INITIAL SAFETY FACTOR ASSESSMENT
PLANT MILLER ASH POND
ALABAMA 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 periodic safety factor assessments. The owner or operator must document that the minimum safety factors outlined in §257.73(e)(1)(i) through (iv) for the critical embankment section are achieved.

The CCR surface impoundment located at Alabama Power Company's Plant Miller, also referred to as the Plant Miller Ash Pond, is located on Plant Miller's property in west Jefferson County, approximately 20 miles northwest of Birmingham, Alabama. The CCR surface impoundment is formed by a primary cross-valley embankment on the southwest-west side of the impoundment. A smaller saddle dike is located on the northeast side of the impoundment. This saddle dike directly retains little to no free water, as dry ash has been stacked against it to near the crest elevation of the dike. The critical section of this CCR unit has been determined to be located on the south west section of the cross-valley embankment.

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

Loading Condition	Minimum Calculated Safety Factor	Minimum Required Safety Factor
Long-term Maximum Storage Pool (Static)	1.91	1.5
Maximum Surcharge Pool (Static)	1.91	1.4
Seismic	1.69	1.0

The embankments are constructed of silts and silty or clayey gravel not susceptible to liquefaction. Therefore, a minimum liquefaction safety factor determination was not required.

I hereby certify that the safety factor assessment was conducted in accordance with 40 C.F.R. Part 257.73 (e)(1).

10/17/17

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Licensed State of Alabama, PE No. 16516

ALABAMA LICENSED 16516 PROFESSIONAL ENGINEER JAMES C. PEGUES, JR.

SOUTHERN COMPANY

Engineering and Construction Services Calculation

Calculation Number: TV-ML-APC413672-001

Project/Plant: Plant Miller	**Unit(s):** Units 1-4	**Discipline/Area:** ES&FS
Title/Subject: Slope Stability Analyses of Ash Pond		
Purpose/Objective: Analyze slope stability of the Ash Pond Dike		
System or Equipment Tag Numbers: NA	**Originator:** Gerrad Wilson	

Contents

Revision Record

Rev. No.	Description	Originator Initial / Date	Reviewer Initial / Date	Approver Initial / Date
0	Issued for Information	GWW 10/07/16	JAJ 10/7/16	JCP 10/7/16

Notes:

Purpose of Calculation

The purpose of this calculation is to determine the stability of the Ash Pond dike under various loading conditions as prescribed by the EPA CCR Rule.

Summary of Conclusions

The analyses determined that the factors of safety of the Ash Pond met or exceeded the minimum criteria set forth in the CCR Rule. The results are summarized in the following table.

Factor of Safety Summary Table

Loading Condition	Factor of Safety (FOS)	Minimum FOS
Long-term, Maximum Storage Pool	1.91	1.50
Maximum Surcharge Pool	1.91	1.40
Seismic	1.69	1.00

Methodology

The calculation was performed using the following methods and software:

GeoStudio 2012 (Version 8.15.5.11777), August 2015 Release, 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.

The Morgenstern-Price analytical method with an entry-exit slip surface was used for slope stability calculation.

Criteria and Assumptions

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

- Long term, maximum storage pool: The maximum pool elevation the pond will maintain under normal operating conditions
- Maximum storage pool: The maximum pool that the pond can retain with no freeboard, but with the phreatic surface not affected from normal operating conditions
- 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 0.046g for use as a horizontal acceleration in the stability analysis.

Design Inputs/References

- The soil properties of unit weight, phi angle, and cohesion for the impervious core and random fill were estimated from historical data. Engineering parameters of the filter, riprap, and bedding material were taken from a slope stability analysis of the Storage Pond Dam. The storage pond dam was designed and constructed concurrently with the Ash Pond Dam and used the same materials with the exception of the core and random fill soils.

- Soil stratigraphy was estimated using historic boring logs.

- Piezometric data was estimated using recent records from the series of piezometers located at the dam.

Body of Calculation

Slope/W modeling is attached.

PLANT MILLER ASH POND

Section A - A'

Maximum Storage Pool

MATERIALS:

Impervious Core - Sandy Silt (ML) 131 pcf 630 psf 19 °

Random Fill - Silty Clayey Gravel (GM-GC) 131 pcf 250 psf 32 °

Fine Filter - Sand (SP) 120 pcf 0 psf 35 °

Coarse Filter - Gravel (GP) 120 pcf 0 psf 35 °

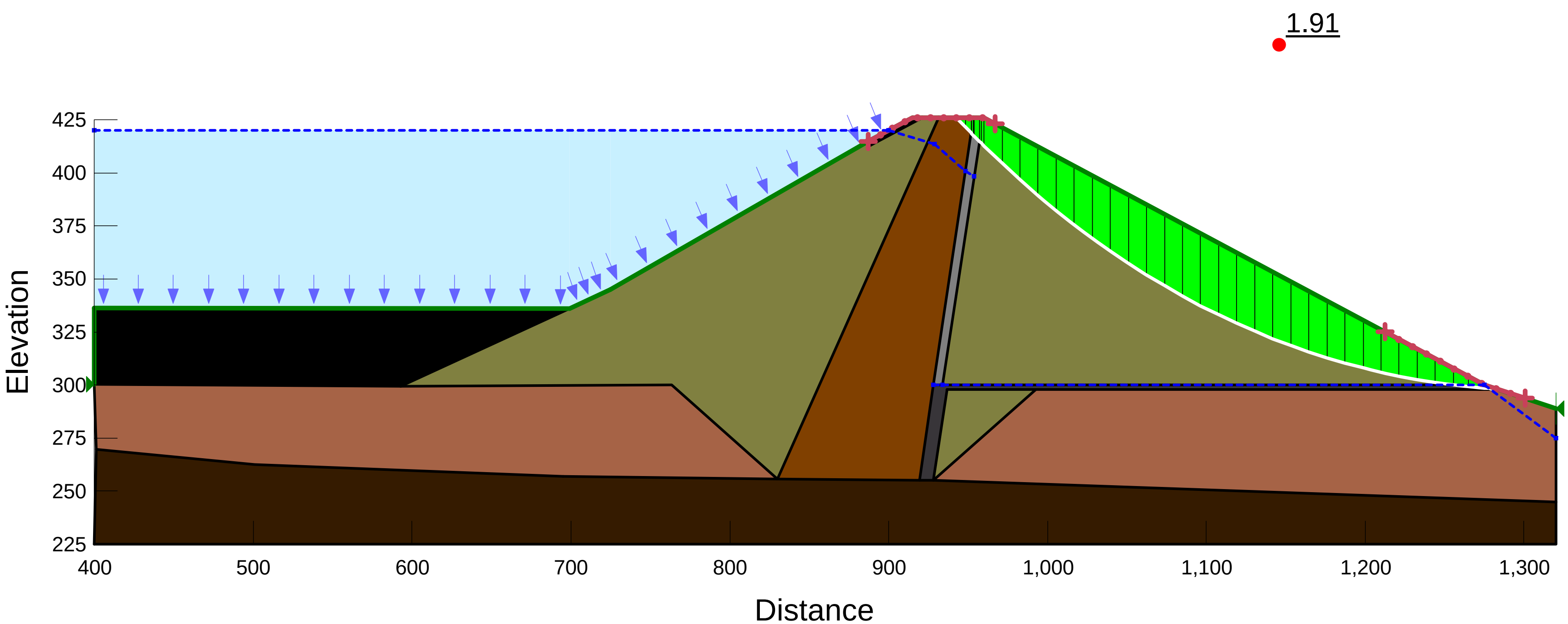
Bedding for Riprap 120 pcf 0 psf 38 °

Riprap 140 pcf 0 psf 38 °

Ash 100 pcf 0 psf 15 °

Weathered Rock (Sandstone or Shale)

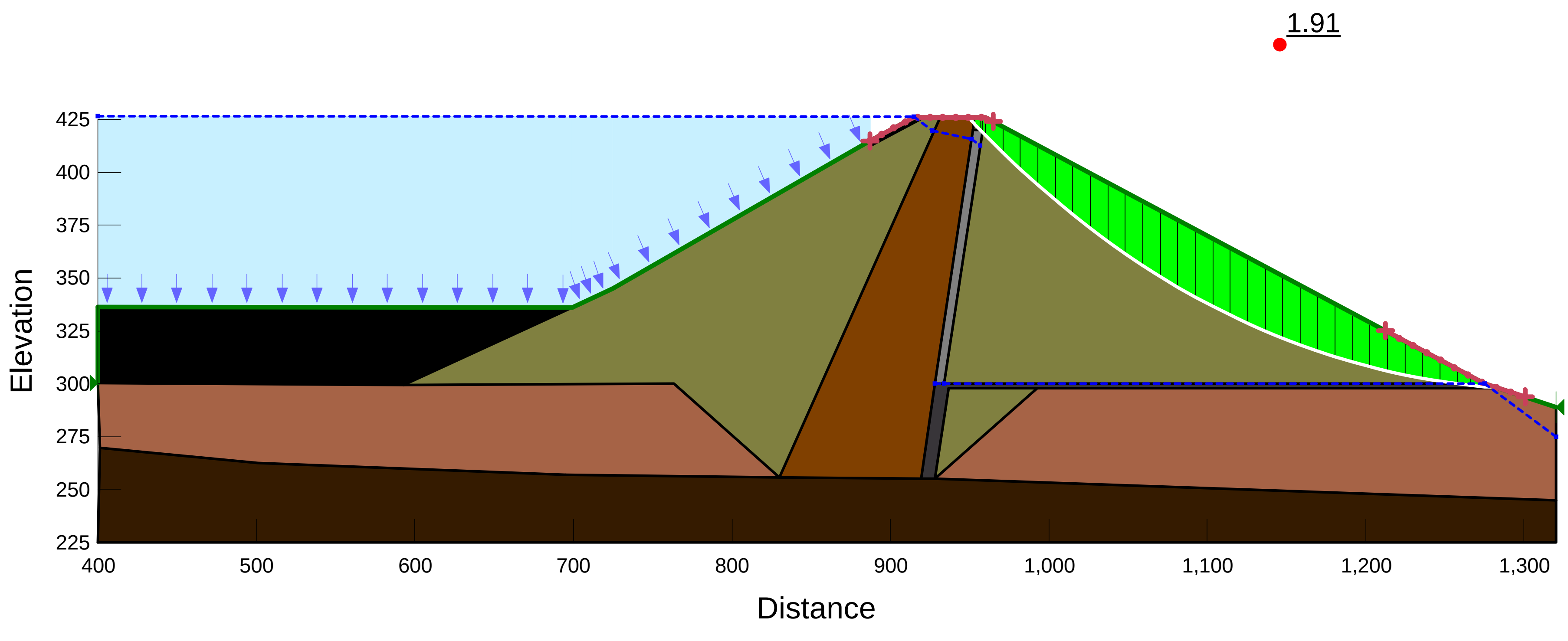
Residuum 135 pcf 1,000 psf 28 °



PLANT MILLER ASH POND

Section A - A'
Maxmium Surcharge Pool

MATERIALS:
Impervious Core - Sandy Silt (ML) 131 pcf 630 psf 19 °
Random Fill - Silty Clayey Gravel (GM-GC) 131 pcf 250 psf 32 °
Fine Filter - Sand (SP) 120 pcf 0 psf 35 °
Coarse Filter - Gravel (GP) 120 pcf 0 psf 35 °
Bedding for Riprap 120 pcf 0 psf 38 °
Riprap 140 pcf 0 psf 38 °
Ash 100 pcf 0 psf 15 °
Weathered Rock (Sandstone or Shale)
Residuum 135 pcf 1,000 psf 28 °



PLANT MILLER ASH POND

Section A - A'
Seismic
kh =0.046g

MATERIALS:
Impervious Core - Sandy Silt (ML) 131 pcf 630 psf 19 °
Random Fill - Silty Clayey Gravel (GM-GC) 131 pcf 250 psf 32 °
Fine Filter - Sand (SP) 120 pcf 0 psf 35 °
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