

MWVG

Midwest Generation, LLC

Waukegan Generating Station

Final Written Closure Plan for East Ash Pond

Revision 2

January 27, 2022

Issue Purpose: Use

Project No.: 12661-098

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1.0 PURPOSE & SCOPE

Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.720(b)

Federal CCR Rule Reference: 40 CFR 257.102(b)

1.1 PURPOSE

The East Ash Pond at Midwest Generation, LLC's (MWG) Waukegan Generating Station ("Waukegan" or the "Station") is an existing coal combustion residual (CCR) surface impoundment that is 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." The East Ash Pond 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), also referred to herein as the "Federal CCR Rule."

Pursuant to 35 Ill. Adm. Code 845.720(b) and 40 CFR 257.102(b), this document provides the final written closure plan for the East Ash Pond at Waukegan. MWG intends to close this CCR surface impoundment by leaving the impounded CCR in place and installing a final cover system over the impoundment in accordance with 35 Ill. Adm. Code 845.750 and 40 CFR 257.102(d). This plan describes the steps necessary to close the East Ash Pond in this manner.

1.2 SCOPE

Per the 2016 Water Infrastructure Improvements for the Nation (WIIN) Act, the East Ash Pond 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 final written closure plan has been prepared pursuant to both sets of regulations.

2.0 CLOSURE PLAN NARRATIVE DESCRIPTION

Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.720(a)(1)(A) & 845.750(a)

Federal CCR Rule Reference: 40 CFR 257.102(b)(1)(i) & 257.102(d)(1)

Pursuant to 35 Ill. Adm. Code 845.750(a) and 40 CFR 257.102(d), the East Ash Pond will be closed by leaving the CCR stored in the pond in place and installing a final cover system over the impoundment. The final cover system will be designed in accordance with the requirements specified in 35 Ill. Adm. Code 845.750(c) and 40 CFR 257.102(d)(3) and as described in the following sections of this closure plan.

The anticipated closure in-place of the East Ash Pond will be performed in accordance with the following sequential steps:

1. Ceasing all CCR and non-CCR inflows to the pond;
2. Drawing down the free surface water in the pond by evaporation and by draining water into the Recycle Water Sump in the northwest corner of the pond;
3. Once the water elevation is below the Recycle Water Sump's overflow weir elevation, promoting additional drainage and dewatering by:
 - a. Excavating sumps and trenches within the ash material,
 - b. Using portable pumps as necessary to remove additional water by pumping water over the weir into the Recycle Water Sump, and/or
 - c. Utilizing earthmoving equipment to move the ash within the pond;
4. Upon completion of dewatering and stabilization of the impounded ash, establishing the slopes for the final cover system by:
 - a. Grading the stabilized ash material, and
 - b. Placing and grading structural fill material over the stabilized ash to establish the slopes for the final cover system;
5. Installing an engineered final cover system (ClosureTurf®), which consists of:
 - a. Structured geomembrane as the system's low permeability layer, and
 - b. Synthetic turf and specialized sand infill as the system's final protective layer; and
6. Initiating post-closure monitoring of groundwater and final cover system integrity.

3.0 FINAL COVER SYSTEM DESCRIPTION

Illinois CCR Rule References: 35 Ill. Adm. Code 845.720(a)(1)(C) & 845.750(a)

Federal CCR Rule References: 40 CFR 257.102(b)(1)(iii) & 257.102(d)(1)

Pursuant to the closure performance standards prescribed in 35 Ill. Adm. Code 845.750(a) and 40 CFR 257.102(d)(1), the final cover system encapsulating the CCR in the East Ash Pond will:

1. Minimize the post-closure infiltration of liquid into the CCR;
2. Minimize the risk of release of CCR or contaminated run-off to the ground or surface waters, or to the atmosphere;
3. Preclude the probability of future impoundment of water, sediment, or slurry;
4. Provide major slope stability to prevent sloughing of the final cover system during the closure and post-closure care period;
5. Minimize future maintenance; and
6. Allow closure activities to be completed as quickly as practical consistent with recognized and generally accepted good engineering practices.

In addition to the preceding performance criteria, the final cover system installed over the East Ash Pond must meet the design criteria promulgated by 35 Ill. Adm. Code 845.750(c) and 40 CFR 257.102(d)(3), both of which require the final cover system to consist of at least two layers: a lower, low-permeability layer for infiltration control and an upper, final protective layer for erosion control and for protecting the low permeability layer. MWG plans to install an engineered final cover system developed by Watershed Geosynthetics, LLC (Watershed Geo) called ClosureTurf®, which will provide the performance metrics stipulated for both the low-permeability and final protective layers promulgated by the Illinois and Federal CCR Rules. ClosureTurf® consists of a structured geomembrane under an engineered synthetic turf with a specialized sand infill. It should be noted that the products used to manufacture these materials are free of per- and polyfluoroalkyl substances (PFAS). Moreover, Watershed Geo has designed its ClosureTurf® product specifically for environmental containment applications and has been tested to ensure long-term compliance with the performance criteria discussed in the following subsections.

3.1 ESTABLISH GRADE & SUPPORT FOR FINAL COVER SYSTEM

Illinois CCR Rule References: 35 Ill. Adm. Code 845.750(a)(2), 845.750(a)(3), & 845.750(c)(3)

Federal CCR Rule References: 40 CFR 257.102(d)(1)(ii), 257.102(d)(1)(iii), & 257.102(d)(3)(i)(D)

To accomplish the performance requirements stipulated by 35 Ill. Adm. Code 845.750 and 40 CFR 257.102(d), the CCR remaining in the East Ash Pond will be graded to direct non-contact storm water run-off to a new low volume waste pond being installed within the footprint of the existing West Ash Pond west of and adjacent to the East Ash Pond. Structural fill material will be placed over the stabilized CCR in the pond to establish the lines and grades for this storm water management scheme. The slopes of this foundation layer for the pond's final cover system will be steep enough to prevent storm water from ponding over the cap but flat enough to limit erosion caused by the storm water run-off. These slopes will also be designed to accommodate potential settling and subsidence while maintaining a positive drainage strategy. In addition, the foundation layer's slopes (and the final cover system in general) will also include measures that provide slope stability to prevent the sloughing or movement of the final cover system during the closure and post-closure care period. Finally, the foundation layer surface will be prepared such that it is free from large, protruding, or sharp materials that could otherwise cause damage to the overlying low permeability layer.

3.2 LOW PERMEABILITY LAYER

Illinois CCR Rule References: 35 Ill. Adm. Code 845.750(a)(1) & 845.750(c)(1)

Federal CCR Rule References: 40 CFR 257.102(d)(1)(i) & 257.102(d)(3)(ii)(A)

The structured geomembrane component of the ClosureTurf® system will be placed on top of the graded CCR and fill in the East Ash Pond to minimize the infiltration of liquids through the pond during its post-

closure life. This low permeability layer will control stormwater run-off from the final cover system and will minimize post-closure infiltration of liquids into the waste and releases of CCR, leachate, or contaminated run-off to the ground or surface waters or to the atmosphere.

Table 1 lists the design criteria for the low permeability layer of a final cover system installed over a CCR surface impoundment as promulgated by the Illinois and Federal CCR Rules. By comparison, the Illinois CCR Rule’s design criteria for the low permeability layer are either as protective or more protective of human health and the environment than the design criteria promulgated by the Federal CCR Rule. Accordingly, the structured geomembrane component of the ClosureTurf® system for the East Ash Pond will be designed in accordance with the design criteria promulgated by the Illinois CCR Rule for a low permeability layer in a final cover system.

Table 1 – Comparison of Illinois and Federal CCR Rules’ Design Criteria for Low Permeability Layer in a CCR Surface Impoundment’s Final Cover System

Construction Material	Parameter	Illinois CCR Rule Design Criterion (35 Ill. Adm. Code 845.750(c)(1))	Federal CCR Rule Design Criterion (40 CFR 257.102(d)(3))
Earthen Material	Thickness	3 feet minimum	1.5 feet minimum
	Hydraulic Conductivity	Least of: <ul style="list-style-type: none"> Permeability of any bottom liner system or natural subsoils 1×10^{-7} cm/sec 	Least of: <ul style="list-style-type: none"> Permeability of any bottom liner system or natural subsoils 1×10^{-5} cm/sec
	Compaction	Minimize void spaces	--
Geomembrane	Thickness	40 mil	--
	Hydraulic Flux	Equivalent or superior reduction in infiltration as a low permeability layer constructed with earthen material	Equivalent or superior reduction in infiltration as a low permeability layer constructed with earthen material
	Prepared Subgrade	Free from sharp objects and other materials that may cause damage	--

The East Ash Pond has a 60-mil HDPE geomembrane liner on its floor and sides; therefore, the low permeability layer in the pond’s final cover system must have a permeability that is equal to or less than the effective permeability of the existing liner. Accordingly, MWG plans to specify a 60-mil HDPE, structured geomembrane for the ClosureTurf® system installed over the pond pursuant to 35 Ill. Adm. Code 845.750(c)(1)(B) and 40 CFR 257.102(d)(3)(ii)(A).

As required by 35 Ill. Adm. Code 845.750(c)(1)(B)(i) and 40 CFR 257.102(d)(3)(ii)(A), Table 2 demonstrates that a 60-mil HDPE geomembrane will provide a superior reduction in infiltration when compared to a 3-foot-thick layer of earthen material with a hydraulic conductivity of 1×10^{-7} cm/sec. The liquid flow rate through a 3-foot-thick layer of earthen material is calculated using the equation derived from Darcy's Law for gravity flow through porous media that is specified by the Illinois and Federal CCR Rules as the basis for demonstrating compliance with both rules' alternative composite liner design criteria (Ref. 1, §845.400(c)(3); Ref. 2, Eq. 1). Meanwhile, the liquid flow rate through a geomembrane liner is calculated using Bernoulli's equation for free flow through an orifice based on the assumption that one 2-mm-diameter hole is present in the geomembrane for every acre (4,000 m²) of liner (Ref. 3). Both liquid flow rates calculated in Table 2 are based on the assumption that 4.37 inches (0.11 meter) of hydraulic head is present on the low permeability layer, which is the estimated 25-year, 24-hour precipitation depth at the Station (Ref. 4). This is a conservative assumption because the final cover system will be sloped to preclude the build-up of liquid on the low permeability layer.

Table 2 – Liquid Flow Rate Comparison Between Low Permeability Layers Constructed Using Geomembrane & Earthen Material

Parameter	Symbol	Value
Liquid Flow Rate Through Earthen Material		
Hydraulic Conductivity	k	1×10^{-9} m/sec
Hydraulic Head Above Layer	h	0.11 m
Layer Thickness	t	3 ft = 0.91 m
Hydraulic Gradient Through Earthen Material	$i = h / t$	0.12
Liquid Flow Rate Through Layer per Acre of Final Cover System (Ref. 1, §845.400(c)(3); Ref. 2, Eq. 1).	$q = k \times (i + 1)$	1.12×10^{-9} m ³ /sec/m ²
Liquid Flow Rate Through Geomembrane		
Hole Area in Geomembrane	a	3.1 mm ² / 4000 m ²
Acceleration Due to Gravity	g	9.81 m/sec ²
Hydraulic Head Above Layer	h	0.11 m
Liquid Flow Rate Through Layer per Unit Area (Ref. 3)	$q = 0.6a(2gh)^{0.5}$	6.83×10^{-10} m ³ /sec/m ²

3.3 FINAL PROTECTIVE LAYER

Illinois CCR Rule References: 35 Ill. Adm. Code 845.750(c)(2)

Federal CCR Rule Reference: 40 CFR 257.102(d)(3)(ii)(B)

To minimize wind and water erosion, the ClosureTurf® system features an engineered synthetic turf with a thin (0.5- to 0.75-in. thick) layer of specialized sand infill that is installed over the structured geomembrane. The artificial turf component consists of a double-layer, woven geotextile base through which tufts of polyethylene fibers are inserted. This engineered synthetic turf and specialized sand infill will cover the entire low permeability layer (*i.e.*, structured geomembrane) and will be installed as soon as possible after placement of the low permeability layer.

Research and testing performed by Watershed Geo has demonstrated that ClosureTurf® provides superior protection against wind and water erosion than a traditional final protective layer consisting of vegetated topsoil or other earthen materials (Ref. 5). Specifically, the engineered synthetic turf component has been tested at hurricane-level wind speeds (using a wind tunnel) and at storm rainfall intensities of more than 6 inches per hour. By comparison, the 500-year, 1-hour rainfall depth for Lake County, Illinois, where the Station is located, is approximately 5.28 inches (Ref. 6). The most significant rainfall event to date at a site with a ClosureTurf® cap occurred in 2014 in Pensacola, Florida, where 22 inches of rain fell over 24 hours, and no damage to the final cover system was observed during the inspections that immediately followed the storm event. By comparison, the 500-year, 24-hour rainfall depth for Lake County, Illinois is 11.24 inches (Ref. 6), or approximately 51% of the aforementioned 2014 storm event.

The aforementioned wind tunnel testing conducted on ClosureTurf® at hurricane-level wind speeds by Watershed Geo has also demonstrated that the 0.5- to 0.75-in.-thick, specialized sand infill layer provides weight to prevent wind from lifting the ClosureTurf® cap and subsequently exposing the underlying CCR to the atmosphere. The hydraulic performance of ClosureTurf® also is not affected by freezing temperatures and freeze-thaw conditions (Ref. 6). Because the final protective layer will consist of synthetic turf, the risk of roots penetrating the underlying geomembrane cap also is not a concern. Therefore, the engineered synthetic turf and specialized sand infill components of the proposed ClosureTurf® final cover system for the East Ash Pond will provide equivalent or superior performance as the 3-foot-thick final protective layer specified in 35 Ill. Adm. Code 845.750(c)(2).

Finally, in addition to providing superior protection against wind and water erosion than a traditional cover system, ClosureTurf® also does not require as much maintenance as a vegetated final protective layer which needs to be mowed regularly and may need to be reseeded, refertilized, and/or regraded throughout the pond's post-closure life.

4.0 ESTIMATED MAXIMUM INVENTORY OF CCR

Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.720(a)(1)(D)

Federal CCR Rule Reference: 40 CFR 257.102(b)(1)(iv)

Detailed records of the maximum inventory of CCR ever stored in the East Ash Pond are not available. For the purposes of this closure plan, the maximum CCR inventory for the East Ash Pond is conservatively based on its estimated maximum capacity, which is 184,000 cubic yards.

5.0 ESTIMATED COVER SURFACE AREA

Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.720(a)(1)(E)

Federal CCR Rule Reference: 40 CFR 257.102(b)(1)(v)

The estimated final cover surface area for the East Ash Pond is 13.5 acres. It is estimated that this area represents the largest surface area that will ever require a final cover at any point over the pond's active life.

6.0 CLOSURE SCHEDULE

Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.720(a)(1)(F)

Federal CCR Rule Reference: 40 CFR 257.102(b)(1)(vi)

Closure activities for the East Ash Pond will commence after the West Ash Pond has been closed and repurposed as a new low-volume waste pond and are estimated to be completed in 2024. Table 3 lists the major milestones necessary for closing the East Ash Pond and the expected duration for completing each milestone.

Table 3 – Planning Level Schedule for Closing the East Ash Pond

Activity	Estimated Duration
Prepare Closure Construction Design Documents	Complete
Obtain Closure Construction Permit from Illinois EPA	12 Months
Hire Contractor to Complete Closure Activities in Accordance with Illinois EPA Permit	4 Months
Close West Ash Pond and Repurpose as Low Volume Waste Pond	10 Months
Dewater Pond & Impounded Ash	6 Months

Activity	Estimated Duration
Grade Dewatered Ash, Place and Grade Structural Fill	3.5 Months
Install Final Cover System	1.5 Months
Submit Closure Report and Certification to Illinois EPA	2 Weeks
Obtain Approval of Closure Report and Certification from Illinois EPA	3 Months
Complete and Certify Closure of the East Ash Pond	--

7.0 AMENDMENTS TO CLOSURE PLAN

Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.720(a)(3)

Federal CCR Rule Reference: 40 CFR 257.102(b)(3)

This closure plan will be amended in accordance with 35 Ill. Adm. Code 845.720(a)(3) and 40 CFR 257.102(b)(3) if a change in the operation of the East Ash Pond would substantially affect this closure plan or if an unanticipated event necessitates a revision to this closure plan. Any and all amendments to this closure plan will be certified by a qualified professional engineer registered in the State of Illinois in accordance with 35 Ill. Adm. Code 845.720(a)(4) and 40 CFR 257.102(b)(4).

8.0 COMPLETION OF CLOSURE ACTIVITIES

Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.760

Federal CCR Rule Reference: 40 CFR 257.102(f)

Upon completion of all closure activities required by 35 Ill. Adm. Code Part 845 and 40 CFR 257.102(d) and approved by the Illinois EPA in a construction permit, a closure report and a closure certification for the East Ash Pond will be submitted to the Illinois EPA in accordance with 35 Ill. Adm. Code 845.760(e). The closure report will include (1) the engineering and hydrogeology reports containing any monitoring well completion reports, boring logs, all construction quality assurance (CQA) reports, certifications, designations of CQA officers-in-absentia required by 35 Ill. Adm. Code 845.290; (2) photographs with time, date, and location information relied upon for documentation of construction activities; (3) a written summary of the closure requirements and completed activities as stated in the closure plan in effect and 35 Ill. Adm. Code Part 845; and (4) any other information relied upon by the qualified professional engineer for certification. Pursuant to 35 Ill. Adm. Code 845.760(e)(2) and 40 CFR 257.102(f)(3), the certification will be prepared by an

independent, qualified professional engineer licensed in the State of Illinois and will verify that the East Ash Pond has been closed in accordance with the closure plan in effect at the time of the closure work, the requirements of 35 Ill. Adm. Code Part 845, and the requirements of 40 CFR 257.102. Finally, within 30 days of the Illinois EPA approving the closure report and closure certification, a notification of completion of closure will be prepared in accordance with 35 Ill. Adm. Code 845.760(f).

9.0 CERTIFICATION

Illinois CCR Rule Reference: 35 Ill. Adm. Code 845.720(a)(4)

Federal CCR Rule Reference: 40 CFR 257.102(b)(4)

I certify that:

- This final written closure plan for the East Ash Pond was prepared by me or under my direct supervision.
- The work was conducted in accordance with the requirements of 35 Ill. Adm. Code Part 845 and with the requirements of 40 CFR 257.102.
- I am a registered professional engineer under the laws of the State of Illinois.

Certified By: Thomas J. Dehlin

Date: January 27, 2022

Seal:



Th. Dehlin
1/27/2022
Exp. 11/30/2023

10.0 REFERENCES

1. Illinois Pollution Control Board. "Standards for Disposal of Coal Combustion Residuals in CCR Surface Impoundments." 35 Ill. Adm. Code 845. Accessed January 26, 2022.
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 January 26, 2022.
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