COAL COMBUSTION RESIDUALS (CCR) ANNUAL SURFACE IMPOUNDMENT REPORT

APRIL 2017 INSPECTION

CAPE FEAR STEAM STATION
500 CP&L Road
Moncure, North Carolina

Prepared For:
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May 18, 2017

Amec Foster Wheeler Project No.: 7810-17-0837
COAL COMBUSTION RESIDUALS (CCR)
ANNUAL SURFACE IMPOUNDMENT REPORT
APRIL 2017 INSPECTION

CAPE FEAR STEAM STATION
1956 Retired Ash Basin Dam (State ID No. CHATH-075)
1963/1970 Retired Ash Basin Dam (State ID No. CHATH-076/077)
1978 Retired Ash Basin Dam (State ID No. CHATH-078)
1985 Retired Ash Basin Dam (State ID No. CHATH-079)

Duke Energy Carolinas LLC
500 CP&L Road
Moncure, Chatham, North Carolina

Inspection Date: 04/03/2017
Report Date: 05/18/2017

Amec Foster Wheeler Project No.: 7810-16-0633

Inspection Team: William A. Williams, PE, PG Senior Engineer, Amec Foster Wheeler
Gretchen Hammond, PE Duke Energy CCP Engineering
Austin Mack Duke Energy CCP Engineering

Summary

Amec Foster Wheeler has been retained to conduct the 2017 Annual Inspection (under the reporting requirements of 40 C.F.R. §257.83(b)) for the coal combustion residuals (CCR) surface impoundments at Cape Fear Steam Station. This annual dam/CCR Surface Impoundment Inspection Report meets the requirements of 40 C.F.R. § 257.83 (b)(1) and (2) and the North Carolina Coal Ash Management Act (Session Law 2014-122) Part V, Section 10 (amending G.S. 143-215.32) inspection of dams. This annual inspection focused primarily on an assessment of (i) the structural stability of the CCR surface impoundment; (ii) the integrity of any hydraulic structures passing underneath the CCR surface impoundments or through the dikes of the units; and (iii) verifying that the construction, design, operation, and maintenance of the CCR surface impoundments appear to be in accordance with recognized and generally accepted good engineering standards. Per Duke Energy, the basins at the Cape Fear Steam Station are not regulated by the CCR rule therefore annual inspection reports are not required to be submitted to the EPA.

The purpose of this inspection and report is to provide an engineering opinion as to whether the impoundments are structurally sound and that the design, operation, and maintenance of the impoundments are in accordance with generally accepted engineering standards.

In summary, no conditions were observed during this field inspection nor identified by existing engineering analyses that represent an unsafe structural stability concern requiring immediate attention. Amec Foster Wheeler concludes that the construction, design, operation, and maintenance of the CCR surface impoundments have been sufficiently consistent with recognized and generally accepted engineering standards for protection of public safety. Issues concerning the hydraulic structures (risers, pipes, spillways) have been addressed by repairs or replacements. Design and construction issues that have been identified for some of the dams have been addressed.
Sincerely,

Amec Foster Wheeler Environment & Infrastructure, Inc.

William A. Williams, PE, PG
Senior Engineer
Registered, North Carolina PE 22943

J Allan Tice, PE (Technical Reviewer)
Principal Engineer
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1. **Design / Geometry of the Impounding Structure**

   Based on the data reviewed and the visual inspection, no modifications to the geometry of impounding structures have been made since the 2016 annual inspection. The following geometry data was obtained from Duke Energy. Values given in the tabulations below should be considered approximate.

   a. **Retired 1956 Ash Basin Dam (State ID No. CHATH-075):**

<table>
<thead>
<tr>
<th>Ash Basin Dam</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dam Length, ft</td>
<td>3,200</td>
</tr>
<tr>
<td>Maximum Dam Height, ft</td>
<td>20</td>
</tr>
<tr>
<td>Crest Elevation, ft</td>
<td>182 - 190</td>
</tr>
<tr>
<td>Crest Width, ft</td>
<td>5-10</td>
</tr>
<tr>
<td>Pond Area, acres</td>
<td>Approx. 12</td>
</tr>
</tbody>
</table>

   b. **Retired 1963/1970 Ash Basin Dam (State ID No. CHATH-076/077):**

<table>
<thead>
<tr>
<th>Ash Basin Dam</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dam Length, ft</td>
<td>8,600 (combined)</td>
</tr>
<tr>
<td>Maximum Dam Height, ft</td>
<td>22</td>
</tr>
<tr>
<td>Crest Elevation, ft</td>
<td>197</td>
</tr>
<tr>
<td>Crest Width, ft</td>
<td>12-14</td>
</tr>
<tr>
<td>Pond Area, acres</td>
<td>Approx. 51 (combined)</td>
</tr>
</tbody>
</table>

   c. **Retired 1978 Ash Basin Dam (State ID No. CHATH-078):**

<table>
<thead>
<tr>
<th>Ash Basin Dam</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dam Length, ft</td>
<td>5,600</td>
</tr>
<tr>
<td>Maximum Dam Height, ft</td>
<td>27</td>
</tr>
<tr>
<td>Crest Elevation, ft</td>
<td>197</td>
</tr>
<tr>
<td>Crest Width, ft</td>
<td>15</td>
</tr>
<tr>
<td>Pond Area, acres</td>
<td>Approx. 35</td>
</tr>
</tbody>
</table>

   d. **Retired 1985 Ash Basin Dam (State ID No. CHATH-079):**

<table>
<thead>
<tr>
<th>Ash Basin Dam</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dam Length, ft</td>
<td>7,400</td>
</tr>
<tr>
<td>Maximum Dam Height, ft</td>
<td>28</td>
</tr>
<tr>
<td>Crest Elevation, ft</td>
<td>194</td>
</tr>
<tr>
<td>Crest Width, ft</td>
<td>15</td>
</tr>
<tr>
<td>Pond Area, acres</td>
<td>Approx. 60</td>
</tr>
</tbody>
</table>

2. **Existing Instrumentation and Maximum Readings**

   Monitoring equipment/devices observed at Cape Fear Steam Station include piezometers at all basins and basin water level gauges in Retired Ash Basin Dams CHATH-078 and CHATH-079. Duke Energy personnel take monthly piezometer readings and continuous basin water level readings and report the readings to CCP Engineering. The data collected is analyzed by CCP Engineering for any changes or anomalies.
a. **Retired 1956 Ash Basin Dam (State ID No. CHATH-075):**

Table 1: Maximum Water Levels for the 1956 Ash Basin Recorded Between January 2016 and March 2017

<table>
<thead>
<tr>
<th>Location (Latitude, Longitude)</th>
<th>Piezometers</th>
<th>Maximum Recorded Elevation Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>35.597354°, -79.050530°</td>
<td>PZ-10</td>
<td>166.72 ft (Dry)</td>
</tr>
<tr>
<td>35.59841°, -79.049351°</td>
<td>CHATH-075- P100</td>
<td>163.55 ft</td>
</tr>
<tr>
<td>35.597238°, -79.048607°</td>
<td>CHATH-075-P101</td>
<td>165.65 ft</td>
</tr>
<tr>
<td>35.598306°, -79.049419°</td>
<td>CHATH-075-P102</td>
<td>165.09 ft</td>
</tr>
<tr>
<td>35.597275°, -79.048393°</td>
<td>CHATH-075-P103</td>
<td>161.50 ft</td>
</tr>
</tbody>
</table>

1 Piezometer was damaged in December 2015. No water levels recorded since December 2015, which is listed here. Final decision on whether to repair or abandon the piezometer is pending.


Table 2: Maximum Water Levels for the 1963/1970 Ash Basin Recorded Between January 2016 and March 2017

<table>
<thead>
<tr>
<th>Location (Latitude, Longitude)</th>
<th>Piezometers</th>
<th>Maximum Recorded Elevation Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>35.589401°, -79.049627°</td>
<td>PZ-8</td>
<td>179.90 ft</td>
</tr>
<tr>
<td>35.588757°, -79.051349°</td>
<td>CHATH-076- P100</td>
<td>167.46 ft</td>
</tr>
<tr>
<td>35.588810°, -79.051129°</td>
<td>CHATH-076-P101</td>
<td>171.75 ft</td>
</tr>
<tr>
<td>35.587333°, -79.051096°</td>
<td>CHATH-076-P102</td>
<td>168.74 ft</td>
</tr>
<tr>
<td>35.587333°, -79.051256°</td>
<td>CHATH-076-P103</td>
<td>165.62 ft</td>
</tr>
<tr>
<td>35.586398°, -79.048342°</td>
<td>PZ-7</td>
<td>179.64 ft</td>
</tr>
<tr>
<td>35.585300°, -79.050811°</td>
<td>CHATH-077- P100</td>
<td>170.01 ft</td>
</tr>
<tr>
<td>35.582678°, -79.047750°</td>
<td>CHATH-077-P102</td>
<td>168.72 ft</td>
</tr>
<tr>
<td>35.582578°, -79.047802°</td>
<td>CHATH-077-P103</td>
<td>170.39 ft</td>
</tr>
</tbody>
</table>

No staff gauge readings recorded between referenced time frame.
c. **Retired 1978 Ash Basin Dam (State ID No. CHATH-078)**

Table 3: Maximum Water Levels for the 1978 Ash Basin Recorded Between January 2016 and March 2017

<table>
<thead>
<tr>
<th>Location (Latitude, Longitude)</th>
<th>Piezometers</th>
<th>Maximum Recorded Elevation Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>35.587904°, -79.047993°</td>
<td>PZ-9</td>
<td>186.92 ft</td>
</tr>
<tr>
<td>35.587705°, -79.045477°</td>
<td>78-1</td>
<td>181.60 ft</td>
</tr>
<tr>
<td>35.588163°, -79.044671°</td>
<td>78-3</td>
<td>183.92 ft</td>
</tr>
<tr>
<td>Basin Discharge Structure</td>
<td>Water Level Instrumentation</td>
<td>185.6 ft¹</td>
</tr>
</tbody>
</table>

¹ Water Level Instrumentation located at the former riser structure to replace staff gauge.

---

d. **Retired 1985 Ash Basin Dam (State ID No. CHATH-079)**

Table 4: Maximum Water Levels for the 1985 Ash Basin Recorded Between January 2016 and March 2017

<table>
<thead>
<tr>
<th>Location (Latitude, Longitude)</th>
<th>Piezometers</th>
<th>Maximum Recorded Elevation Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>35.593019°, -79.045191°</td>
<td>PZ-1</td>
<td>167.36 ft</td>
</tr>
<tr>
<td>35.592838°, -79.042392°</td>
<td>PZ-2</td>
<td>170.92 ft</td>
</tr>
<tr>
<td>35.588979°, -79.037737°</td>
<td>PZ-3S</td>
<td>170.40 ft</td>
</tr>
<tr>
<td>35.588956°, -79.037742°</td>
<td>PZ-3D</td>
<td>170.58 ft</td>
</tr>
<tr>
<td>35.585846°, -79.038852°</td>
<td>PZ-4</td>
<td>165.70 ft</td>
</tr>
<tr>
<td>35.588862°, -79.041906°</td>
<td>PZ-5</td>
<td>168.50 ft</td>
</tr>
<tr>
<td>35.589894°, -79.039690°</td>
<td>PZ-6</td>
<td>183.01 ft</td>
</tr>
<tr>
<td>35.589028°, -79.041609°</td>
<td>CHATH-079-P100</td>
<td>180.93 ft</td>
</tr>
<tr>
<td>35.586507°, -79.039622°</td>
<td>CHATH-079-P101</td>
<td>172.65 ft</td>
</tr>
<tr>
<td>35.586371°, -79.039723°</td>
<td>CHATH-079-P102</td>
<td>166.67 ft</td>
</tr>
<tr>
<td>35.588938°, -79.037961°</td>
<td>CHATH-079-P103¹</td>
<td>169.17 ft</td>
</tr>
<tr>
<td>35.592140°, -79.041466°</td>
<td>CHATH-079-P104²</td>
<td>167.25 ft</td>
</tr>
<tr>
<td>35.592344°, -79.041386°</td>
<td>CHATH-079-P105</td>
<td>171.56 ft</td>
</tr>
<tr>
<td>Basin Discharge Structure</td>
<td>Water Level Instrumentation</td>
<td>179.1 ft³</td>
</tr>
</tbody>
</table>

¹ Infested with ants. No readings following October 2016. Infested area treated with non-chemical element to eliminate ants. Readings to resume in May 2017.

² Piezometer buried under gravel in the roadway. No water levels recorded after August 2015 (Reading from August 2015). Piezometer is to be located and readings resumed in May 2017.

³ Water Level Instrumentation located at the riser structure.
3. **Approximate Depth & Elevation of the Impounded Water and CCR**

The data presented is based on information obtained from Duke Energy. We assume that depths are from normal pool elevation.

a. **Retired 1956 Ash Basin Dam (State ID No. CHATH-075):**
   - Minimum Depth of Water: 0 ft
   - Maximum Depth of Water: 0 ft
   - Present Depth of Water: 0 ft

b. **Retired 1963/1970 Ash Basin Dam (State ID No. CHATH-076/077):**
   - Minimum Depth of Water: 0 ft
   - Maximum Depth of Water: unknown (no staff gauge readings)
   - Present Depth of Water: 3.05 feet on April 4, 2017 (staff gauge reading)

c. **Retired 1978 Ash Basin Dam (State ID No. CHATH-078):**
   - Minimum Elevation of Water: 183.3 ft., July 19-20, 2016 (water level instrumentation)
   - Maximum Elevation of Water: 185.6 ft., October 19-21, 2016 (water level instrumentation)
   - Present Elevation of Water: 181.2 ft. as recorded on April 3, 2017 (water level instrumentation)
   - As recorded during the 2016 calendar year

d. **Retired 1985 Ash Basin Dam (State ID No. CHATH-079):**
   - Minimum Elevation of Water: 177.0 ft., December 1-29, 2016 (water level instrumentation)
   - Maximum Elevation of Water: 179.1 ft., February 24-29, 2016 (water level instrumentation)
   - Present Elevation of Water: 175.5 ft. as recorded on April 3, 2017 (water level instrumentation)
   - As recorded during the 2016 calendar year

4. **Storage Capacity of Impounding Structure at the Time of the Inspection**

Since the Cape Fear Steam Station has been retired and demolished, and there is no active ash management; storage capacity and remaining life is not applicable to this report. See Section 5 of this report for approximate volume of impounded water at the time of the inspection and CCR as of last inventory.

a. **Retired 1956 Ash Basin Dam (State ID No. CHATH-075):**
   - Ash Basin has been retired.

b. **Retired 1963/1970 Ash Basin Dam (State ID No. CHATH-076/077):**
   - Ash Basin has been retired.

c. **Retired 1978 Ash Basin Dam (State ID No. CHATH-078):**
   - Ash Basin has been retired.

d. **Retired 1985 Ash Basin Dam (State ID No. CHATH-079):**
   - Ash Basin has been retired.

5. **Approximate Volume of the Impounded Water and CCR at the Time of the Inspection**

Primary Basin volumes presented are based on the data summary sheet provided by Duke Energy dated March 2, 2017. Plant operations ceased in 2012.

a. **Retired 1956 Ash Basin (State ID No. CHATH-075):**
   - Approximate Weight: 422,400 tons
   - Approximate Volume: Dry
b. **Retired 1963/1970 Ash Basin (State ID No. CHATH-076/077):**  
   Approximate Weight: 1,598,400 tons  
   Approximate Volume: 0.66 million gallons of water  

c. **Retired 1978 Ash Basin (State ID No. CHATH-078):**  
   Approximate Weight: 896,400 tons  
   Approximate Volume: 16 million gallons of water  

d. **Retired 1985 Ash Basin (State ID No. CHATH-079):**  
   Approximate Weight: 2,823,600 tons  
   Approximate Volume: 34 million gallons of water  

6. **Existing Conditions That Are Disrupting or Have Potential to Disrupt the Operation and Safety of the CCR Unit and Appurtenant Structures Based On Inspections**  

The observations made during the April 3, 2017 annual inspection indicate that the dam structures are generally well maintained and appear to comply with regulatory standards and requirements.  

**Field Inspection**  

The field inspection was performed on April 3, 2017 by Bill Williams, PE, of Amec Foster Wheeler. He was accompanied by Austin Mack and Gretchen Hammond, PE, Duke Energy. The weather during the inspection was mostly cloudy with an air temperature ranging from the mid-60°F to mid-70°F. Based on data from the WeatherUnderground.com, no significant rainfall occurred within the prior 48 hours to the inspection.  

a. **Retired 1956 Ash Basin (State ID No. CHATH-075):**  
   At the time of our inspection, Amec Foster Wheeler did not observe items that indicate a potential structural weakness of the ash pond dam. The ash pond dam appears to be in the same general condition as in the 2016 inspection. The outlet structure was abandoned with grout in October 2015. The western interior portion of the ash pond dam is cleared and graded as a retention basin. No water was observed in the retention basin at the time of the inspection.  

b. **Retired 1963/1970 Ash Basin (State ID No. CHATH-076/077):**  
   At the time of our inspection, Amec Foster Wheeler did not observe items that indicate a potential structural weakness of the ash pond dam. The ash pond dam appears to be in the same general condition as in the 2016 inspection. A CCTV inspection of the drainage pipe was completed on February 6, 2017. The pipe was found to be in excellent condition, with no repairs or modifications warranted.  

c. **Retired 1978 Ash Basin (State ID No: CHATH-078):**  
   At the time of our inspection, Amec Foster Wheeler did not observe items that indicate a potential structural weakness of the ash pond dam. The ash pond dam appears to be in the same general condition as in the 2016 inspection.  

   Amec Foster Wheeler performed field inspection and evaluation of the CCR units as part of the CCP Duke Energy Programatic documents for the Ash Pond Design. The following items were identified as deficiencies in the report. The current status of these items is also noted:  
   - The pond will not draw down 80% of the IDF volume due to the water elevation never reaching the outlet riser elevation.  

   **Status:** Based on the results of a 2015 Flood Evaluation Study, the 1978 Ash Pond has sufficient storage to safely store the design storm (1/2 PMP) without an uncontrolled discharge, and therefore, its discharge structures were properly abandoned in July 2016, and pumping structures were installed with the pumping rate calculated in accordance with 15A NCAC 2K 0.0205. A dewatering/pumping plan has been implemented, and basin water is pumped to an on-site water treatment system. Following treatment, the water is discharged into the canal. An emergency bypass pumping line has been installed to allow stormwater to discharge...
through the permitted discharge point during severe flooding conditions. Work was completed in July 2016 under Work Order No. 7257804.

- Riser fails to meet the MPD stability criteria for moment equilibrium and indicates a negative FS for bearing pressure capacity under the foundation for the extreme load (MDE) seismic condition with the current ash/water level in the ash pond. It appears overturning of the riser would likely occur during the MDE event. The RCP sections of the riser appear to have separations at the joints between stacked sections under the unusual load (OBE) and extreme load (MDE) conditions with the ash/water level at the current levels. For these seismic events, it appears separation between the stacked RCP sections would likely occur allowing for a potential release of liquefied ash.

  **Status:** Riser and outlet barrel were grouted in July 2016, and basin water is pumped to a water treatment system prior to discharge to the discharge canal. Work was completed in July 2016 under Work Order No. 7257668 and 7257804.

The above issues have been noted as a Notice of Deficiency dated June 26, 2014. The deficiency was addressed by the repairs completed under Work Order Nos. 7257668 and 7257804. The North Carolina Department of Environmental Quality (NC DEQ) issued a Final Approval of Repair on February 2, 2017.

**d. Retired 1985 Ash Basin (State ID No: CHATH-079):**

At the time of our inspection, Amec Foster Wheeler did not observe items that indicate a potential structural weakness of the ash pond dam. Ditch construction to alleviate stormwater ponding at the toe of the downstream slope at the inlet of the drainage pipe that runs underneath the access road to the outlet control drain valve was completed in December 2015. The ash pond dam appears to be in the same general condition as in the 2016 inspection. A CCTV inspection of the outlet pipe was completed on February 22, 2017. No modifications or repairs were recommended. A CCTV inspection of the riser was completed on March 9, 2017, with no modifications or repairs recommended.

Amec Foster Wheeler performed field inspection and evaluation of the CCR units as part of the CCP Duke Energy Programatic documents for the Ash Pond Design. The following items were identified as deficiencies in the report. The current status of these items is also noted.

- The pond will not draw down 80% of the IDF volume due to the water elevation never reaching the outlet riser elevation.

  **Status:** Work to address this condition involved the initial installation of a valve (remains under locked condition) in the outfall pipe and the lowering of the ash pond riser by 4 feet to an elevation of +184.1 feet. The project included the armoring of the ash pond slopes. Work was completed in 2015. A pumping system was installed in July 2016 to allow for dewatering of the basin. The basin water is pumped to an on-site water treatment system. Following treatment, the water is discharged into the canal.

- RCP sections of the primary riser appear to have separations at the joints between the stacked sections under the extreme load (MDE) condition with the ash/water level at the current levels. For the seismic event, it appears separation between the stacked RCP sections would likely occur allowing for a potential release of liquefied ash.

  **Status:** The locked gate valve would prevent a release due to a riser failure. Basin water is now pumped to a water treatment system prior to discharge to the discharge canal. The existing spillway would only be operated to allow stormwater to discharge through the permitted discharge point during severe flooding conditions through manually operating the gate valve. Work was completed in July 2016 under Work Order No. 7257668. The North Carolina Department of Environmental Quality (NC DEQ) issued a Final Approval of Repair on February 2, 2017.
7. **Maintenance**

Duke Energy has developed an Operations and Maintenance (O&M) Manual to instruct operation and engineering personnel the proper procedures for operating and maintaining the Ash Basin System. The Station Owners and Station Environmental Coordinators operate and maintain the impoundment facility in a safe and regulatory-compliant manner such as meeting State and Federal laws along with company guidelines without interruption to the station’s generation of electricity. The O&M manual provides the necessary information in a concise and comprehensive manner and assists those responsible for operating and maintaining the ash impoundment facility and associated support features.

Observations during this 2017 inspection indicate that Duke is adequately maintaining the facility.