INITIAL SAFETY FACTOR ASSESSMENT
40 C.F.R. PART 257.73
PLANT WANSLEY ASH POND 1 (AP-1)
GEORGIA POWER COMPANY

EPA’s “Disposal of Coal Combustion Residuals from Electric Utilities” Final Rule (40 C.F.R. Part 257 and Part 261), §257.73(e), requires the owner or operator of an existing CCR surface impoundment to conduct initial and periodic safety factor assessments. The owner or operator of the CCR unit must conduct an assessment and document that the minimum safety factors outlined in §257.73(e)(1)(i) through (iv) for the critical cross-section of the embankment are achieved.

The CCR surface impoundment known as Plant Wansley AP-1 is located on Plant Wansley property, south of Carrollton, Georgia. AP-1 is formed by engineered cross-valley embankments. The foundations and abutments generally consist of Piedmont Physiographic Province residual soils consisting of silt, silty sand, sandy clay, and silty clay. A transitional layer of partially weathered rock is present between the residual soils and the underlying bedrock. The bedrock consists primarily of graphitic schist, biotite schist, schist with interlayered mafic units, amphibolite/hornblende gneiss, granitic gneiss, and feldspathic quartzite. The critical cross-section of AP-1 has been determined to be located on the southern third section of the embankment at the maximum height of fill.

The analyses used to determine the minimum safety factor for the critical section resulted in the following minimum safety factors:

<table>
<thead>
<tr>
<th>Loading Condition</th>
<th>Minimum Calculated Safety Factor</th>
<th>Minimum Required Safety Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long-term Maximum Storage Pool (Static)</td>
<td>1.8</td>
<td>1.5</td>
</tr>
<tr>
<td>Maximum Surcharge Pool (Static)</td>
<td>1.7</td>
<td>1.4</td>
</tr>
<tr>
<td>Seismic</td>
<td>2.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>

The embankments of AP-1 are not constructed of soils that are susceptible to liquefaction. Therefore, a minimum liquefaction safety factor determination was not required.

This assessment is supported by appropriate engineering calculations which are attached.
I hereby certify that the safety factor assessment was conducted in accordance with 40 C.F.R. Part 257.73 (e)(1).

James C. Pegues, P.E.
Licensed State of Georgia, PE No. 17419
Engineering and Construction Services Calculation

Calculation Number:
TV-WN-GPC603330 591-001

<table>
<thead>
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<th>Project/Plant:</th>
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<th>Discipline/Area:</th>
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<tbody>
<tr>
<td>Plant Wansley Ash Pond</td>
<td>Units 1-2</td>
<td>ESFS</td>
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<table>
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<tr>
<td>Slope Stability Analyses of Ash Pond Separator Dike</td>
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<table>
<thead>
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<th>Purpose/Objective:</th>
<th></th>
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<tr>
<td>Analyze slope stability of Ash Pond Separator Dike</td>
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<th>System or Equipment Tag Numbers:</th>
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<td>NA</td>
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Total # of pages including cover sheet & attachments: 18

### Revision Record

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<th>Description</th>
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<th>Reviewer Initial / Date</th>
<th>Approver Initial / Date</th>
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<td>0</td>
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<td>ARW / 10-3-16</td>
<td>JAL / 10-3-16</td>
<td>JCP / 10-3-16</td>
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</tbody>
</table>

Notes:
Purpose of Calculation

Plant Wansley currently disposes of coal combustion residuals (CCR) in the Ash Pond located directly northwest of the plant generating facility and separated from the Storage Water Pond by a Separator Dike. The Plant Wansley Ash Pond was commissioned in 1975, and the Separator Dike was constructed to a crest elevation of 805 ft. with 2.3 (H):1(V) and 3(H): 1(V) upstream and downstream slopes, intermediate berms at elevations 775 ft. and 745 ft. The maximum height of the Ash Pond Separator Dike is approximately 105 ft.

The purpose of this calculation is to check the stability of the dike of Ash Pond 1 using current software.

Methodology

The calculation was performed using the following methods and software:

GeoStudio 2012 (Version 8.15, Build 11777), Copyright 1991-2016, GEO-SLOPE International, Ltd

Strata (Version alpha, Revision 0.2.0), Geotechnical Engineering Center, Department of Civil, Architectural, and Environmental Engineering, University of Texas.

Morgenstern-Price analytical method was reported.

Criteria and Assumptions

The slope stability models were run using the following assumptions and design criteria:

- Seismic site response was determined using a one-dimensional equivalent linear site response analysis. The analysis was performed using Strata and utilizing random vibration theory. The input motion consisted of the USGS published 2008 Uniform Hazard Response Spectrum (UHRS) for Site Class B/C at a 2% Probability of Exceedance in 50 years. The UHRS was converted to a Fourier Amplitude Spectrum, and propagated through a representative one dimensional soil column using linear wave propagation with strain-dependent dynamic soil properties. The input soil properties and layer thickness were randomized based on defined statistical distributions to perform Monte Carlo simulations for 100 realizations, which were used to generate a median estimate of the surface ground motions.

- The median surface ground motions were then used to calculate a pseudostatic seismic coefficient for utilization in the stability analysis using the approach suggested by Bray and Tavasarou (2009). The procedure calculates the seismic coefficient for an allowable seismic displacement and a probability exceedance of the displacement. For this analysis, an allowable displacement of 0.5 ft, and a probability of exceedance of 16% were conservatively selected, providing a seismic coefficient of 0.026g for use as a horizontal acceleration in the stability analysis.
• The stability of the Plant Wansley Separator Dike is based on the safety factor requirements from EPA’s “Disposal of Coal Combustion Residuals from Electric Utilities Final Rule (40 C.F.R. Part 257 and Part 261) subsection §257.73(e).
• The soil and CCR material properties for unit weight, phi angle, and cohesion were obtained from the summary table of material properties in the Ash Pond Closure Feasibility Study by Geosyntec Consultants (Geosyntec). The estimated material properties are a result of laboratory testing conducted for the feasibility study completed in 2016.
• A surcharge load is applied to the sluiced ash due to the short-term gypsum cell berm located adjacent to the Separator Dike. The short-term gypsum cells were constructed on the ash delta in 2008.

Ash Pond 1

• The cross-section of the dike was obtained using the original design drawings H12399 and H12365, Section G-G.
• The cross-section of the sluiced CCR was obtained from the 2014 bathymetric survey of the Ash Pond.
• Material properties were obtained from recent material testing conducted by Geosyntec Consultants (Geosyntec) for the Ash Pond Closure Feasibility Study completed in 2016.

Input Data

The CCR and soil material properties for unit weight, phi angle, and cohesion were obtained from recent material testing conducted by Geosyntec for the Ash Pond Closure Feasibility Study completed in 2016. The final recommended parameters used in the study and therefore also used in this analysis are shown in Appendix B from Geosyntec’s Ash Pond Closure Feasibility Study final deliverable.

Based on Georgia Power’s (GP) Land Department Drawing P355-6 (1), Plant Wansley Ash Pond 2014 Survey, top of the ash in the impoundment is at an elevation of approximately 800 ft.

Hydraulic Considerations

The normal pool elevation of the Ash Pond is 795 ft., based on plant operations. The maximum storage water elevation is based on the calculation package DC-WN-WAN16030-001 Hydrologic and Hydraulic Study for the Ash Pond dated 8/19/16 prepared by Southern Company Services, Inc. This calculation states the Plant Wansley Ash Pond is capable of handling the 100-year 24-hour storm event with a maximum surcharge pool elevation of 800 ft.

The normal (and maximum) pool elevation of the Storage Water Pond is 780 ft. This maximum level constraint has been established to minimize the occurrence of excessive seepage conditions along the downstream slope / toe of the dike.
The following hydraulic information identified in Table 1 is a summary of the hydraulic data identified in the slope stability analyses:

Table 1: Pool Level Elevations for the Ash Pond and Storage Water Pond.

<table>
<thead>
<tr>
<th></th>
<th>Normal Pool Level Elevation (ft.)</th>
<th>Maximum Pool Level Elevation (ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ash Pond</td>
<td>795</td>
<td>800</td>
</tr>
<tr>
<td>Storage Water Pond</td>
<td>780</td>
<td>780</td>
</tr>
</tbody>
</table>

**Loading Condition**

The Separator Dike for the Plant Wansley Ash Pond was evaluated for the loading conditions indicated in the Table 2.

**Summary of Conclusions**

The following table lists the factors of safety for various slope stability failure conditions and the minimum required values as provided in EPA’s 40 C.F.R. Part 257.

Table 2: Summary of the Minimum Calculated Safety Factor and the Minimum Required Safety Factor for the Critical Section of the Dike.

<table>
<thead>
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<th>Loading Condition</th>
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<tr>
<td>Seismic</td>
<td>2.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Safety factors for all cases were acceptable and exceeded the minimum safety factors required. Therefore, the analyses show the separation dike is stable in all cases.

**Design Inputs/References**

Calculation package DC-WN-WAN16030-001 Hydrologic and Hydraulic Study for the Ash Pond prepared by Southern Company Services, Inc
GPC Land Department Drawing P355-6 (1), Plant Wansley Ash Pond 2014 Survey
GPC Drawing H10027 - Project Location Map
GPC Drawing H12363 - Plant Wansley Ash Pond Discharge Structure General Arrangement
GPC Drawing H12364 - Plant Wansley Separation Dike Construction
GPC Drawing H12365 - Plant Wansley Separation Dike section and Details
GPC Drawing H12366 - Plant Wansley Separation Dike Construction
GPC Drawing H12399 - Plant Wansley Separation Dike General Arrangement
GPC Drawing E1C11102 - Short Term Gypsum Disposal General Arrangement and Site Plan

**Body of Calculation**

Calculation consists of Slope/W modeling attached.
Plant Wansley Ash Pond Separation Dam Stability Analysis

Long-Term Maximum Storage Pool (Static)

Material Properties

**Sluiced Ash**
- Effective Unit Weight = 80pcf
- Effective Friction Angle = 10 degrees
- Effective Cohesion = 0 psf

**Embankment Fill / Separator Dike**
- Effective Unit Weight = 123pcf
- Effective Friction Angle = 32 degrees
- Effective Cohesion = 140 psf

**Foundation Soil (Residual)**
- Effective Unit Weight = 112pcf
- Effective Friction Angle = 37 degrees
- Effective Cohesion = 0 psf

**Foundation 2 (Filter Gravel)**
- Effective Unit Weight = 130pcf
- Effective Friction Angle = 40 degrees
- Effective Cohesion = 0 psf

**Rack**
- Effective Unit Weight = 150pcf
- Effective Friction Angle = 40 degrees
- Effective Cohesion = 3,000 psf

Method: Morgenstern-Price
Material Properties

Suiced Ash
Effective Unit Weight = 80 pcf
Effective Friction Angle = 10 degrees
Effective Cohesion = 0 psf

Embankment Fill / Separator Dike
Effective Unit Weight = 123 pcf
Effective Friction Angle = 32 degrees
Effective Cohesion = 140 psf

Foundation Soil (Residual)
Effective Unit Weight = 112 pcf
Effective Friction Angle = 37 degrees
Effective Cohesion = 0 psf

Foundation 2 (Filter Gravel)
Effective Unit Weight = 130 pcf
Effective Friction Angle = 40 degrees
Effective Cohesion = 0 psf

Rock
Effective Unit Weight = 150 pcf
Effective Friction Angle = 40 degrees
Effective Cohesion = 3,000 psf

Method: Morgenstern-Price
Material Properties

Sluiced Ash
Effective Unit Weight = 80 pcf
Effective Friction Angle = 10 degrees
Effective Cohesion = 0 psf

Embankment Fill / Separator Dike
Effective Unit Weight = 123 pcf
Effective Friction Angle = 32 degrees
Effective Cohesion = 140 psf

Foundation Soil (Residual)
Effective Unit Weight = 112 pcf
Effective Friction Angle = 37 degrees
Effective Cohesion = 0 psf

Foundation 2 (Filter Gravel)
Effective Unit Weight = 130 pcf
Effective Friction Angle = 40 degrees
Effective Cohesion = 0 psf

Rock
Effective Unit Weight = 150 pcf
Effective Friction Angle = 40 degrees
Effective Cohesion = 3,000 psf

Method: Morgenstern-Price
# Attachment A

Geosyntec Estimated Material Properties

<table>
<thead>
<tr>
<th>Material</th>
<th>Unit Weight (pcf)</th>
<th>Drained Effective Friction Angle (degrees)</th>
<th>Drained Cohesion (psf)</th>
<th>Undrained Effective Friction Angle (degrees)</th>
<th>Undrained Cohesion (psf)</th>
<th>Undrained Shear Strength Ratio[^1]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shredded Ash</td>
<td>80</td>
<td>10[^2]</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>0.12[^3-4]</td>
</tr>
<tr>
<td>Dry Ash</td>
<td>80</td>
<td>25</td>
<td>0</td>
<td>25</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>Gypsum</td>
<td>120</td>
<td>35</td>
<td>0</td>
<td>35</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>Embankment Fill/Separator Dike</td>
<td>123</td>
<td>32</td>
<td>140</td>
<td>29</td>
<td>400</td>
<td>-</td>
</tr>
<tr>
<td>Foundation Soil</td>
<td>112</td>
<td>37</td>
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<td>24</td>
<td>80</td>
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<td>Rock</td>
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<td>3,000</td>
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<tr>
<td>Concrete</td>
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<td>55</td>
<td>0</td>
<td>55</td>
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<tr>
<td>Stabilized Ash</td>
<td>100</td>
<td>0</td>
<td>7,200[^3]</td>
<td>0</td>
<td>7,200[^3]</td>
<td>-</td>
</tr>
</tbody>
</table>

Notes:
[^1] The listed value has been reduced by 20% to account for shear strength reduction in pseudo-static stability analyses.
[^2] Increased to 25 degrees as part of the sensitivity analyses.
[^3] Increased to 0.4 (i.e., reduced value of 0.32) as part of the sensitivity analyses.
[^4] The undrained shear strength ratio was estimated based on in situ cone penetrometer tests; all other properties were based on previous analyses completed by Southern Company Services.
[^5] Changed to 3,240 and 10,100 psf as part of the sensitivity analyses.
Attachment B

Reference Drawings