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U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: Duke Energy Carolinas, LLC
William States Lee III Nuclear Station - Docket Nos. 52-018 and 52-019
AP1000 Combined License Application for the
William States Lee III Nuclear Station Units 1 and 2
Response to Request for Additional Information
Ltr# WLG2008.12-11

Reference: Letter from J.M. Muir (NRC) to B.J. Dolan (Duke Energy), *Request for Additional Information Regarding the Environmental Review of the Combined License Application for William States Lee Nuclear Station Units 1 and 2*, dated August 21, 2008

This letter provides the Duke Energy response to the Nuclear Regulatory Commission's (NRC) request for the following additional information (RAI) item listed in the reference letter:

RAI 48, Alternative Energy

The response to this NRC request is addressed in the enclosure which also identifies any associated changes that will be made in a future revision of the William States Lee III Nuclear Station application.

If you have any questions or need any additional information, please contact Peter S. Hastings at 980-373-7820.

Bryan J. Dolan
Vice President
Nuclear Plant Development

D093
NRO

Enclosure:

1. Response to RAI 48, Alternative Energy

AFFIDAVIT OF BRYAN J. DOLAN

Bryan J. Dolan, being duly sworn, states that he is Vice President, Nuclear Plant Development, Duke Energy Carolinas, LLC, that he is authorized on the part of said Company to sign and file with the U. S. Nuclear Regulatory Commission this supplement to the combined license application for the William States Lee III Nuclear Station and that all the matter and facts set forth herein are true and correct to the best of his knowledge.

Bryan J. Dolan

Subscribed and sworn to me on December 12, 2008

Phoebe P. Elliott
Notary Public

My commission expires: June 26, 2011

SEAL

xc (wo/enclosure):

Loren Plisco, Deputy Regional Administrator, Region II
Stephanie Coffin, Branch Chief, DNRL
Gregory Hatchett, Branch Chief, DSER

xc (w/enclosure):

Linda Tello, Project Manager, DSER
Brian Hughes, Senior Project Manager, DNRL

Lee Nuclear Station Response to Request for Additional Information (RAI)

RAI Letter Dated: August 21, 2008

Reference NRC RAI Number: ER RAI-48

NRC RAI:

Provide a quantified evaluation of natural gas-combined cycle power generation as an alternative to the proposed action.

Duke Energy Response:

Section 9.2 of the ER will be revised to include an evaluation of natural gas-combined cycle power generation as an alternative to the proposed action. The revisions which will be made are included below.

Associated Revisions to the Lee Nuclear Station Combined License Application:

1. ER Subsection 9.2.2, page 9.2-5, will be revised as follows:

   Conventional Technologies (technologies in common use):

   Base Load Technologies

   800 MW class Supercritical Coal (Greenfield)

   2-1117 MW Nuclear units, AP1000

   2410 MW Natural Gas Combined Cycle

2. ER Subsection 9.2.2, page 9.2-6, will be revised as follows:

   Overall, experience with integrated gasification combined cycle (IGCC) still shows generation costs are more expensive than comparably sized pulverized coal plants, due in part to the coal gasifier and other specialized equipment.

   Natural Gas Combined Cycle (NGCC)

   Natural-gas-fired generation using combined-cycle turbines is a technology that is available and economical. Current estimates indicate that capital costs for natural-gas-fired power plants average $575/kW.

   Electrical generation with natural gas has a higher cost due to fuel costs rather than capital costs. It has been indicated that if the fuel prices increase 100 percent, this would result in a 16 percent increase in the cost of nuclear generation, a 55 percent increase for coal, and a 79 percent increase for natural gas. Further, the overall costs for generation of electricity gave costs of $0.0266/kWh for nuclear, $0.0328/kWh for coal, and $0.0353/kWh for natural gas.

   Existing manufacturers' standard-sized units include a natural-gas-fired combined-cycle plant of 482 MW net capacity, consisting of two 172 MW natural gas turbines (e.g., General Electric Frame 7FA) and 138 MW of heat recovery capacity. Duke Energy assumed five 482 MWe units, having a total capacity of 2410 MWe, as the natural-gas-fired alternative at the Lee Nuclear Site capacity of two AP1000 units. The total generation from this replacement

power source is 2410 MWe and would only slightly overestimate the impacts from an exact replacement of Lee Nuclear Station Units 1 and 2. Table 9.2-4 shows the amounts of the 2410 MWe natural gas-fired plant emissions. Table 9.2-5 presents the assumed basic operational characteristics of the natural-gas-fired units. For the purposes of analysis, Duke Energy has assumed that there would be sufficient natural gas availability.

Based on the well-known technology, fuel availability, and generally understood environmental impacts associated with constructing and operating a natural-gas-fired power generation plant, it is considered a competitive alternative and is therefore examined further in Subsection 9.2.3.

3. ER Subsection 9.2.2, Subheading "Landfill Gas," paragraphs 4 and 5, page 9.2-8, will be revised as follows:

   In the above list of generating alternatives Duke Energy considered, the only technologically feasible, base_load-comparable alternatives to the Lee Nuclear Station ~~is the~~are coal-fired facilities and NGCC units.

   Conclusion: Duke Energy identified and evaluated a comprehensive set of alternative generation technologies, both fossil fuel and renewables, and properly concluded that ~~only a coal-fired facility is a potential alternative~~ coal-fired and NGCC facilities are the potential alternatives to the Lee Nuclear Station that are~~is~~ acceptable from a regulatory and risk standpoint and can serve base_load needs. Therefore, Subsection 9.2.3 ~~will~~ assesses ~~this~~ these alternative ~~resource~~technologies.

4. ER Subsection 9.2.3, beginning at paragraph 1, will be revised as follows:

   As discussed in Subsection 9.2.2, the only technologically feasible, base_load-comparable alternatives to the Lee Nuclear Station ~~is the~~ are coal-fired and NGCC facilities.

   9.2.3.1 Coal-Fired Facility

5. ER Subsection 9.2.3.1, Heading ,will be revised as follows:

   9.2.3.1.1 ~~9.2.3.1~~ Air Quality

6. ER Subsection 9.2.3.2, Heading ,will be revised as follows:

   9.2.3.1.2 ~~9.2.3.2~~ Waste Management

7. ER Subsection 9.2.3.3, Heading ,will be revised as follows:

   9.2.3.1.3 ~~9.2.3.3~~ Other Effects

8. ER Subsection 9.2.3 will be revised by adding Subsection 9.2.3.2 as follows:

   9.2.3.2 Natural Gas Generation (Combined Cycle)

   A 482 MWe NGCC unit has been identified as a probable standard size unit to be used. This alternative would require five 482 MWe units to adequately replace the Lee Nuclear Station's generating capacity. The total generation from this replacement power source is 2410 MWe and would only slightly overestimate the impacts from an exact replacement of the Lee Nuclear Station's 2400 MWe.

   The economics of combined cycle technology are largely dependent on the price of natural gas, which is highly volatile. As noted in Subsection 9.2.2, the overall cost of generating

electricity from natural gas is currently higher than the costs for nuclear generation ($0.0353/kWh vs. $0.0266/kWh).

Construction of a natural gas pipeline from the plant location to a supply point where a firm supply of gas is available would be needed. There is currently no gas pipeline to the Lee Nuclear Site. It is anticipated that the environmental impacts of constructing a gas pipeline to the Lee Nuclear Site would be similar to those associated with constructing a new transmission line right-of-way. Soil impacts from construction of the natural gas pipeline are considered MODERATE because of the disturbance to the topsoil along its route.

The overall impacts associated with the construction and operation of the natural-gas-fired alternative using a closed-cycle cooling system are summarized in Table 9.2-3 and discussed in the following subsections.

9.2.3.2.1 Water Use and Quality

A trade-off of water quality impacts would be associated with a large base load NGCC plant. Though water requirements are less for combined cycle plants than for conventional steam electric plants, the site would require the construction of a new intake structure to provide water needs for the facility. New base gas combined cycle units would likely utilize closed-loop cooling towers. Because water requirements for combined cycle generation are less than for conventional steam electric generation, evaporation from combined cycle cooling towers would be less than the anticipated evaporation associated with the Lee Nuclear Station's cooling tower system. Sediment caused by construction activities would impact adjacent waters. Plant discharges would comply with all appropriate permits. No low-level radioactive waste discharges to surface water are associated with a combined cycle unit. The overall impacts are characterized as SMALL.

9.2.3.2.2 Waste Management

The solid waste generated from this type of facility would be minimal. The only significant waste would be from spent SCR catalyst used for NO_x control. The SCR process would generate approximately 1500 cubic feet (cu. ft.) of spent catalyst material per year. The overall impacts are characterized as SMALL.

9.2.3.2.3 Air Quality

Natural gas is a relatively clean-burning fuel. The combined-cycle operation is highly efficient (60 percent versus 33 percent for the coal-fired alternative) because the heat recovery steam generator does not receive supplemental fuel. The natural-gas-fired alternative would release similar types of emissions, but in lesser quantities than the coal-fired alternative, and in much larger quantities than the nuclear alternative.

The largest environmental impact from this type of facility would result from the air emissions. The emissions resulting from burning natural gas only would be 34.4 T. per year of SO_2, 517 T. per year of NO_x, 287 T. per year of particulate matter (PM), and 482 T. per year of carbon monoxide (CO). A facility of this size would add 6,755,712 T. per year of CO_2 to the environment. Assumptions and calculations for these emissions are provided in Table 9.2-5 and Table 9.2-4 respectively. The $PM_{2.5}$ and regional haze rules would not be of concern with NGCC generation because these units have minimal SO_2 emissions. The overall impacts are characterized as SMALL to MODERATE.

9.2.3.2.4 Other Impacts

Land - Use of the Lee Nuclear Site for a natural-gas-fired combined cycle plant would require no new lands. A major combined cycle generation station can be located on less than 200 ac.

One obstacle to the consideration of combined cycle generation using only natural gas is the availability of the gas. Based on current technology, a facility of this size would require in excess of 100 billion cu. ft. per year of natural gas. If legislation is passed, requiring the reduction of CO_2 levels, increased use of natural gas in the generation mix would be required in order to meet these standards, resulting in reduced availability of natural gas. There are four natural gas pipelines, all located in the same right-of-way, approximately 4 mi. northwest of the site. A large, new base load combined cycle facility would require extending one or more of the existing gas pipelines to the site, which would disturb significant acreage between the right-of-way and the plant site. This assumes that the current gas supply is adequate to fuel a new facility along with the current users. If these lines do not have adequate capacity to service the current users as well as the new site a new pipeline would need to be run which would have a larger impact then assumed here. The overall impacts are characterized as MODERATE.

Ecology - Locating a new combined cycle facility at the Lee Nuclear Site would alter the ecology. On-site impacts would likely not be as significant as with coal-fired generation due to the smaller footprint requirement. However, ecological impacts created by new gas transmission needs could create significant off-site issues. Impacts would include wildlife habitat loss and reduced productivity, and could include habitat fragmentation and a local reduction in biological diversity. Impacts from a new intake (impingement and entrainment) and discharge (waste heat to a receiving water body) would be created. These ecological impacts would vary depending upon the corridor selected for the gas pipeline. However, the overall impacts are characterized as SMALL to MODERATE.

Human Health - A new combined cycle power plant introduces small risks to workers and the public. The generic environmental impact statement (GEIS) analysis noted that there could be human health impacts from the inhalation of toxins and particulates. Regulatory agencies, such as the EPA, have established regulatory requirements for power plant emissions and discharges to protect human health. A new combined cycle plant would comply with these regulatory requirements. The overall impacts are characterized as SMALL.

Socioeconomics - Construction of a major combined cycle plant would take approximately 2 – 3 years. Construction of a new combined cycle station of this size would employ a construction workforce of approximately 800, which would stimulate the economy of the region. The surrounding communities would experience demands on housing and public services. After construction, the workers would leave, and the operating plant would provide new jobs. However, long-term job opportunities would be less than for a coal-fired station and substantially less than those during operation of the Lee Nuclear Station.

Operational impacts could result in moderate socioeconomic benefits in the form of jobs, tax revenue, and plant expenditures. However, by comparison, these benefits will be less than those achieved through operation of the Lee Nuclear Station.

The size of the construction workforce for a combined cycle plant and plant-related spending during construction could be substantial. Operational impacts, once the combined cycle plant is constructed, would result in approximately 807 fewer jobs available to the regional economy (Lee Nuclear Station Units 1 and 2 would employ 957 workers compared to a

projected 150 for the combined cycle plant). The overall impacts are characterized as MODERATE.

Aesthetics - The five power plant units with their approximately 200-ft. stacks could be visible at a distance of several miles. Combined cycle generation would introduce additional mechanical sources of noise that would be audible off-site. Sources contributing to total noise produced by plant operation are classified as continuous or intermittent. Continuous sources include the mechanical equipment (e.g., combustion turbine units and mechanical-draft cooling towers) associated with normal plant operations. Intermittent sources include the equipment related to ammonia handling and solid waste disposal. Noise levels associated with a combined cycle generation facility are expected to be similar to those of a nuclear facility as discussed in subsection 5.8.1.5. The overall impacts are characterized as SMALL to MODERATE.

Cultural Resources - The GEIS analysis concluded that impacts to cultural resources would be relatively small unless important site-specific resources were affected. Construction impacts would be similar to those for construction of two nuclear units, which have been discussed and evaluated for the Lee Nuclear Site in Subsections 2.5.3 and 4.1.3. The overall impacts are characterized as SMALL.

Environmental Justice - Environmental justice effects depend upon the nearby population distribution. Construction activities offer new employment possibilities, but have negative effects on the availability and cost of housing, which disproportionately affect low-income populations. The overall impacts are characterized as SMALL.

9.2.3.2.5 Conclusion

A natural gas-fired combined cycle facility would be a viable replacement for Lee Nuclear Station base load generation. However, the air quality, land, ecology, socioeconomic, and aesthetic impacts would be greater than the impacts from construction and operation of the Lee Nuclear Station.

9. ER Subsection 9.2.4 will be revised by adding the following reference as follows:

   15. U.S. Environmental Protection Agency (EPA), Section 1.4, "Natural Gas Combustion" Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point Sources and Area Sources, EPA Report No. AP-42, Fifth ed., Washington, DC, September 1998, Website, http://www.epa.gov/ttn/chief/ap42/, accessed September 19, 2008.

10. ER Table 9.2-3 will be revised, as shown in Attachment 48-1.

11. ER Subsection 9.2 will be revised by adding ER Table 9.2-4, as shown in Attachment 48-2.

12. ER Subsection 9.2 will be revised by adding ER Table 9.2-5, as shown in Attachment 48-3.

Associated Attachments:

Attachment 48-1 Table 9.2-3 Comparison of the Environmental Impacts of the Coal-Fired and Natural Gas Alternatives to the Lee Nuclear Station

Attachment 48-2 Table 9.2-4 Air Emissions from Gas-Fired Alternative

Attachment 48-3 Table 9.2-5 Gas-Fired Alternative Characteristics

TABLE 9.2-3
COMPARISON OF THE ENVIRONMENTAL IMPACTS OF THE COAL-FIRED AND NATURAL GAS ALTERNATIVES TO THE LEE NUCLEAR STATION

Attribute	Environmental Impacts		
	Lee Nuclear Station	Coal-Fired Alternative	Natural Gas Generation
Air Quality	SMALL	MODERATE	SMALL to MODERATE
Waste Management	SMALL	MODERATE	SMALL
Land	SMALL	SMALL	MODERATE
Ecology	SMALL	SMALL	SMALL to MODERATE
Water Use & Quality	SMALL	SMALL	SMALL
Human Health	SMALL	SMALL	SMALL
Socioeconomics	SMALL	SMALL	MODERATE
Aesthetics	SMALL	SMALL	SMALL to MODERATE
Cultural Resources	SMALL	SMALL	SMALL
Environmental Justice	SMALL	SMALL	SMALL

TABLE 9.2-4
AIR EMISSIONS FROM GAS-FIRED ALTERNATIVE

Pollutant	Emission
SO_x[c]	34.4 T. SO_2 per year
NO_x[d]	517 T. NO_x per year
CO_x[d]	482 T.CO per year
PM_x[c]	287 T. filterable TSP per year
PM_{10x}[c]	287 T. filterable PM_{10} per year

Notes:

a. Assumes annual gas consumption of 2,404,470 T. per year

b. Assumes annual Btu input of 114,847,104 MMBtu per year

c. Recent CT application

d. 2.5 parts per million (ppm) recent NC combined cycle air permit

Btu	British thermal unit
CO	Carbon monoxide
kWh	Kilowatt hour
lb.	Pound
MW	Megawatt
NO_x	Oxides of Nitrogen
PM	Total particulate matter
PM_{10}	Particulates having diameter less than 10 microns
SO_2	Sulfur dioxide
T.	Ton
yr.	Year

TABLE 9.2-5
GAS-FIRED ALTERNATIVE CHARACTERISTICS
(Sheet 1 of 2)

Characteristic	Basis
Unit size = 482 MW IS0 rating net a Two 112 MW-combustion turbines 138 MW-heat recovery boiler	Standard size (Duke Energy experience)
Number of units = 5	Approximate capacity to replace 2400 MWe net
Fuel type = natural gas	Assumed
Fuel heating value = 23,882 Btu/lb (HHV)	Typical for natural gas used in NC (Duke Energy experience)
Fuel sulfur content = 0.0006 lb/MMBtu	Used when sulfur content is not available
NOx control = selective catalytic reduction (SCR) with water injection	Best available for minimizing NOx emissions
Fuel NOx content = 0.009 lb/MBtu (2.5 ppm)	Typical for large SCR-controlled combined cycle gas-fired units (EPA BACT Clearinghouse)
Fuel CO content = 0.0084 lb/MMBtu (9 ppm)	Typical for large SCR-controlled gas fired units
Heat rate = 6800 Btu/kWh	Typical for combined cycle gas-fired turbines (@ ISO)
Capacity factor = 0.8	Typical for baseload units

TABLE 9.2-5
GAS-FIRED ALTERNATIVE CHARACTERISTICS
(Sheet 2 of 2)

Notes

a.	The difference between "net" and "gross" is electricity consumed on-site.
Btu	British thermal unit
ISO rating	International Standards Organization rating at standard atmospheric conditions of 59°F 60% relative humidity and 14.696 lb. of atmospheric pressure per sq. in.
kWh	Kilowatt hour
MM	Million
MW	Megawatt
MWe	Megawatts electric
NOx	Nitrogen oxides
HHV	High Heating Value