

# MWVG

Midwest Generation, LLC

## Powerton Generating Station

# 2022 Safety Factor Assessment for Ash Surge Basin, Bypass Basin, & Former Ash Basin



**Revision 0**

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## 1.0 PURPOSE & SCOPE

### 1.1 PURPOSE

The Ash Surge Basin, Bypass Basin, and Former Ash Basin (the Basins) at Midwest Generation, LLC's (MWG) Powerton Generating Station ("Powerton" or the "Station") are existing coal combustion residual (CCR) surface impoundments that are regulated by the Illinois Pollution Control Board's "Standards for the Disposal of Coal Combustion Residuals in CCR Surface Impoundments." These regulations are codified in Part 845 to Title 35 of the Illinois Administrative Code (35 Ill. Adm. Code 845, Ref. 1) and are also referred to herein as the "Illinois CCR Rule." Pursuant to 35 Ill. Adm. Code 845.460(a), MWG must conduct and complete an annual safety factor assessment that documents whether the critical cross section at each of the Basins achieves the minimum safety factors specified in 35 Ill. Adm. Code 845.460(a).

This report documents the 2022 safety factor assessment conducted and completed in accordance with the Illinois and Federal CCR Rules by Sargent & Lundy (S&L) on behalf of MWG for the Ash Surge, Bypass, and Former Ash Basins at Powerton. This report:

- Lists the inputs and assumptions used in the 2022 safety factor assessment,
- Discusses the methodology used to conduct the 2022 safety factor assessment,
- Lists and compares the safety factor acceptance criteria for CCR surface impoundments promulgated by the Illinois CCR Rule and by the U.S. Environmental Protection Agency's (EPA) regulations for CCR surface impoundments,
- Summarizes the results from the initial federal safety factor assessments completed for the Basins that were conducted in accordance with the aforementioned U.S. EPA regulations,
- Evaluates potential changes to the inputs used in the initial federal safety factor assessments to determine whether new or updated liquefaction and/or structural stability analyses are warranted, and
- Provides the 2022 factors of safety for the Ash Surge, Bypass, and Former Ash Basins in accordance with 35 Ill. Adm. Code 845.460(a).

### 1.2 SCOPE

In addition to being regulated under the Illinois CCR Rule, the Basins at Powerton are also regulated by the U.S. EPA's "Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments," 40 CFR Part 257 Subpart D (Ref. 2), also referred to herein as the "Federal CCR Rule." Per the 2016 Water Infrastructure Improvements for the Nation (WIIN) Act, the Ash Surge, Bypass, and Former Ash Basins will continue to be subject to both the Illinois and Federal CCR Rules until the U.S. EPA approves the Illinois EPA's CCR permit program; the Illinois EPA has yet to publish a timeline for submitting its proposed CCR permit program to the U.S. EPA for approval. However, the scope of this 2022 safety

factor assessment is strictly limited to demonstrating compliance with the Illinois CCR Rule. Pursuant to 20 CFR 257.73(f)(3), the next safety factor assessment for demonstrating compliance with the Federal CCR Rule will be completed in 2026, five years after the last federal assessment was completed (2021).

## 2.0 INPUTS

### **Safety Factor Acceptance Criteria for CCR Surface Impoundments**

The Illinois CCR Rule (Ref. 1, § 845.460) requires each existing CCR surface impoundment to achieve four minimum safety factors at the impoundment’s critical cross section, which is defined by the Illinois CCR Rule as “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 Federal CCR Rule (Ref. 2, § 257.73(e)) has the same safety factor acceptance criteria as the Illinois CCR Rule. Table 2-1 presents the safety factor acceptance criteria promulgated by both sets of regulations for existing CCR surface impoundments.

**Table 2-1 – Safety Factor Acceptance Criteria for Existing CCR Surface Impoundments**

Loading Condition	Minimum Allowable Factor of Safety	Illinois CCR Rule Reference	Federal CCR Rule Reference
Long-Term, Maximum Storage Pool	1.50	§ 845.460(a)(2)	§ 257.73(e)(1)(i)
Maximum Surcharge Pool	1.40	§ 845.460(a)(3)	§ 257.73(e)(1)(ii)
Seismic	1.00	§ 845.460(a)(4)	§ 257.73(e)(1)(iii)
Liquefaction	1.20	§ 845.460(a)(5)	§ 257.73(e)(1)(iv)

### **Initial Federal Safety Factor Assessments**

Appendix A provides the initial federal safety factor assessment conducted by Geosyntec Consultants in 2016 for the Ash Surge Basin and the Bypass Basin (Ref. 3). Meanwhile, Appendix B provides the initial federal safety factor assessment conducted by Geosyntec Consultants in 2018 for the Former Ash Basin (Ref. 4).

### **Site Topography & Aerial Images**

Topographic data for the Ash Surge Basin, Bypass Basin, and surrounding areas was obtained from an aerial survey performed by Aero-Metric, Inc. in 2008 (Ref. 5). Historical and recent aerial images of the Basins and adjacent areas were obtained from Google Earth Pro (Ref. 6).

### **Groundwater**

Static water elevation data for groundwater at the site was obtained from annual groundwater monitoring reports prepared by KPRG and Associates, Inc. for the Basins in accordance with 40 CFR 257.90(e) (Refs. 13 through 17) and 35 Ill. Adm. Code 845.610(e)(1) (Ref. 18).

### **Basin Conditions**

The operating and physical conditions for the Ash Surge and Bypass Basins were based on visual observations by S&L during a site visit on September 22, 2022, discussions with MWG personnel, and the annual inspection reports prepared for the two CCR surface impoundments in accordance with 40 CFR 257.83(b) (Refs. 7 through 12).

### **Horizontal Seismic Coefficient**

Pursuant to 35 Ill. Adm. Code 845.460(a)(4), the Basins must have a minimum factor of safety of 1.00 when analyzed under a seismic loading condition. This loading condition is represented by a horizontal seismic coefficient that is based on a peak ground acceleration (PGA) with a 2 percent probability of exceedance in 50 years in accordance with the definition of “[m]aximum horizontal acceleration in lithified earth material” promulgated by 35 Ill. Adm. Code 845.120. The design horizontal seismic coefficient is also based on the mapped spectral response acceleration at a period of 1 second adjusted for site-specific soil conditions ( $S_{M1}$ ). Table 2-2 presents the seismic response parameters obtained from ASCE 7-22 (Ref. 19) on which the Basins’ seismic loading condition was based.

**Table 2-2 – Horizontal Seismic Coefficient Inputs**

Parameter	Symbol	Value
Peak Ground Acceleration	PGA	0.10
Mapped Spectral Response, 1-Second Period, Adjusted for Site Effects	$S_{M1}$	0.20

## **3.0 ASSUMPTIONS**

There are no assumptions in this document that require verification.

## **4.0 METHODOLOGY**

As documented in last year’s safety factor assessment, the 2021 factors of safety for the Ash Surge and Bypass Basins were based on the initial factors of safety calculated for the basins in 2016 pursuant to the Federal CCR Rule after it was determined that the bases for the initial federal safety factor assessment were still valid. Accordingly, the bases for the Ash Surge and Bypass Basins’ initial factors of safety as

documented within their federal safety factor assessment were re-evaluated to determine if any changes have occurred since the initial federal assessment was completed. Identified changes were then evaluated to determine if updates to the basins' previous structural stability and/or liquefaction analyses were warranted. Where no changes were noted for a given input, or where identified changes were determined to have no impact to the results and conclusions of the initial federal safety factor assessment, the previous evaluation of that input was considered to still be valid for this 2022 assessment.

Per last year's safety factor assessment, the initial federal safety factor assessment completed in 2018 for the Former Ash Basin (Ref. 4) concluded that an engineering analysis to calculate the safety factors for the basin could not be performed given the lack of necessary information due to the construction age of the basin. Since the minimum safety factors of the Former Ash Basin could not be demonstrated, MWG is closing the Former Ash Basin in accordance with 40 CFR 257.102. Consequently, the inputs, assumptions, and methodology utilized in the Former Ash Basin's initial safety factor assessment were not evaluated in 2022 assessment.

## **5.0 ASSESSMENT**

### **5.1 SUMMARY OF 2021 SAFETY FACTOR ASSESSMENT**

The previous safety factor assessment for the Ash Surge and Bypass Basins was completed on October 15, 2021. Ultimately, the 2021 factors of safety for the Ash Surge and Bypass Basins were based on the factors of safety calculated in the initial federal safety factor assessment after it was determined that the bases for the initial federal safety factor assessment were still valid. The initial federal safety factor assessment for the Ash Surge and Bypass Basins ultimately concluded the basin's critical cross-sections are stable and meet the safety factor requirements presented in 40 CFR 257.73(e)(1)(i) through 257.73(e)(1)(iv). Because the Illinois and Federal CCR Rules have the same safety factor acceptance criteria, the 2021 safety factor assessment ultimately concluded that the factors of safety calculated for the Ash Surge and Bypass Basins in the initial federal safety factor assessment are in conformance with the safety factor criteria promulgated under 35 Ill. Adm. Code 845.460(a)(2) through 845.460(a)(5).

### **5.2 SUMMARY OF INITIAL FEDERAL SAFETY FACTOR ASSESSMENT**

The initial federal safety factor assessment for the Ash Surge and Bypass Basins was completed in October 2016 and is included in its entirety in Appendix A. As previously stated, the results of this assessment indicated that the critical cross-sections for these basins are stable and meet the factor of safety requirements presented in 40 CFR 257.73(e)(1)(i) through 257.73(e)(1)(iv).

### **5.3 CHANGES IN BASES FOR INITIAL FEDERAL SAFETY FACTORS**

The following subsections summarize the evaluation conducted to determine if (1) changes to the design inputs used in the Ash Surge and Bypass Basins' initial federal safety factor assessment have occurred since the assessment was completed in 2016, and (2) whether the 2016 structural stability and liquefaction analyses can be accepted as-is for this 2022 assessment or if further analysis is required.

#### **5.3.1 CHANGES IN GEOTECHNICAL DATA**

Based on reviews of the annual inspection reports (Refs. 7 through 12) and Google Earth aerial images (Ref. 6), there have been no changes to the embankments or underlying soils that would require updating the geotechnical parameters used in the 2016 analysis (Ref. 3).

#### **5.3.2 CHANGES IN TOPOGRAPHY ADJACENT TO BASINS**

Based on reviews of the annual inspection reports (Refs. 7 through 12) and Google Earth aerial images (Ref. 6), there have been no significant modifications to the ground surfaces adjacent to the Ash Surge and Bypass Basins (mass excavations, mass fill placement, *etc.*) since the initial federal safety factor assessment was completed. Therefore, the topographic data collected for the site in 2008 (Ref. 5) remains valid for use in this 2022 assessment.

#### **5.3.3 CHANGES IN GROUNDWATER TABLE**

Based on reviews of the annual groundwater monitoring and corrective action reports for the Ash Surge and Bypass Basins (Refs. 13 through 18), no significant variations in the groundwater were noted. Because these two CCR surface impoundments are lined with a geomembrane, the embankments are not hydraulically connected to the water levels within the basins, and a typical phreatic surface normally associated with seepage through an earthen embankment is not applicable. The reported static groundwater elevation is valid for this analysis, and there have been no significant changes in the surface water conditions near the site that would impact the site's groundwater levels.

#### **5.3.4 CHANGES IN EMBANKMENT GEOMETRY**

Based on reviews of the annual inspection reports (Refs. 7 through 12), Google Earth aerial images (Ref. 6), and visual observations made by S&L in September 2022, there have been no significant modifications to the embankments for the Ash Surge Basin and Bypass Basin since the initial federal safety factor assessments were completed. Therefore, there is no basis to re-evaluate the embankment geometry of the basins for this 2022 assessment.

### 5.3.5 CHANGES IN EARTHQUAKE DESIGN BASIS

The design horizontal seismic coefficient utilized in the existing technical analysis (Ref. 3) is based on published data in ASCE 7-10 (Ref. 20). Since developing the technical analysis, an updated publication of the reference material has been produced (ASCE 7-22 (Ref. 19)), which provides updated values for the parameters used to determine the design horizontal seismic coefficient (see Tables 2-2 and 5-1). Based on the reduction in the site seismic loading parameters from ASCE 7-10 to ASCE 7-22, the horizontal seismic coefficient for the basins' seismic loading condition will be less than the value used in the initial federal safety factor assessment. Therefore, the horizontal seismic coefficient used for the 2016 analysis is conservative. Thus, it is not necessary to change the earthquake design basis used to conduct the initial federal safety factor assessment for the Ash Surge and Bypass Basins.

**Table 5-1 – Seismic Loading Parameters Comparison**

Parameter	Symbol	2016 Values per ASCE 7-10	2022 Values per ASCE 7-22
Peak Ground Acceleration	PGA	0.11	0.10
Mapped Spectral Response, 1-Second Period, Adjusted for Site Effects	$S_{M1}$	0.20	0.20

### 5.3.6 CHANGES IN BASIN OPERATIONS

In early October 2020, Powerton took the Bypass Basin out of service for routine cleaning. During a site visit in September 2021 conducted by S&L, it was noted that most of the CCR previously stored in the Bypass Basin had been removed and minimal surface water remained. During a subsequent site visit by S&L in September 2022, it was noted that almost all of the CCR previously stored in the Bypass Basin had been removed and minimal surface water remained. MWG currently plans to retrofit the Bypass Basin with a new composite liner system and a new leachate collection and removal system (LCRS). Retrofit construction activities will commence at the basin upon receipt of a retrofit construction permit from the Illinois EPA in accordance with Subpart B of the Illinois CCR Rule. Meanwhile, Powerton continues to operate the Ash Surge Basin to manage the Station's ash dewatering bin effluent and various non-CCR wastestreams in accordance with 40 CFR 257.103(f)(1). Operating conditions at this basin have not changed since the basin's initial safety factor assessment was conducted in 2016.

Of the two CCR surface impoundments, only the operating conditions at the Bypass Basin have changed since the initial federal safety factor assessment was completed for the Ash Surge and Bypass Basins. The decrease in surface water elevation in the Bypass Basin decreases the driving forces in the embankment; therefore, the surface water elevation used for the 2016 analysis is conservative for the basin's current



operating condition. Because the operating conditions at the Ash Surge Basin have not changed since the initial federal safety factor assessment was completed, the 2016 structural stability analysis for the basin remains valid. Therefore, there is no basis to re-evaluate the surface water elevations used to conduct the initial federal safety factor assessment for the Ash Surge and Bypass Basins.

## **5.4 2022 SAFETY FACTOR ASSESSMENT**

Other than the change in operational status of the Bypass Basin, there have been no significant modifications to the Ash Surge and Bypass Basins. In addition, there have been no significant changes to the embankments, underlying soils, adjacent topography, or groundwater levels. While the seismic design criteria for the basins has changed, the horizontal seismic coefficient calculated using the updated seismic design parameters will be less than the value used in the initial federal safety factor assessment, thereby making the 2016 analysis conservative under present design criteria. Therefore, the initial federal safety factor assessment completed in 2016 for the Ash Surge and Bypass Basins remains valid.

Based on the preceding observations, the initial factors of safety calculated for the Ash Surge and Bypass Basins in 2016 pursuant to the Federal CCR Rule and the bases for these safety factors remain valid for this 2022 assessment. As previously discussed, because the Illinois and Federal CCR Rules have the same safety factor acceptance criteria, these factors of safety for the Ash Surge and Bypass Basins are in conformance with the safety factor criteria promulgated under 35 Ill. Adm. Code 845.460(a)(2) through 845.460(a)(5).

## **6.0 CONCLUSIONS**

### **6.1 ASH SURGE & BYPASS BASINS**

This assessment re-evaluated the factors and design inputs used as the bases for the initial federal safety factor assessment completed in 2016 in accordance with the Federal CCR Rule for Powerton's Ash Surge and Bypass Basins (Ref. 3). It was determined that no significant changes have occurred within the last six years that would invalidate the conclusions of the initial federal safety factor assessment for the Ash Surge Basin and Bypass Basin. Therefore, the factors of safety reported in the initial federal safety factor assessment for the Ash Surge and Bypass Basins remain valid for this 2022 assessment. Moreover, because the Illinois and Federal CCR Rules have the same safety factor acceptance criteria, these federal factors of safety for the Ash Surge and Bypass Basins are in conformance with the safety factor criteria promulgated under 35 Ill. Adm. Code 845.460(a)(2) through 845.460(a)(5).

Table 6-1 presents the 2022 factors of safety for the Ash Surge Basin and Bypass Basin as determined in accordance with 35 Ill. Adm. Code 845.460(a).

**Table 6-1 – 2021 Illinois CCR Rule Factors of Safety for the Ash Surge Basin and Bypass Basin at the Powerton Generating Station**

Loading Condition	Ash Surge Basin	Bypass Basin	Min. Allowable Factor of Safety
Long-Term, Maximum Storage Pool	≥ 1.50	≥ 1.50	<b>1.50</b>
Maximum Surcharge Pool	≥ 1.40	≥ 1.40	<b>1.40</b>
Seismic	≥ 1.00	≥ 1.00	<b>1.00</b>
Liquefaction	Note 1	Note 1	<b>1.20</b>

Notes: 1) The embankment soils for the Ash Surge and Bypass Basins are not considered susceptible to liquefaction because saturation of the embankment soils is unlikely based on the installed geomembrane liner system. A limited portion of the bottom of the embankments may become saturated with groundwater based on the design phreatic surface. Liquefaction triggering analyses of these saturated soils show that liquefaction and associated post-liquefaction shear strength loss is unlikely for the design seismic event (Ref. 3). Thus, liquefaction safety factors are not reported.

## 6.2 FORMER ASH SURGE BASIN

The initial federal safety factor assessment completed for the Former Ash Basin in 2018 (Ref. 4) concluded that an engineering analysis to calculate the safety factors for the basin could not be performed given the lack of necessary information due to the construction age of the Former Ash Basin. Since the minimum safety factors of the Former Ash Basin could not be demonstrated, MWG is closing the Former Ash Basin in accordance with 40 CFR 257.102. Closure of the Former Ash Basin will also comply with the requirements promulgated under 35 Ill. Adm. Code Part 845 Subpart G.

### 7.0 CERTIFICATION

I certify that:

- This safety factor assessment was prepared by me or under my direct supervision.
- The work was conducted in accordance with the requirements of 35 Ill. Adm. Code 845.460.
- I am a registered professional engineer under the laws of the State of Illinois.

Certified By: Thomas J. Dehlin

Date: October 14, 2022

Seal:



## 8.0 REFERENCES

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**APPENDIX A: 2016 FEDERAL SAFETY FACTOR  
ASSESSMENT FOR ASH SURGE BASIN & BYPASS BASIN**

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**APPENDIX B: 2018 FEDERAL SAFETY FACTOR  
ASSESSMENT FOR FORMER ASH BASIN**

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