November 21, 2007

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
SOUTHERN NUCLEAR OPERATING CO.	)	Docket No. 52-011-ESP
	)	
(Early Site Permit for Vogtle ESP Site)	)	

NRC STAFF'S MOTION TO STRIKE PORTIONS OF JOINT INTERVENORS' ANSWER OPPOSING SUMMARY DISPOSITION OF EC 1.3

INTRODUCTION

Pursuant to 10 C.F.R § 2.323(a), the Staff of the Nuclear Regulatory Commission ("Staff") hereby moves to strike portions of "Joint Intervenors' Answer Opposing Southern Nuclear Operating Co.'s Motion to Dismiss as Moot, or in the Alternative, for Summary Disposition of Joint Intervenors' Contention 1.3" (Nov. 13, 2007) ("Joint Intervenors' EC 1.3 Answer"). The Staff submits that portions of Joint Intervenors' EC 1.3 Answer identified below should be stricken and should not be considered by the Board because they are outside of the scope of Environmental Contention ("EC") 1.3.

BACKGROUND

As originally proffered by the Joint Intervenors,[1] Contention EC 1.3 challenged the discussion of "alterative cooling technologies" in the Environmental Report ("ER"). *See* Petition for Intervention at 14 (Dec. 11, 2006) ("Petition"). Contention EC 1.3, as admitted, was restated by the Atomic Safety and Licensing Board ("Board") as follows:

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[1] The Joint Intervenors include the Center for a Sustainable Coast, Savannah Riverkeeper, Southern Alliance for Clean Energy, Atlanta Women's Action for New Directions, and Blue Ridge Environmental Defense League.

> The ER fails to satisfy 10 C.F.R. § 51.45(b)(3) because its analysis of the dry cooling alternative is inadequate to address the appropriateness of a dry cooling system given the presence of extremely sensitive biological resources.

Southern Nuclear Operating Co. (Early Site Permit for Vogtle ESP Site), LBP-07-3, 65 NRC 237, 280 (2006) ("*Vogtle ESP")*. The Board concluded that "this contention concerning the need for an additional discussion of dry cooling as an alternative cooling system . . . is supported by bases establishing a genuine material dispute to warrant further inquiry." *Id.* at 261. Neither the Board's decision nor the Joint Petitioners' supporting bases made any mention of alternative cooling technologies other than dry cooling. *See id.* at 259-61; Petition at 14-15.

DISCUSSION

Under the Commission's rules of practice, an opposition to summary disposition must state specific facts showing a genuine issue of material fact to be litigated. *See* 10 C.F.R. §§ 2.710(b) and 2.1205(c). However, a party may not use a summary disposition answer to expand the scope of an admitted contention. *See, e.g., Entergy Nuclear Generation Co. & Entergy Nuclear Operations, Inc.* (Pilgrim Nuclear Power Station), LBP-07-13, 66 NRC __, __ (Oct. 30, 2007) (slip op. at 16) (finding that certain matters raised in a motion seeking to strike portions of a summary disposition answer were outside the scope of the proceeding); *Amergen Energy Co., LLC* (Licensing Renewal for Oyster Creek Nuclear Generating Station), No. 50-0219-LR, slip op. at 5-6 (LBP June 19, 2007) (unpublished order) (granting, in part, a motion to strike portions of a summary disposition answer that were outside the scope of the proceeding). New contentions or bases stemming from new information may be raised in a proceeding only with prior Board permission to amend the existing contention or to add an additional contention. *See* 10 C.F.R. § 2.309(c) and (f)(2). As the Commission observed in an analogous situation, allowing responsive pleadings "to provide, for the first time, the necessary threshold support for contentions . . . would effectively bypass and eviscerate [the Commission's] rules governing timely filing, contention amendment, and submission of late-filed contentions." *Louisiana Energy Servs., L.P.* (National Enrichment Facility), CLI-04-35, 60 NRC 619, 623 (2004), *denying reconsideration of* CLI-04-25, 60 NRC 223, 224 (2004) (upholding a Board decision refusing to consider information in reply filings that constituted untimely attempts to amend original filings without addressing late-filing factors in 10 C.F.R. § 2.309(c) and (f)(2)).

The Joint Intervenors' EC 1.3 Answer attempts to expand the scope of the admitted contention by seeking to challenge the analysis of hybrid and parallel wet/dry alternative cooling systems. The Joint Intervenors point to hybrid and parallel wet/dry cooling systems throughout their answer in an attempt to show a genuine dispute of material fact. *See* Joint Intervenors' EC 1.3 Answer at 7, 9, 11-12; *see also* Decl. of Bill Powers ¶¶ 20, 22 & Attachment D (Nov. 12, 2007).[2] However, in admitting this contention, the Board limited its scope from the broad topic of "alternative cooling technologies," which the Joint Intervenors proposed, to the more limited "dry cooling alternative." *See Vogtle ESP*, LBP-07-3, 65 NRC at 259-61, 280. The Board's limitation on the scope of this contention was appropriate given that the only alternative cooling technology discussed in the Joint Intervenors' supporting bases was the dry cooling alternative. *See* Petition at 14-15. The Joint Intervenors improperly attempt to broaden their admitted contention to hybrid and parallel wet/dry cooling systems or raise a new contention pertaining to such systems without obtaining Board approval under the late-filed contention standards in 10 C.F.R. § 2.309(c) and (f)(2). Accordingly, the Board should strike the

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[2] To better illustrate the portions of Joint Intervenors' EC 1.3 Answer that should be stricken, the Staff has included, as Attachment 1 to the Staff's motion, a copy of Joint Intervenors' EC 1.3 Answer with the offending material deleted in red-line.

discussion of hybrid and parallel wet/dry cooling system alternatives in the Joint Intervenors' EC 1.3 Answer.[3]

The Joint Intervenors' challenge to one type of alternative cooling technology (*i.e.,* dry cooling), does not open up the entire spectrum of alternative cooling technologies to challenge. If the Joint Intervenors had wished to challenge additional alleged deficiencies concerning hybrid and parallel wet/dry cooling systems, they should have raised them, with sufficient support, in the Petition, or should have timely moved to add additional bases to Contention EC 1.3. Despite the Board's May 7, 2007 Memorandum and Order at 3 (Prehearing Conference and Scheduling Order), which specifically set forth the timeframe in which a motion for amended/late-filed contentions based on new information could be filed, the Joint Intervenors filed no such motion. Accordingly, in deciding whether summary disposition is appropriate, the Board should not consider the Joint Intervenors' attempt to raise a new or amended contention concerning hybrid and parallel wet/dry cooling system alternatives.

Pursuant to 10 C.F.R. § 2.323(b), Staff counsel contacted counsel for the other parties to resolve the issues raised in this motion. Southern supports the Staff's motion. Although the Joint Intervenors do not support the Staff's motion, they do not dispute that hybrid and parallel wet/dry alternative cooling system alternatives are beyond the scope of Contention EC 1.3.

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[3] The Staff recognizes that the granting of this motion will not result in the actual expungement of material from the record because it could become relevant in a subsequent appeal. *See PPL Susquehanna LLC* (Susquehanna Steam Elec. Station, Units 1 & 2), LBP-07-4, 65 NRC 281, 301 n.86 (2007). In granting this motion, the Board would simply decline to consider portions of Joint Intervenors' EC 1.3 Answer that are outside of the scope of Contention EC 1.3.

CONCLUSION

For the reasons discussed above, the Staff's motion to strike should be granted and the Board should not consider portions of the Joint Intervenors' EC 1.3 Answer that are beyond the scope of EC 1.3, as admitted.

/signed (electronically) by/
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Dated at Rockville, Maryland
this 21st day of November, 2007

Attachment 1

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board
G. Paul Bollwerk, III, Chairman
Nicholas G. Trikouros
Dr. James Jackson

In the Matter of	)	
	)	November 7, 2007
SOUTHERN NUCLEAR OPERATING CO.	)	
	)	Docket No. 52-011-ESP
(Early Site Permit for Vogtle ESP Site)	)	ASLBP No. 07-850-01-
	)	ESP-BD01

JOINT INTERVENORS' ANSWER OPPOSING SOUTHERN NUCLEAR OPERATING CO.'S MOTION TO DISMISS AS MOOT, OR IN THE ALTERNATIVE, FOR SUMMARY DISPOSITION OF JOINT INTERVENOR'S CONTENTION 1.3

Joint Intervenors Center for a Sustainable Coast, Savannah Riverkeeper, Southern Alliance for Clean Energy, Atlanta Women's Action for New Directions, and Blue Ridge Environmental Defense League (collectively "Intervenors") hereby enter their answer opposing Southern Nuclear Operating Company's ("SNC" or "Applicant") Motion to Dismiss as Moot or in the alternative for Summary Adjudication ("Motion") of Intervenors' Environmental Contention 1.3 ("E.C. 1.3"). SNC failed to demonstrate that there is no genuine issue as to any material fact regarding the Draft Environmental Impact Statement ("DEIS). Without an adequate analysis of cooling alternatives on record, E.C 1.3 is not moot. Summary adjudication is inappropriate. Pursuant to 10 CFR §2.1205, SNC must demonstrate that there is no genuine issue as to any material fact in dispute. The Applicant must do more than merely issue a statement that there is no issue of material fact to meet its burden under 10 CFR §2.1205. Accordingly the Applicant's Motion should be denied.

The applicant's argument that E.C 1.3 is merely a contention of omission is flawed. As admitted by the Atomic Safety and Licensing Board ("Board"), E.C. 1.3 determined that the existing analysis of alternatives was inadequate. *Memorandum and Order* at 47 (March 12, 2007). The mere submission of information by the SNC or issuance of the DEIS does not render E.C. 1.3 moot. Submissions by SNC and the issuance of the DEIS have failed to provide adequate analysis of cooling alternatives to satisfy E.C. 1.3.

The Board must dismiss the applicant's Motion. The Intervenors will demonstrate that genuine issues of material fact regarding cooling alternative analysis remain in dispute. Furthermore, it will be shown that E.C. 1.3 is not one of omission. For mootness to apply here, the cooling alternative analysis on record must be "adequate." It will be shown that the analysis as required by the ASLB Order remains absent from this record and that E.C. 1.3 is not moot. Because SNC's Motion is unsupported by material fact or by an adequate alternatives analysis, there is no legal basis for granting the Applicant's Motion.

I. INTERVENORS STATEMENT OF GENUINE ISSUES OF MATERIAL FACT IN DISPUTE

On October 17, 2007, SNC concurrently filed its Motion for Summary Adjudication and submitted a "Statement of Undisputed Material Facts." Intervenors hereby reply to SNC's submission and contend that there are genuine issues of material fact still in dispute. Where Intervenors contend that no dispute exists, the statement is followed by the word "ADMITTED"; where the matter remains in dispute, the statement is followed by the word "DENIED or "ADMITTED IN PART AND DENIED IN PART" or "DENIED INSOFAR AS" and statement and/or reference for the basis of denial.

1. As permitted in 10 C.F.R. Part 52, SNC filed an application for an ESP for two additional units at the existing Vogtle Electric Generating Plant ("VEGP"). The 3,169-acre VEGP

site is located on a coastal plain bluff on the southwest side of the Savannah River in eastern Burke County, Georgia. The site is approximately 30 river miles above the U.S. 301 bridge and directly across the river from the Department of Energy's Savannah River Site (Barnwell County, South Carolina). Southern Nuclear Operating Company Vogtle Early Site Permit Application ("Application") Part 1, Section 1. SNC has selected two Westinghouse Electric Company, LLC AP1000 standard reactors as the proposed design to be constructed and operated at the VEGP site. Application Part 2, Section 1.1. **ADMITTED.**

2. The Nuclear Regulatory Commission ("NRC" or "Commission") has repeatedly expressed its desire that the next generation of nuclear plants be standardized, including the balance of plant beyond the nuclear island. *See Draft Statement of Policy on Conduct on New Reactor Licensing Proceedings,* 72 Fed. Reg. 32139, 32142 ("the Commission encourages applicants to standardize the balance of their plants insofar as is practicable"). The NRC approved the AP1000 reactor as one of four standard designs that applicants may reference in applications for combined operating licenses. The NRC has encouraged applicants to choose one of those designs to maintain standardization in their license applications. *Draft Statement on Policy of Conduct of new Reactor Licensing Proceedings,* 72 Fed. Reg. 32139 (June 11, 2007), *citing* 10 C.F.R. § 52.63 (2006). Although the balance of plant, including site specific systems such as cooling systems, are not required to be standardized by the design certification rule, the NRC has said it encourages standardization of such systems "insofar as is practicable." 72 Fed. Reg. at 32142. **DENIED**. The above-quoted language constitutes SNC's characterization of a draft NRC policy, and not a statement of material fact. If anything, this is a legal question, not a factual one, and should not be included in a statement of undisputed facts. Furthermore, the applicant relies on a draft rule that discusses standardization in terms of a streamlined application process. 72. Fed. Reg. 3239, 3214. The balance of the "standard design" for the AP1000 does not specify a dry-cool or wet-cool technology preference. Powers Declaration ¶ 12.

3. The conceptual design for the cooling system for the AP1000 Nuclear Plant was developed by Westinghouse/Toshiba with the objective of achieving a generic standardized design for use at all potential sites and for all potential clients. The standardized plant design would facilitate and expedite the licensing, procurement, construction, and commercial operation of all the standardized units. Based on the Commission's policy directive codified in 10 C.F.R. Part 52, Westinghouse and Toshiba conceptualized the design of the turbine island and cooling system components. Cuchens Affidavit, Exhibit 1 at p. 2. **DENIED**. The design by Westinghouse/Toshiba is not sacrosanct. "A standard design serves as a point of departure for customizing the design for a specific site, with specific site constrains." Powers Declaration ¶ 11. The AP 1000 standard design did not contemplate specifics unique to Plant Votgle. See *Id.* By definition the term "generic" implies that "standardized design" is broad enough to accommodate a number of potential sites with certain modifications. The cooling system falls outside the scope of standardization as described by the NRC. The NRC does not require standardization for cooling systems, of systems in the balance of the plant. 72 Fed. Reg. at 32142. The "standard design" by Westinghouse/Toshiba "accommodates

any cooling system, wet or dry, as long as the cooling system maintains steam turbine backpressure within the design limitations." Powers Declaration ¶ 13. In short, the standard design discusses backpressures, and does not, as Cuchens asserts, specify a particular cooling design. *Id.*

4. The standard AP1000 plant cooling system design includes a closed loop cooling system with a traditional steam surface condenser to condense steam from the turbine and a wet evaporative cooling tower. Cooling water is re-circulated from the tower to the condenser (for condensing steam) as the medium for transfer of heat from condensed steam emerging from the turbine. Air flowing through the cooling tower transfers heat to the air via evaporation of warm water (as a steam/plume leaving the cooling tower). Cuchens Affidavit, Exhibit 1 at. p. 3. **ADMITTED IN PART AND DENIED IN PART.** The standard AP 1000 design is not specific to any cooling system, wet or dry. As long as the steam turbine backpressure is maintained a wet or dry cooling technology can be used. Powers Declaration ¶ 12. While it is admitted that a closed loop design proposed by SNC may be integrated into the plant, the plant is not exclusive to any particular dry-cool or wet-cool technology application, contrary to SNC's assertion. *Id.*.

5. The standard design configuration of the AP1000 Nuclear Plant provides for steam to be passed across a steam turbine which turns a generator, creating electricity. The steam leaves the turbine and goes to a steam surface condenser, a large heat exchanger filled with tubes that have cold water flowing through them. The cold water in the tubes absorbs the heat from the steam, causing it to condense back into liquid form; it is then pumped back to the nuclear reactor and the process begins again. The cold water circulating through the condenser tubes is pumped out to a wet cooling tower where it is cooled off by dumping its heat to the surrounding air. Once cool, the water is pumped back through the condenser tubes. Both circuits continue in a continuous process (hence the name – "closed loop cooling system"). Cuchens Affidavit, Exhibit 1 at p. 3. **DENIED**. The standard design configuration does not contemplate a specific cooling technology. Rather, "the standard design accommodates any cooling system, wet or dry as long as the cooling system maintains steam turbine backpressure. Powers Declaration ¶ 12.

6. The Design Control Document (DCD) for the AP1000 provides that the standard turbine generator for the AP1000 Nuclear Plant is a triple exhaust turbine, which means that steam from the turbine(s) will exhaust into three separate steam surface condenser shells. These are generally referred to the high pressure, intermediate pressure, and the low pressure turbines. *Id.* For optimum plant efficiency, the multi-pressure turbine generator for the AP1000 Nuclear Plant is designed to have the following backpressures at the design inlet cold water temperature of 91ºF as indicated below (from DCP/NUS0302).

HP Turbine backpressure 3.57 "HgA
IP Turbine backpressure 2.82 "HgA
LP Turbine backpressure 2.37 "HgA
Avg. Turbine backpressure 2.92 "HgA

Cuchens Affidavit, Exhibit 1 at pp 3-7. **DENIED.** Cuchens is incorrect in asserting that only standard backpressure turbines can be used with the AP1000 design. "High backpressure turbines, rated to 8 HgA backpressure or greater, are normally specified with air-cooled installations. High backpressure turbines are simpler and less expensive than standard backpressure turbines." Powers Declaration ¶ 13.

7. Normal operation of the turbine generator is designed to be within an exhaust pressure (backpressure) range of ~ 1.0 to 5.0 "HgA. The higher the backpressure on the turbine, the less electricity the generator is able to produce, while the lower the backpressure is on the turbine, the more electricity the generator is able to produce (down to choke flow backpressure @ ~ 1.0 "HgA). Further, this corresponding increase in exhaust or backpressure associated with a dry system causes the unit to exceed its alarm point much more frequently than with a wet system, leading to more shutdowns of the unit. Cuchens Affidavit, Exhibit 1 at pp. 3-4, 10. The AP1000 standard condenser is designed to yield a gross unit generation of approximately 1,193 MW. Cuchens Affidavit, Exhibit 1 at p. 8 and Figure 5. **DENIED**. Mr. Cuchens' analysis is flawed because he assumed that only a standard backpressure turbine can be used when in fact, high pressure backpressure turbines may be used with the AP1000 design. Powers Declaration ¶ 13.

8. The AP1000 standard design calls for the turbine generator to be located on a concrete pedestal above the steam surface condenser which allows steam to be routed directly from the turbine to the condenser below. The exhaust duct carrying the steam to the condenser is called the turbine hood which functions as a distribution/transition piece from the turbine to the surface condenser below. Minimizing the pressure losses in the hood from the turbine to the condenser is important to avoid loss of turbine efficiency and electric output. The design of the entire turbine island (thermal cycle) depends on the turbine and condenser performance. The powerhouse building design is dependent on the turbine and condenser arrangement, size, and configuration. The turbine pedestal supports the turbine with the steam surface condenser located directly under the turbine and pedestal. The design of the turbine extraction piping, location of feed-water heaters, and condensate pumps is largely dependent on turbine and condenser design and location. Cuchens Affidavit, Exhibit 1 at pp. 3-4. **DENIED.** The turbine island design does not depend on the condenser performance. In modifying the design of the turbine building, the condenser may be removed and ACC steam ducts may be located in the exact spot below the steam turbine outlet. Powers Declaration ¶ 16. The steam turbine design used with the AP 1000 design, however, would not require any modification. *Id.* at 18.

9. The configuration of the triple exhaust turbine requires the steam surface condenser to also be segmented into three shells, similarly called the high pressure (HP), intermediate pressure (IP), and low pressure (LP) shells. The average pressure of the three condenser shells (HP+IP+LP)/3 is the key parameter for unit performance considerations and operating limitations on the turbine generator. Cuchens Affidavit, Exhibit 1 at p. 4. **ADMMITTED IN PART**. High backpressure turbines in combination with ACC system can be used with the AP1000 design. Powers Declaration ¶ 13.

10. The standard design for an AP1000 Nuclear Plant includes a cooling system utilizing a conventional steam surface condenser and either natural draft or mechanical cooling towers. The system relies on the cooling properties of circulating water, to achieve cooling. The standard steam surface condenser for the AP1000 Nuclear Plant includes the following design parameters:

Type Condenser:		Multi-pressure, Single Pass, Three Shell
Design Tube Material:		Titanium
Design Tube O.D. / Tube Gage:		1.0 " O.D / 22 BWG
Design Tube Velocity:		8.2 FPS
Design Flow:		600,000 GPM
Design Heat Load (MBtu/Hr):		7,565.2 Btu/Hr x 106
Design Inlet Cold Water Temperature:		91.0 °F
Design Range (Delta T - ° F):		25.2 °F
Design Surface Area:		1,235,737 Sq. Ft.
Design TTD - ° F		5.33 °F
Design Pressures	High Pressure (HP) Shell	3.57 "HgA
Intermediate Pressure (IP) Shell	2.82 "HgA	
Low Pressure (LP) Shell	2.37 "HgA	
Average (Avg.) Shell Pressure	2.92 "HgA	

Cuchens Affidavit, Exhibit 1 at p. 7. **DENIED.** Intervenors deny that the standard design of the AP1000 specifies the cooling system described above, or any cooling system. The standard design accommodates any cooling system as long as the cooling system maintains steam turbine backpressure within the design limitations of the steam turbine in the standard AP1000 design. Powers Declaration ¶ 12.

11. In contrast to the wet cooling system described in the AP1000 DCD, a dry cooling system would rely on air pumped from the outside and flowing over large metal-finned tubes to cool the steam. The steam would be piped through large ducts (16 to 20 feet or more in. diameter) to the tubes. In the cooling unit (module), the fans force the air across the finned tubes to achieve optimum heat transfer. As it rejects its heat, the steam would condense to water and be drained to a large tank from which it would be pumped back to the nuclear steam supply system. Cuchens Affidavit, Exhibit 1 at p. 9. **ADDMITTED.**

12. The chief governing design characteristic of an air cooled condenser used in a dry cooling system is the Initial Temperature Difference ("ITD"), the constant difference between the temperature of the outside air and the temperature of the steam condensing within the tube bundles. The higher the ambient temperature in which an air-cooled turbine operates, the higher the steam saturation temperature, and therefore the backpressures, of the turbine will be. Backpressure, in turn, limits the efficiency and operability of the turbine. Current "state-of-the art" air-cooled condensers for the utility industry are designed with an ITD of around 40° F, although there have been a few such condensers

built in the United States with an ITD of 35° F. No manufacturer of air-cooled condensers has successfully designed or built an air-cooled condenser with a lower ITD than this. Air cooled condensers in the United States have typically been employed in connection with smaller, combined cycle generating units with much lower heat loads than the AP1000. Cuchens Affidavit, Exhibit 1 at pp. 10-13. **DENIED** Contrary to Mr. Cuchens' assertion, air cooling at large generating units is employed in the US. Midlothian Energy uses an air cooling system at its 1,650 MW combined cycle plant located near Dallas, Texas. ~~Dominion Resources is proposing a parallel dry-wet cooling system for reactor 3 and dry- cooling system in reactor 4 at their North Anna plant in Virginia. The estimated annual average efficiency penalty of using dry cooling at Plant Vogtle is about 1.5% using a 35 F ITD ACC. Powers Declaration ¶ 15.~~ Contrary to Cuchens' assertion, it is not necessary to maintain the same backpressure with dry cooling at peak conditions that would be achieved with wet cooling. *Id.*

13. Assuming an ACC could be designed for an AP1000 that can operate at 35ºF ITD, this would result in a steam saturation temperature approaching 133.5°F at 95°F ambient temperature. This steam saturation temperature would increase backpressures on the turbine far above the optimum design backpressure (average of 2.92 "HgA) and exceed the operational limit (5.0 "HgA) in at least one of the sections of the turbine. Thus, at the design ambient temperature of 95ºF, an ACC would seriously undermine the efficiency, electrical output and even the reliability of the standard AP1000 turbine. Cuchens Affidavit, Exhibit 1 at pp. 10-12. Steam duct losses would likely further drive up the unit backpressure from the turbine outlet to the ACC significant enough (0.5-1.0 "HgA) such that that the turbine itself would almost certainly see a pressure in excess of its allowable operating pressure at the design temperature. Because of the current limit of technology as described above (a minimum 35º- 40° F internal temperature differential ITD), an ACC could not provide adequate cooling to an AP1000 standard turbine operating in South Georgia. Cuchens Affidavit, Exhibit 1 at p. 11. In South Georgia, extreme maximum temperatures recorded in the vicinity of the site have ranged from 105°F to 112°F at Louisville IE station. The station record high temperature for the Midville Experiment Station (i.e., 105°F) has been reached on four separate occasions. Individual station extreme maximum temperature records were set at multiple locations on the same or adjacent dates. The similarity of the respective extremes indicates that these statistics are reasonably representative of the temperature extremes that might be expected to be observed at the VEGP site. Application, Part 3, Section 2.7.4.1.1. An ITD of 35° at these ambient temperatures would force steam saturation temperatures for a standard AP1000 above the minimum of 133.5°, and consequently backpressures would far exceed the maximum of 5 "HgA in the high pressure shell. Cuchens Affidavit at p. 11. The minimum ITD is a material limitation on the technical feasibility of an ACC system in conjunction with the AP1000 steam turbine, especially when the peak ambient temperatures in the vicinity of Plant Vogtle are taken into account. Cuchens Affidavit, Exhibit 1 at p. 10-12. **DENIED.** Mr. Cuchens assumptions are flawed. Peak summertime design conditions occur no more than 29 hours a year. During much of the year, the ambient temperature is less than 70 F and there would be little or no differential in the MW output of wet, dry, ~~or parallel fry-wet~~ AP1000 alternatives. Powers Declaration ¶ 20. ~~See Powers Attachment D.~~ In any case, the MW differential between a

dry and a wet cooling system would only be between 15-20 MW at peak conditions. Additionally, high backpressure turbines may be substituted with standard backpressure turbine in the AP1000 design, to address efficiencies at higher temperatures. Powers Declaration ¶ 13.

14. On hot days, water tends to stay cooler than the surrounding air. Unlike wet bulb temperature, the driving force behind a wet cooling system, which remains much more constant over a day, the dry air temperature at the VEGP site can vary up to 20-30 degrees over the course of the same day. Such fluctuations in temperature translate into 20°-30° swings in the ITD. This kind of instability would harm the operation of the power plant and create reliability difficulties for the electric grid as a whole. Cuchens Affidavit, Exhibit 1 at p. 19. **DENIED.** There is no factual evidence to substantiate Cuchens' claim that temperature fluctuations create instability and potentially harm the power plant the grid as a whole. An ambient air environment absent temperature fluctuation does not exist. Considerations of swings in ambient temperature are incorporated in every plant design. Furthermore, to establish a material fact, Cuchens must do more than merely state an assumption. He must support his assertions with facts. His affidavit provides nothing outside his personal assertion that there are reliability and instability issues with temperature swings.

15. No one has ever built a triple pressure turbine that could operate continuously at pressures higher than 5 "HgA. Even if a non-standard turbine were designed to operate at high backpressures necessary for utilization of an air-cooled condenser, significant inefficiencies, loss of standardization, adverse environmental consequences and prohibitive increases in cost would result. Cuchens Affidavit, Exhibit 1 at pp. 10-13. **DENIED.** There would be no loss of standardization as outlined by the NRC draft rules. Standardization does not apply to the balance of the plant. Cooling systems are ancillary and standardization is not necessary, required or preferred. See 72 Fed. Reg. 3239, 3214 The cost of would not be prohibitive.

16. Any increase in backpressure below the trip point for the current turbine would result in a substantial reduction in electrical output. For example, assuming an *average* turbine backpressure of 4 "HgA could be achieved using an ACC in conjunction with the standard AP1000 turbine, which as noted above could not be achieved during the periods of the year in which the unit was needed most, the result would be a loss of around 40 MW out of the generator as compared to operation at the current design backpressure of 2.92 "HgA. Cuchens Affidavit, Exhibit 1 at pp. 10-12. In addition, increased station service requirements for an air-cooled system would decrease net output by another approximately 41 MW and steam duct losses of approximately 37 MW. Cuchens Affidavit, Exhibit 1 at pp. 11, 14. Thus, the minimum reduction in net output per unit would amount to approximately 118 MW. Georgia Power Company and the other utility-owners of Vogtle 3 and 4, would need to obtain other generating resources to make up the shortfall. Cuchens Affidavit, Exhibit 1 at pp. 15-16. **DENIED**. Mr. Cuchens miscalculated the minimum reduction per unit. Mr. Cuchens analysis is critically flawed. He rounds the power output differential between wet and dry cooling at peak conditions from 37MW to 40MW. Powers Declaration ¶ 20. Then he mistakenly

assumes that this differential is maintained every hour of the year. *Id.* Peak summertime conditions occur no more than 29 hours of the 8,760 hours in a year. *Id.* Calculated correctly, the average MW differential would be in the range of 15 to 20 MW during peak conditions. *Id.* And, See Powers, Attachment C. During much of the year, whenever ambient temperature is less than 70º F, there would be little or no differential in the MW output of wet, dry, ~~or parallel dry-wet~~ AP-1000 alternatives. ~~See Powers Declaration, Attachment D.~~

17. Designing a dry cooling system to match the AP1000 steam surface condenser performance is purely academic, since no such system exists and the lack of any experience with a multi-pressure turbine suggests caution in assuming viability of concept. To approximate backpressure low enough to permit efficient operation of the turbine the ACC would need to operate at an ITD of less than 20ºF, i.e. more than 40% less than the minimum ITD using current technology. Cuchens Affidavit, Exhibit 1 at pp. 12-13. **DENIED.** A dry-cool system designed to match the AP1000 design is not academic. See Powers Attachment A. See Powers Declaration ¶ 23.

18. The closed-cycle wet cooling system described in the AP1000 approved design, and included as the basis for SNC's application for an ESP, capitalizes on the cooling properties of the water to cause evaporation, something the dry system cannot do. Due to this degradation in efficiency, an air-cooled system must be significantly larger than a comparable wet system to maintain the same unit performance. Cuchens Affidavit, Exhibit 1 at p. 12-18. **DENIED**. The AP 1000 "approved design" is not limited to a closed-cycle wet cooling system. ~~There are alternative designs to dry-cool that would reduce land requirements, such as a parallel dry-cooling tower.~~ Powers Declaration ¶12.

19. Assuming the limits of current technology of dry cooling could be improved to the point that an ACC could operate at an ITD of 20ºF in order to deliver appropriate backpressures to the turbine, the VEGP site would necessitate construction of approximately 334 modules linked with large ducts and would require SNC to clear an additional area equivalent to seven football fields, or more than half a linear mile, by 300 feet for each additional VEGP unit. Cuchens Affidavit, Exhibit 1 at pp. 12-20. The additional construction and land use would harm the environment, such as by necessitating filling existing bodies of water on or on the border of the site. Such adverse environmental impacts would include the grubbing and clearing of several wooded areas, excavation impacts, and adverse impacts to Mallard Pond, a natural area within the site. Application, Part 3, Section 2.3.1.1; Affidavit of Thomas C. Moorer. **DENIED**. Only 230 modules would be required. Cuchens affidavit (14-15) identifies an ACC system composed of 230 modules at the cost of $200 million. Here, however Cuchens asserts that the only viable ACC design consists of 334 modules at a cost of $341 million. The 230 module ACC with a 30 MW parasitic fan load would result in the same annual energy penalty as the 334 module with a parasitic fan load of 44MW. Powers Declaration ¶ 15. No reason is given by Mr. Cuchens as to why the 230 ACC module is excluded from his feasibility study in favor of the larger, costlier design with no discernable advantage. Furthermore the Cuchens Affidavit offers no explanation as to

why the wet cooled system must match performance of the standard wet tower condition during peak conditions. Powers Declaration ¶ 15.

20. Specifically, installation of a dry cooling system to an AP1000 would require substantial changes to the AP1000 standard turbine building design. In place of the current steam surface condenser, three large ducts would have to be constructed beneath the turbine. These ducts would then have to be run through the walls of the turbine building and outside to a distance a minimum of 100 feet away prior to routing the ducts to individual sections of the dry cooling system up to 2000 feet away. This would necessitate changes to the wall of the turbine building and potentially the turbine pedestal. It could also cause layout changes to other equipment in order to provide a path for the steam ducts. Cuchens Affidavit, Exhibit 1 at pp. 12-18. **DENIED.** Dry cooling would not require a substantial change to the AP1000. "Removal of surface condensers will create adequate space for ACC steam ducts in the exact spot where these ducts need to be located below the steam turbine outlet." Powers Declaration ¶ 16. Although holes will have to be cut in the turbine building wall to allow the steam ducts to be interconnected to the ACC, this "in no way rises to the level of reworking the entire turbine building." No changes in the turbine pedestal would be required. Powers Declaration ¶ 16.

21. Another change that an ACC would certainly necessitate is to relocate the feed-water heaters that are currently designed to be placed in the neck of the steam surface condenser. Since there would no longer be an exhaust hood in the steam surface condenser in which to mount them, the heaters would have to be moved to a different location within the turbine building. The changes would also represent significant further deviation from the standardization of the AP1000 design. Cuchens Affidavit, Exhibit 1 at p. 19. **DENIED.** The turbine building would not have to be redesigned. These adjustments present no engineering challenge. Powers Declaration ¶ 4. Every power plant requires number of modification to a generic standard design to accommodate site-specific conditions. Powers Declaration ¶ 9. No surface condensers are used with an ACC. Powers Declaration ¶ 16. Once removed, there will be adequate space for ACC steam ducts below the steam turbine outlet.

22. The cost of constructing approximately 334 modules alone is estimated to be an additional $361 million for each nuclear unit over the cost of the standard closed cycle wet cooling system for the AP1000. Cuchens Affidavit, Exhibit 1 at p. 14. **ADMITTED IN PART, DENIED IN PART.** It is admitted that 334 modules are estimated to cost $361 million. It is denied, however, that this is a reasonable cost estimation for an ACC system. Cuchens initially identifies a 230 module system at the cost of $200 million. Yet the cooling cost study consists of 334 modules at a cost of $361 million. Powers Declaration ¶ 14. "It makes no sense to build a 334 module ACC that costs $361 and has a 44MW parasitic fan load, when a 230 module ACC with 30 MW parasitic fan load would have the same results." Powers Declaration ¶ 5. Essentially, Mr. Cuchens has ramped up the size and load of the dry-cool option, increasing fiscal and environmental costs and impacts to the dry-cool alternative. This is unreasonable as Cuchens already identified a feasible dry-cool system that was smaller and cheaper.

23. The cost of a dry cooling system is estimated to be approximately five times greater than that of the closed-cycle wet system SNC proposed in its ESP. Cuchens Affidavit, Exhibit 1 at pp. 19-20 and Appendix. This cost comparison does not take into account the additional costs arising out of changes to the re-design of the turbine building and powerhouse and of the equipment, such as condensate storage tanks, air removal systems and piping. Neither does this estimate calculate the costs of the 16-20 foot (or more) wide ducts, which no one has ever designed for turbines as large as those necessary for the AP1000. Cuchens Affidavit, Exhibit 1 at pp. 19-20 and Appendix. **DENIED.** Though Cuchens initially proposes a 230 ACC module system costing $200 million (pp 14-15), he assumes a 360 ACC modules system costing $361 million in his feasibility study. Contrary to Mr. Cuchens' assertion, the use of Air cool would not require an entire rework of the turbine building. Powers Declaration ¶ 16. In fact, Mr. Cuchens states that the AP1000 with an air-cooled condenser would be a simpler design than the design incorporating a wet-cool design. See Cuchens p.11.

24. The Draft Environmental Impact Statement ("DEIS") analyzes a dry cooling system as an alternative cooling method for Vogtle 3 and 4. The DEIS concluded that a dry cooling system, larger in size than the proposed wet cooling system, would occupy more land, affecting land use and increasing terrestrial impacts of the plant. DEIS at 9-26. **DENIED.** The DEIS discusses a hybrid wet/dry cooling system ~~but does not provide any basis or data to support this assertion~~. Size estimates are limited to characterizations as "large units," or "more land" compared to wet-cooling. *Id.* The DEIS did not determine to what extent dry-cooling would impact the land beyond impacts already imposed by the existence of the two reactors already present. There are already two nuclear reactors on site. With the addition of two more nuclear reactors and support structures, the environmental impact of dry-cooling systems might be negligible in context of entire site. Absent, any analysis on a dry-cooling system, however, the DEIS merely makes an assertion that its environmental benefits do not offset its impacts.

25. The DEIS concluded that a dry cooling system at VEGP would have greater environmental impacts, because the cooling fans would create more noise pollution, and the dry cooling system would consume more electricity. The DEIS concludes that "based on the environmental impacts related with increased land use, fuel use, spent fuel transport, spent fuel storage, and the small impact that the proposed natural draft wet-cooling tower would have on the site environment and the Savannah River, the Staff concludes that a wet cooling tower system is preferable to either a dry or hybrid wet/dry cooling system for VEGP Units 3 and 4. *Id.* **ADMITTED IN PART, DENIED IN PART**. It is admitted that the DEIS erroneously concluded that dry-cooling would pose environmental impacts and fuel requirements as stated above. As the DEIS did not include any data upon which its conclusions were based, it is unclear how the staff reached this conclusion. ~~The parasitic load for a dry cooling system could largely be eliminated by utilizing a parallel dry-wet cooling system similar to the one Dominion Resources is proposing for North Anna 3 nuclear reactor in Virginia. Powers Declaration ¶ 20.~~ During most of the year "whenever the ambient temperature is less than approximately 70º F, there would be little or no differential in the MW output of the wet, dry ~~or parallel dry-wet~~ AP 1000 alternative. *Id.* ~~See Powers Declaration Attachment D.~~

Furthermore, the land use and impacts to land would be mitigated to a large extent by designing an ACC system requiring only 230 modules. Powers Declaration ¶ 15. The DEIS concluded that the dry-cooling option would "largely eliminate" impacts on aquatic biota in the Savannah River. DEIS at 9-25. Furthermore, a dry-cool system would significantly decrease the risks associated with drought and water availability. DEIS at 9-26. Given the current drought Georgia is experiencing, issues of water usage are not adequately addressed here.

26. The need for more electricity would create more spent fuel to transport and to store. *Id.* **DENIED.** ~~The parasitic load for a dry cooling system could largely be eliminated by utilizing a parallel dry-wet cooling system similar to the one Dominion Resources is proposing for North Anna 3 nuclear reactor in Virginia. Powers Declaration ¶ 20.~~ During most of the year "whenever the ambient temperature is less than approximately 70º F, there would be little or no differential in the MW output of the wet, dry~~-or parallel dry-wet~~ AP 1000 alternative. *Id.* ~~See Powers Declaration Attachment D.~~

27. The DEIS concluded that the additional expenses associated with a dry cooling system would make it significantly less cost effective than the wet system. DEIS at 9-25. **DENIED.** The DEIS did not conclude that additional expenses purportedly associated with dry cooling systems were significant. DEIS at 9-25. Rather, the DEIS concluded that additional expenses associated with a dry cooling system rendered the technology less cost effective, but cost did not render the dry-cool infeasible. DIES at 9-25. The DEIS concluded that based on land use impacts of a dry cool system and potential noise pollution, the benefits of dry-cooling did not offset the harms imposed by a wet-cool system. DEIS at 9-25. It is not clear what data the DEIS is based on to reach its conclusion. There is no analysis provided in terms of how many dry-cool modules would be needed, at what cost or how much of a parasitic load dry-cool would require. Rather, the DEIS makes generalizations absent any apparent analysis. SNC and Cuchens asserted that 334 module ACC units would be required at the site. This is a miscalculation. See Powers Declaration ¶ 15. Mr. Powers calculates that only 230 model ACC units would be required with a 30MW parasitic fan load would be required for the same annual energy dry-cooling. *Id.* Mr. Powers points out that Mr. Cuchens identified this option, but failed to study it, instead opting to analyze a 334 module ACC. *Id.* at 14.

II. SUMMARY ADJUDICATION MUST BE DENIED BECAUSE THERE ARE GENUINE ISSUES OF MATERIAL OF FACT IN DISPUTE

The factual citations and argument set forth above are hereby realleged herein as applied to the legal issues. SNC is not entitled to summary adjudication as there are genuine issues of material fact in dispute. *See* 10 C.F.R. §§ 2.105 and 2.710(d)(2). SNC failed to meet its burden of demonstrating there is no genuine issue of material fact in dispute.

As outline above, there are a number of material facts in dispute. Submissions by SNC are riddled with flawed assumptions, misstatements of fact and policy misinterpretation. See Section I, "Statement of Fact (1-26)."

"Standardized" AP 1000 design is compatible with dry and wet cooling systems. Every power plant requires modifications to a generic standard design to accommodate site-specific conditions. Powers Declaration ¶9. The "standard design serves as a point of departure." *Id.* at ¶10. The standard design accommodates any cooling system, wet or dry, as long as the cooling system maintains steam turbine backpressure within the design specifications. *Id.* at ¶12.

A Dry-cooling System would not require an "entire rework" of the AP 1000 design. Moving Boiler feedwater pumps to a slightly different location and providing openings in exterior building walls to accommodate air cooled condenser (ACC) steam ducts is not an engineering challenge. Powers Declaration ¶11. With ACC system no surface condensers are used and can therefore be removed. *Id.* at ¶16. Removal of surface condensers will create adequate space for ACC steam ducts below the steam turbine outlet. *Id.* Holes would then have to be cut in the turbine building wall to allow the steam ducts to be interconnected to the ACC. *Id.* No other significant physical modifications would be required in or to the turbine building. *Id.*

SNC's ACC system size calculation is flawed. The estimated annual average efficiency penalty of using dry cooling at Plant Vogtle is approximately 1.5 percent using a 35 ^{o}F ITD ACC (see Attachment C). Powers Declaration¶ 15. The presumption used by SNC's expert in selecting a 20 ^{o}F ITD ACC for the feasibility study is flawed. *Id.* It is not necessary to maintain the same backpressure with dry cooling at peak hot summer day site conditions that would be achieved with wet cooling. *Id.* This presumption will always result in a spectacularly oversized

ACC design as seen in the feasibility study that considers 334 module ACC that costs $361 million and has a 44 MW parasitic fan load when a 230 module ACC with 30 MW parasitic fan load would result in the same annual energy penalty for the dry cooling option. *Id.*

SNC's dry cooling system efficiency analysis is flawed. Powers Declaration ¶18. There should be little or no difference in the parasitic load of the 35 ^{o}F ITD ACC and the 10 ^{o}F approach temperature wet cooling tower that Mr. Cuchens uses in his comparative analysis. *See Powers Attachment C for a comparison of the parasitic load of wet and dry cooling systems*. Pumping 600,000 gallons per minute of cooling water through the surface condensers in the standard AP1000 design requires large amounts of power. Power Declaration

SNC's statement that ACC systems are "Purely Academic," is a blatant misstatement of the facts. The largest air-cooled plant in the U.S. is the 1,650 MW Midlothian Energy natural gas combined cycle plant near Dallas, Texas. Powers Declaration ¶23. The largest coal-fired air-cooled plant in the U.S. is the 330 MW Wyodak plant in Wyoming. *Id.* The largest air-cooled coal-fired plant in the world is the 4,000 MW Matimba power plant in South Africa. Powers Attachment B.

The Applicant must do more than merely issue a statement that there is no issue of material fact to meet its burden under 10 CFR §2.1205. The Applicant must demonstrate that there is no issue of material fact in dispute. As set forth above, there are issues of material fact in dispute in this matter. Accordingly the Applicant's Motion should be denied.

III. INTERVENORS' CONTENTION 1.3 IS NOT MOOT

A. E.C. 1.3 is not a Contention of Omission

In asserting that E.C. 1.3 is a contention of omission, SNC fails to recognize the distinction between "inadequate analysis" and the "absence of analysis." As admitted by the Board, E.C. 1.3 contends that the existing analysis was "inadequate:"

> "The ER fails to satisfy 10 C.F.R. § 51.45(b)(3) because its analysis of the dry cooling alternatives is inadequate to address the appropriateness of a dry cooling system given the presence of extremely sensitive biological resources." CITE

(March 12, 2007). The Order establishes the presence of some kind of analysis on record; that this analysis did not satisfy federal requirements; and that as a result the analysis was inadequate.

A contention of omission is one that "alleges the omission of particular information or an issue from an application." *In the Matter of Duke Energy Corp.*, CLI-02-08, 56 N.R.C. 373, 383 (2002). If the information claimed lacking in the contention is later supplied, the contention is considered moot. *Id.* Here there was an alternative cooling analysis on record. E.C. 1.3 states that the "[ER's] analysis of dry cooling alternatives is inadequate…" *ASLB Order* at 47. The Contention identifies the ER as the submission on record containing the analysis and then determines that the analysis inadequate. The Contention does not state nor does it imply that an analysis of cooling alternatives is absent or missing. This contention does not omit particular information or an issue. Rather, the information provided is inadequate.

If the information claimed lacking in a contention of omission is later supplied, the contention is considered moot. *In the Matter of Duke Energy Corp.*, CLI-02-08, 56 N.R.C. 373, 383 (2002). But, because E.C. 1.3 is not a contention of omission, it cannot be mooted by the merely submitting information into the record. Here, there was already information in the record regarding dry-cooling alternatives. *See SNC ER XXX*. At issue here is not an absence of information, but rather the inadequacy of information. E.C. 1.3, therefore can only be rendered moot with the submission of an adequate dry-cool analysis pursuant to *ASLB Order 47*.

B. The Cooling Alternative Analysis on Record is Inadequate

Determining mootness in this case requires an examination of the information contained in the record to determine its adequacy. E.C. 1.3 established that the record was not adequate as "[t]he ER fails to satisfy 10 C.F.R. § 51.45(b)(3) because it fails to address impacts to aquatic species in its discussion of alternatives. In particular, the ER's discussion of the no-action alternative and of alternative cooling technologies fails to consider environmental and economic benefits of avoiding construction of the proposed cooling system."

When the scope of an admitted contention is in question, the Board must look to the bases discussed in support of the contention. *Duke Energy,* 56 N.R.C. at 379. The NRC Staff based admission of EC 1.3 on "whether SNC has provided an adequate analysis of dry cooling as an alternative cooling system for the proposed Vogtle facilities." NRC's Memorandum and Order: Rulings on Standings and Contentions, LBP-07-03, March 12 2007 at 19. SNC generally is obligated in the ER to discuss project alternatives and emphasize those that "appear promising in terms of environmental protection." *Id.* at 19. NRC declared that "SNC should be required to conduct further analysis as to whether, considering the present sensitive species and other pertinent factors, dry cooling is appropriate for the Vogtle site." *Id.* at 20. This contention is not about a lack of discussion, but about a lack of significant and adequate analysis on dry cooling alternatives. This is not a contention of omission, and the discussion is inadequate, therefore EC 1.3 is not moot.

The analysis on record is inadequate and does not render EC 1.3 moot. . As asserted above in the "Statement of Material Facts" and in Section II(A), material facts asserted by SNC in recent submissions are disputed do not constitute an "adequate analysis" as described by E.C.1.3. The DEIS did not analyze the dry-cooling in any detail beyond that already present in the ER. The DEIS did not identify any specific dry-cooling alternative. It did not discuss size, cost or efficiencies of dry-cooling beyond generalizations already put forward by the ER

IV. CONCLUSION

SNC's Motion for Summary Adjudication should be denied. The record shows that there are genuine issues of material fact in dispute. Assumptions and analysis put forward by SNC are flawed. SNC submissions are contradictory, misleading, and flawed. The cooling alternative analysis on record is in dispute and cannot be considered adequate without further review and clarification. Without an "adequate analysis" of cooling alternatives, E.C. 1.3 is not rendered moot. Accordingly, SNC's Motion must be dismissed.

Respectfully submitted this 13th day of November, 2007,

[Original signed by L. Sanders]

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of	)	
	)	
SOUTHERN NUCLEAR OPERATING COMPANY	)	Docket No. 52-011-ESP
	)	
	)	
(Early Site Permit for the Vogtle ESP Site)	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of the foregoing **JOINT INTERVENORS ANSWER OPPOSING SOUTHERN NUCLEAR OPERATING CO.'S MOTION FOR SUMMARY DISPOSITION OF ENVIRONMENTAL CONTENTION 1.3** have been served upon the following persons by Electronic Information Exchange and/or electronic mail.

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Dated this 13th day of November, 2007

[Original signed by L. Sanders]

____
Lawrence D. Sanders

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENCING BOARD

In the Matter of	
SOUTHERN NUCLEAR OPERATING COMPANY	Docket No. 52-011- ESP
(Early Site Permit-Vogtle Electric Generating Plant)	ASLBP No. 07-850-01-ESP-BD01

DECLARATION OF BILL POWERS

State of California

San Diego County

I, Bill Powers, do hereby declare as follows:

1. My name is Bill Powers. I am the principal of Powers Engineering, an engineering firm that consults on power generation, pollution control, and cooling technology issues and implementation. My office is located in San Diego, California. My professional and educational experience is summarized in the curriculum vitae attached to this affidavit.

2. I received a Bachelor of Science from Duke University in Mechanical Engineering and a Masters of Public Health in Environmental Sciences from the University of North Carolina. I am a registered engineer in the state of California. In 1986 I received "Engineer of the Year" award from the Naval Energy and Environment Support Activity, Port Hueneme. I also received the "Engineer of the Year" award from ENSR, Consulting and Engineering, in 1991 and "Productivity Award of Excellence" from the US Department of Defense in 1985.

3. I have over 25 years experience as a lead engineer and project manager for power generation, permitting, and emissions control projects for a number of clients. I have also served

as a power engineering expert for the cities of Carlsbad, CA, Houston, TX and Dallas, TX. I have provided expert testimony, conducted feasibility studies, and consulted on permitting regulation in a number of states including Kentucky, Georgia, Massachusetts and California.

4. In May of 2003 I co-authored and presented a paper entitled "Design Performance of Optimized Air-Cooled Condenser at Crockett Co-Generation Plant" at the EPA Symposium, Technologies Protecting Aquatic Organisms from Cooling Intake Structures. In 2005, I authored a study that examined efficiencies of Air-Cooling. See Attachment C.

5. I am familiar with SNC's application for an early site permit ("ESP") at the VEGP site. I have reviewed excerpts of NRC's Draft EIS, SNC's feasibility study on Air Cooling Condensation (ACC) system, SNC's Motion for Summary Adjudication and related documents submitted in this matter.

6. I am providing testimony in support of interveners' response to the SNC's motion for summary adjudication.

7. The analysis put forward by SNC's feasibility study and its expert, Mr. Cuchens, is flawed. Despite the absence of a cooling technology in a standard design, Mr. Cuchens asserts that a dry cool system at Plant Vogtle deviates from the AP100 "standard design." His statement claiming the plant would need to be "totally reworked" to accommodate the AAC system, is a gross mischaracterization of the simple modifications that would be required. Disregarding other nuclear plant designs incorporating dry-cooling technology in the U.S. and abroad, Mr. Cuchens and SNC incorrectly state that dry cool technologically is impossible and economically infeasible. These conclusions and assertions are incorrect.

8. The cooling component of a nuclear plant is an ancillary system that is not part of the core generating system. Use of air- cooling technology in this case has no impact on this or any

AP1000 reactor design that contains or carries radioactive substances. There is no nuclear safety risk in selecting air cooling over a wet cooling tower in this pressurized water reactor application.

9. Every power plant that is built requires numerous modifications to a generic standard design to accommodate site-specific conditions. Water availability and environmental impacts are issues at nuclear plant sites and may make modification to a standard design based on a wet cooling tower necessary. ~~For example, Dominion Resources is currently proposing a parallel dry-wet cooling system to greatly reduce water consumption in the cooling system that will be used at the North Anna 3 and 4 nuclear reactors (Virginia).~~ At the Palo Verde Nuclear Plant in Arizona, a plant expansion proposed in the late 1970s included the construction of two dry-cooled 1,100 MW nuclear reactors. If water availability is an issue, either to protect aquatic resources or for lack of sufficient flow, either dry cooling ~~or parallel dry-wet cooling~~ must be used. This is not an engineering gamble that could pose a risk to the reliable performance of the nuclear power plant. It is a necessary technical adjustment to the plant design to accommodate site-specific limitations.

10. Dry-Cool technology does not deviate from any "standard design" of the AP1000. Mr. Cuchens of Southern Company implies that the standard AP1000 design is sacrosanct and cannot be modified without ominous repercussions asserted in his June 25, 2007 analysis titled, "*Feasibility of Air-Cooled Condenser Cooling System for the Standardized AP1000 Nuclear Plant – Revision 3*." There is no engineering or technical basis for these implications, and those that are offered are not substantiated in any way.

11. A standard design serves as a point of departure for customizing the design for a specific site with specific site constraints. The engineering teams at Westinghouse Nuclear and Toshiba

that developed the standard AP1000 design have no knowledge of site constraints specific to Plant Vogtle or any other site-specific design. To imply that moving boiler feedwater pumps to a slightly different location and providing openings in building walls to accommodate air cooled condenser (ACC) steam ducts is a major engineering challenge is erroneous. These adjustments present no engineering challenge. They are simply design engineering adjustments necessary to accommodate the air-cooled system.

12. Mr. Cuchens's statements regarding cooling system within the context of a "standard design" are contradictory and misleading. Mr. Cuchens correctly states that the cooling system is part of the "balance of plant," including ancillary systems that are necessary for the plant to function, but that are not part of the core power generation system. He goes further to point out that no particular wet cooling system is identified in the standard design. It could be any wet cooling system. Mr. Cuchens is incorrect, however, in claiming that the standard design precludes dry cooling or air cooling technology. In fact, the standard design accommodates any cooling system, wet or dry, as long as the cooling system maintains steam turbine backpressure within the design limitations of the steam turbine established by Westinghouse Nuclear in its standard AP1000 design.

13. One implication of Mr. Cuchens's flawed analysis is that only a standard backpressure turbine can be used with the AP1000 design. High backpressure turbines, rated to 8 inches of mercury (Hg) backpressure or greater, are normally specified with air-cooled installations. High backpressure turbines are simpler and less expensive than standard backpressure turbines. This

means that Southern Company might save money on the steam turbine portion of the AP1000 standard design if an air-cooled system is selected.[1]

14. Mr. Cuchens identifies 35 ^{o}F ITD as the state-of-the-art level for ACC technology, and shows that 35 ^{o}F ITD ACC will maintain steam turbine backpressure within the performance envelope of the standard AP1000 steam turbine across the entire ambient temperature range at the Vogtle site. Mr. Cuchens identifies the size and cost of a 35 ^{o}F ITD ACC as 230 modules and $200 million respectively (pp. 14-15), yet he does the cooling case study using a 20 ^{o}F ITD ACC that consists of 334 modules and costs $361 million. The 20 ^{o}F ITD ACC matches the hot day performance of the wet cooling tower assumed to be a part of the standard AP1000 design. No reason is given by Mr. Cuchens explaining why the dry cooled system must match the performance of the standard wet tower system at peak hot day conditions.

15. The estimated annual average efficiency penalty of using dry cooling at Plant Vogtle is approximately 1.5 percent using a 35 ^{o}F ITD ACC (see Attachment C). The presumption used by Mr. Cuchens in selecting a 20 ^{o}F ITD ACC for the case study: that it is necessary to maintain the same backpressure with dry cooling at peak hot summer day site conditions that would be achieved with wet cooling. This presumption will always result in a spectacularly oversized ACC design. It makes no sense to build a 334 module ACC that costs $361 million and has a 44 MW parasitic fan load when a 230 module ACC with 30 MW parasitic fan load would result in the same annual energy penalty for the dry cooling option. ACC design is a balance between cost, size, and performance.

16. Contrary to Mr. Cuchens's assertion, the use of Air Cool technology would not require an entire "reworking of the turbine building." Mr. Cuchens refers to the large surface condensers

[1] Telephone communication between Charles Jones, General Electric, and Bill Powers, Powers Engineering, July 26, 2002, regarding the design and cost of a high backpressure GE D11 steam turbine for use with an air-cooled condenser.

included in the standard AP1000 design and provides an artist's rendition of the condensers (pp. 7-8). He then goes on to state, "If an ACC were to be designed for an AP1000 unit, the entire turbine building would have to be reworked. In place of the current steam surface condenser, three large ducts would have to be constructed beneath the turbine." Mr. Cuchens' assertion that the entire turbine building would have to be reworked is an inaccurate characterization. Mr. Cuchens discusses plant modifications, none of which constitute a "reworking" of the entire turbine building. As he points out, the surface condensers necessary for wet cool systems are very large. No surface condensers are used with an ACC. Removal of surface condensers will create adequate space for ACC steam ducts in the exact spot where these ducts need to be located below the steam turbine outlet. Holes will have to be cut in the turbine building wall to allow the steam ducts to be interconnected to the ACC. Cutting 20-foot diameter holes in the wall of a large industrial building in no way rises to the level of "reworking the entire turbine building." No other significant physical modifications will be required in or to the turbine building.

17. Mr. Cuchens correctly notes that the AP1000 with an air-cooled condenser would be simpler than the standard AP1000 design (p. 11). It is generally considered desirable in the power plant design engineering world to simplify complex systems wherever possibility. Simplification generally makes the system more reliable.

18. Dry cooling technology has the potential for far greater efficiency than SNC and Mr. Cuchens purport in their analysis. Mr. Cuchens examines efficiencies of 334 and 230 module dry cooling design compared to a wet cooling system. The 14 MW higher parasitic fan load of the 334 module ACC design essentially negates the higher efficiency of the 334 module design relative to the 230 module design. There should be little or no difference in the parasitic load of the 35 ^{o}F ITD ACC and the 10 ^{o}F approach temperature wet cooling tower that Mr. Cuchens uses

in his comparative analysis. See Attachment C for a comparison of the parasitic load of wet and dry cooling systems. Pumping 600,000 gallons per minute of cooling water through the surface condensers in the standard AP1000 design requires large amounts of power. The wet cooling tower also has 48 modules and the power demand of 48 large fans serving those modules.

19. Mr. Cuchens correctly states that use of this 35 ^{o}F state-of-the-art design would not require any modification to the standard steam turbine used with the AP1000 design. Use of the 35 ^{o}F ITD ACC would result in a 37 MW reduction in gross power output, a reduction from 1,193 MW to 1,156 MW, at the design ambient temperature of 95 ^{o}F (see table on p. 12). The design ambient temperature is also known as the 1 percent summertime temperature, the temperature that is reached or exceeded for 1 percent of the summertime hours. One (1) percent of summertime hours is 29 hours per year.

20. Mr. Cuchens then goes on to round the 37 MW power output differential between wet and dry cooling at peak summertime design conditions to 40 MW and to assume that this differential is maintained every hour of the year. Mr. Cuchens states (p. 11):

> "For example, assuming an average turbine backpressure 4" HgA could be achieved using an ACC in conjunction with the standard AP1000 turbine, which as noted above could not be achieved during the periods of the year in which the unit was needed most, the result would be a loss of around 40 MW out of the generator as compared to operation at the current design backpressure of 2.92" HgA."

This assumption is flawed. Peak summertime design conditions occur no more than 29 hours a year. The 37 MW differential occurs for 29 hours a year. There are 8,760 hours in a year. The average MW differential between wet and dry cooling using a 35 ^{o}F ITD ACC would fall in the range of 15 to 20 MW. See Attachment C. ~~This MW differential can be further reduced by utilizing a parallel dry-wet cooling system, as Dominion Resources is proposing for the North Anna 3 nuclear reactor in Virginia.~~ However, during much of the year, whenever the ambient temperature is less than approximately 70 ^{o}F, there would be little or no differential in the MW output of the wet, dry, ~~or parallel dry-wet~~ AP1000 alternatives. ~~See Attachment D.~~

21. Also, peak summertime load is not met by power produced by nuclear generation. Nuclear generation serves baseload power demand. When there is a peak in power demand, simple cycles gas turbines are brought online. Unlike nuclear plants, gas can be brought on and off line quickly. Peak load in most regions of the country is on the order of double the average annual load. If Southern Company considers it essential to maintain the standard wet-cooled AP1000 output on hottest day with a unit equipped with dry cooling, the most inexpensive approach would the addition of one 47 MW LM6000 peaking gas turbine at the site to address the peak day output reduction associated with use of the 35 ^{o}F ITD ACC. The equipment cost of one 47 MW LM6000 is approximately $13 million.[2] This is far less than the difference in cost of $161 million between a 20 ^{o}F ITD ACC and a 35 ^{o}F ITD ACC for the AP1000. The LM6000 is also much more thermally efficient than the AP1000. Given that the LM6000 would be used very infrequently, on the order of a few hundred hours per year at most, this approach would have almost no impact on the overall cost of the power produced at Vogtle.

22. The parasitic fan load of the ACC can also be completely eliminated by selecting a natural draft ACC. A discussion of Heller natural draft ACCs is included in Attachment E. Attachment E also includes a description of ACC spray augmentation to increase power output on hot days~~ as well as several types of parallel dry-wet cooling system designs~~. Direct and indirect natural draft ACCs provided by Balcke Durr, now SPX, are described in Attachment E.

23. There are dozens of coal- and natural gas-fired plants in the U.S. that use air-cooled condensers. The largest air-cooled plant in the U.S. is the 1,650 MW Midlothian Energy natural gas combined cycle plant near Dallas, Texas. The largest coal-fired air-cooled plant in the U.S.

[2] Gas Turbine World, 2006 Gas Turbine World Handbook – Simple Cycle Prices, 2006, p. 15.

is the 330 MW Wyodak plant in Wyoming. The largest air-cooled coal-fired plant in the world is the 4,000 MW Matimba power plant in South Africa. Photographs of the Midlothian and Matimba ACCs are provided in Attachment B.

I declare under penalty of perjury that the foregoing is true and correct. Executed on November 12, 2007.

Executed in Accord with 10 C.F.R. § 2.304(d)

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Bill Powers, P.E.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
SOUTHERN NUCLEAR OPERATING CO.	)	Docket No. 52-011-ESP
	)	
(Early Site Permit for Vogtle ESP Site)	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of "NRC STAFF'S MOTION TO STRIKE PORTIONS OF JOINT INTERVENORS' ANSWER OPPOSING SUMMARY DISPOSITION OF EC 1.3" have been served upon the following persons by Electronic Information Exchange this 21st day of November, 2007:

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