LINER DESIGN DOCUMENTATION AND CERTIFICATION

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Bottom Ash CCR Surface Impoundment
Stanton Station
Great River Energy

Submitted To: Great River Energy
Stanton Station
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1.0 INTRODUCTION

This report presents documentation and certification of the liner design for the Bottom Ash CCR Surface Impoundment (Bottom Ash Impoundment) at Great River Energy's (GRE) Stanton Station (SS). The Bottom Ash Impoundment at SS is an existing (i.e., received coal combustion residuals both before and after October 14, 2015) coal combustion residual (CCR) surface impoundment. This report addresses the requirements of 40 CFR Section §257.71, Liner Design Criteria for Existing CCR Surface Impoundments (EPA 2015).

Stanton Station is a coal-fired electric generation facility located in Mercer County, North Dakota, approximately 3 miles southeast of the city of Stanton along the Missouri River. The Bottom Ash Impoundment at SS consists of three cells used in conjunction with one another to temporarily store and dewater bottom ash. Bottom ash is conveyed to the north and south cells with the center (retention) cell acting as a clarifier facility that receives de minimis CCR material.

2.0 SUMMARY OF LINER DESIGN CRITERIA

The Bottom Ash Impoundment was constructed with a composite liner over the entire footprint for each of the three cells. This composite liner includes a 60-mil smooth high-density polyethylene (HDPE) geomembrane (GM) overlaying a minimum of 2 feet of compacted clay.

Regulation §257.71(a)(1) requires documentation that each existing CCR surface impoundment is constructed with one of the following liner systems.

- A liner consisting of a minimum of 2 feet of compacted soil with a hydraulic conductivity of no more than 1x10-7 cm/sec.
- A composite liner that meets the requirements of §257.70(b), consisting of:
  - An upper component composed of at least a 30-mil geomembrane liner (GM) or 60-mil if using high density polyethylene (HDPE) installed in direct and uniform contact with the compacted soil or lower liner component, and
  - A lower component consisting of at least a 2-foot layer of compacted soil with a hydraulic conductivity less than or equal to 1x10-7 centimeters per second (cm/sec).
- An alternative composite liner that meets the requirements of §257.70(c), consisting of:
  - An upper component composed of at least a 30-mil geomembrane liner (GM) or 60-mil if using high density polyethylene (HDPE) installed in direct and uniform contact with the compacted soil or lower liner component, and
  - A lower component, that is not a GM, with a liquid flow rate no greater than the liquid flow rate of 2 feet of compacted soil with a hydraulic conductivity of less than or equal to 1x10-7 cm/sec.

Additionally, composite liners and alternative composite liners must meet the following criteria regarding compatibility, engineering properties and installation, outlined in § 257.70(b):

- 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;
- 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;
- 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
- Installed to cover all surrounding earth likely to be in contact with the CCR or leachate.

3.0 BOTTOM ASH IMPOUNDMENT LINER EVALUATION

The Bottom Ash Impoundment was constructed with a composite liner over the entire footprint for each of the three cells, and complies with the requirements of §257.70(b).

The upper component of the composite liner is a 60-mil thick HDPE geomembrane liner, and the lower component is a minimum of 2 feet of compacted clay. Design and technical specifications for the composite liner are contained in the Stone & Webster Design Report (Stone & Webster 1994). The Bottom Ash Impoundment composite liner was constructed in 1995, and construction quality assurance (CQA) of the 60-mil smooth HDPE liner and the compacted clay liner was performed by Huntingdon Engineering & Environmental, Inc. d/b/a Maxim Technologies Inc. (UPA 1996).

Clay fill was placed a minimum of 2 feet thick in horizontal loose lifts of no more than 8 inches in thickness and compacted to near optimum moisture content and to at least 95 percent maximum density as determined from a Standard Proctor (Stone & Webster 1994). Testing conducted on the clay liner during construction consisted of grain size distribution, Proctor compaction curves, Atterberg limits, and field density and moisture testing. Field density measurements averaged 97 percent maximum density with average moisture content 1 percent above optimum moisture content.

The clay fill used for liner construction was collected from a borrow location at the Glenharold ash disposal site. Laboratory hydraulic conductivity testing was performed for 17 borrow soil samples taken from the Glenharold ash disposal area (Stone & Webster 1994). The samples were compacted to dry densities between 90% and 100% of maximum and had coefficient of hydraulic conductivity values ranging from $6x10^{-9}$ cm/sec to $6.5x10^{-8}$ cm/sec (geometric mean of $2.0x10^{-8}$ cm/sec). In addition to this hydraulic conductivity testing, a shelby tube sample of the clay used in the embankment construction was collected in 2011. Hydraulic conductivity testing of the sample (ASTM D5084) indicated a coefficient of hydraulic conductivity of $1.7x10^{-8}$ cm/sec (Golder 2011).

The liner system meets additional composite liner requirements outlined in §257.70(b):

- §257.70(b)(1) – The composite liner (60-mil HDPE geomembrane and 2 feet of soil) is constructed of competent materials with appropriate strength and meet the composite liner design requirements for CCR materials outlined in §257.71.
- §257.70(b)(2) –Based on design information and visual observations of the Bottom Ash Impoundment, the composite liner system was constructed with soil-filled anchor trenches to provide shear resistance to movement of the liner system.
- §257.70(b)(3) – Earthworks (embankments and clay liner) were designed to be compacted to at least 95 percent maximum density as determined from a Standard Proctor and were compacted to an average of 97 percent maximum density based on field testing. Based on this information and visual observations, both historic and new embankment fill materials appear to have been compacted to densities sufficient for loading conditions expected at the impoundment cells.
- §257.70(b)(4) – The composite liner system has been constructed to the top of the impoundment embankments (elevation 1720 feet). In addition, operating procedures restrict operating the impoundment to within 2 feet of the top of the embankment (elevation 1718 feet). Therefore, the composite liner is installed to cover surrounding earth that could come into contact with CCR material.

4.0 CERTIFICATION

The undersigned attest to the completeness and accuracy of this liner design documentation, and certify that the installed liner in the Bottom Ash Impoundment meets the requirements detailed in 40 CFR §257.71 and that the Bottom Ash Impoundment is a "lined" CCR surface impoundment.

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5.0 REFERENCES

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