Five-Year Periodic Safety Factor Assessment

Fly Ash Reservoir II
Brilliant, Ohio

October 2026

Prepared For:

Cardinal Operating Company
306 County Road 7E
Brilliant, Ohio 43913

Prepared By:

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1.0 Introduction

The Cardinal Power Plant (Plant) is located in Wells Township, Jefferson County, near the town of Brilliant in eastern Ohio. The Plant is owned by Buckeye Power and operated by Cardinal Operating Company (Operator). The Plant operates the Fly Ash Reservoir II (FAR II) surface impoundments for storing coal combustion residuals (CCR). The FAR II is subject to the requirements of the United States Environmental Protection Agency's (USEPA) final CCR rule Title 40 Code of Federal Regulations (40 CFR) Part 257 Subpart D - "Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments." The initial safety factor assessment system plan was completed and placed into the Plant's operating record on October 9, 2016. A periodic safety factor assessment is required every 5 years pursuant to 40 CFR 257.73(e)(3).

FAR II became operational in the 1980s and has been raised twice during its service life, the first raising performed in 1997, and the most recent raising being in 2013. Currently, FAD II has a design crest elevation of 983 feet, a maximum reservoir operating elevation of 974 feet, and a dam height of approximately 250 ft per. The 2013 raising of FAR II was completed using back-to-back mechanically stabilized earth (MSE) walls which were constructed over the then-existing crest placed during the 1997 dam raising, which was constructed using roller-compacted concrete (RCC). The MSE walls were constructed as back-to-back MSE walls over the RCC crest surface with installation of a vinyl sheet pile cut-off wall through the MSE backfill and RCC concrete (using a slurry trench excavation), which extends into the clay core of the dam. The emergency overflow spillway was raised using mass concrete to a minimum elevation of 974.5 as part of the second dam raising.

The Operator ceased sluicing fly ash into the impoundment in July 2021 and is nearing completion of closing FAR II, in accordance with the Closure Plan and the Permit to Install issued by the Ohio Environmental Protection Agency.

Federal Regulations

Pursuant to 40 CFR 257.73(e), the calculated factor of safety for the critical cross section of a CCR unit must meet the following requirements:

(i) The calculated static factor of safety under the long-term, maximum storage pool loading condition must equal or exceed 1.50;

(ii) The calculated static factor of safety under the maximum surcharge pool loading condition must equal or exceed 1.40;

(iii) The calculated seismic factor of safety must equal or exceed 1.00; and,

(iv) For dikes constructed of soils that have susceptibility to liquefaction, the calculated liquefaction factor of safety must equal or exceed 1.20.

2.0 Objective

This report was prepared by TRC Engineers, Inc. (TRC) to fulfill requirements for the periodic Safety Factor Assessment (40 CFR 257.73(e)), documenting whether the calculated factors of safety the FAR II achieve the minimum requirements. This is the second 5-year periodic assessment as required per 40 CFR 257.73(f), with the first assessment completed in October 2021.

To develop the periodic assessment, TRC performed the following scope:

- Reviewed historical documents including:
  - Five-Year Periodic Safety Factor Assessment (TRC, October 2021).
  - Initial Safety Factor Assessment (S&ME, 2015).
  - 2025 Annual Dam and Dike Inspection Report (TRC, 2025)
  - Components of the FAR II Dam Permit Modification Application (S&ME, 2012)
    - Appendix D-3: Slope Stability Shear Strength Parameter Justification and Seismic Parameter Justification
    - Appendix D-4: Slope Stability Analysis
- Performed a site visit on August 14, 2025 to observe current conditions, and
- Developed a 5-year periodic Safety Factor Assessment.

3.0 Factor of Safety Calculations

The Dam Permit Modification Application (S&ME, 2012) provides slope stability calculations for the FAR II dam representing the current configuration of the dam. These calculations provide support for the shear strength parameters used to model the dam features. TRC performed a cursory review of the model input parameters and determined that the parameters were consistent with good and accepted engineering practices.

These slope stability analyses for the Initial Safety Factor Assessment (S&ME, 2015) determined the factor of safety for the following conditions: end-of-construction, maximum storage pool, maximum surcharge pool, seismic, and liquefaction. The results are presented in appendix A. Factor of safety results were obtained using the Spencer Method of slope-stability analysis. The results are presented in the table below.

Condition	**Minimum Safety Factor** 40 CFR 257.73 (e)(1)(i) – (iv)	**Calculated Safety Factor**
End-of-construction	n/a	1.58
Steady-state, maximum storage pool loading	1.5	1.75
Steady-state, maximum surcharge pool loading	1.4	1.68
Seismic loading	1.0	1.11
Embankment liquefaction	1.2	Non-liquefiable(1)

(1) The foundation soils were determined to be non-liquefiable by S&ME because the dam embankment is founded on bedrock.

A stability analysis for the current condition was not performed as part of the current assessment as no major modifications have occurred other than lowering the water level. Based on our experience with similar projects, the Factor of Safety will be higher due to the impoundment closing.

4.0 Site Visit

TRC performed a site visit on August 14, 2025, as part of the annual dike and dam inspection for the facility. Based on the observations made during the site visit, the conditions modeled in the slope stability analysis (S&ME, 2015) accurately and conservatively reflect the conditions of the FAR II. Ther outlet features for the FAR II appeared in good working order and functioning as designed.

The FAR II dam has a deformation review completed every 28 days which includes inclinometer and monument surveys of the dam to monitor potential deformation. TRC has been coordinating the 28-day dam deformation surveys since March 2024. Based on the latest set of data (28-Day Dam Deformation Survey dated August 21, 2026), the deformations observed by the survey monuments and inclinometers appear to be within expected ranges and tolerances of an earthen dam of a similar size and age given consideration to the dewatering activities that occurred as a part of the FAR II closure.

5.0 Conclusions

Based on the document review, TRC determined that the conditions modeled in the Initial Safety Factor Assessment (S&ME, 2015) are representative of the FAR II and the only change encountered is lowering the water level which will result in a higher factor of safety. These global stability calculations developed by others meet the criteria of 40 CFR 257.73(e). TRC reviewed the available data and found it reasonable and consistent with good and accepted engineering practice.

This Assessment has been completed in compliance with the requirements set forth in 40 CFR 257.73(e). This document will be placed in the operating record, posted to the publicly accessible website, and government notifications will be provided.

A Safety Factor Assessment must be performed every 5 years. The next periodic assessment is required by October 2031.

6.0 Limitations

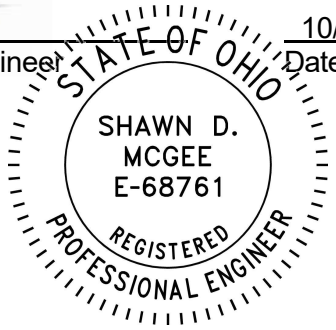
The observations, assessment, and recommendations presented in this Report are based on our limited scope of work and on information disclosed by our visual observations, the conditions at the time of the August 14, 2025, site inspection for the TRC 2025 Annual Inspection, the design information available at the time of this investigation and only apply to the Cardinal FAR II Dam. This work has been performed in accordance with our authorized scope of work and is based on the level of effort and investigative techniques using that degree of care and skill ordinarily exercised under similar conditions by reputable members of the profession practicing in the same or similar locality at the time of service. No other warranties, expressed or implied, are made or intended by this Report. These services were intended to provide an indication of the current, observable conditions of the dam at the time of the visual observations on the date indicated in this Report. Such a limited visual review does not account for other non-visible, hidden, subsurface or material condition analyses, and the professional services rendered are not guaranteed to be a representation by TRC of inaccessible and unobservable site conditions or actual conditions subsequent to the date of TRC's site visit. Therefore, the evaluations, conclusions, recommendations and opinions provided in this Report are subject to change as a result of future natural or manmade processes and as a result of an additional comprehensive, intrusive investigation and engineering analyses beyond TRC's visual observations. TRC is not responsible for any conclusions or opinions drawn by others from the data included herein, nor are the recommendations specifically presented in this Report intended for use or reliance as construction specifications.

7.0 Certification

I, the undersigned Ohio Professional Engineer, hereby certify that I am familiar with the technical requirements of 40 CFR 257 Subpart D. I also certify that it is my professional opinion that, to the best of my knowledge, information, and belief, the information in this demonstration is in accordance with current good and accepted engineering practice(s) and standard(s) and meets the requirements of 40 CFR 257.73(e).

For the purpose of this document, “certify” and “certification” shall be interpreted and construed to be a “statement of professional opinion.” The certification is understood and intended to be an expression of my professional opinion as a Licensed Professional Engineer, based upon knowledge, information, and belief. The statement(s) of professional opinion are not and shall not be interpreted or construed to be a guarantee or a warranty of the analysis herein.

Shawn D. McGee, P.E.	PE.68761
Name	Engineer License Number
	10/06/2026
Signature of Professional Engineer	Date



8.0 References

TRC Engineers, Inc., 2021. Five-Year Periodic Safety Factor Assessment: Fly Ash Reservoir II, Brilliant, OH. October 2021.

TRC Engineers, Inc., 2025. 2025 Annual Dam and Dike Inspection Report: Cardinal Power Plant, Brilliant, OH. October 8, 2025.

S&ME. 2012. Permit Modification Application for the Fly Ash Reservoir II Dam at the Cardinal Power Plant. Brilliant, Ohio