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September 10, 2020

Ms. Kimberley A. Campbell, Chief Clerk
North Carolina Utilities Commission
4325 Mail Service Center
Raleigh, North Carolina 27699-4300

Re: Sierra Club's Testimony, Exhibits and Summaries Entered into the Record –
Witnesses Quarles and Wilson
Docket No. E-7, Sub 1214, Duke Energy Carolinas, LLC

Dear Ms. Campbell,

In response to the North Carolina Utilities Commission's ("Commission") Order Providing Additional Requirements for Consolidated, Remote Expert Witness Hearing issued on July 17, 2020, as well the Order Granting in Part Joint Motion for Additional Clarification for Consolidated Expert Witness Hearings issued on August 21, 2020. Attached for filing in the above-referenced docket is Sierra Club's Testimony, Exhibits and Summaries entered into the record for Sierra Club witnesses Mark Quarles and Rachel Wilson for the separate DEC-specific expert witness hearing.

If you have any questions, please do not hesitate to contact us. Thank you for your assistance with this matter.

Sincerely,



Catherine Cralle Jones

Enclosure

OFFICIAL COPY

Sep 10 2020

Sierra Club
Docket No. E-7, Sub 1214
List of Testimony and Exhibits

| Prefiled Testimony | Pre-marked Exhibits | Date Introduced | Date Entered |
|--|--|------------------------|---------------------|
| Sierra Club Direct Testimony & Exhibits of Mark Quarles (filed February 18, 2020) | Ex. MQ-1 Resume | 9/10/2020 | 9/10/2020 |
| | Ex. MQ-2 1984 Duke 1984 Groundwater Investigation | | |
| | Ex. MQ-3 1985 AD Little Report | | |
| | Ex. MQ-4 DEC Response to Public Staff Data Request 36-2 | | |
| Summary of Mark Quarles Testimony | | Served: 9/4/2020 | 9/10/2020 |
| Sierra Club (Corrected) Direct Testimony and Exhibits of Rachel Wilson (filed February 25, 2020) (<i>Contains Confidential Information</i>) | Ex. RW-1 Resume | 9/10/2020 | 9/10/2020 |
| | Confidential Ex. RW-2 Historical Analysis | | |
| | Confidential Ex. RW-3 Forward Looking Analysis | | |
| | Ex. RW-4 Update Comparison | | |
| Summary of Rachel Wilson Quarles Testimony | | Served: 9/4/2020 | 9/10/2020 |

List of Potential Cross Examination Exhibits
Docket Nos. E-7, Sub 1214

| Exhibit Id. | Ex. Marked | Description | Witness | Attorney | Date Introduced | Date Entered |
|---------------------|-------------------------------|---|----------------|-----------------|------------------------|---------------------|
| Sierra Club Cross 1 | | DEC Response to Sierra Club Data Request No. 3-3 (Jan 2. 2020) No. 1 | | Jones/Lee | | |
| Sierra Club Cross 2 | | DEC Response to Sierra Club Data Request No. 5-3 (Jan. 28, 2020) | | Jones/Lee | | |
| Sierra Club Cross 3 | Sierra Club Bednarcik Cross 1 | Duke Environmental Management Program for Coal Combustion Products (May 29, 2007) (Kerin AGO Cross Exhibit 3, Docket No. E-7, Sub 1146) | Bednarcik | Jones | 9/8 | 9/8 |
| Sierra Club Cross 4 | | Joint Factual Statement (filed 14 May 2015) (Fountain/McManeus Sierra Club Cross Exhibit 1, Docket No. E-7, Sub 1146) | | Jones/Lee | | |
| Sierra Club Cross 5 | | Duke Energy Coal Combustion Products Ten Year Plan (2012) | | Jones/Lee | | |
| Sierra Club Cross 6 | | Site Facts – DEC (Kerin Direct Exhibit 4, Docket No. E-7, Sub 1146) | | Jones/Lee | | |
| Sierra Club Cross 7 | | Ash Basin Information (DEC) (Kerin Revised Direct Exhibit 5, Docket No. E-7, Sub 1146) | | Jones/Lee | | |
| Joint Ex. 7 | Joint Ex. 7 | 1981 EPRI “Coal Ash Disposal Manual, 2d Ed | Bednarcik | Jones | 9/8 | 9/8 |

List of Potential Redirect Examination Exhibits
Docket Nos. E-7, Sub 1214

| Marked Exhibit No. | Description | Witness | Attorney | Date Introduced | Date Entered |
|-------------------------------|--|----------------|-----------------|------------------------|---------------------|
| Sierra Club Redirect 8 | 2006 EPA/DOE CCR Report | | Jones/Lee | | |
| Sierra Club Redirect 9 | 2007 EPA Attenuation | | Jones/Lee | | |
| Sierra Club Redirect 10 | 2014 DE Ash Basin Closure Update | | Jones/Lee | | |
| Sierra Club Redirect11 | 2015 DE Comprehensive Site Assessment - Allen | | Jones/Lee | | |
| Sierra Club Redirect 12 | DEC Response to AGO Data Requires NO. 2-18 | | Jones/Lee | | |

Sierra Club
Docket No. E-2, Sub 1219
List of Prefiled Testimony and Exhibits

| Prefiled Testimony | Pre-marked Exhibits | Party | Docket No. | Date Introduced | Date Entered |
|--|--|--------------|-------------------|------------------------|---------------------|
| Sierra Club Direct Testimony of Mark Quarles (filed April 13, 2020) <i>(Contains Confidential Information, pp. 5 and 26)</i> | Ex. MQ-1 Resume | DEP | E-2, Sub 1219 | | |
| | Ex. MQ-2 1985 AD Little Report Excerpts | | | | |
| | Ex. MQ-3 1976 Mingle memo re Sutton | | | | |
| | Ex. MQ-4 Zimmerman Summary re Sutton | | | | |
| | Ex. MQ-5 1984 Wilson Letter Re Sutton | | | | |
| | Ex. MQ-6 Greeson Memo re Sutton | | | | |
| | Ex. MQ-7 1979 Mayo Groundwater Report | | | | |
| Sierra Club Direct Testimony and Exhibits of Rachel Wilson (filed April 13, 2020) <i>(Contains Confidential Information, pp. 3, 8-12, 14-16, 24)</i> | Ex. RW-1 Resume | DEP | E-2, Sub 1219 | | |
| | Ex. RW-2 Historical Analysis | | | | |
| | Ex. RW-3 Forward Looking Analysis | | | | |

List of Potential Cross Examination Exhibits
Docket Nos. E-7, Sub 1219

| Marked Exhibit No. | Description | Witness | Attorney | Date Introduced | Date Entered |
|-------------------------------|--------------------|----------------|-----------------|------------------------|---------------------|
| Sierra Club Cross 1 | | | Jones/Lee | | |
| Sierra Club Cross 2 | | | Jones/Lee | | |

List of Potential Redirect Examination Exhibits
Docket Nos. E-7, Sub 1219

| Marked Exhibit No. | Description | Witness | Attorney | Date Introduced | Date Entered |
|-------------------------------|--------------------|----------------|-----------------|------------------------|---------------------|
| Sierra Club Redirect 1 | | | Jones/Lee | | |
| Sierra Club Redirect 2 | | | Jones/Lee | | |

**Summary of Direct Testimony of Mark Quarles, P.G., for Sierra Club
Docket No. E-7, SUB 1214**

In 2008, approximately 5.4 million cubic yards of coal ash were released into the environment following a dike failure at a coal ash pond at the Tennessee Valley Authority's Kingston coal plant. The Kingston spill brought national attention to the risks associated with the mismanagement of coal ash disposal areas, including risks of catastrophic releases as well as contamination of groundwater and surface waters. In connection with spill response efforts, I was involved with the development of a monitoring program to determine the lateral extent of the release, and I have since been involved with investigations at more than 100 coal ash disposal sites in the U.S. I have gained significant experience regarding coal combustion waste, the potential for constituents of concern to migrate in the environment, the toxicity of such constituents, and sampling programs to determine their extent in soil, surface water, sediment, and groundwater. Based on this experience, I have an acute understanding of the dangers presented by storing coal ash in unlined disposal units—and especially unlined surface impoundments.

For this proceeding, I evaluated the Company's historical coal ash management practices against the backdrop of what the Company knew or should have known, from a scientific and engineering perspective, about the dangers posed by storing millions of tons of coal ash in unlined pits in contact with groundwater and adjacent to lakes and rivers. Historical documents available to the Company demonstrate that the risks of groundwater contamination from unlined coal ash ponds were reported as early as the late 1970s and were well understood by the early 1990s. The fact that the US EPA did not finalize its federal coal ash regulations until 2014 does not diminish the fact that the Agency concluded in the 1980s that "[t]he primary concern regarding the disposal of wastes from coal-fired power plants is the potential for waste leachate to cause groundwater contamination." (1988 EPA Report to Congress at E-3 [PDF page 17].)

**Summary of Direct Testimony of Mark Quarles, P.G., for Sierra Club
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Given this understanding, the Company's continued operation of unlined surface impoundments that were constructed directly in streams, adjacent to rivers and streams, and with coal ash saturated in groundwater, could be expected to result in the introduction of coal ash constituents to surface and groundwater and was therefore unreasonable. At the very least, the Company should have conducted more robust groundwater monitoring at its coal ash sites.

Indeed, industry manuals available in the 1980s also highlighted the risks to groundwater resources and recommended that groundwater monitoring systems be installed where there was the potential for discharge of contaminants to underground water resources. A 1982 EPRI manual explained clearly the hydrogeological underpinnings of such risks, stating that: "the potential for groundwater degradation should be noted, especially when an unlined ash pond is constructed on a site with relatively permeable soils and a shallow groundwater table. . . . The existence of a constant hydraulic head (standing water) in the pond makes leachate generation and migration inevitable." (1982 EPRI Manual at 4-19.) In addition, that manual made clear the importance of adequate groundwater monitoring, stating that: "monitoring of groundwater and leachate, is nevertheless necessary to provide convincing proof of safe disposal practice." (Id.)

Nevertheless, the Company's monitoring of groundwater at its coal ash sites was far from adequate. Groundwater well sampling at the Company's Allen site in the mid-1980s revealed arsenic concentrations in groundwater beneath the site that exceeded drinking water standards. In general, the Company did not begin routine monitoring of groundwater until the early 2000s—that is, several decades after the impoundments were put into use. Detections of contaminants above regulatory standards were quick—usually within the first year of monitoring. Nevertheless, upon learning of such exceedances, the Company did not take any action to limit the introduction of coal ash constituents into groundwater or abate the

**Summary of Direct Testimony of Mark Quarles, P.G., for Sierra Club
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contamination. Unsurprisingly, this lack of action led to widespread contamination of groundwater at every single one of the Company's coal ash disposal sites—a fact that the Company finally admitted in 2014.

Had the Company switched to dry handling of ash sooner, the volume of ash that sat submerged in the ponds for decades and that now must be excavated would be much smaller. Consequently, the costs that the Company has incurred and will continue to incur to excavate its coal ash ponds would have been smaller if the Company had switched to dry ash handling sooner. For every additional ton of coal ash that was disposed of in a pond and now must be excavated, the Company will incur additional costs. Similarly, groundwater monitoring costs would have been smaller if the Company had switched to dry ash handling sooner because properly designed landfills are less likely to leak and if so, the plume would be smaller. A smaller more geographically limited plume would require fewer monitoring wells and less associated monitoring costs.

In conclusion, the combination of the historical documents available to the Company and the Company's own identification of a leachate plume at its Allen site in 1984 should have led the Company to take action to mitigate the risks posed by its unlined ash ponds at some point in the thirty years before the adoption of the federal coal ash rule and the enactment of the North Carolina coal ash law. Instead, the Company sat on its hands. The Company's inaction resulted in more widespread contamination of the state's groundwater resources, jeopardy to present and future drinking water sources, the need for alternative drinking water supplies, and millions of tons more ash to be dewatered, excavated, and redispersed of, all driving higher cleanup and risk reduction costs.

**Summary of Direct Testimony of Rachel Wilson, for Sierra Club
Docket No. E-7, SUB 1214**

My name is Rachel Wilson and I am a Principal Associate with Synapse Energy Economics, Inc., a research and consulting firm specializing in electricity industry regulation, planning, and analysis. At Synapse, my work focuses on a variety of issues relating to electric utilities, including integrated resource planning, resource adequacy, electric system dispatch, environmental regulations and compliance strategies, and power plant economics.

The purpose of my testimony is to evaluate the economics of the coal-fired units owned by Duke Energy Carolinas (DEC or the Company) and assess the prudence of the Company's capital investments in these units as well as its operation and maintenance costs.

Using data provided by DEC, I evaluated the net value of each of the Company's coal units between 2016 and 2018. The input data set included each unit's energy value, fuel costs, O&M costs, environmental costs, capital costs, ash management costs, hourly generation, and the DEC system lambda. These various costs that I mention were subtracted from each unit's energy value to arrive at annual net value. (Because the information provided by DEC on which I based my analysis is confidential, the Company has also deemed the dollar values resulting from my analysis confidential—that is the amount by which the costs to operate the units exceeded the value provided by the units.)

My primary findings indicate that all DEC's coal units—which include Cliffside Units 5 and 6, Belews Creek Units 1 and 2, Allen Units 1 through 5, and Marshall Units 1 through 4—operated uneconomically for at least the combined three-year period from 2016 through 2018. Despite these net losses, DEC continues to set unit retirement dates for its coal fleet based solely on its depreciation study, which does not reflect the actual economic value, or lack thereof, to ratepayers.

Summary of Direct Testimony of Rachel Wilson, for Sierra Club
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In addition, my analysis shows that each of DEC's coal units will continue to operate uneconomically in the future. I conducted a similar analysis evaluating the forward-looking economic performance of DEC's coal units for years 2019 through 2040 and found that, based on DEC's projections, its coal units are likely to remain uneconomic through 2040. Each of DEC's units, with the exception of one, is projected to have a negative net value in each year from 2019 through 2028, and all units are projected to have negative net values for 2029 to 2040.

Nevertheless, DEC is seeking to recover \$192.8 million for operations and maintenance expenses and \$509.4 million for capital expenditures incurred at its four coal plants in 2018. Future O&M and capital costs could be even higher. DEC has not demonstrated the prudence of its coal unit costs for which it is seeking cost recovery. Specifically, the Company has not demonstrated that its decision to incur additional capital expenses at its individual coal units rather than retiring them is justified. Instead, the Company assumes that its coal units will continue to operate until the dates identified in its most recent depreciation study—that is, 2024 for Allen Units 1 through 5; 2026 for Cliffside Unit 5; 2034 for Marshall Units 1 through 4; 2037 for Belews Creek Units 1 and 2; and 2048 for Cliffside 6. These life span estimates were not based on economic analyses of alternative retirement dates.

In addition, DEC's continued operation of and investment in its aging coal fleet ignores Governor Roy Cooper's Executive Order 80 and the subsequent North Carolina Department of Environmental Quality Clean Energy Plan. That Plan, released in October 2019, sets the goal of 70 percent reduction of carbon dioxide emissions below 2005 levels from the electric sector by 2030. And Duke Energy has its own carbon-reduction goals of cutting carbon dioxide emissions by 50 percent or more by 2030 and to attain net-zero emissions by 2050. Continued investment in all of DEC's coal units does not reflect a plan to meet these emission reduction goals.

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Given this, and based on the findings of my analysis of coal unit economics, I have two recommendations for this Commission: first, that the Commission disallow past spending on capital projects incurred between the 2017 rate case and this rate case, given that the data show that all of DEC's coal units had negative net value in 2016 and 2017, and eleven of DEC's thirteen coal units had net negative value in 2018; and second, that the Commission place a cap on future capital expenditures intended to prolong the lives of the DEC coal units as generating assets, and require the utilities to come to the Commission for approval of any expenditure that exceeds that cap before the expenditure can be recovered from ratepayers.