

# MWVG

Midwest Generation, LLC

**Powerton Generating Station**

## Alternative Composite Liner Design Certification for Retrofitted Bypass Basin

**Revision 1**

**April 5, 2024**

**Issue Purpose: Use**

**Project No.: 12661-181**

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## 1.0 PURPOSE & SCOPE

**Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.410(c)**

**Federal CCR Rule Reference: 40 CFR 257.72(c)**

### 1.1 PURPOSE

The Bypass Basin at Midwest Generation, LLC's (MWG) Powerton Generating Station ("Powerton" or the "Station") is an existing coal combustion residual (CCR) surface impoundment that is being retrofitted with a new composite liner system and a new leachate collection and removal system (LCRS). As a CCR surface impoundment, the Bypass Basin is regulated by the Illinois Pollution Control Board's "Standards for the Disposal of Coal Combustion Residuals in CCR Surface Impoundments," which is codified in Part 845 of Title 35 of the Illinois Administrative Code (35 Ill. Adm. Code 845, Ref. 1) and is referred to herein as the "Illinois CCR Rule." The Bypass Basin is also regulated by the U.S. Environmental Protection Agency's (EPA) "Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments," 40 CFR Part 257 Subpart D (Ref. 2), which is referred to herein as the "Federal CCR Rule."

Pursuant to 35 Ill. Adm. Code 845.410(c) and 40 CFR 257.72(c), this document demonstrates and provides certification that the design of the new composite liner system for the retrofitted Bypass Basin complies with the requirements of 35 Ill. Adm. Code 845.410 and 40 CFR 257.72 for an alternative composite liner.

Revision 1 of this document represents the first revision to the initial certification for the design of the new composite liner system to be installed in the retrofitted Bypass Basin, which was included with the retrofit construction permit application submitted to Illinois EPA on July 15, 2022. This liner design certification was revised to account for the following updates to the retrofit design for the Bypass Basin:

- A collection sump has been added to the leachate collection and removal system.
- The final embankment crest elevations have been adjusted in accordance with updated topographical survey information obtained in 2022.

### 1.2 SCOPE & APPLICABLE CCR REGULATIONS

Per the 2016 Water Infrastructure Improvements for the Nation (WIIN) Act, the retrofitted Bypass Basin 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, and so this demonstration and certification has been prepared pursuant to both sets of regulations.

### 1.2.1 FEDERAL CCR RULE

The following excerpts from the Federal CCR Rule are applicable to the design of an alternative composite liner system for a retrofitted CCR surface impoundment:

- § 257.72(a): New CCR surface impoundments...must be designed, constructed, operated, and maintained with either a composite liner or an alternative composite liner that meets the requirements of § 257.70(b) or (c).
- § 257.70(c): If the owner or operator elects to install an alternative composite liner, all of the following requirements must be met:
  - An alternative composite liner must consist of two components: the upper component consisting of, at a minimum, a 30-mil GM, and a lower component, that is not a geomembrane, with a liquid flow rate no greater than the liquid flow rate of two feet of compacted soil with a hydraulic conductivity of no more than  $1 \times 10^{-7}$  cm/sec. GM components consisting of high density polyethylene (HDPE) must be at least 60-mil thick. If the lower component of the alternative liner is compacted soil, the GM must be installed in direct and uniform contact with the compacted soil.
  - The hydraulic conductivity for the two feet of compacted soil used in comparison [to the alternative composite liner's lower component] shall be no greater than  $1 \times 10^{-7}$  cm/sec. The hydraulic conductivity of any alternative to the two feet of compacted soil must be determined using recognized and generally accepted methods. The liquid flow rate comparison must be made using Equation 1 of [40 CFR 257.70(c)], which is derived from Darcy's Law for gravity flow through porous media.

### 1.2.2 ILLINOIS CCR RULE

The following excerpts from the Illinois CCR Rule are applicable to the design of an alternative composite liner system for a retrofitted CCR surface impoundment:

- § 845.410(a): New CCR surface impoundments...must be designed, constructed, operated, and maintained with either a composite liner or an alternative composite liner that meets the requirements of Section 845.400(b) or (c).
- § 845.400(c)(1): An alternative composite liner must consist of two components: the upper component consisting of, at a minimum, a 30-mil geomembrane liner, and a lower component, that is not a geomembrane, with a liquid flow rate no greater than the liquid flow rate of two feet of compacted soil with a hydraulic conductivity of no more than  $1 \times 10^{-7}$  cm/sec. The geomembrane liner components consisting of high-density polyethylene (HDPE) must be at least 60 mil. If the lower component of the alternative liner is compacted soil, the geomembrane liner must be installed in direct and uniform contact with the compacted soil.

- § 845.400(c)(2): The liquid flow rate through the lower component of the alternative composite liner must be no greater than the liquid flow rate through two feet of compacted soil with a hydraulic conductivity of  $1 \times 10^{-7}$  cm/sec. The hydraulic conductivity for the two feet of compacted soil used in the comparison must be no greater than  $1 \times 10^{-7}$  cm/sec. The hydraulic conductivity of any alternative to the two feet of compacted soil must be determined using recognized and generally accepted methods.
- § 845.400(c)(3): The liquid flow rate comparison must be made using the following equation, which is derived from Darcy's Law for gravity flow through porous media.

## 2.0 DEMONSTRATION

The alternative composite liner design for the retrofitted Bypass Basin at the Powerton Generating Station is compliant with the referenced regulations as demonstrated in the following sections.

### 2.1 UPPER COMPONENT

**Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.400(c)(1)**

**Federal CCR Rule Reference: 40 CFR 257.70(c)(1)**

The upper component of the alternative composite liner design for the retrofitted Bypass Basin consists of a 60-mil HDPE geomembrane. This complies with 35 Ill. Adm. Code 845.400(c)(1) and 40 CFR 257.70(c)(1).

### 2.2 LOWER COMPONENT

**Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.400(c)(2) & 845.400(c)(3)**

**Federal CCR Rule Reference: 40 CFR 257.70(c)(2)**

The lower component of the alternative composite liner design for the retrofitted Bypass Basin consists of a geosynthetic clay liner (GCL). To demonstrate the specified GCL complies with 35 Ill. Adm. Code 845.400(c)(2) and 845.400(c)(3) and 40 CFR 257.70(c)(2), the maximum liquid flow rate allowed by the project construction specifications is compared to the liquid flow rate through two feet of soil with a hydraulic conductivity of  $1 \times 10^{-7}$  cm/sec. Table 1 presents this flow rate comparison. As shown in the table, the maximum allowable hydraulic conductivity specified for the GCL is  $1 \times 10^{-9}$  cm/sec. The GCL's hydraulic conductivity will be determined by ASTM D5887, which is a recognized and generally accepted method for determining the hydraulic conductivity of a GCL.

Per Table 1, the design liquid flow rate through the GCL specified for the lower component of the alternative composite liner for the retrofitted Bypass Basin is less than the liquid flow rate through two feet of compacted

soil with a hydraulic conductivity of  $1 \times 10^{-7}$  cm/sec. This complies with 35 Ill. Adm. Code 845.400(c)(2) and 845.400(c)(3) and 40 CFR 257.70(c)(2).

**Table 1 – Liquid Flow Rate Comparison Between Compacted Soil Liner & GCL for Retrofitted Bypass Basin**

Parameter	Symbol	Compacted Soil Liner	GCL
Crest Elevation	$EL_{crest}$	468 feet	
Minimum Retrofitted Bypass Basin Floor Elevation	$EL_{floor}$	457.5 feet	
Hydraulic Head on Liner (Omitting Geomembrane Thickness)	$h = EL_{crest} - EL_{floor}$	10.5 feet	
Thickness of Liner Lower Component	$t$	2 feet	7 mm = 0.023 feet
Hydraulic Gradient Through Liner	$i = h / t$	5.25	457
Maximum Hydraulic Conductivity of Liner	$k$	$1.0 \times 10^{-7}$ cm/sec	$1.0 \times 10^{-9}$ cm/sec
Liquid Flow Rate Through Liner (per Unit Area)	$q = k \times (i + 1)$	$6.25 \times 10^{-7}$ cm <sup>3</sup> /sec/cm <sup>2</sup>	$4.58 \times 10^{-7}$ cm <sup>3</sup> /sec/cm <sup>2</sup>

### 3.0 CERTIFICATION

**Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.410(c)**

**Federal CCR Rule Reference: 40 CFR 257.72(c)**

I hereby certify that:

- Per the preceding demonstration and pursuant to 35 Ill. Adm. Code 845.400(c)(2) and 845.400(c)(3) and 40 CFR 257.70(c)(2), the design liquid flow rate through the lower component of the alternative composite liner for the retrofitted Bypass Basin is no greater than the liquid flow rate through two feet of compacted soil with a hydraulic conductivity of  $1 \times 10^{-7}$  cm/sec.
- The design of the alternative composite liner for the retrofitted Bypass Basin complies with the requirements of 35 Ill. Adm. Code 845.410 and 40 CFR 257.72.
- This pre-construction composite liner design certification was prepared by me or under my direct supervision, and
- I am a registered professional engineer under the laws of the State of Illinois.

Certified By: Thomas J. Dehlin

Date: April 5, 2024

Seal:



### 4.0 REFERENCES

1. Illinois Pollution Control Board. "Standards for Disposal of Coal Combustion Residuals in CCR Surface Impoundments." 35 Ill. Adm. Code 845. Accessed April 4, 2024.
2. U.S. Environmental Protection Agency. "Standards for Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments." 40 CFR Part 257 Subpart D. <https://www.ecfr.gov/current/title-40/chapter-I/subchapter-I/part-257/subpart-D>. Accessed April 4, 2024.