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MEMORANDUM

16 October 2016
File No. 128064-003

SUBJECT: Written Closure Plan
Associated Electric Cooperative, Inc.
Thomas Hill Energy Center – Cell 001
Clifton Hill, MO

Associated Electric Cooperative, Inc. (AECI) operates the existing coal combustion residuals (CCR) surface impoundment referred to as Cell 001 at the Thomas Hill Energy Center (THEC) located near Clifton Hill, MO. This CCR surface impoundment is active and will continue to receive CCR generated by the THEC in the future. This Written Closure Plan (Plan) addresses the requirements of §257.102 *Criteria for conducting the closure or retrofit of CCR units*, specifically section §257.102(b) for written closure plans, of the US Environmental Protection Agency's (EPA's) Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities, 40 CFR Part 257 (CCR Rule) effective 19 October 2015. The information required for the Plan for Cell 001 is presented in the following sections in accordance with §257.102(b) of the CCR Rule.

This Plan has been developed based upon information provided by AECI and describes the CCR impoundment, closure elements, a general schedule for closure, and steps required to amend the Plan in the future if necessary. AECI will determine in the future whether the impoundment will be closed leaving CCR in place and installing a final cover system or through closure by removal of CCR in accordance with the allowable closure methods in the CCR Rule. This Plan includes both closure methods at this time. AECI will amend this Plan in the future once those decisions are made.

§257.102(b)(1): The owner or operator of a CCR unit must prepare a written closure plan that describes the steps necessary to close the CCR unit at any point during the active life of the CCR unit consistent with recognized and generally accepted good engineering practices. The written closure plan must include, at a minimum, the information specified in paragraphs (b) (1) (i) through (vi) of this section.

At any point during the active life of the impoundment, closure may be necessary. Regardless of when the impoundment is closed the following steps will be necessary for closure of the unit identified for both closure methods:

Closure-in-place

1. Finalize detailed construction plans for closure.
2. Obtain written Professional Engineer (PE) certification that design of the cover system meets the requirements of the CCR Rule.

3. No later than the date closure is initiated, prepare a notification of intent to close a CCR unit and place notification in the facility operating record. The notification of intent to close must include the PE certification from Step 2.
4. Obtain closure design approval from Missouri Department of Natural Resources (MDNR) as determined necessary at that time.
5. Cease placing CCR in the impoundment.
6. Commence closure no later than 30-days after known final receipt of CCR.
7. Complete installation of final cover system within 5-years of commencing closure activities, unless allowable extensions are determined appropriate and certified.
8. Obtain PE certification verifying closure has been completed in accordance with this closure plan.
9. Within 30-days of completion of closure of the CCR unit, prepare a notification of closure of a CCR unit and place notification in the facility operating record. The notification of closure must include the PE certification from step 8.
10. Following closure of the CCR unit, record a notation on the deed to the property or some other instrument normally examined during title search.
11. Within 30-days of recording a notation on the deed to the property, prepare a notification stating that the notation has been recorded and place the notification in the facility operating record.

Closure by Removal

1. Finalize detailed construction plans for closure.
2. Obtain written Professional Engineer (PE) certification that design of the construction plan for closure meets the requirements of the CCR Rule.
3. No later than the date closure is initiated, prepare a notification of intent to close a CCR unit and place notification in the facility operating record. The notification of intent to close must include the PE certification from Step 2.
4. Obtain closure design approval from Missouri Department of Natural Resources (MDNR) as determined necessary at that time.
5. Cease placing CCR in the impoundment.
6. Commence closure no later than 30-days after known final receipt of CCR.
7. Complete removal of CCR within 5-years of commencing closure activities, unless allowable extensions are determined appropriate and certified.
8. Obtain PE certification verifying closure has been completed in accordance with this closure plan.
9. Within 30-days of completion of closure of the CCR unit, prepare a notification of closure of a CCR unit and place notification in the facility operating record. The notification of closure must include the PE certification from step 8.

§257.102(b) (1) (i): *A narrative description of how the CCR unit will be closed in accordance with this section*

Closure-in-place

The final cover system will be designed and constructed to meet the USEPA's CCR Rule requirements of §257.102(i)(A-D). The proposed final cover system will consist of a minimum 18-inch thick soil infiltration layer that will minimize the infiltration of liquids through the CCR unit. The infiltration layer will have a permeability less than or equal to any natural subsoils present, or no greater than 1×10^{-5} cm/s, whichever is less. An equivalent alternative may also be chosen in the future. Erosion of the final cover system will be minimized by the placement of a minimum 6-inch thick soil erosion layer, capable of supporting native plant growth. It is anticipated that soils will be imported from adjacent borrow areas proximate to the CCR impoundment.

The final cover system will be placed and graded to elevations necessary to prevent future impoundment of stormwater on the final cover system. Grading of the in-place CCR may be necessary prior to placement of cover system soils to ensure positive drainage and manage surface water run-off. Additional fill may also be necessary to meet design subgrade elevations. Surface water run-off and run-on will be managed to minimize the need for future maintenance of the cover system. The final cover system design grades will be analyzed and designed to provide appropriate safety factors against slope failure, sloughing or movement of the final cover system. Final cover grades will also be designed to accommodate settling and subsidence of the impoundment to minimize disruption of the integrity and function of the final cover system.

Closure by Removal

After final receipt of CCR and dewatering is completed, the CCR materials will be removed from Cell 001 and areas that have been affected by releases from the impoundment will be decontaminated. Once CCR have been removed, the constructed liner for Cell 001 will also be removed. Additionally, the berm above original grade (before impoundment construction) will be breached to prevent future impoundment of water or the unit may potentially be retrofitted for other use. Finally, groundwater monitoring concentrations will be evaluated to determine if the established groundwater protection standards are met pursuant to §257.95(h).

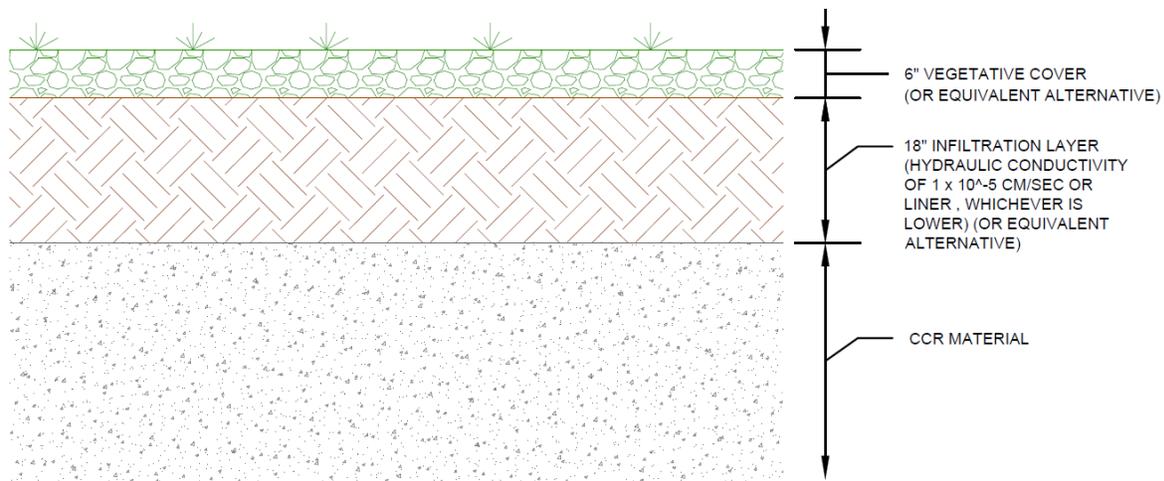
§257.102(b)(1)(ii): If closure of the unit will be accomplished through removal of CCR from the CCR unit, a description of the procedures to remove the CCR and decontaminate the CCR unit in accordance with paragraph (c) of this section.

§257.102(c): An owner or operator may elect to close a CCR unit by removing and decontaminating all areas affected by releases from the CCR unit. CCR removal and decontamination of the CCR unit are complete when constituent concentrations throughout the CCR unit and any areas affected by releases from the CCR unit have been removed and the groundwater monitoring concentrations do not exceed the groundwater protection standard established pursuant to §257.95(h) for constituents listed in appendix IV to this part.

Removal of CCR materials will be completed by excavation and use of the CCR either as beneficial use or disposal in a landfill. Since the groundwater monitoring program for the unit is currently being developed in accordance with the CCR Rule, AECI has yet to establish the groundwater protection standard established pursuant to §257.95(h). Once the unit commences closure, groundwater concentrations will be evaluated by comparing to the determined protection standards and either the unit will meet those standards and be certified as closed or in the event that the statistically significant increases above the protection standards exist, managed in accordance with the requirements of the CCR Rule to meet the protection standards.

§257.102(b)(1)(iii): *If closure of the unit will be accomplished by leaving CCR in place, a description of the final cover system, designed in accordance with paragraph (d) of this section, and the methods and procedures to be used to install the final cover. The closure plan must also discuss how the final cover system will achieve the performance standards specified in paragraph (d) of this section.*

A typical section of the final cover is presented below.



§257.102(b)(1)(iii): *If closure of the unit will be accomplished by leaving CCR in place, a description of the final cover system, designed in accordance with paragraph (d) of this section, and the methods and procedures to be used to install the final cover. The closure plan must also discuss how the final cover system will achieve the performance standards specified in paragraph (d) of this section.*

The following general installation methods and procedures are expected to be used to construct the final cover system:

Subgrade Preparation

Prior to installation of the infiltration layer, any existing vegetation will be removed and the surface smoothed to provide a suitable working base for cover system installation. Fill soil may

be required to bridge soft materials, shape the subgrade, fill in low areas or repair erosion as necessary. As determined necessary, any soft soils will be under-cut and recompacted as necessary to provide a firm, unyielding foundation for placement and compaction of the infiltration layer. The subgrade shall be maintained in a smooth, uniform, and drained condition prior to placement of the infiltration layer.

The subgrade will be surveyed to establish elevations of the surface prior to placement of the infiltration layer.

Infiltration Layer

Soil materials for the infiltration layer will be obtained from an on-site or off-site source, delivered using haul trucks, spread with a dozer, and compacted with soil compaction equipment. Soil will be compacted to achieve compaction and permeability requirements. The final surface of the infiltration layer will be maintained in a smooth, uniform drainage condition. Upon completion, the infiltration layer will be surveyed to establish elevations and verify a minimum thickness of 18-inches is provided.

Erosion Layer

Soil materials for the erosion layer will be obtained from an on-site or off-site source, delivered using haul trucks, and spread with a dozer. The erosion layer does not require compaction control however it should be stable for construction traffic. The erosion layer top surface will remain rough to promote the establishment of native vegetation. Stabilization and seeding of the erosion layer must begin immediately after placement (weather permitting).

Upon completion, the erosion layer will be surveyed to establish elevations and verify a minimum thickness of 6-inches is provided.

Temporary or permanent erosion control materials (mulches, fabrics, rock check dams, soil tackifier) may be used to minimize erosion and aid in establishment of vegetation. Hard armor such as cobbles or rip rap may be used in areas where establishment of vegetation may be difficult or impractical.

Stormwater Run-off Controls

Appropriate drainage channel design and/or sediment/stormwater management ponds may be used to manage runoff.

§257.102(b)(1)(iii): If closure of the unit will be accomplished by leaving CCR in place, a description of the final cover system, designed in accordance with paragraph (d) of this section, and the methods and procedures to be used to install the final cover. The closure plan must also discuss how the final cover system will achieve the performance standards specified in paragraph (d) of this section.

§257.102(d)(1): *The owner or operator of a CCR unit must ensure that, at a minimum, the CCR unit is closed in a manner that will:*

§257.102(d)(1)(i): *Control, minimize or eliminate, to the maximum extent feasible, 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;*

The proposed final cover system will have a permeability less than or equal to any natural subsoils present, or no greater than 1×10^{-5} cm/s, whichever is less, which will minimize infiltration of liquids into the waste and generate of leachate. The final cover system will minimize releases of CCR and CCR contaminated run-off by completely covering the in-place CCR preventing exposure to erosive conditions. The final cover system will minimize the potential for CCR fugitive dust by covering the in-place CCR preventing exposure to wind and vehicle traffic.

§257.102(d)(1)(ii): *Preclude the probability of future impoundment of water, sediment, or slurry;*

The final cover will be graded to promote positive drainage and prevent the impoundment of water, sediment, or slurry.

§257.102(d)(1)(iii): *Include measures that provide for major slope stability to prevent the sloughing or movement of the final cover system during the closure and post-closure care period;*

The final cover system design grades will be analyzed and designed to provide appropriate slope stability and be designed to guard against slope failure, sloughing or movement of the final cover system. Stormwater controls will be designed to remove stormwater from the impoundment and prevent erosion.

§257.102(d)(1)(iv): *Minimize the need for further maintenance of the CCR unit; and*

Erosion of the final cover system will be minimized by design of stormwater controls such as ditches, swales, and diversions and establishment of native vegetation on the erosion layer minimizing the need for future maintenance. The design grades of the final cover system will accommodate settling and subsidence without disrupting the integrity of the final cover system. By accounting for potential settlement and subsidence the final cover system minimizes the need for future maintenance.

§257.102(d)(1)(v): *Be completed in the shortest amount of time consistent with recognized and generally accepted good engineering practices.*

Closure will be completed in the shortest amount of time consistent with generally accepted good engineering practices and industry standard construction methods but need to incorporate

detailed engineering design, any regulating agency review and comment, weather conditions, and available construction materials.

§257.102(b)(1)(iv): An estimate of the maximum inventory ever on-site over the active life of the CCR unit.

The approximated maximum volume of CCR expected to be stored in the unit over the active life is approximately 7 acre-feet, if the impoundment is filled to its design total capacity, per the Annual Inspection report.

§257.102(b)(1)(v): Estimate of the largest area of the CCR unit ever requiring a final cover as required by paragraph (d) of this section at any time during the CCR unit's active life.

The area of the impoundment requiring final cover is approximately 2 acres.

§257.102(b)(1)(vi): A schedule for completing all activities necessary to satisfy the closure criteria in this sections, including an estimate of the year in which all closure activities for the CCR unit will be completed. The schedule should provide sufficient information to describe the sequential steps that will be taken to close the CCR unit, including identification of major milestones such as coordinating with and obtaining necessary approvals and permits from other agencies, the dewatering and stabilization phases of CCR surface impoundment closure, or installation of the final cover system, and the estimated timeframes to complete each step or phase of CCR unit closure. When preparing the written closure plan, if the owner or operator of a CCR unit estimates that the time required to complete closure will exceed the timeframes specified in paragraph (f) (1) of this section, the written closure plan must include the site-specific information, factors and considerations that would support any time extension sought under paragraph (f)(2) of this section.

An estimated schedule for completing the activities necessary to satisfy the closure in place criteria of the CCR Rule is provided below. The schedule lists the sequential steps that need to be taken to close the impoundment.

**AECI – THEC Cell 001
 Closure in Place Schedule**

Item #	Task Item	Completion Timeframe															
		Design and Permitting (months)															
		-8	-7	-6	-5	-4	-3	-2	-1								
1	Prepare Construction Plans	█	█	█	█	█	█										
2	PE Design Certification						█										
3	Notice of Intent to Close Impoundment						█										
4	MDNR Closure Approval (As Needed)						█	█	█								
5	Cease placing CCR in impoundment									█							
		Closure (years)															
												1	2	3	4	5	6
6	Commence Closure										█						
7	Final Cover Installation											█	█	█	█	█	
8	PE Closure Certification																█
9	Notice of Impoundment Closure																█
10	Record Deed Notation																█
11	Notice of Deed Recordation																█

An estimated schedule for completing the activities necessary to satisfy the closure by removal criteria of the CCR Rule is provided below. The schedule lists the sequential steps that need to be taken to close the impoundment.

**AECI – THEC Cell 001
 Closure by Removal Schedule**

Item #	Task Item	Completion Timeframe																
		Design and Permitting (months)																
		-8	-7	-6	-5	-4	-3	-2	-1									
1	Prepare Construction Plans																	
2	PE Design Certification																	
3	Notice of Intent to Close Impoundment																	
4	MDNR Closure Approval (As Needed)																	
5	Cease placing CCR in impoundment																	
		Closure (years)																
													1	2	3	4	5	6
6	Commence Closure																	
7	CCR Removal																	
8	Groundwater Protection Standards	Timeframe TBD – Dependent on Data Evaluation and Results																
9	PE Closure Certification																	

AECI will need to initiate some activities prior to commencing closure. As indicated on the schedule, AECI will need to take action on Steps 1-4 as early as 8 months prior to the anticipated final receipt of CCR at the impoundment. The schedules as shown above should be considered a preferred timing path and that the order and ability to perform the upfront work prior to AECI ceasing placing CCR in the unit is subject to circumstances at the time of closure and will be altered accordingly.

Per §257.102(e)(3) closure of the impoundment has commenced when AECI has ceased placing CCR in the impoundment and completes any of the following actions or activities: (i) Taken any steps necessary to implement the written closure plan; (ii) Submitted a completed application for any required state or agency permit or permit modification; (iii) Taken any steps necessary to comply with state or other agency standards that are a prerequisite, or are otherwise applicable, to initiating or completing the closure of the CCR impoundment.

Closure activities for the CCR impoundment will occur in accordance with the allowable timeframes when either the impoundment ceases receiving CCRs, reaches capacity, or is triggered for closure. AECI will complete closure in the allowable timeframes including any closure time extensions in accordance with §257.102(f).

§257.102(b)(3)(i): The owner or operator may amend the initial or any subsequent written closure plan developed pursuant to paragraph (b) (1) of this section at any time.

AECI will assess the Plan and amend the Plan whenever there is a change in operation of the CCR impoundment that would substantially affect the closure plan or when unanticipated events necessitate a revision of the plan either before or after closure activities have commenced.

The Plan will be amended at least 60 days prior to a planned change in the operation of the facility or the CCR impoundment, or no later than 60 days after an unanticipated event requires the need to revise the Plan. If the Plan needs to be revised after closure activities have commenced, the Plan will be revised no later than 30 days following the triggering event.

The amended closure plan will be placed in the facility operating record as required by the CCR Rule.

A record of amendments to the plan will be tracked below. The latest version of the closure plan will be noted on the front cover of the plan.

Version	Date	Description of Changes Made
1	16 October 2016	Initial Issuance

§257.102(b)(4): The owner or operator of the CCR unit must obtain a written certification from a qualified professional engineer that the initial and any amendment of the written closure plan meets the requirements of this section.

I certify that this initial written closure plan meets the requirements of §257.102(b).

I certify that the design of the final cover system referenced in this Closure Plan for AECI's closure of Cell 001 at the Thomas Hill Energy Center meets the USEPA's CCR Rule requirements of §257.102(d)(3)(i).

Signed: 

Certifying Engineer

Print Name: Steven F. Putrich
Missouri License No.: 2014035813
Title: Project Principal
Company: Haley & Aldrich, Inc.

Professional Engineer's Seal:

