Cardinal Power Plant

Safety Factor Assessment for

Retrofitted Bottom Ash Pond of the Bottom Ash Pond Complex

Issue Purpose: For Use, Rev. 0

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PREPARED BY:

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1 PURPOSE

Pursuant to 40 CFR 257.74(e), this report provides a safety factor assessment for embankment stability of the retrofitted Bottom Ash Pond at the Cardinal Power Plant. Beginning in 2021, the South Pond of the Bottom Ash Pond Complex (BAPC) was retrofitted with a CCR-compliant liner system and will receive bottom ash in accordance with 40 CFR 257.102(k). Upon completion of the retrofit, the South Pond's name is changed from the former "Recirculation Pond" to the retrofitted "Bottom Ash Pond."

2 APPLICABLE CCR REGULATIONS

To perform the safety factor assessment for the retrofitted Bottom Ash Pond, the following excerpts from 40 CFR Part 257 Subpart D (Federal CCR Rule) are applicable:

- **§257.74(e) – Periodic Safety Factor Assessments:**
  (1) The owner or operator must conduct an initial and periodic safety factor assessments for each CCR unit and document whether the calculated factors of safety for each CCR unit achieve the minimum safety factors specified in paragraphs (e)(1)(i) through (v) of this section for the critical cross section of the embankment. The critical cross section is the cross section anticipated to be the most susceptible of all cross sections to structural failure based on appropriate engineering considerations, including loading conditions. The safety factor assessments must be supported by appropriate engineering calculations.
  (i) The calculated static factor of safety under end-of-construction loading condition must equal or exceed 1.30. The assessment of this loading condition is only required for the initial safety factor assessment and is not required for subsequent assessments.
  (ii) The calculated static factor of safety under the long-term, maximum storage pool loading condition must equal or exceed 1.50.
  (iii) The calculated static factor of safety under the maximum surcharge pool loading condition must equal or exceed 1.40.
  (iv) The calculated seismic factor of safety must equal or exceed 1.00.
  (v) For dikes constructed of soils that have susceptibility to liquefaction, the calculated liquefaction factor of safety must equal or exceed 1.20.
  (2) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial assessment and each subsequent periodic assessment specified in paragraph (e)(1) of this section meets the requirements of this section."

3 RESULTS & CONCLUSIONS

Safety factor analyses were performed in 2020-2021 for the critical cross section stability for the design work associated with the liner system which meets the requirements of the Code of Federal Regulations (CFR) §257.72, "Liner design criteria for new CCR surface impoundments and any lateral expansion of a CCR surface impoundment". The lowest factor of safety (FOS) corresponding to the potential failure surface for the critical cross section is summarized in Table 1. The analyses were submitted, reviewed, and approved by the Ohio Department of Natural Resources (ODNR) Division of Water Resources and Ohio EPA Division of Surface Water for safety and environmental compliance aspects of the dikes.

Table 1: Summary of Safety Factors for Cardinal Power Plant's Retrofitted Bottom Ash Pond

FOS Assessment	Retrofitted Bottom Ash Pond	Minimum Allowable FOS
40 CFR 257.74(e)(1)(i) Calculated Static FOS for End-of-Construction	1.30	Note 1
40 CFR 257.73(e)(1)(ii) Calculated Static FOS for Long-Term, Maximum Storage Pool Loading Condition	1.52	**1.50**
40 CFR 257.73(e)(1)(iii) Calculated Static FOS for Maximum Surcharge Pool Loading Condition	1.42	**1.40**
40 CFR 257.73(e)(1)(iv) Calculated Seismic FOS Loading Condition	1.26	**1.00**
40 CFR 257.73(e)(1)(v) Calculated Liquefaction	Note 2	**1.20**
Does CCR Unit Satisfy the Requirements of 40 CFR 257.74(e)?	**Yes**	-

Notes: 1) The assessment of this loading condition is not applicable for this facility given that no lateral or vertical expansion is planned (*i.e.*, no new load is applied to evaluate end-of-construction condition).
2) The dikes are not constructed of material susceptible to liquefaction. Thus, liquefaction safety factor is not reported.

The factors of safety calculated for each required load case for the CCR unit satisfy the minimum safety factors specified in 40 CFR 257.74(e)(1)(i) through (v) for the critical cross section of the embankment.

4 CERTIFICATION

I certify that

- This initial safety factor assessment for the retrofitted Bottom Ash Pond was prepared by me or under my supervision,
- Pursuant to 40 CFR 257.74(f), this initial safety factor assessment meets the requirements of 40 CFR 257.74(e), and
- I am a registered professional engineer under the laws of the State of Ohio.

Certified By: James T. Perry Date: 01/13/2022

Seal:

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