PERIODIC 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) and the State of Alabama's ADEM Admin. Code Chapter 335-13-15 require the owner or operator of an existing CCR surface impoundment to conduct periodic safety factor assessments. Per §257.73(e) and ADEM Admin. Code r. 335-13-15-.04(4)(e), the owner or operator must document that the minimum safety factors outlined in §257.73(e)(1)(i) through (iv) and ADEM Admin. Code r. 335-13-15-.04(4)(e)(1)(i) through (iv) for the critical embankment section are achieved. In addition, §257.73(f)(3) and ADEM Admin. Code r. 335-13-15-.04(4)(f)3. require a subsequent assessment be performed within 5 years of the previous assessment.

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 CCR has historically been stacked against it to near the crest elevation of the dike. The critical section of this CCR unit had previously been determined to be located on the southwest section of the cross-valley embankment. The surface impoundment is currently undergoing closure and some CCR relocation as a part of the planned CCR footprint consolidation has begun. A review of recent changes within the impoundment has determined that the critical section remains on the southwest section of the 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)	1.9	1.5
Maximum Surcharge Pool (Static)	1.9	1.4
Seismic	1.6	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. §257.73 (e)(1) and ADEM Admin. Code r. 335-13-15-.04(4)(e)(1).

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

10/15/2021

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Technical and Project Solutions Calculation

Calculation Number:
TV-ML-APC881985-001

Project/Plant: Plant Miller	**Unit(s):** 1-4	**Discipline/Area:** Env. Solutions
Title/Subject: Periodic Factor of Safety Assessment for CCR Rule		
Purpose/Objective: Determine the Factor of Safety of the Ash Pond Dike		
System or Equipment Tag Numbers: n/a	**Originator:** Jacob A. Jordan, P.E.	

Contents

Revision Record

Rev. No.	Description	Originator Initial / Date	Reviewer Initial / Date	Approver Initial / Date
0	Issued for Information	JAJ/06-14-21	JCP/06-14-21	JCP/06-14-21

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, updated from the 2016 submittal.

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	1.9	1.50
Maximum Surcharge Pool	1.9	1.40
Seismic	1.6	1.00

Methodology

The calculation was performed using the following methods and software:

GeoStudio 2021 R2, version 11.1.1.22085, Copyright 1991-2021, GEO-SLOPE International, Ltd. The Morgenstern-Price analytical method used for the analyses.

Strata (Version 0.8.0),University of Texas, Austin

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 0.071g for use as a horizontal acceleration in the stability analysis.

Criteria

The current required minimum criteria (factors of safety) were taken from the structural integrity criteria for existing CCR surface impoundments from 40 CFR 257.73, published April 17, 2015.

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.

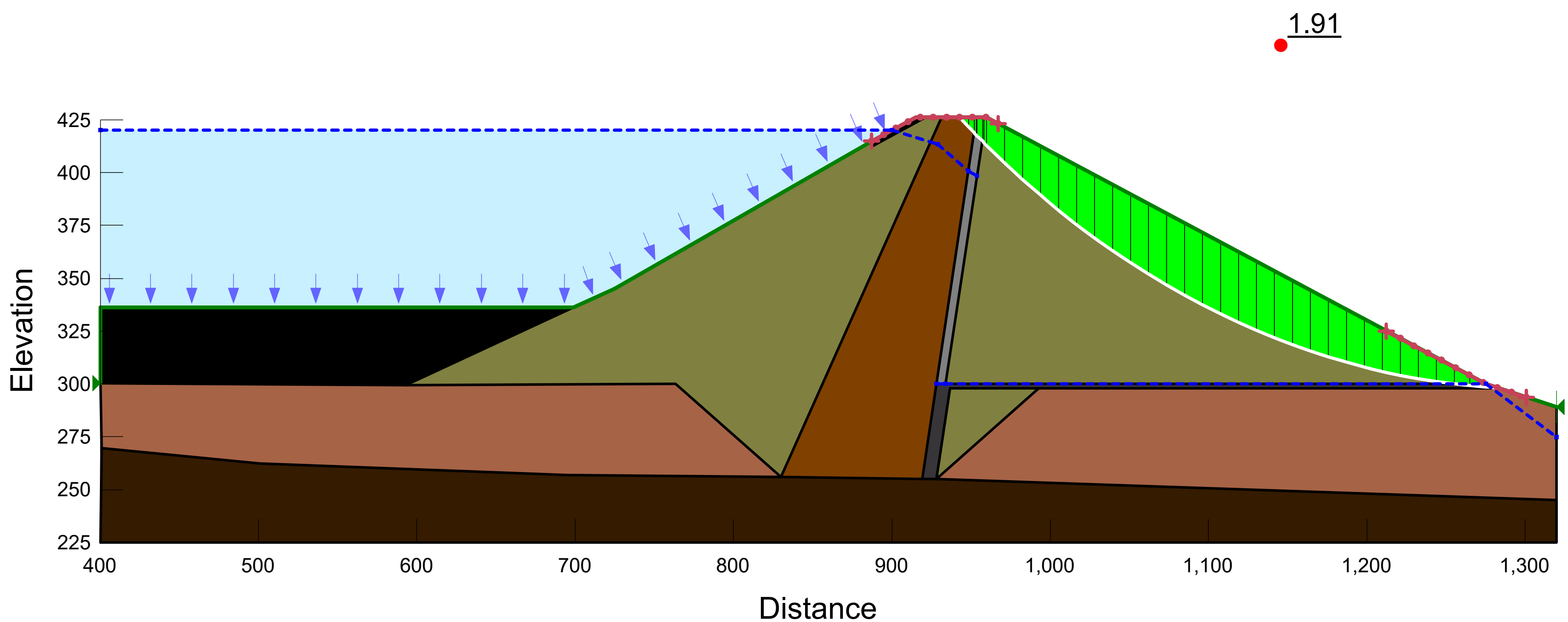
Body of Calculation

Slope/W modeling is attached.

PLANT MILLER ASH POND

Section A - A'
Maximum Storage Pool

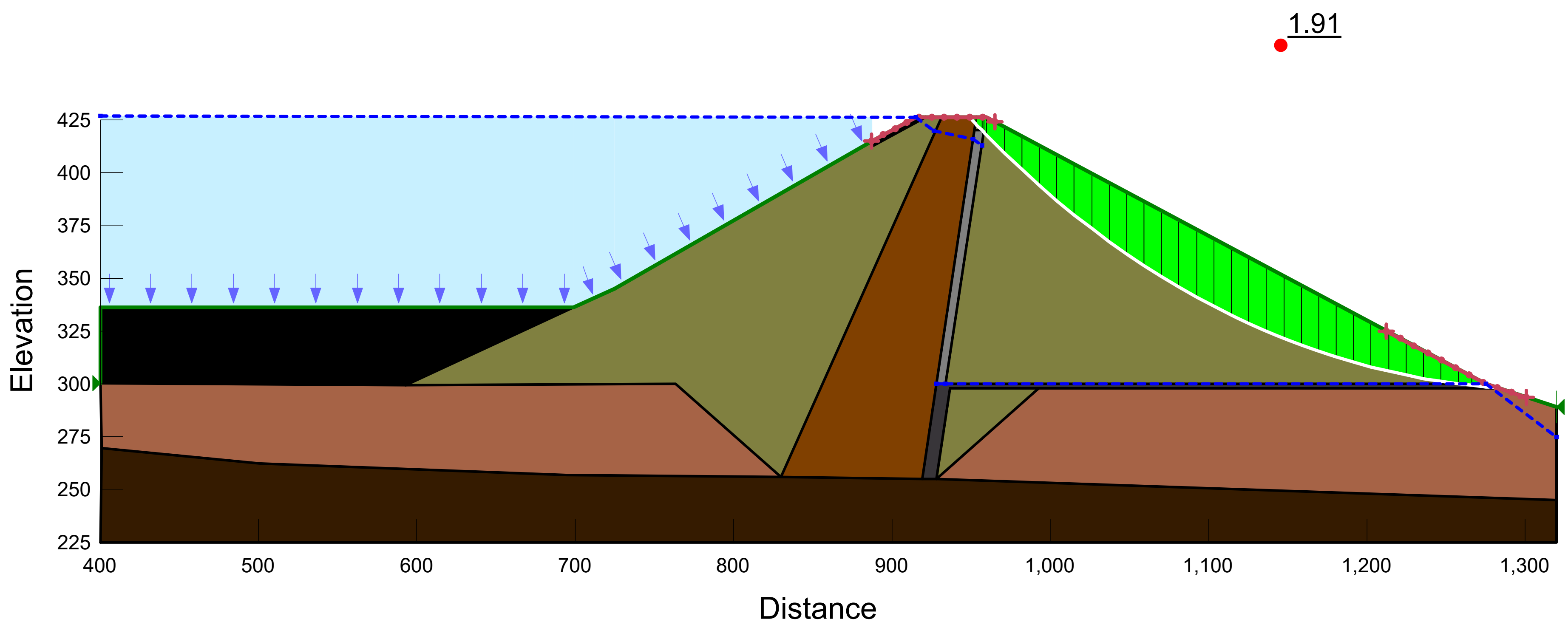
Color	Name	Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Ash	Mohr-Coulomb	100	0	15
	Bedding for Riprap	Mohr-Coulomb	120	0	38
	Coarse Filter - Gravel (GP)	Mohr-Coulomb	120	0	35
	Fine Filter - Sand (SP)	Mohr-Coulomb	120	0	35
	Impervious Core - Sandy Silt (ML)	Mohr-Coulomb	131	630	19
	Random Fill - Silty Clayey Gravel (GM-GC)	Mohr-Coulomb	131	250	32
	Residuum	Mohr-Coulomb	135	1,000	28
	Riprap	Mohr-Coulomb	140	0	38
	Weathered Rock (Sandstone or Shale)	Bedrock (Impenetrable)			



PLANT MILLER ASH POND

Section A - A'
Maxmium Surcharge Pool

Color	Name	Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Ash	Mohr-Coulomb	100	0	15
	Bedding for Riprap	Mohr-Coulomb	120	0	38
	Coarse Filter - Gravel (GP)	Mohr-Coulomb	120	0	35
	Fine Filter - Sand (SP)	Mohr-Coulomb	120	0	35
	Impervious Core - Sandy Silt (ML)	Mohr-Coulomb	131	630	19
	Random Fill - Silty Clayey Gravel (GM-GC)	Mohr-Coulomb	131	250	32
	Residuum	Mohr-Coulomb	135	1,000	28
	Riprap	Mohr-Coulomb	140	0	38
	Weathered Rock (Sandstone or Shale)	Bedrock (Impenetrable)			



PLANT MILLER ASH POND

Section A - A'
Seismic
kh =0.071g

Color	Name	Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)
	Ash	Mohr-Coulomb	100	0	15
	Bedding for Riprap	Mohr-Coulomb	120	0	38
	Coarse Filter - Gravel (GP)	Mohr-Coulomb	120	0	35
	Fine Filter - Sand (SP)	Mohr-Coulomb	120	0	35
	Impervious Core - Sandy Silt (ML)	Mohr-Coulomb	131	630	19
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