Compliance with CCR Rule 40 CFR §257.74(d)

Initial Structural Stability Assessment for Cell 4

Prepared for
Minnkota Power Cooperative, Inc.
Milton R. Young Station

September 2018
Initial Structural Stability Assessment for CCR Surface Impoundment
Cell 4
September 2018

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Appendix CCR Rule §257.74 Excerpt – Structural Integrity Criteria for New CCR Surface
Impoundments and any Lateral Expansion of a CCR Surface Impoundment
Certifications

I hereby certify that I have examined the facility and, being familiar with the provisions of 40 CFR 257 Subpart D, attest that this Coal Combustion Residuals (CCR) surface impoundment initial structural stability assessment has been prepared in accordance with good engineering practice, including consideration of applicable industry standards and the requirements of 40 CFR §257.74(d). I certify that the assessment is adequate for this facility and that procedures for recordkeeping and reporting have been established.

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Thomas J. Radue
Barr Engineering Co.
ND Registration Number PE-3632

Dated this 28th day of September, 2018
Chapter 1.0 Introduction

Minnkota Power Cooperative, Inc. (MPC) operates the Milton R. Young Station (MRYS), near Center, North Dakota. MRYS operates two lignite-fired cyclone boilers, resulting in production of coal combustion residuals (CCR). CCR management is subject to Federal Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments per 40 CFR 257 Subpart D (CCR Rule).

This initial structural stability assessment for the MRYS surface impoundment Cell 4 has been developed to satisfy the requirements described in 40 CFR §257.74(d).

Cell 4 is being constructed in one phase to be completed in 2018. Cell 4 is a composite lined facility with a compacted clay liner overlain by geomembrane liner.

1.1 Requirements

Section §257.74(d)(1) of the CCR Rule indicates this initial structural assessment is to include review of whether the CCR unit has been designed, constructed, operated and maintained with:

i. Stable foundations and abutments

ii. Adequate slope protection to protect against surface erosion, wave action, and adverse effects of sudden drawdown

iii. Dikes mechanically compacted to a density sufficient to withstand the range of loading conditions for the CCR unit

iv. Vegetated slopes of dikes and surrounding areas

v. A single spillway or a combination of spillways configured as specified in paragraph (d)(1)(v)(A) of this section. The combined capacity of all spillways must be designed, constructed, operated, and maintained to adequately manage flow during and following the peak discharge from the event specified in paragraph (d)(1)(v)(B) of this section.

A. All spillways must be either:

1. Of non-erodible construction and designed to carry sustained flows; or

2. Earth- or grass-lined and designed to carry short-term, infrequent flows at non-erosive velocities where sustained flows are not expected.

B. The combined capacity of all spillways must adequately manage flow during and following the peak discharge from a:

1. Probable maximum flood (PMF) for a high hazard potential CCR surface impoundment; or

2. 1000-year flood for a significant hazard potential CCR surface impoundment; or

3. 100-year flood for a low hazard potential CCR surface impoundment.

vi. Hydraulic structures underlying the base of the CCR unit or passing through the dike of the CCR unit that maintain structural integrity and are free of significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, and debris which may negatively affect the hydraulic structure; and
vii. For CCR units with downstream slopes which can be inundated by the pool of an adjacent water body, such as a river, stream or lake, downstream slopes that maintain structural stability during the low pool of the adjacent water body or sudden drawdown of the adjacent water body.

An excerpt of this portion of the CCR Rule is in the Appendix. The initial structural assessment must identify any structural stability deficiencies associated with the CCR unit in addition to recommending corrective measures. Written certification from a qualified professional engineer is also required.
2.0 Initial Structural Stability Assessment

2.1 Stable Foundations and Abutments
Cell 4 is constructed on stable foundation soils as documented in the Site Characterization Investigation Report and Environmental Monitoring System Proposal for Modification to North Dakota Department of Health (NDDH) Solid Waste Permit SP-159 report that was reviewed and approved by the NDDH; this report is included in the History of Construction for Cell 3. Prior to Cell 4 excavation and embankment construction, the upper topsoil and subsoil layers were stripped, exposing suitable subgrade foundation soils. Topsoil and subsoil were stockpiled for future use in closure/reclamation. The Cell 4 subgrade soil properties, embankment fill procedures, and construction photographs will be included in the construction documentation report for Cell 4.

2.2 Slope Protection/Vegetated Slopes
Exterior slopes of Cell 4 will be vegetated to establish a dense grassy vegetation to minimize erosion. The exterior slopes will periodically be managed to promote thick vegetation and control tree growth. If any areas develop where vegetation does not become well established, these areas will be reseeded, fertilized and mulched to aid in vegetation establishment. The interior slope of Cell 4 is covered by the exposed Cell 4 geomembrane liner which provides adequate slope protection.

2.3 Embankment Compaction
The Cell 4 embankment is constructed with native random fill materials that were placed in maximum 12-inch loose lifts. The moisture content at the time of material placement and compaction of each lift was at or above the moisture content required to meet or exceed 95 percent of Standard Proctor maximum dry density as determined by ASTM moisture-density test method D-698. The Cell 4 embankment materials are tested in accordance with the Construction Quality Assurance/ Quality Control Plan. Test results will be documented in the Cell 4 construction documentation report.

2.4 Spillways
The Cell 4 surface impoundment does not include spillways. Per the Cell 4 Inflow Design Flood Control System Plan, even in the event of a 1,000-year storm event, there would still be 4.3 feet of freeboard between the computed peak water surface elevation and the top of the composite liner for the Cell 4 embankment, and 6.3 feet of freeboard to the crest of the Cell 4 embankment. Based on these Cell 4 design characteristics, freeboard for the inflow design flood event is adequate and a spillway is not required.

2.5 Hydraulic Structures
To control possible hydraulic pressure within the Hagel bed coal seam, a 6-inch diameter high density polyethylene (HDPE) perforated pipe was installed along the south and east interior slopes of Cell 4, directly beneath the compacted clay liner. This pipe adjoins a riser pipe that extends to the top of the embankment, providing access for water withdrawal from the perforated pipe and pressure relief if
needed during clay liner construction. Possible hydraulic pressure beneath the compacted clay liner is only a concern during initial construction and filling of the surface impoundment until the pool elevation exceeds the Hagel bed elevation.

Failure of this pipe would not cause any impact to the stability of Cell 4 because the outlet of the pipe is at an elevation always above the maximum pool elevation and does not penetrate the embankment. Further, the pipe is covered by the composite Cell 4 clay and geomembrane liner, which block potential seepage to the pipe from within the cell. Therefore, the pipe is not configured in a manner that would facilitate pore water pressure buildup in the Cell 4 dike and reduced slope stability factor of safety that might result from increased pore water pressure.

A second hydraulic structure consists of a 4-foot wide by 4-foot tall granular finger drain, constructed partially through the Cell 4 east embankment. The finger drain was installed where the Hagel bed coal seam outcropped within the east embankment fill area and day-lights at the toe of the exterior embankment slope. The drain prevents pore water pressure within the Hagel bed coal seam from building up within the east embankment that, if it occurred, might affect embankment stability. Inclusion of the finger drain is precautionary; the Hagel bed seam in this area has historically been dry so no pore water pressure build-up is anticipated. Similar finger drains were installed in Cell 3 directly to the north and ongoing inspections of the day-light locations confirm that no unanticipated drainage is occurring.

2.6 Downstream Slope Inundation

No lakes or rivers are present at the toe of the perimeter dikes at the MPC CCR surface impoundment facility. Nelson Lake is approximately 1 mile north of Cell 4. The top of the Nelson Lake dam is approximately elevation 1936 and the Cell 4 lowest toe of embankment elevation is approximately elevation 2020; nearly 84 feet above the lake. The closest named tributaries to Cell 4 are the Hagel Creek to the west and the Square Butte Creek to the east. Both lie greater than 4,000 feet from the toe of the embankment.
3.0 Summary & Conclusions

The purpose of this report is to document and certify results of the structural stability assessment for the Cell 4 surface impoundment at MPC. Through review of the Cell 4 surface impoundment at MPC, the requirements for structural stability criteria for existing CCR surface impoundments as defined by 40 CFR §257.74(d) are satisfied. Periodic assessments following this initial assessment will be conducted in accordance with the timeframes outlined in §257.74.
Appendix

CCR Rule §257.74 Excerpt – Structural Integrity Criteria for New CCR Surface Impoundments and any Lateral Expansion of a CCR Surface Impoundment
that the initial assessment and each subsequent periodic assessment specified in paragraph (a)(1) of this section meets the requirements of this section.

(ii) Timelines for periodic assessments—(1) Initial assessments. Except as provided by paragraph (D)(2) of this section, the owner or operator of the CCR unit must complete the initial assessments required by paragraphs (a)(2), (d), and (e) of this section no later than October 17, 2016. The owner or operator has completed an initial assessment when the owner or operator has placed the assessment required by paragraphs (a)(2), (d), and (e) of this section in the facility's operating record as required by §257.106(f)(5), (10), and (12).

(3) Use of a previously completed assessment(s) in lieu of the initial assessment(s). The owner or operator of the CCR unit may elect to use a previously completed assessment to serve as the initial assessment required by paragraphs (a)(2), (d), and (e) of this section provided that the previously completed assessment(s):

(I) Was completed no earlier than 42 months prior to October 17, 2016;

(II) Meets the applicable requirements of paragraphs (a)(2), (d), and (e) of this section.

(iii) Frequency for conducting periodic assessments. The owner or operator of the CCR unit must conduct and complete the assessments required by paragraphs (a)(2), (d), and (e) of this section every five years. The date of completing the initial assessment is the date for establishing the deadline to complete the first subsequent assessment. If the owner or operator elects to use a previously completed assessment(s) in lieu of the initial assessment as provided by paragraph (D)(2) of this section, the date of the date of completing the previously completed assessment is the basis for establishing the deadline to complete the first subsequent assessment. The owner or operator may complete any required assessment prior to the required deadline provided the owner or operator places the completed assessment(s) into the facility's operating record within a reasonable amount of time. In all cases, the deadline for completing subsequent assessments is based on the date of completing the previous assessment. For purposes of this paragraph (D)(3), the owner or operator has completed an assessment when the relevant assessment(s) required by paragraphs (a)(2), (d), and (e) of this section has been placed in the facility's operating record as required by §257.106(f)(5), (10), and (12).

(iv) Closure of the CCR unit. An owner or operator of a CCR unit who either fails to complete a timely safety factor assessment or fails to demonstrate minimum safety factors as required by paragraph (a) of this section is subject to the requirements of §257.101(b)(2).

(g) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in §257.106(f), the notification requirements specified in §257.106(f), and the Internet requirements specified in §257.107(f).

§257.74 Structural integrity criteria for new CCR surface impoundments and any lateral expansion of a CCR surface impoundment.

(a) The requirements of paragraphs (a)(1) through (4) of this section apply to all new CCR surface impoundments and any lateral expansion of a CCR surface impoundment, except for those new CCR surface impoundments that are incised CCR units. If an incised CCR surface impoundment is subsequently modified (e.g., a dike is constructed) such that the CCR unit no longer meets the definition of an incised CCR unit, the CCR unit is subject to the requirements of paragraphs (a)(1) through (4) of this section.

(i) No later than the initial receipt of CCR, the owner or operator of the CCR unit must place on or immediately adjacent to the CCR unit a permanent identification marker, at least six feet high showing the identification number of the CCR unit. If one has been assigned by the state, the name associated with the CCR unit and the name of the owner or operator of the CCR unit.

(ii) Periodic hazard potential classification assessments. The owner or operator of the CCR unit must conduct initial and periodic hazard potential classification assessment of the CCR unit according to the timeframes specified in paragraph (D)(6) of this section. The owner or operator must document the hazard potential classification of each CCR unit as either a high hazard potential CCR surface impoundment, a significant hazard potential CCR surface impoundment, or a low hazard potential CCR surface impoundment. The owner or operator must also document the basis for each hazard potential classification.

(iii) Changes to hazard potential classification. (A) If the owner or operator of a CCR unit determines during a periodic hazard potential assessment that the CCR unit is no longer classified as either a high hazard potential CCR surface impoundment or a significant hazard potential CCR surface impoundment, then the owner or operator of the CCR unit is no longer subject to the requirement to prepare and maintain a written EAP beginning on the date the periodic hazard potential assessment documentation is conducted in accordance with the requirements of this section.

(B) Emergency Action Plan (EAP)—(1) Development of the plan. Prior to the initial receipt of CCR in the CCR unit, the owner or operator of a CCR unit determined to be either a high hazard potential CCR surface impoundment or a significant hazard potential CCR surface impoundment under paragraph (a)(2) of this section must prepare and maintain a written EAP. At a minimum, the EAP must:

(A) Define the events or circumstances involving the CCR unit that represent a safety emergency, along with a description of the procedures that will be followed to detect a safety emergency in a timely manner;

(B) Define responsible persons, their respective responsibilities, and notification procedures in the event of a safety emergency involving the CCR unit;

(C) Provide contact information of emergency responders;

(D) Include a map which delineates the downstream area which would be affected in the event of a CCR unit failure and a physical description of the CCR unit; and

(E) Include provisions for an annual face-to-face meeting or exercise between representatives of the owner or operator of the CCR unit and the local emergency responders.

(2) Amendment of the plan. (A) The owner or operator of a CCR unit subject to the requirements of paragraph (a)(3)(i) of this section may amend the written EAP at any time providing the revised plan is placed in the facility's operating record as required by §257.105(f)(6). The owner or operator must amend the written EAP whenever there is a change in conditions that would substantially affect the EAP in effect.

(B) The written EAP must be evaluated, at a minimum, every five years to ensure the information required in paragraph (a)(3)(i) of this section is accurate. As necessary, the EAP must be updated and a revised EAP placed in the facility's operating record as required by §257.105(f)(6).

(iii) Changes to hazard potential classification. (A) If the owner or operator of a CCR unit determines during a periodic hazard potential assessment that the CCR unit is no longer classified as either a high hazard potential CCR surface impoundment or a significant hazard potential CCR surface impoundment, then the owner or operator of the CCR unit is no longer subject to the requirement to prepare and maintain a written EAP beginning on the date the periodic hazard potential assessment documentation is conducted in accordance with the requirements of this section.
placed in the facility's operating record as required by § 257.165(f)(6).

(iii) A Statement of the purpose for which the CCR unit is being used.

(iv) The name and size in acres of the watershed within which the CCR unit is located.

(v) A description of the physical and engineering properties of the foundation and channel, peak discharges on which the CCR unit is constructed.

(vi) A statement of the type, size, range, and physical and engineering properties of the materials used in constructing each zone or stage of the CCR unit; the method of site preparation and construction of such zone or stage of the CCR unit; and the dates of construction of each successive stage of construction of the CCR unit.

(vii) At a scale that details engineering structures and appurtenances relevant to the design, construction, operation, and maintenance of the CCR unit, detailed dimensional drawings of the CCR unit, including a plan view and cross sections of the length and width of the CCR unit, showing all zones, foundation improvements, drainage provisions, spillways, diversion ditches, outlets, instrument locations, and slope protection, in addition to the normal operating pool surface elevation and the maximum pool surface elevation following peak discharge from the inflow design flood, the expected maximum depth of CCR within the CCR surface impoundment, and any identifiable features that could adversely affect operation of the CCR unit due to malfunction or mis-operation.

(viii) A description of the type, purpose, and location of existing instrumentation.

(ix) Area-capacity curves for the CCR unit.

(x) A description of each spillway and diversion design features and capacities and calculations used in their determination.

(xi) The construction specifications and provisions for surveillance, maintenance, and repair of the CCR unit.

(xii) Any record or knowledge of structural instability of the CCR unit.

(xiii) Changes in the design and construction. If there is a significant change to any information compiled under paragraph (c)(11) of this section, the owner or operator of the CCR unit must update the relevant information and place it in the facility's operating record as required by § 257.165(f)(13).

(xiv) Periodic structural stability assessments. (1) The owner or operator of the CCR unit must conduct initial and periodic structural stability assessments and document whether the design, construction, operation, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering practices for the maximum volume of CCR and CCR wastewater which can be impounded therein. The assessment must, at a minimum, document whether the CCR unit has been designed, constructed, operated, and maintained with:

(I) Stable foundations and abutments;

(II) Adequate slope protection to protect against surface erosion, wave action, and adverse effects of sudden drawdown;

(III) Dikes mechanically compacted to a density sufficient to withstand the range of loading conditions in the CCR unit;

(IV) Vegetated slopes of dikes and surrounding areas not to exceed a height of six inches above the slope of the dike, except for slopes which have an alternate form or forms of slope protection;

(V) A single spillway or a combination of spillways configured as specified in paragraph (d)(1)(v)(A) of this section. The combined capacity of all spillways must be designed, constructed, operated, and maintained to adequately manage flow during and following the peak discharge from the event specified in paragraph (d)(1)(v)(B) of this section.

(A) All spillways must be either:

(I) Of non-erodible construction and designed to carry sustained flows; or

(II) Earth- or grass-lined and designed to carry short-term, intermittent flows at non-erosive velocities where sustained flows are not expected.

(B) The combined capacity of all spillways must adequately manage flow during and following the peak discharge from a:

(V) Probable maximum flood (PMF) for a high hazard potential CCR surface impoundment; or

(2) 100-year flood for a significant hazard potential CCR surface impoundment.

(vi) Hydraulic structures underlying the base of the CCR unit or passing through the dike of the CCR unit that maintain structural integrity and are free of significant deterioration, deformation, distortion, boding deficiencies, sedimentation, and debris which may negatively affect the operation of the hydraulic structure; and

(vii) For CCR units with downstream slopes which can be flooded by the pool of an adjacent water body, such as a river, stream or lake, downstream slopes that maintain structural stability
during low pool of the adjacent water body or sudden drawdown of the adjacent water body.

(2) The periodic assessment described in paragraph (d)(1) of this section must identify any structural stability deficiencies associated with the CCR unit in addition to recommending corrective measures. If a deficiency or a release is identified during the periodic assessment, the owner or operator unit must remedy the deficiency or release as soon as feasible and prepare documentation detailing the corrective measures taken.

(3) The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial assessment and each subsequent periodic assessment was conducted in accordance with the requirements of this section.

(i) Periodic safety factor assessments.

(1) The owner or operator must conduct an initial and periodic safety factor assessments for each CCR unit and document whether the calculated factors of safety for each CCR unit achieve the minimum safety factors specified in paragraphs (a)(1)(i) through (v) of this section for the critical cross section of the embankment. The critical cross section is 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 safety factor assessments must be supported by appropriate engineering calculations.

(ii) The calculated static factor of safety under the end-of-construction loading condition must equal or exceed 1.30. The assessment of this loading condition is only required for the initial safety factor assessment and is not required for subsequent assessments.

(iii) The calculated static factor of safety under the long-term, maximum storage pool loading condition must equal or exceed 1.50.

(iv) The calculated seismic factor of safety under the maximum surcharge pool loading condition must equal or exceed 1.40.

(4) Closures of the CCR unit. An owner or operator of a CCR unit who either fails to complete a timely periodic safety factor assessment or fails to demonstrate minimum safety factors as required by paragraph (e) of this section is subject to the requirements of §257.101(c).

(5) Any owner or operator of a CCR unit must comply with the recordkeeping requirements specified in §257.105(f), the notification requirements specified in §257.106(f), and the internet requirements specified in §257.107(f).

Operating Criteria

§257.80 Air criteria.

(a) The owner or operator of a CCR landfill, CCR surface impoundment, or any lateral expansion of a CCR unit must adopt measures that will effectively minimize CCR from becoming airborne at the facility, including CCR fugitive dust originating from CCR units, roads, and other CCR management and material handling activities.

(b) CCR fugitive dust control plan. The owner or operator of the CCR unit must prepare and operate in accordance with a CCR fugitive dust control plan as specified in paragraphs (b)(1) through (7) of this section. This requirement applies in addition to, not in place of, any applicable standards under the Occupational Safety and Health Act.

(1) The CCR fugitive dust control plan must identify and describe the CCR fugitive dust control measures the owner or operator will use to minimize CCR from becoming airborne at the facility. The owner or operator must select, and include in the CCR fugitive dust control plan, the CCR fugitive dust control measures that are most appropriate for site conditions, along with an explanation of how these measures selected are applicable and appropriate for site conditions.

Examples of control measures that may be appropriate include: Locating CCR inside an enclosure or partial enclosure; operating a water spray or fogging system; reducing wind speed at critical points; using wind barriers, compaction, or vegetative covers; establishing and enforcing reduced vehicle speed limits; paving and sweeping roads; covering trucks transporting CCR; reducing or halting operations during high wind events; or applying a daily cover.

(2) If the owner or operator operates a CCR landfill or any lateral expansion of a CCR landfill, the CCR fugitive dust control plan must include procedures to eliminate CCR as conditioned CCR. Conditioned CCR means wasting CCR with water in a moisture condition that will prevent wind dispersal, but will not result in free liquids. In lieu of water, CCR conditioning may be accomplished with an appropriate chemical dust suppression agent.

(3) The CCR fugitive dust control plan must include procedures to log citizen complaints received by the owner or operator involving CCR fugitive dust events at the facility.

(4) The CCR fugitive dust control plan must include a description of the procedures the owner or operator will