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Revision 0

Indiana-Kentucky Electric Corporation
3932 U.S. Route 23
P.O. Box 468
Piketon, Ohio 45661

**RE: Liner Design Criteria for New CCR Surface Impoundment
West Boiler Slag Pond - Retrofit (CCR Unit)
EPA CCR Rule: 40 CFR §257.72(a and c) and §257.70(c)
IKEC Clifty Creek Station
Madison, Jefferson County, Indiana**

1.0 PURPOSE

This letter documents Stantec's certification of the alternative composite liner design for the retrofit area (CCR Unit) within the Clifty Creek Station's West Boiler Slag Pond. Based on this assessment, the CCR Unit is in compliance with the alternative composite liner design requirements in the EPA Final CCR Rule at 40 CFR 257.70(c)(1).

2.0 LINER DESIGN

As described in 40 CFR 257.102(k), retrofit of an existing CCR surface impoundment must comply with the requirements in §257.72. Prior to construction of the CCR surface impoundment, certification must be provided that the design of the alternative composite liner meets the requirements of §257.70(c).

Under §257.70(c), 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 1×10^{-7} centimeter per second (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 §257.70(c), which is derived from Darcy's Law for gravity flow through porous media.

The alternative composite liner must meet the requirements specified in §257.70(b). A composite liner must consist of two components; the upper component consisting of, at a minimum, a 30-mil geomembrane liner (GM), and the lower component consisting of at least a two-foot layer of compacted soil with a hydraulic conductivity of no more than 1×10^{-7} cm/sec. GM components consisting of high density polyethylene (HDPE) must be at least 60-mil thick. The GM or upper liner component must be installed in direct and uniform contact with the compacted soil or lower liner component. The composite liner must be:

- (1) Constructed of materials that have appropriate chemical properties and sufficient strength and thickness to prevent failure due to pressure gradients (including static head and external hydrogeologic forces), physical contact with the CCR or leachate to which they are exposed, climatic conditions, the stress of installation, and the stress of daily operation;

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- (2) Constructed of materials that provide appropriate shear resistance of the upper and lower component interface to prevent sliding of the upper component including on slopes;
- (3) Placed upon a foundation or base capable of providing support to the liner and resistance to pressure gradients above and below the liner to prevent failure of the liner due to settlement, compression, or uplift; and
- (4) Installed to cover all surrounding earth likely to be in contact with the CCR or leachate.

3.0 SUMMARY OF FINDINGS

The alternative composite liner design for the retrofit area within the Clifty Creek Station's West Boiler Slag Pond includes:

Upper component: 30-mil LLDPE geomembrane. This complies with §257.70(c)(1).

Lower component: a polymer-enhanced geosynthetic clay liner (GCL) tested for leachate compatibility.

The specified GCL was tested in accordance with ASTM D6766 using site-specific leachate. The measured hydraulic conductivity was 1.1×10^{-9} cm/sec at a testing duration of 1,960.3 hours. The following table presents the calculation of flow rate comparison.

	Compacted Soil Liner	GCL
Hydraulic Head on Liner (Not Considering GM) (h)	5 feet	5 feet
Compacted Soil/GCL Bentonite Thickness (t)	2 feet	0.3 inch (0.025 feet)
Hydraulic Conductivity of Liner (k)	1×10^{-7} cm/sec	1.1×10^{-9} cm/sec
Liquid Flow Rate per Unit Area ($q = k \times ((h/t)+1)$)	3.5×10^{-7} cm/sec	2.2×10^{-7} cm/sec

Per the preceding table, the liquid flow rate through the GCL specified for the lower component of the alternative composite liner for the retrofit area of the West Boiler Slag Pond is less than the liquid flow rate through two feet of compacted soil with a hydraulic conductivity of 1×10^{-7} cm/sec. This complies with §257.70(c)(1).

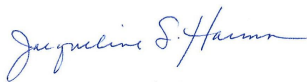
4.0 QUALIFIED PROFESSIONAL ENGINEER CERTIFICATION

I, Jacqueline S. Harmon, being a Professional Engineer in good standing in the State of Indiana, do hereby certify, to the best of my knowledge, information, and belief:

1. that the information contained in this certification is prepared in accordance with the accepted practice of engineering;
2. that the information contained herein is accurate as of the date of my signature below; and
3. that, pursuant to 40 CFR 257.102(k) and 40 CFR 257.72(c), the alternative composite liner design for the retrofit of Clifty Creek Station's West Boiler Slag Pond meets the requirements specified in 40 CFR 257.70(c).

Design with community in mind

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SIGNATURE  DATE 11/3/2025

Jacqueline S. Harmon, PE
Principal

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