer(s) under the riprap shall be designed according to established filter criteria. However, existing riprap cover may be evaluated based on performance and observations during inspections.*

4.1 SFAP PERIMETER DIKE

4.1.1 Background

Slope protection for the SFAP Perimeter Dike consists of grass on the exterior slopes. Due to the operational nature of the pond, the interior slopes are granular and dressed and maintained as part of dredging operations. Flow from the primary spillway's discharge pipe is adequately dissipated through a gradual pipe slope and discharge elevation into the receiving stream (AEPSC, 2015).

4.1.1 Assessment

As reported by the CHA (2009), regular drive-by inspections are performed with a checklist inspection quarterly, and an annual inspection by AEPSC. The spillway is regularly visited to take water quality samples, while the instrumentation in the dams are read monthly. Areas of erosion are prioritized for appropriate repairs. Regular site inspections performed by a registered professional engineer have been conducted and documented for the South Fly Ash Pond from 1976 to 2015. Site inspection reports generally indicate appropriate maintenance of slope protection features of the dam.

The exterior slope of the SFAP Perimeter Dike is vegetated with maintained grass. The interior slope is dressed and maintained as part of the dredging activities. A few locations of the shoreline show signs of minor sloughing on the interior slope that can be addressed as maintenance. The last annual dam and dike inspection observed erosion due to wave action from 2014 had been repaired (AEPSC, 2015). Riprap has been placed along approximately 100 feet of the north interior slope to protect against wave erosion.

4.1.1 Conclusion

Based on the assessment of the slope protection for the SFAP Perimeter Dike, the EPA Final CCR Rule-related criteria listed above have been met.

5.0 EMBANKMENT DIKE COMPACTION (§257.73(d)(1)(iii))

Per §257.73(d)(1)(iii), the initial structural stability assessment must document whether the unit has been designed, constructed, operated, and maintained with dikes mechanically compacted to

a density sufficient to withstand the range of loading conditions in the CCR unit. The South Fly Ash Pond has the following features that fall within this requirement:

- SFAP Perimeter Dike

Assessment of the dike compaction associated with these features was completed considering the following criteria related to the EPA Final CCR Rule:

1. Documentation showing the dike was mechanically compacted. Acceptable documentation may include construction drawings, field notes, construction photographs, correspondences, or any evidence showing the dike was mechanically compacted during construction.

2. If no construction documentation is available specific data from geotechnical explorations of dike may be used. Geotechnical borings with continuous SPTs may be used to assess compaction of the dike. Appropriate methodology correlating blow counts and compaction (density) should be used.

5.1 SFAP PERIMETER DIKE

5.1.1 Background

The South Fly Ash Pond was designed by Sargent Lundy Engineers of Chicago, Illinois and constructed by George B. Herring & Sons, Inc. of Mansfield, Ohio. Arthur and Leo Casagrande of Cambridge, Massachusetts were also retained during the construction phase and reportedly made a number of site visits as the embankment and appurtenances were being built. Only limited design drawings exist for the SFAP Perimeter Dike. Technical memoranda and letters between the Casagrande firm and the plant during the design and construction of the plant and other structures do exist. Construction photos are available showing period-appropriate large construction equipment working on the site. Subsurface explorations of the dike were also available that provided SPT data used in the assessment.

5.1.1 Assessment

Historical construction photographs, technical memoranda, and letters provide documentation of compaction requirements related to the construction of the SFAP Perimeter Dike. Construction criteria related to dike embankment materials and dike compaction as noted on this documentation include:

- A discussion of proposed dike materials and the need for proper moisture control and compaction in thin layers with heavy, rubber-tired equipment slightly on the dry side of optimum (A. Casagrande, 1952).

Two previous geotechnical explorations were available to review as part of this assessment (DLZ, 2011 and DLZ, 2015). Each was a geotechnical exploration and slope stability evaluation of the SFAP Perimeter Dike. The programs included drilling and laboratory testing.

DLZ (2011) stated that results of the subsurface investigations indicated subsurface conditions were similar for the Boiler Slag Pond and the South Fly Ash Pond. Embankment fill was stiff to very stiff lean clay with varying amounts of silt and fine sand. Standard penetration testing within the borings indicated blow count N_{60} values ranging from 5 to 30 with an average of 13. The N_{60} values have been adjusted to account for hammer efficiency and field procedures. Based on laboratory testing results, DLZ assigned the embankment clay fill drained shear strength parameters of 100 psf cohesion and an internal friction angle of 32 degrees with a wet unit weight of 125 pounds per cubic foot (pcf). Correlating these results using NAVFAC DM-7.2 indicate that appropriate compaction exists within the embankment of the SFAP Perimeter Dike (NAVFAC, 1986).

5.1.2 Conclusion

Based on the assessment of the embankment dike compaction for the SFAP Perimeter Dike, the EPA Final CCR Rule-related criteria listed above have been met.

6.0 VEGETATED SLOPES (§257.73(d)(1)(iv))

Per §257.73(d)(1)(iv), the initial structural stability assessment must document whether the unit has been designed, constructed, operated, and maintained with vegetated slopes of dikes and surrounding areas, except for slopes which have an alternate form or forms of slope protection. The South Fly Ash Pond has the following features that fall within this requirement:

- SFAP Perimeter Dike

Assessment of the vegetated slopes associated with these features was completed considering the following criteria related to the EPA Final CCR Rule:

1. Regular inspection records showing vegetative cover sufficient to prevent surface erosion while allowing an unobstructed view to visually inspect the slope.

6.1 BACKGROUND

The SFAP Perimeter Dike is vegetated along exterior slopes. The South Fly Ash Pond is being actively dredged to dry and remove fly ash for the CCR Landfill. The interior slopes are granular with limited to moderate vegetation (CHA, 2009). AEPSC (2015) observed the vegetation cover as good and recently mowed.

6.2 ASSESSMENT

Slope protection for the SFAP Perimeter Dike exterior slope consists of grass with some riprap along the drainage channel on the western exterior toe. The South Fly Ash Pond's interior slope is granular with some vegetation due to operations.

6.3 CONCLUSION

Based on the assessment of the vegetated slopes for the SFAP Perimeter Dike, the EPA Final CCR Rule-related criteria listed above have been met.

7.0 SPILLWAY CONDITION AND CAPACITY(§257.73(d)(1)(v))

Per §257.73(d)(1)(v), the initial structural stability assessment must document whether the unit has been designed, constructed, operated, and maintained with a single spillway or combination of spillways that meet the condition and capacity requirements as outlined in this section of the EPA Final CCR Rule. The combined capacity of all spillways are to be designed, constructed, operated, and maintained to adequately manage flow during and following the peak discharge from the event specified in this section. The South Fly Ash Pond has the following features that fall within this requirement:

- South Fly Ash Pond Primary Spillway System

Assessment of the spillway condition and capacity associated with these features was completed considering the following criteria related to the EPA Final CCR Rule:

1. Outlet channel must be of non-erodible material designed to carry sustained flow velocities based on the required flood events. [Estimate flow velocities and select appropriate material using hydraulic analysis for the following flood events: PMF (high hazard potential unit), 1000-year flood (Significant hazard unit), 100-year flood (low hazard potential unit).]

2. Must adequately manage flow during and following the peak discharge. [Estimate size of outlet structure based of hydraulic analysis for the following flood events: PMF (High hazard potential unit), 1000-year flood (Significant hazard potential unit), and 100-year flood (low hazard potential unit).]

3. Must be structurally stable. [Assess stability of structure using stability and stress analyses according to an appropriate methodology. Some acceptable methodologies may include: EM 1110-2-2400, EM 1110-2-2100, ACI 350, etc.]

4. Must maintain structural integrity. [Structural integrity may be warranted by periodic inspections of existing conduits. Inspections must show no significant presence of deformation, distortions, cracks, joint separation, etc.]

5. Must be free from significant amounts of obstruction and anomaly which may affect the operation of the hydraulic structure [Perform periodic pipe inspections to detect deterioration, deformation, distortion, bedding deficiencies, and sediment, and debris accumulations.]

7.1 PRIMARY SPILLWAY SYSTEM

7.1.1 Background

The South Fly Ash Pond is classified as a significant hazard structure requiring the combined capacity of all spillways be adequate to manage the flow during and following the peak discharge from a 1000-year flood.

7.1.2 Assessment

7.1.2.1 Spillway Capacity

The Inflow Design Flood Control System Plan for the South Fly Ash Pond demonstrates the South Fly Ash Pond meets the capacity requirements outlined in §257.73(d)(1)(v) of the EPA Final CCR Rule. During the October 2015 annual dam and dike inspection, the overflow discharge pipe was flowing unobstructed into Kyger Creek. No spalling or deterioration of the concrete structure was observed. The metal walkway leading to the outlet pipe was in good condition. (AEPSC, 2015).

7.1.2.2 Structural Stability

The South Fly Ash Pond primary spillway intake structure is located at the northwestern corner of the pond. The intake structure is rectangular in shape with a 24-inch by 39-inch cross section. Flow discharges through a 30-inch concrete pipe at elevation 558.33 feet into Kyger Creek Pond (CHA, 2009). The outlet is a reinforced concrete head wall.

The South Fly Ash Pond's spillway system is inspected monthly during water quality sampling and annually as part of the dam and dike inspection. Physical condition, flow through the pipe, and maintenance concerns are noted and addressed. A video camera inspection of the structure were performed in 2013, but was limited in quality due to the high flow through the structure.

7.1.3 Conclusion

Based on the assessment of the Primary Spillway System condition and capacity for the South Fly Ash Pond, the EPA Final CCR Rule-related criteria listed above have been met.

8.0 SUDDEN DRAWDOWN ASSESSMENT (§257.73(d)(1)(vii))

Per §257.73(d)(1)(vii), the initial structural stability assessment must document whether the unit has been designed, constructed, operated, and maintained with downstream slopes that can be inundated by an adjacent water body (such as a river, stream, or lake) to determine is structural stability is maintained during low pool or sudden drawdown of the adjacent water body. The South Fly Ash Pond has the following feature that falls within this requirement:

- SFAP Perimeter Dike

Assessment of the sudden drawdown associated with these features was completed considering the following criteria related to the EPA Final CCR Rule:

1. Maintain slope stability during sudden drawdown of adjacent water body.

Guidance provided by the USEPA (2015) described the basis of the EPA Final CCR Rule's factor of safety criteria and methodology as EM 1110-2-1902 (USACE, 2003) or other appropriate methodologies. Table 3-1 of EM 1110-2-1902 (USACE, 2003) recommends a required minimum factor of safety of 1.1 for maximum surcharge pool under rapid drawdown conditions.

8.1 PERIMETER DIKES

8.1.1 Background

The South Fly Ash Pond has a potential sudden drawdown loading from the Ohio River and Kyger Creek. A sudden drawdown slope stability analysis of the downstream slope is required under the EPA Final CCR Rule §257.73(d)(1)(vii). The sudden drawdown slope stability analysis was performed based on the static safety factor assessment discussed in DLZ (2015).

8.1.2 Assessment

8.1.2.1 Material Properties

DLZ performed a 2010 geotechnical exploration to characterize the dikes of the South Fly Ash Pond and the Boiler Slag Pond (DLZ, 2011). A laboratory testing program was performed to support derivation of soil parameters for stability analyses. The strength parameters derived using the laboratory data and used in this sudden drawdown slope stability evaluation are presented

in Table 1. The results of the laboratory testing and derivation of the strength parameters can be found in DLZ (2011 and 2015).

Table 1 Strength Parameters for Stability Analysis

Soil Horizon	Unit Weight (pcf)	Effective Stress Strength Parameters		Total Stress Strength Parameters	
		c' (psf)	ϕ' (degrees)	c (psf)	ϕ (degrees)
Embankment Clay Fill	125	100	32	350	20
Stiff to Very Stiff Clay	125	100	32	500	16
Soft to Medium Stiff Clay	125	100	28	300	16
Dense Sand/Gravel	125	0	35	0	35

8.1.2.2 Critical Cross Section Selection

Slope stability analyses were available from DLZ (2015). Six cross sections from the South Fly Ash Pond were analyzed under static, steady-state conditions using the maximum surcharge pool. The six sections that were analyzed were labeled Sections 1 through 6 and are shown below in Figure 1.

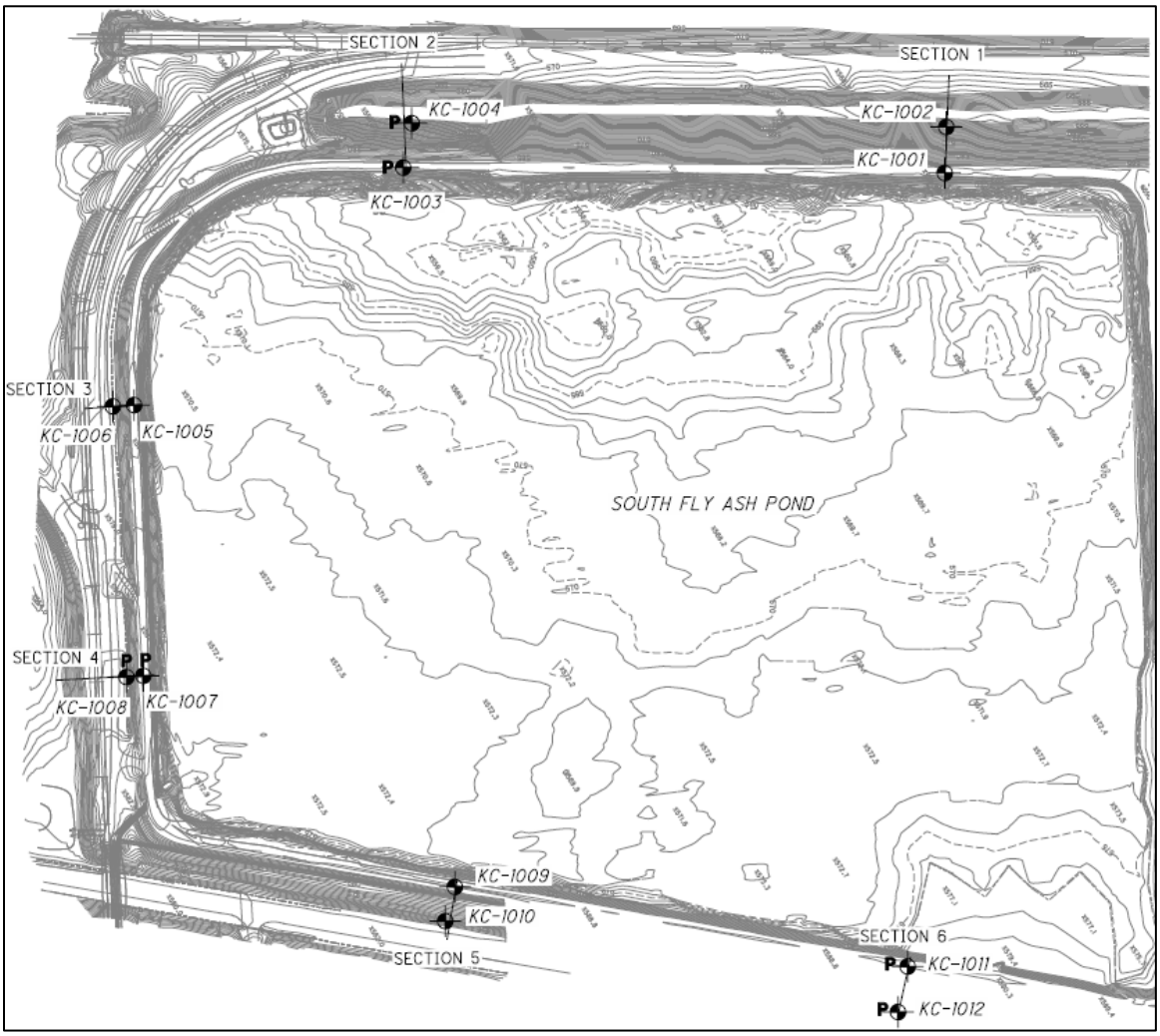

Figure 1 Kyger Creek Station South Fly Ash Pond – Plan View of Cross Sections *(DLZ, 2015)*

The summary of the slope stability results from DLZ (2015) is listed in Table 2. The pond levels were set at the 50% PMF elevation (586.0 feet for the South Fly Ash Pond). The tailwater was set near the surface of the toe.

Table 2 Static Slope Stability Results

Facility	Cross Section	Maximum Surcharge Pool Factor of Safety
South Fly Ash Pond	1	1.60
South Fly Ash Pond	2	1.51
South Fly Ash Pond	3	3.24
South Fly Ash Pond	4	3.26
South Fly Ash Pond	5	2.02
South Fly Ash Pond	6	2.22

This analysis indicate that Section 2 is the critical cross section. A sudden drawdown stability analysis was performed for Section 2 of the South Fly Ash Pond based on the proposed water levels discussed in Section 8.1.2.3.

8.1.2.3 Water Levels

Kyger Creek Station's CCR surface impoundments are classified as significant hazard. Under the EPA Final CCR Rule, the inflow design flood for a significant hazard potential CCR surface impoundment is the 1,000-year flood (§257.82(a)(3)(ii)). A rainfall amount for the 1,000-year storm event (5.61 inches) was obtained from the "Precipitation Frequency Atlas of the United States, NOAA Atlas 14" using a precipitation event duration of 6 hours (Bonnin et al, 2016).

DLZ (2015) presents the hydrologic and hydraulic data for the South Fly Ash Pond assuming the 50-percent probable maximum flood (PMF) event for the maximum storage pool. A rainfall depth for the six-hour, 1 square mile probable maximum precipitation (PMP) of 19 inches was used in the analysis (DLZ, 2015 and AWA, 2013).

The sudden drawdown analysis has been performed assuming a maximum surcharge pool within the surface impoundment equal to the 50- percent PMF and a long-term maximum storage pool equal to the operating pool elevation reported in DLZ (2015).

Tailwater for the model is Kyger Creek, which flows into the Ohio River. The 100-year flood level for the Ohio River was used for the tailwater flood pool elevation (FEMA, 2011). The normal pool for the Ohio River was determined from the elevations provided by Ohio River Valley Water Sanitation Commission (ORSANCO) for Ohio River navigational dams (ORSANCO, 2016). Table 3 lists the headwater and tailwater elevations used for analysis.

Table 3 Kyger Creek Station Water Elevations for Stability Modeling

CCR Rule Criteria	Headwater South Fly Ash Pond Elevation (feet)	Tailwater Ohio River Elevation (feet)
Long-term maximum storage pool loading condition	582.0	538.0
Maximum surcharge pool loading condition	586.0	571.8

8.1.2.4 Analysis Methodology

Stantec performed the sudden drawdown slope stability analyses using the GeoStudio 2007, Version 7.23 software package developed by GEO-SLOPE International, Ltd. of Calgary, Alberta, Canada (GEO-SLOPE International, Ltd., 2007). This package includes the SLOPE/W module for slope stability analysis. The analyses were performed in accordance with the recommendations and criteria outlined in the USACE Design Manuals EM 1110-2-1902 "Slope Stability" (USACE, 2003).

8.1.2.5 Acceptance Criteria

A minimum factor of safety is not explicitly specified within the EPA Final CCR Rule §257.73(d)(1)(vii). In the EPA Final CCR Rule discussion, USACE (2003) is considered the basis for the slope stability analyses. Table 3-1, Minimum Required Factors of Safety: New Earth and Rock-Fill Dams, requires a factor of safety of 1.1 for a rapid drawdown condition from maximum surcharge pool.

8.1.2.6 Analysis Results

The slope stability assessment presented in this report is focused on the potential for slope failures of significant mass, which could directly impact potential release of water and CCR materials from the South Fly Ash Pond. The search for a critical slip surface in the slope stability assessments is thus restricted to consider only potential surfaces where the depth (measured at the base of at least one slice) is more than ten feet vertically below the ground surface. Table 4 summarizes the sudden drawdown safety factor evaluation results at the South Fly Ash.

The results show that the sudden drawdown factor of safety assuming the 50-percent PMF event meets the criteria; therefore, the design is also acceptable for the 1000-year event and the requirements set forth in 40 CFR 257.73(d)(1)(vii).

Table 4 Factor of Safety Assessment Results

Facility	Cross Section	EPA Final CCR Rule Criteria	Recommended Factor of Safety Criteria	Calculated Factor of Safety
South Fly Ash Pond	2	Sudden Drawdown	1.1	1.3

8.1.3 Conclusion

Based on the assessment of the sudden drawdown for the SFAP Perimeter Dike, the EPA Final CCR Rule-related criteria listed above has been met.

9.0 REFERENCES

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Appendix A PLAN VIEW OF KYGER CREEK STATION

Appendix B SUDDEN DRAWDOWN ASSESSMENT

APPENDIX A
PLAN VIEW OF KYGER CREEK STATION

2070206 2073487

334645 331364

Figure No.
A-1

Title
Plan View of Kyger Creek Station

Client/Project
Kyger Creek Station - Structural Stability
South Fly Ash Pond and Boiler Slag Pond

Project Location
Cheshire
Gallia County, OH

175534017

Prepared by AP on 2016-10-13
Technical Review by JH on 2016-10-13
Independent Review by SH on 2016-10-13

0 300 600 Feet
1:3,600 (At original document size of 11x17)

Notes
1. Coordinate System: NAD 1983 StatePlane Ohio South FIPS 3402 Feet
2. Ohio Statewide Imagery Program (OSIP) - 2014

Stantec OVEC IKEC

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APPENDIX B
SUDDEN DRAWDOWN ASSESSMENT

Ohio Valley Electric Corporation
Kyger Creek Station
South Fly Ash Pond
Cheshire, Ohio
Section 2

Existing Geometry
Sudden Drawdown
Undrained, Sudden Drawdown Strengths

Sudden Drawdown

Material Type	Unit Wt.	Effective Cohesion	Effective Friction Angle	Total Cohesion	Total Friction Angle
Embankment Clay Fill	125 pcf	100 psf	32 °	350 psf	20 °
Stiff to Very Stiff Clay	125 pcf	100 psf	32 °	500 psf	16 °
Soft to Medium Stiff Clay	125 pcf	100 psf	28 °	300 psf	16 °
Dense Sand/Gravel	125 pcf	0 psf	35 °	0 psf	35 °

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. The drawing depicts approximate subsurface conditions based on historical drawings or specific borings at the time of drilling. No warranties can be made regarding the continuity of subsurface conditions between the borings.