DEQ Coal Combustion Residuals Surface Impoundment Closure Determination

Mayo Steam Station

April 1, 2019
Executive Summary

The Coal Ash Management Act (CAMA) establishes criteria for the closure of coal combustion residuals (CCR) surface impoundments. The CCR surface impoundment located at Duke Energy Progress, LLC’s (Duke Energy) Mayo Steam Station (Mayo) in Person County, NC has received a low-risk classification. Therefore, according to N.C. Gen. Stat. § 130A-309.214(a)(3), the closure option for CCR surface impoundments is at the election of the North Carolina Department of Environmental Quality (DEQ). CAMA provides three principal closure pathways: (a) closure in a manner allowed for a high-risk site, such as excavation and disposal in a lined landfill [CAMA Option A]; (b) closure with a cap-in-place system similar to the requirements for a municipal solid waste landfill [CAMA Option B]; or (c) closure in accordance with the federal CCR rule adopted by EPA [CAMA Option C].

In preparing to make its election, DEQ requested information from Duke Energy related to closure options. By November 15, 2018, Duke Energy provided the following options for consideration: closure in place, full excavation, and a hybrid option that included some excavation with an engineered cap on a smaller footprint of the existing CCR surface impoundment. DEQ held a public information session on January 15, 2019 in Roxboro, NC where the community near Mayo had the opportunity to learn about options for closing coal ash CCR surface impoundments and to express their views about proposed criteria to guide DEQ’s coal ash closure decision making process. To evaluate the closure options, the Department considered environmental data gathered as part of the site investigation, permit requirements, ambient monitoring, groundwater modeling provided by Duke Energy and other data relevant to the CAMA requirements.

DEQ elects the provisions of CAMA Option A that require movement of coal ash to an existing or new CCR, industrial or municipal solid waste landfill located on-site or off-site for closure of the CCR surface impoundment at the Mayo facility in accord with N.C. Gen. Stat. § 130A-309.214(a)(3). In addition, DEQ is open to considering beneficiation projects where coal ash is used as an ingredient in an industrial process to make a product as an approvable closure option under CAMA Option A.

DEQ elects CAMA Option A because removing the coal ash from the unlined CCR surface impoundment at Mayo is more protective than leaving the material in place. DEQ determines that CAMA Option A is the most appropriate closure method because removing the primary source of groundwater contamination will reduce uncertainty and allow for flexibility in the deployment of future remedial measures.

Duke Energy will be required to submit a final Closure Plan for the CCR surface impoundment at Mayo by August 1, 2019. The Closure Plan must conform to this election by DEQ.
I. **Introduction**

DEQ has evaluated the closure options submitted by Duke Energy for the CCR surface impoundment at the Mayo Steam Station. This document describes the CAMA requirements for closure of coal ash CCR surface impoundments, the DEQ evaluation process to make an election under CAMA for the subject CCR surface impoundment at the Mayo site, and the election by DEQ for the final closure option.

II. **Site History**

Duke Energy owns and operates the Mayo Steam Electric Plant located at 10660 Boston Road in Roxboro, Person County, North Carolina. The eastern portion of the Site, excluding Mayo Lake, encompasses 460 acres. The Mayo Plant began operations in 1983 with a single 727-megawatt capacity generating coal-fired unit. CCR have historically been managed in the Plant’s on-site ash basin. CCR were initially deposited in the ash basin by hydraulic sluicing operations. CCR were managed at the Plant’s on-site ash basin and transported via wet sluicing until 2013 when the Mayo Plant converted to a dry ash system in which 90 percent of CCR was dry. Final system upgrades were completed in October 2016; all CCR collection is dry. A Flue Gas Desulfurization (FGD) system is active at the Mayo Plant.

There is one CCR surface impoundment at the site, called the Active Ash Basin. According to the Duke Energy website and data current as of September 30, 2018, the Active Ash Basin is approximately 140 acres in size and contains approximately 6,600,000 tons of CCR.

III. **CAMA Closure Requirements**

CAMA establishes closure requirements for CCR surface impoundments. The General Assembly has mandated that DEQ “shall review a proposed Coal Combustion Residuals Surface Impoundment Closure Plan for consistency with the minimum requirements set forth in subsection (a) of this section and whether the proposed Closure Plan is protective of public health, safety, and welfare; the environment; and natural resources and otherwise complies with the requirements of this Part.” N.C. Gen. Stat. § 130A-309.214(b). Similarly, the General Assembly has required that DEQ “shall disapprove a proposed Coal Combustion Residuals Surface Impoundment Closure Plan unless the Department finds that the Closure Plan is protective of public health, safety, and welfare; the environment; and natural resources and other complies with the requirements of this Part.” N.C. Gen. Stat. § 130A-309.214(c).

Pursuant to N.C. Gen. Stat. § 130A-309.213(d)(1), DEQ has classified the CCR surface impoundment at Mayo as low-risk. The relevant closure requirements for low-risk CCR surface impoundments are in N.C. Gen. Stat. § 130A-309.214(a)(3), which states the following:

- Low-risk impoundments shall be closed as soon as practicable, but no later than December 31, 2029;
- A proposed closure plan for a low-risk impoundment must be submitted as soon as practicable, but no later than December 31, 2019; and
- At a minimum, impoundments located in whole above the seasonal high groundwater table shall be dewatered and impoundments located in whole or in part beneath the seasonal high groundwater table shall be dewatered to the maximum extent practicable.

In addition, N.C. Gen. Stat. § 130A-309.214(a)(3) requires compliance with specific closure criteria set forth verbatim below in Table 1. The statute provides three principal closure pathways: (a) closure in a manner allowed for a high-risk site, such as excavation and disposal in a lined landfill [CAMA Option A]; (b) closure with a cap-in-place system similar to the requirements for a municipal solid waste landfill [CAMA Option B]; or (c) closure in accordance with the federal CCR rule adopted by EPA [CAMA Option C]. For each low-risk impoundment, the choice of the closure pathway in CAMA is at the “election of the Department.”
Table 1: CAMA Closure Options for Low-Risk CCR Surface Impoundments  

At the election of the Department, the owner of an impoundment shall either:

- **a.** Close in any manner allowed pursuant to subdivision (1) of this subsection; [CAMA Option A]

- **b.** Comply with the closure and post-closure requirements established by Section .1627 of Subchapter B of Chapter 13 of Title 15A of the North Carolina Administrative Code, except that such impoundments shall not be required to install and maintain a leachate collection system. Specifically, the owner of an impoundment shall Comply with the closure and post-closure requirements established by Section .1627 of Subchapter B of Chapter 13 of Title 15A of the North Carolina Administrative Code, except that such impoundments shall not be required to install and maintain a leachate collection system. Specifically, the owner of an impoundment shall install and maintain a cap system that is designed to minimize infiltration and erosion in conformance with the requirements of Section .1624 of Subchapter B of Chapter 13 of Title 15A of the North Carolina Administrative Code, and, at a minimum, shall be designed and constructed to (i) have a permeability no greater than 1 x 10^-5 centimeters per second; (ii) minimize infiltration by the use of a low-permeability barrier that contains a minimum 18 inches of earthen material; and (iii) minimize erosion of the cap system and protect the low-permeability barrier from root penetration by use of an erosion layer that contains a minimum of six inches of earthen material that is capable of sustaining native plant growth. In addition, the owner of an impoundment shall (i) install and maintain a groundwater monitoring system; (ii) establish financial assurance that will ensure that sufficient funds are available for closure pursuant to this subdivision, post-closure maintenance and monitoring, any corrective action that the Department may require, and satisfy any potential liability for sudden and nonsudden accidental occurrences arising from the impoundment and subsequent costs incurred by the Department in response to an incident, even if the owner becomes insolvent or ceases to reside, be incorporated, do business, or maintain assets in the State; and (iii) conduct post-closure care for a period of 30 years, which period may be increased by the Department upon a determination that a longer period is necessary to protect public health, safety, welfare; the environment; and natural resources, or decreased upon a determination that a shorter period is sufficient to protect public health, safety, welfare; the environment; and natural resources. The Department may require implementation of any other measure it deems necessary to protect public health, safety, and welfare; the environment; and natural resources, including imposition of institutional controls that are sufficient to protect public health, safety, and welfare; the environment; and natural resources. The Department may not approve closure for an impoundment pursuant to sub-subdivision b. of subdivision (3) of this subsection unless the Department finds that the proposed closure plan includes design measures to prevent, upon the plan's full implementation, post-closure exceedances of groundwater quality standards beyond the compliance boundary that are attributable to constituents associated with the presence of the impoundment; [CAMA Option B] or

- **c.** Comply with the closure requirements established by the United States Environmental Protection Agency as provided in 40 CFR Parts 257 and 261, "Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities." [CAMA Option C]
By referencing the closure options for high-risk CCR surface impoundments in “subdivision (1)” or N.C. Gen. Stat. § 130A-309.214(a)(1), CAMA allows for closure of a low-risk CCR surface impoundment in N.C. Gen. Stat. § 130A-309.214(a)(3) through the same removal scenarios:

- “Convert the coal combustion residuals impoundment to an industrial landfill by removing all coal combustion residuals and contaminated soil from the impoundment temporarily, safely storing the residuals on-site, and complying with the requirements for such landfills.” N.C. Gen. Stat. § 130A-309.214(a)(1)a.; or
- “Remove all coal combustion residuals from the impoundment, return the former impoundment to a nonerosive and stable condition and (i) transfer the coal combustion residuals for disposal in a coal combustion residuals landfill, industrial landfill, or municipal solid waste landfill or (ii) use the coal combustion products in a structural fill or other beneficial use as allowed by law.” N.C. Gen. Stat. § 130A-309.214(a)(1)b.

IV. DEQ Election Process

Beginning with a letter to Duke Energy on October 8, 2018, DEQ began planning for a thorough evaluation of the closure options for low-risk CCR surface impoundments before making an election as outlined in Table 1 above. DEQ’s objectives were to receive input on closure options from Duke Energy and to engage with community members near low-risk sites. DEQ outlined the following schedule in the October 8, 2018 letter:

- November 15, 2018 – Duke Energy submittal of revised option analyses and related information
- January 15, 2019 – DEQ public meeting near Mayo
- April 1, 2019 – DEQ evaluation of closure options
- August 1, 2019 – Duke Energy submittal of closure plan
- December 1, 2019 – Duke Energy submittal of updated corrective action plan for all sources at the Mayo that are either CCR surface impoundments or hydrologically connected to CCR surface impoundments

DEQ received the requested information from Duke Energy by November 15, 2018: closure options analysis, groundwater modeling and net environmental benefits assessment. These materials are posted on the DEQ website. Duke Energy provided the following options for consideration: closure in place, full excavation with an onsite landfill, and a hybrid option that included some excavation with an engineered cap on a smaller footprint of the existing CCR surface impoundment.

In preparing to make its election of the closure option, DEQ considered environmental data contained in the comprehensive site assessment, permit requirements, ambient monitoring, closure options analysis and groundwater modeling provided by Duke Energy and other data relevant to the CAMA requirements. The Mayo site has extensive amounts of data that have been collected during the site assessment process, and these data were used as part of the evaluation of closure options. DEQ’s evaluation of closure in place and hybrid option based on groundwater monitoring and modeling data is provided in Attachment A. That analysis
demonstrates that the contaminated plume is already beyond the compliance boundary for the site. All of these references are part of the record supporting DEQ’s determination.

DEQ conducted a public meeting in Roxboro, NC near Mayo on January 15, 2019. Approximately 31 people attended the meeting. Approximately 1009 comments were received during the comment period, which closed on February 15, 2019. Almost all comments expressed concerns about coal ash’s impact on groundwater and surface water and expressed a desire to protect the long-term health of residents and future generations. The majority of commenters supported excavation of coal ash from the CCR surface impoundment without expressing a preference for whether the excavated ash should be stored at an onsite or offsite landfill. For those who did express a preference as to disposal onsite or offsite, most recommended excavation and disposal to an onsite landfill. A small number of comments encouraged the beneficial reuse of ash excavated from the CCR surface impoundment. Only two comments expressed support for the cap in place closure option. No comments indicated a preference for a hybrid closure option. A review and response to comments are included in Attachment B.

V. **DEQ Evaluation of Closure Options**

DEQ has evaluated the closure options proposed by Duke Energy for the CCR surface impoundment at the Mayo facility. The purpose of this evaluation was to determine which closure option or options may be incorporated into an approvable Closure Plan under CAMA.

DEQ elects the provisions of CAMA Option A that require movement of coal ash to an existing or new CCR, industrial or municipal solid waste landfill located on-site or off-site for closure of the Active Ash Basin and the Retired Ash Basin at Mayo in accord with N.C. Gen. Stat. § 130A-309.214(a)(3). In addition, DEQ is open to considering beneficiation projects where coal ash is used as an ingredient in an industrial process to make a product as an approvable closure option under CAMA Option A.

DEQ elects CAMA Option A because removing the coal ash from the unlined CCR surface impoundment at Mayo is more protective than leaving the material in place. DEQ determines that CAMA Option A is the most appropriate closure method because removing the primary source of groundwater contamination will reduce uncertainty and allow for flexibility in the deployment of future remedial measures.

DEQ does not elect CAMA Option B for the closure of the CCR surface impoundment at Mayo. DEQ has considered whether the closure in place or hybrid options would be protective of public health, safety, welfare, the environment and natural resources. CAMA mandates that DEQ must disapprove any proposed Closure Plan that DEQ finds does not meet these requirements. See N.C. Gen. Stat. § 130A-309.214(c). DEQ does not elect CAMA Option B for the CCR surface impoundment at Mayo because the agency does not believe that a finding of protection of the environment can be made for these closure options. Duke Energy’s estimated depth of ash in groundwater for its closure in place option is approximately 63 feet, while the estimated depth for the hybrid option is 43 feet. DEQ is concerned that leaving this coal ash in direct contact with groundwater will present future environmental concerns. Leaving nearly seven million tons of coal ash in Active Ash Basin at Mayo is less protective of the environment than removing and storing it in a lined landfill. As such, DEQ further considered these closure options with the final
closure decision in mind and concludes that CAMA Option A is the most appropriate closure method.

As DEQ considered the closure options presented by Duke Energy, DEQ evaluated whether the closure in place or the hybrid options met the requirement for CAMA Option B. Specifically, DEQ attempted to determine whether upon full implementation of the closure plan the design would prevent any post-closure exceedances of groundwater standards beyond the compliance boundary. To address this question, DEQ considered the current state of the groundwater contamination and reviewed the results of the groundwater modeling submitted by Duke Energy. The evaluation is provided in Attachment A.

DEQ does not elect CAMA Option C (i.e., closure under the federal CCR Rules found in 40 CFR Part 257) for the CCR surface impoundment at Mayo. DEQ has determined that:

a. Under the facts and circumstances here, CAMA Option C is less stringent than CAMA Option A. Specifically, DEQ’s election of Option A would also require Duke Energy to meet the requirements of the federal CCR Rule (i.e., CAMA Option C) but election of CAMA Option C would not require implementation of CAMA Option A.

b. Because CAMA Option A adds additional requirements or performance criteria beyond Option C, it advances DEQ’s duty to protect the environment (see N.C. Gen. Stat. §§ 279B-2 & 143-211) and the General Assembly’s mandate under CAMA that DEQ ensure that any Closure Plan, which must incorporate an approvable closure option, is protective of public health, safety, and welfare, the environment, and natural resources (see N.C. Gen. Stat. § 130A-309.214(b) & (c)).

c. For the CCR surface impoundments for which the closure option(s) must be determined, CAMA Option A provides a better CAMA mechanism for ensuring State regulatory oversight of the closure process than Option C, as well as greater transparency and accountability.

d. While the federal CCR Rule was written to provide national minimum criteria for CCR surface impoundments across the country, CAMA was written specifically to address the CCR surface impoundments in North Carolina.

e. While the federal CCR Rule allows CCR surface impoundment owners to select closure either by removal and decontamination (clean closure) or with a final cover system (cap in place), EPA anticipates that most owners will select closure through the less protective method of cap in place.

f. There is considerable uncertainty regarding the status and proper interpretation of relevant provisions of the federal CCR Rule. For instance, EPA is reconsidering portions of the federal CCR Rule. Also, the performance standards in 40 CFR 257.102(d) for cap in place closure are the subject of conflicting interpretations (and possible litigation) among industry and state authorities.
VI. Conclusion

The final closure plan is due on August 1, 2019 in accordance with this determination. Based on DEQ’s evaluation of the options submitted by Duke Energy, DEQ elects the provisions of CAMA Option A that require movement of coal ash to an existing or new CCR, industrial or municipal solid waste landfill located on-site or off-site for closure of the Active Ash Basin at Mayo in accord with N.C. Gen. Stat. § 130A-309.214(a)(3). In addition, DEQ is open to considering beneficiation projects where coal ash is used as an ingredient in an industrial process to make a product as an approvable closure option under CAMA Option A.

While beneficiation is not a requirement of the closure plan, DEQ encourages Duke Energy to consider opportunities for beneficiation of coal ash that would convert coal combustion residuals into a useful and safe product.
ATTACHMENT A

DEQ EVALUATION OF CLOSURE IN PLACE AND HYBRID OPTIONS BASED ON GROUNDWATER MONITORING AND MODELING DATA
DEQ EVALUATION OF CLOSURE IN PLACE AND HYBRID OPTIONS BASED ON GROUNDWATER MONITORING AND MODELING DATA

I. Groundwater Monitoring Summary

As DEQ considered the closure options presented by Duke Energy, DEQ evaluated whether the closure in place or the hybrid options met the requirement for CAMA Option B. Specifically, DEQ attempted to determine whether the design would prevent any post-closure exceedances of groundwater standards beyond the compliance boundary upon full implementation of the closure plan. Significantly, the contaminated groundwater plume has already extended beyond the compliance boundary in a portion of the CCR surface impoundment. The inferred general extent of groundwater impacts above applicable Background Threshold Values or 2L Standards are shown on Figure ES-1. Additional monitoring and hydrogeological data is available in the Mayo Steam Station October 2017 CSA Update Report (available on the DEQ website).

Prior to the construction of the CCR surface impoundment, groundwater and surface water discharge from the area appears to have flowed into Crutchfield Branch which was the primary surface water unit in this basin like feature. The flow direction was to the north-northeast into Mayo Creek. The groundwater investigation has demonstrated that, following the construction of the impoundment, some migration of groundwater continues along the natural flow paths in the area below (downslope) the dam where Crutchfield Branch begins and flows to the north-northeast where it discharges into Mayo Creek. A good indication of the natural drainage paths for groundwater in the basin area appears to be manifested in the current configuration of the boron plume which extends into the area below/downgradient of the impoundment dam. Boron is being detected in groundwater at concentrations greater than the 2L standard near or beyond the compliance boundary as well as manganese and strontium above the respective PBTVs.

The vertical extent of the CCR plume appears to be fairly well defined with the exception of strontium within the ash basin and some uncertainty with manganese in the area dowgradient of the impoundment.

DEQ concludes that the boron groundwater plume above the 2L groundwater standard has extended beyond the compliance boundary dowgradient of the ash basin around Crutchfield Branch. Manganese and strontium appear to be the COIs detected furthest dowgradient from the impoundment at approximately 500+ feet beyond the compliance boundary in the surficial flow unit. In the transition zone and bedrock wells boron is detected above the 2L Standard. Manganese was detected above PBTVs in bedrock wells including wells near the compliance boundary.

II. Groundwater Cross-section Modeling

DEQ evaluated cross-sections of the groundwater modeling results provided by Duke Energy to determine whether Duke Energy’s final closure Option 1: Hybrid and Option 2: Closure-in-Place would meet the criteria of CAMA Option B. DEQ considered if the agency could conclude that the proposed closure option includes design measures to prevent any post closure
exceedances of the 2L groundwater quality standards (15A NCAC 02L) at the compliance boundary upon the plan’s full implementation. Cross section A’ was evaluated and can be seen in the figures below. This cross section represents where the boron concentration above the 2L standard of 700 µg/L has crossed the compliance boundary based on groundwater monitoring and modeling.

Next, the model results were evaluated based on the following model simulations:

- current conditions in 2017 when the model was calibrated based on raw field data
- upon completion of the final closure-in-place cover system at t=0 years
- closure-in-place option at t=100 years
- upon completion of the hybrid option at t=0 years
- hybrid option at t=100 years

The table below summarizes the results from the model simulations. The boron concentrations depicted in the table represent the maximum boron concentration in any layer (ash, saprolite, transition zone, and bedrock) of the model.

<table>
<thead>
<tr>
<th>Model Simulation</th>
<th>Maximum Concentration of Boron Above 2L Beyond Compliance Boundary (µg/L)</th>
<th>Depth of GW Contamination Above 2L Beyond Compliance Boundary (feet bgs)</th>
<th>Width of Contamination Plume Beyond Compliance Boundary (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Conditions</td>
<td>700-4,000</td>
<td>40</td>
<td>110</td>
</tr>
<tr>
<td>Completion of Final Cover (t=0 yrs)</td>
<td>700-4,000</td>
<td>35</td>
<td>40</td>
</tr>
<tr>
<td>Final Cover (t=100 yrs)</td>
<td>No contamination</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Completion of Hybrid (t=0 yrs)</td>
<td>700-4,000</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Hybrid (t=100 yrs)</td>
<td>No contamination</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

bgs – below ground surface

These data illustrate that after completion of closure with the final cover or hybrid option, the groundwater plume still extends beyond the compliance boundary above the 2L groundwater standard, requiring further remediation.

DEQ has considered whether these options can be found to be protective of public health, safety, welfare, the environment and natural resources. CAMA mandates that DEQ must disapprove any proposed Closure Plan that DEQ finds does not meet these requirements. See N.C. Gen. Stat. § 130A-309.214(c). DEQ does not elect CAMA Option B for the CCR surface impoundment at Mayo because the agency does not believe that a finding of protection of the environment can be made for these closure options. DEQ concludes that CAMA Option A is the most appropriate closure method for this impoundment.
Figure ES-1: from 2017 CSA Update
LEGEND

- AREA OF CONCENTRATION IN GROUNDWATER ABOVE NC2L (SEE NOTE 5)
- INFERRED AREA OF CONCENTRATION IN GROUNDWATER ABOVE NC2L (SEE NOTE 5)
- ASH BASIN WASTE BOUNDARY
- APPROXIMATE LANDFILL WASTE BOUNDARY
- GENERALIZED GROUNDWATER FLOW DIRECTION
- RESIDENTIAL UNIT
- STREAM WITH FLOW DIRECTION
- DUKE ENERGY PROPERTY BOUNDARY

NOTE:


2. STREAM FROM WSP SURVEY, 2014.

3. GENERALIZED GROUNDWATER FLOW DIRECTION BASED ON APRIL 10, 2017 WATER LEVEL DATA.

4. PROPERTY BOUNDARY PROVIDED BY DUKE ENERGY.

5. GENERALIZED AREAL EXTENT OF MIGRATION REPRESENTED BY NCAC 02L EXCEEDANCES.
CURRENT CONDITIONS IN 2017

MAX BORON ANY LAYER

green = 75-700, tan = 700-4000, red = 4000-10,000, blue = 10,000-40,000
UPON COMPLETION OF FINAL COVER IN 2023, \( t = 0 \)
MAX BORON ANY LAYER
- green = 75-700,
- tan = 700-4000,
- red = 4000-10,000,
- blue = 10,000-40,000
MAYO  FINAL COVER IN 2123, $t = 100$ years
MAX BORON ANY LAYER  
green = 75-700,  tan = 700-4000, red = 4000-10,000, blue = 10,000-40,000
UPON COMPLETION OF HYBRID IN 2023, t = 0
MAX BORON ANY LAYER
  green = 75-700, tan = 700-4000, red = 4000-10,000, blue = 10,000-40,000
MAYO HYBRID IN 2123, $t = 100$ years
MAX BORON ANY LAYER         green = 75-700, tan = 700-4000, red = 4000-10,000, blue = 10,000-40,000
CURRENT CONDITIONS IN 2017
CROSS SECTION A-A' (VIEWED FROM SE SIDE OF CROSS SECTION LOOKING NW)
MAX BORON ANY LAYER  green = 75-700, tan = 700-4000, red = 4000-10,000, blue = 10,000-40,000

Mayo model layers:
- Ash 1-8
- Saprolite 9-11
- TZ 12-13
- Bedrock 14-21

Vertical exaggeration X 3

A-A' ~900 ft
Mayo model layers:
- Ash 1-8
- Saprolite 9-11
- TZ 12-13
- Bedrock 14-21

Vertical exaggeration X 3

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Upon completion of final cover in 2023, t = 0
Cross section A-A’ (viewed from SE side of cross section looking NW)
Max boron any layer: green = 75-700, tan = 700-4000, red = 4000-10,000, blue = 10,000-40,000

A-A’ ~900 ft
MAYO    FINAL COVER IN 2123, \( t = 100 \) years
CROSS SECTION A-A' (VIEWED FROM SE SIDE OF CROSS SECTION LOOKING NW)
MAX BORON ANY LAYER  \( \text{green} = 75-700, \ \text{tan} = 700-4000, \ \text{red} = 4000-10,000, \ \text{blue} = 10,000-40,000 \)

**Mayo model layers:**
- Ash 1-8
- Saprolite 9-11
- TZ 12-13
- Bedrock 14-21

Vertical exaggeration X 3

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A-A' ~900 ft
MAYO    UPON COMPLETION OF HYBRID IN 2023, t = 0
CROSS SECTION A-A' (VIEWED FROM SE SIDE OF CROSS SECTION LOOKING NW)
MAX BORON ANY LAYER    green = 75-700,  tan = 700-4000, red = 4000-10,000, blue = 10,000-40,000

Mayo model layers:
Ash  1-8
Saprolite  9-11
TZ    12-13
Bedrock  14-21

Vertical exaggeration X 3

A-A' ~900 ft
MAYO  UPON COMPLETION OF HYBRID IN 2123, t = 100 years
CROSS SECTION A-A’ (VIEWED FROM SE SIDE OF CROSS SECTION LOOKING NW)
MAX BORON ANY LAYER  green = 75-700,  tan = 700-4000, red = 4000-10,000, blue = 10,000-40,000

Mayo model layers:
Ash  1-8
Saprolite  9-11
TZ   12-13
Bedrock  14-21

Vertical exaggeration X 3

A-A’  ~900 ft
RESPONSE TO COMMENTS
I. Summary of Responses to Comments

The North Carolina Department of Environmental Quality (NCDEQ) received approximately 1009 comments regarding the closure options for the coal ash impoundment at the Mayo facility. The overwhelming majority of comments supported closure by excavation of ash from the CCR surface impoundment. Approximately 950 comments were submitted using the following form email:

“Dear Coal Ash Comment Administrator North Carolina DEQ: Mayo,

The North Carolina Department of Environmental Quality (DEQ) should require Duke Energy to remove its coal ash from its leaking, unlined pits and move it to dry lined storage away from our waterways and out of our groundwater.

Duke Energy plans to leave its coal ash sitting in the groundwater at six sites in North Carolina, where it will keep polluting our groundwater, lakes, and rivers. Recent monitoring shows Duke Energy is polluting the groundwater at its coal ash ponds in North Carolina with toxic and radioactive materials. We need cleanup—not coverup!

The communities around the coal ash ponds have come out time after time over the last several years, making clear that we’re concerned about pollution from Duke Energy’s coal ash and want Duke Energy to get its coal ash out of its unlined, leaking pits. It is long past time for DEQ and Duke Energy to listen to the communities.

Duke Energy is already required to remove its coal ash at eight other sites in North Carolina and all of its sites in South Carolina—our families and our community deserve the same protections.”

Almost all comments expressed concerns about coal ash’s impact on groundwater and surface water and expressed a desire to protect the long-term health of citizens and future generations.

Similar to the form comment above, an overwhelming majority of comments supported excavation of coal ash from the impoundment without expressing a preference for whether the excavated ash should be stored at an onsite or offsite landfill. For those who did express a preference as to disposal onsite or offsite, most recommended excavation and disposal to an onsite landfill. A small number of comments encouraged the beneficial reuse of ash excavated from the impoundment. Only two comments expressed support for the cap in place closure option. No comments indicated a preference for a hybrid closure option.

II. Detailed Responses to Comments

A. Comments Supporting Excavation

Comment: As discussed above, the overwhelming majority of comments expressed a preference for ash to be excavated from the CCR impoundment and placed in a lined landfill in order to protect groundwater and surface water, but did not express a preference as to whether the excavated ash should be stored onsite or offsite.
Response: NCDEQ has elected excavation, rather than cap-in-place, as the appropriate closure option for the CCR surface impoundment located at the Mayo facility.

Comment: Many comments expressed a desire for excavation due to concerns that capping in place would leave coal ash saturated in groundwater, where it will continue to be a source of groundwater pollution that will threaten future generations.

Response: NCDEQ has determined that the CCR surface impoundment at the Mayo facility must be excavated.

Comment: Several commenters noted that NCDEQ is already requiring Duke Energy to excavate coal ash at eight sites in North Carolina and indicated that communities around and downstream the remaining six coal ash plants should be afforded the same protections.

Response: The Department has determined, pursuant to its authority under CAMA, that the CCR surface impoundment at Mayo must be excavated.

Comment: Several commenters noted that other states, such as South Carolina and Virginia, are already requiring Duke Energy to excavate their coal ash impoundment and expressed a desire to be afforded the same protection as the citizens in those states.

Response: NCDEQ must apply the laws of this State, namely the Coal Ash Management Act. Pursuant to CAMA, NCDEQ has determined that the CCR surface impoundment at Mayo must be excavated.

Comment: A number of comments indicated that traffic concerns associated with excavation are over-exaggerated and noted that all options will involve trucking in some form or fashion. Several commenters also stated that if there was an increase in traffic, they would prefer dealing with traffic inconvenience as opposed to continued water pollution.

Response: NCDEQ will take these comments into consideration when it conducts a comprehensive examination of Duke Energy’s Mayo facility closure plan, along with consideration of further public comments, in its final assessment of onsite and offsite landfill disposition options.

Comment: A few comments noted that the topography and hydrology of the area around the Mayo Facility is not conducive to capping in place, as the area contains a number of natural springs which will continue to feed water into any capped impoundment, thereby rendering the cap in place option ineffective.

Response: NCDEQ has determined that the CCR impoundment at Mayo must be excavated.

Comment: A number of comments supported excavation in order to remove ash from floodplains, as they believe current groundwater models of 100 or 500-year floodplains are obsolete or unpredictable in light of recent flooding events.
Response: NCDEQ has determined that the CCR impoundment at Mayo must be excavated.

Comment: Many comments supported excavation due to concerns over the potential impacts that global warming or extreme weather events, such as Hurricane Florence, may have on a capped impoundment.

Response: NCDEQ has determined that the CCR impoundment at Mayo must be excavated.

Comment: Several comments supported excavation as they believe there is an increased risk of catastrophic failure associated with impoundment containing coal ash, citing the Dan River coal ash spill of 2014 in North Carolina and TVA Kingston spill in Tennessee as previous examples of catastrophic failures.

Response: NCDEQ has determined that the CCR impoundment at Mayo must be excavated.

Comment: Several commenters disagreed with the cost analysis put forward by Duke Energy, stating that Duke Energy overestimated the cost of excavation and underestimated the cost of capping in place. One comment stated that Duke Energy underestimated the cost of capping in place due to improper assumptions related to dewatering of pore water, while other comments pointed to lower cost figures for excavations that have already taken place in other states. Many comments also indicated that cost should not be a factor for the Department’s consideration.

Response: NCDEQ has determined that the CCR surface impoundment at Mayo must be excavated. To the extent that this comment applies to the ultimate disposition of excavated ash, NCDEQ will take these comments into consideration, along with further public comments, in its final assessment of Duke Energy’s closure plan.

Comment: Several comments expressed concerns with the legitimacy of Duke Energy’s groundwater modeling, community impact analysis, and other submissions to NCDEQ. Many of these comments felt that Duke Energy’s submissions have been manipulated to persuade NCDEQ that excavation would be worse than leaving capped in place and expressed a desire for NCDEQ to conduct their own independent studies.

Response: NCDEQ has determined that the CCR impoundment at Mayo must be excavated.

Comment: A few comments supported excavation because they believe this is the best option from an environmental justice perspective.

Response: NCDEQ has determined that the CCR impoundment at Mayo must be excavated.
Comment: One comment supported excavation so long as excavation was done in a manner that minimized the release of airborne particulates.

Response: NCDEQ will take this concern into consideration when reviewing the closure plan for the CCR surface impoundment at the Mayo Facility.

Comment: A couple of comments noted that the public’s participation in the public meetings held by NCDEQ on coal ash has conclusively demonstrated that North Carolinians want excavation, stating that virtually everyone called on NCDEQ to require full excavation while cap in place and hybrid options were met with loud booing.

Response: NCDEQ has determined that the CCR impoundment at Mayo must be excavated.

Comment: A few comments supported excavation so long as NCDEQ requires landfills to go beyond the minimal mandatory protections. For example, one comment stated that NCDEQ should carry out independent studies to obtain the best liner technologies and materials available, while other comments encouraged the department to impose stricter requirements for excavated ash disposed into landfills.

Response: NCDEQ will take these comments into consideration when it conducts a comprehensive examination of Duke Energy’s Mayo facility closure plan, along with consideration of further public comments, in its final assessment of onsite and offsite landfill disposition options.

Comment: One comment supported excavation because they believe this is the only option in compliance with state and federal law and the only option that will withstand both judicial review and public scrutiny.

Response: NCDEQ has determined that the CCR impoundment at Mayo must be excavated.

Comment: A couple of comments supported excavation due to concerns regarding the structural stability associated with capping in place or hybrid options. Specifically, concerns were raised that stacking ash over a saturated ash pond deposit would be unstable and may lead to failure and safety risks.

Response: NCDEQ has determined that the CCR impoundment at Mayo must be excavated.

Comment: One comment supported excavation because of the direct benefits to North Carolina workers and minority businesses. This comment cited Duke Energy filings which estimated that between October 2017 and September 2018, coal ash excavation work in North Carolina has created jobs for nearly four thousand North Carolinians.
Response: NCDEQ has determined that the CCR impoundment at Mayo must be excavated.

Comment: A few comments supported excavation because they believe this is the best way to be a good steward and neighbor to surrounding states. These comments stated that current groundwater contamination at the Mayo Facility already runs to the Virginia state line and that excavation is the only way to stop this from continuing.

Response: NCDEQ has determined that the CCR impoundment at Mayo must be excavated.

Comment: Several comments supported excavation because they believe that is the best option to help preserve the natural benefits provided by the Mayo Reservoir, Crutchfield Branch and other nearby waterbodies. For example, several comments stated excavation was the best option for the long term protection of recreation and tourism activities, and that capping in place would threaten the future development of the local economy in these areas.

Response: NCDEQ has determined that the CCR impoundment at Mayo must be excavated.

B. Comments Supporting Excavation to an Onsite Landfill

Comment: Several comments expressed support for excavation and storage on an onsite landfill in order to protect surrounding waterbodies and groundwater. For example, approximately thirty-five people stated in a form letter that “DEQ should require Duke Energy to remove its coal ash from its leaking, unlined pit and move it to the permitted, dry, lined landfill on its own property – away from Mayo Lake, Mayo Creek, Crutchfield Branch, and the Hyco River and out of our groundwater.”

Response: NCDEQ will take these comments into consideration when it conducts a comprehensive examination of Duke Energy’s Mayo facility closure plan, along with consideration of further public comments, in its final assessment of onsite and offsite landfill disposition options.

Comment: Several comments expressed a preference for excavation to an onsite landfill due to the fact that Mayo already has a dry, lined ash landfill on its property that is permitted to hold ash from its impoundment. One comment also noted that the already existing landfill would alleviate the need to clear cut acres of land and forests for new landfills.

Response: NCDEQ will take these comments into consideration when it conducts a comprehensive examination of Duke Energy’s Mayo facility closure plan, along with consideration of further public comments, in its final assessment of onsite and offsite landfill disposition options.

Comment: A number of comments supported excavation to an onsite landfill due to traffic and trucking concerns associated with disposing excavated ash at an offsite landfill. These comments noted that ash staying onsite would prevent the ash from travelling through the...
community or to other communities and would also require less trucking traffic in comparison to offsite storage.

Response: NCDEQ will take these comments into consideration when it conducts a comprehensive examination of Duke Energy’s Mayo facility closure plan, along with consideration of further public comments, in its final assessment of onsite and offsite landfill disposition options.

Comment: A few comments supported excavation and storage on an onsite landfill, as they believe this is the most cost-efficient option after taking into account maintenance costs, future liability costs, and the cost of human capital associated with capped in place impoundment or for transportation to an offsite landfill.

Response: NCDEQ will take these comments into consideration when it conducts a comprehensive examination of Duke Energy’s Mayo facility closure plan, along with consideration of further public comments, in its final assessment of onsite and offsite landfill disposition options.

Comment: A few comments supported excavation and storage on an onsite landfill because they believe this is the best option from an environmental justice perspective. For example, some comments expressed concern that excavated coal ash would be taken to offsite landfills which are often surrounded by low-income and minority communities.

Response: NCDEQ will take these comments into consideration when it conducts a comprehensive examination of Duke Energy’s Mayo facility closure plan, along with consideration of further public comments, in its final assessment of onsite and offsite landfill disposition options.

Comment: A few comments stated that they believe coal ash should always be stored on Duke Energy’s property.

Response: NCDEQ will take these comments into consideration when it conducts a comprehensive examination of Duke Energy’s Mayo facility closure plan, along with consideration of further public comments, in its final assessment of onsite and offsite landfill disposition options.

C. Comment Supporting Excavation to an Offsite Landfill

Comment: One comment supported excavation and disposal to an offsite landfill. This comment stated that ash should be moved to a rural or unpopulated area outside of North Carolina.

Response: The Department does not have the legal authority to require Duke Energy to dispose of coal ash in a “rural area outside of North Carolina.”
D. Comment Supporting Excavation and Encouraging Beneficial Use

Comment: A couple of comments encouraged the beneficial reuse of excavated coal ash, rather than disposing the ash in its entirety to lined landfills. These comments suggested that excavated coal ash should be recycled and encased into cement blocks, concrete, or other creative uses that are deemed to be environmentally safe.

Response: NCDEQ agrees that Duke Energy may evaluate the potential for recycling, reusing or converting excavated coal ash into a coal ash product at the Mayo facility.

E. Comments Supporting Cap in Place

Comment: One comment supported closure in place because they believe this is the least costly and quickest way to address the problem.

Response: NCDEQ has determined that the CCR impoundment at Mayo must be excavated.

Comment: One comment suggested that cap in place could potentially be a viable option, but expressed concern regarding the specific proposal presented by Duke, stating additional study and safeguards would be necessary for this option to comply with applicable regulations and safety standards.

Response: NCDEQ has determined that the CCR impoundment at Mayo must be excavated.

F. Other Comments

Comment: Several comments suggested that NCDEQ fine or penalize Duke Energy.

Response: The Coal Ash Management Act requires the Department to elect the closure option for CCR surface impoundment at the six remaining Duke Energy sites. In other contexts, the Department has taken several enforcement actions against Duke Energy related to coal ash pollution.

Comment: Several comments suggested concerns about worker safety measures. These comments stated that appropriate protective equipment should be required for everyone that works in or around coal ash and cited the health issues faced by workers handling the Kingston, Tennessee coal ash spill in 2008.

Response: NCDEQ will take these comments into consideration when it conducts a comprehensive examination of Duke Energy’s Mayo facility closure plan, along with consideration of further public comments, in its final assessment of the closure plan.

Comment: A couple of comments expressed their desire for the Plant to be shut down along with closure of the impoundment.
Response: CAMA requires closure of all CCR surface impoundment – not the closure of the facility itself.

Comment: A couple of comments stated that they did not feel the public meetings held by NCDEQ on closure options were conducive for citizens to be properly heard.

Response: NCDEQ appreciates the public’s input and considered feedback received from the public at public meetings and through the public comment process when electing excavation as the closure option for the CCR surface impoundment at the Mayo facility. NCDEQ will also take this comment into consideration, along with further public comments, in its final assessment of Duke Energy’s closure plan.

Comment: Several comments expressed their desire that Duke Energy not be allowed to pass along any clean-up or closure costs to customers and urged the North Carolina Utilities Commission to deny any rate increase proposals. A number of these concerns cited the profits reported by Duke Energy during the last quarter and stated that any closure costs should be borne entirely by Duke Energy.

Response: This issue is not within the purview of NCDEQ. Rather, this issue rests with the North Carolina Utilities Commission.

Comment: A few comments expressed concern about thyroid cancer and other health risks, stating that it was NCDEQ’s responsibility to rectify these issues, but did not express a preference on a closure option.

Response: NCDEQ has determined that the CCR impoundment at Mayo must be excavated.

Comment: A few comments expressed their desire for NCDEQ to protect recreational activities - such as swimming, boating and fishing - in the waterbodies in the surrounding area, but did not express a preference on a closure option.

Response: NCDEQ has determined that the CCR impoundment at Mayo must be excavated.

Comment: One comment stated that all ash used as structural fill should be excavated.

Response: The Coal Ash Management Act requires closure of all CCR surface impoundment – not closure of coal ash structural fills.