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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 TESTIMONY OF DR. MICHAEL T. MASNIK, REBEKAH H. KRIEG, JILL S. CAVERLY, AND LANCE W. VAIL CONCERNING ENVIRONMENTAL CONTENTION EC 1.3

Q1. Please state your names, occupations, and by whom are you employed.

A1(a). (MTM) My name is Michael T. Masnik (MTM). I am employed as a Senior Aquatic Biologist in the Division of Site and Environmental Reviews in the U.S. Nuclear Regulatory Commission's ("NRC") Office of New Reactors. I am the lead technical reviewer for the NRC on the aquatic resources issues associated with the application submitted on August 14, 2006, by Southern Nuclear Operating Company, Inc. ("Southern" or "Applicant") for an early site permit ("ESP") for a site within the existing Vogtle Electric Generating Plant ("VEGP") site near Waynesboro, Georgia. A statement of my professional qualifications is attached hereto.

A1(b). (RHK) My name is Rebekah H. Krieg (RHK). I am employed as a Senior Research Scientist in the Ecology Group, Environmental Sustainability Division, Energy and environment Directorate of the Pacific Northwest National Laboratory ("PNNL"). I am a technical reviewer for PNNL's contract with the NRC on aquatic resource issues associated with the application submitted on August 14, 2006, by Southern for an ESP for a site within the existing VEGP site near Waynesboro, Georgia. A statement of my professional qualifications is attached hereto.

A1(c). (LWV) My name is Lance Vail (LWV). I am employed as a Senior Research Engineer in the Hydrology Group, Environmental Sustainability Division, Energy and

environment Directorate of PNNL. I am a technical reviewer for PNNL's contract with the NRC on hydrological alterations, water use, and water quality issues associated with the application submitted on August 14, 2006, by Southern for an ESP for a site within the existing VEGP site near Waynesboro, GA. A statement of my professional qualifications is attached hereto.

A1(d). (JSC) My name is Jill S. Caverly (JSC). I am employed as a Hydrologist in the Division of Site and Environmental Reviews, Office of New Reactors (NRO), NRC. I am a technical reviewer for the NRC on hydrological alterations, water use, and water quality issues associated with the application submitted on August 14, 2006, by Southern for an early site permit ESP for a site within the existing VEGP site near Waynesboro, GA. A statement of my professional qualifications is attached hereto.

Q2. Please describe your current responsibilities in relation to this review.

A2(a). (MTM) As part of my official responsibilities as the senior aquatic biologist assigned to the VEGP ESP review, I provided technical oversight to the NRC and PNNL reviewers as well as performing aspects of the review related directly to a portion of evaluation of impact to aquatic organisms due to interactions with the proposed station intake and discharge structures. My assessment of impact is contained in part in sections 4.4, 5.4 and 7.5 of NUREG 1872, Final Environmental Impact Statement for an Early Site Permit (ESP) at the VEGP site, August 2008 ("FEIS") (Exhibit NRC-1). I also had technical input to the descriptive information contained in Section 2.7.2 of the FEIS.

A2(b). (RHK) In my current responsibility as the aquatic ecology technical reviewer assigned to the VEGP ESP review, I wrote the descriptive information contained in Section 2.7.2 and performed the review of the impact to aquatic organisms due to interactions with the proposed station intake and discharge structures as presented in Sections 5.4 and 7.5 of NUREG 1872, Final Environmental Impact Statement for an Early Site Permit (ESP) at the VEGP site," August 2008 ("FEIS"). I worked under the technical oversight of Dr. Michael T. Masnik of the NRC.

A2(c). (LWV) In my current responsibility as the hydrology technical reviewer assigned to the VEGP ESP review, I am responsible for the analysis related to surface water and plant water systems documented in Chapters 2, 3, 4, 5, 7, and 9 of NUREG 1872, Final Environmental Impact Statement for an Early Site Permit (ESP) at the VEGP site," August 2008 ("FEIS").

A2(d). (JSC) In my current responsibility as the hydrology technical reviewer assigned to the VEGP ESP review, I am responsible for reviewing the text prepared by Mr. Vail (LWV) related to surface and groundwater and plant water systems and documented in Chapters 2, 3, 4, 5, 7, and 9 of NUREG 1872, Final Environmental Impact Statement for an Early Site Permit (ESP) at the VEGP site," August 2008 ("FEIS"). I became familiar with this review when I was assigned responsibility in June 2008.

Q3. What is the purpose of this testimony?

A3. (ALL) The purpose of this testimony is to present the NRC Staff's views with respect to Contention EC 1.3, which challenges the adequacy of the alternatives analysis of a dry cooling system in the FEIS.

Q4(a). Are you familiar with Contention 1.3?

A4(a). (ALL) Yes. Contention EC 1.3, submitted in this proceeding by 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 (collectively, "Joint Intervenors"), as restated by the Atomic Safety and Licensing Board in its Memorandum and Order of March 12, 2007, alleges that:

> The [Environmental Report (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.

(MTM, RHK) We are familiar with the contention and the bases submitted in its support presented in the Joint Intervenors' filing dated December 11, 2006, as well as with the

declarations of Shawn Paul Young, Ph.D., dated December 07, 2006, November 11, 2007, and September 22, 2008. It is our understanding that the contention concerns the adequacy of the alternatives analysis regarding the appropriateness of a dry cooling system for VEGP Units 3 and 4. Specifically, it alleges that the Staff is required to perform a more in-depth alternatives analysis given the presence of extremely sensitive biological resources.

(JSC, LWV) We are familiar with the contention and the bases submitted in its support presented in the Joint Intervenors' filing dated December 11, 2006, as well as with the declaration of Barry W. Sulkin, dated November 9, 2007, the declaration of Bill Powers dated November 12, 2007, and the declarations of Thomas C. Moorer dated October 17, 2007 and James W. Cuchens dated October 15, 2007. It is our understanding that the contention concerns the adequacy of the alternatives analysis regarding the appropriateness of a dry cooling system for VEGP Units 3 and 4. Specifically, it alleges that the Staff is required to perform a more in-depth alternatives analysis given the presence of extremely sensitive biological resources

(All) The Staff discusses system design alternatives, including plant cooling systems, in section 9.3 of the FEIS. That FEIS section discusses once-through cooling systems, dry cooling towers, and wet/dry hybrid cooling towers. Our testimony therefore focuses on the Staff analysis documented in the FEIS. However, in preparing this testimony we have also considered and referenced the specific documents listed below:

- NUREG-1555 Standard Review Plans for Environmental Reviews for Nuclear Power Plants ("ESRP") (2000) (Exhibit NRC-9).
- NUREG-1555 Standard Review Plans for Environmental Reviews for Nuclear Power Plants ("ESRP") Rev. 1 (2007) (Exhibit NRC-10).
- United States Environmental Protection Agency, "National Pollutant Discharge Elimination System; Regulations Addressing Cooling Water Intake Structures for New Facilities; Final Rule" 66 Fed. Reg. 65,256, (December 18, 2001) (Exhibit NRC-35)
- Regulatory Guide 4.2 Rev. 2, "Preparation of Environmental Reports for Nuclear Power Stations" (1976) (Exhibit NRC-7).

- Status Review of the Atlantic sturgeon, (prepared by the Atlantic Sturgeon Status Review Team for the National Marine Fisheries Service National Oceanic and Atmospheric Administration dated February 23, 2007, updated with corrections on July 27, 2007) (Exhibit NRC-25).

- Grabowski T.B. and J.J. Isely. 2006. "Seasonal and Diel Movements and Habitat Use of Robust Redhorses in the Lower Savannah River, Georgia, and South Carolina." Transactions of the American Fisheries Society 135(5):1145-1155. (Exhibit NRC-17).

- Draft Interim Report of Fish Impingement and Entrainment Assessment at the Plant Vogtle Electric Generating Plant (Exhibit NRC-30).

- Richmond, A.M. and B. Kynard. 1995. "Ontogenetic Behavior of Shortnose Sturgeon, Acipenser brevirostrum." Copeia (1):72-182. (Exhibit NRC-46).

- Hall J.W., T.I.J. Smith, and S.D. Lamprecht. 1991. "Movements and Habitats of Shortnose Sturgeon, Acipenser brevirostrum, in the Savannah River." Copeia 1991 (3):695-702 (Exhibit NRC-47).

- Collins M.R. and T.I.J. Smith. 1997. "Distributions of Shortnose and Atlantic Sturgeon in South Carolina." North American Journal of Fisheries Management, 17:995-1000. (Exhibit NRC-22).

- Letter from United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service from Roy E. Crabtree, Ph.D., Regional Administrator, to William Burton, dated August 11, 2008, “A Biological Assessment for the Shortnose Sturgeon for the Vogtle Electric Generating Plant Early Site Permit Application.” (Exhibit SNC000022).

I. Cooling System Designs

Q5. Describe briefly the cooling system that is proposed in the application.

A5. (LWV, JSC) The applicant proposes a closed-cycle wet cooling system. Exhibit NRC-1 at 3-5 to 3-8. In a closed-cycle wet cooling system, the majority of the heat is dissipated to the atmosphere through the evaporation of water. A fraction of the water withdrawn from the river is returned as blowdown to the river. The entire volume of the water evaporated is assumed to be consumed. In contrast, the water returned to the river is generally not assumed to be consumed. Conversely, an open-cycle cooling once-through system withdraws vastly more water than a closed-cycle wet cooling system and returns all the reject heat to the water body as sensible heat instead of discharging it to the atmosphere. Compared to a once-through

system, a closed-cycle system results in greater net loss of water to the water source, in this case the Savannah River.

Q6. What regulations or guidance does the Staff follow in evaluating alternatives to the cooling system proposed by the applicant?

A6. (LWV, JSC) Pursuant to 10 C.F.R. 51.45(b)(3), the Staff must consider alternatives to the proposed heat dissipation system. The Staff analyzes heat dissipation design alternatives using the guidance in Section 9.4.1 of the ESRP. Exhibit NRC-10 at 9.4.1-1 to 9.4.1-13.

Q7. Did the Staff evaluate cooling system design alternatives in the FEIS? Did the analysis include evaluation of a dry cooling system?

A7. (LWV, JSC) Yes, in Chapter 9 of the FEIS, the Staff considered open-cycle once–through, and closed-cycle dry or wet/dry hybrid cooling systems. The Staff found that a once-through system for both units would withdraw essentially the entire flow of the river during a low flow period, making this alternative clearly unsuitable for the VEGP site and not preferable to the proposed closed-cycle wet cooling system. Exhibit NRC-1 at 9-26. The Staff determined that a wet/dry closed-cycle alternative would reduce the impacts to water supply and water quality. *Id*. The Staff also determined that a dry closed-cycle cooling system would eliminate impacts to water supply and water quality. *Id.* at 9-27.

Q8. Please describe in general terms the “dry cooling” system design the Staff considered.

A8. (LWV, JSC) As considered by the Staff in the FEIS, a dry cooling system transfers reject heat to the atmosphere as sensible heat, whereas wet cooling transfers most of the heat into the latent heat of evaporation of water. Simply stated, dry cooling systems transfer heat to the atmosphere by heating up the air, whereas wet cooling towers transfer heat by adding water vapor to the atmosphere. Therefore, a dry cooling system involves moving large volumes of air to exchange heat directly to the air and is limited by the temperature of the air. A

wet cooling tower is controlled by the air temperature and relative humidity. The effect of the humidity (wet bulb temperature) makes it easier for wet cooling systems to obtain a lower temperature of cooling water being returned to the condenser in most conditions.

Q9. Did the Staff reach a conclusion as to whether a dry cooling system would be preferable to the wet tower system proposed for Units 3 and 4?

A9. (LWV, JSC) Yes, the Staff found that a dry cooling system would not be environmentally preferable to the proposed wet tower system. *Id*.

Q10. Would dry cooling largely eliminate impacts on aquatic biota (by eliminating thermal and chemical discharges as well as losses to organisms due to impingement and entrainment)?

A10. (MTM) Yes. Dry cooling towers would transfer sensible heat directly to the atmosphere. The makeup flow rate to the circulating water system would be negligible. It is estimated to be on the order of one gallon per minute. There would be no routine blowdown from the circulating water system. Therefore, with no makeup other than the one gallon per minute mentioned above and no blowdown, there would be no impingement or entrainment of any significance and no thermal or chemical discharges from a dry cooling system.

Q11. If dry cooling would eliminate those impacts, what was the Staff's basis for concluding that dry cooling would not be preferable to the proposed wet cooling system?

A11. (LWV, JSC, MTM) The Staff explicitly states in the FEIS that use of a dry cooling system would essentially eliminate all impacts to water resources (including with respect to water use, water quality, and aquatic ecosystems). Exhibit NRC-1 at 9-26 and 9-27. However, the Staff also acknowledges that there would be some disadvantages with use of a dry cooling system, including with respect to land use, fuel use, spent fuel transport, and spent fuel storage. *Id.* at 9-27. Dry cooling systems involve very large heat-exchange surface areas that would require more land area than an equivalent capacity natural-draft or mechanical-draft cooling system. As mentioned in the answer to Question 8, the temperature of cooling water being

returned to the condenser would be lower for a wet cooling system than a dry cooling system, thereby allowing the plant with the wet cooling system to operate at a higher electrical generation efficiency. Therefore, a dry cooling system would have an increase in fuel use and an associated increase in spent fuel transport and spent fuel storage to match the electrical output of a similar plant with wet cooling.

Q12. Were the disadvantages of dry cooling mentioned in the FEIS (parasitic energy costs such as fans, reduced generation efficiency, fuel cycle, land use, etc.) the sole basis for the Staff's conclusion with respect to whether a dry cooling system would be preferable at the Vogtle ESP site?

A12. (LWV) No. The FEIS stated that even with those disadvantages, the Staff might consider a dry cooling system to be a preferred option if the proposed wet tower system would cause significant adverse impacts to water availability, water quality, or aquatic resources. *Id.* at 9-27.

Q13. Did the Staff find that the proposed wet tower system would cause significant adverse impacts?

A13. (MTM, LWV) No. In Chapters 4, 5, and 7 of the FEIS, the Staff concluded that the impacts of the proposed cooling tower system would be SMALL.

Q14. Did the Staff consider the arguments set forth by the Applicant and Joint Intervenors regarding the technical feasibility of using a dry cooling system at VEGP?

A14. (LWV, JSC) In connection with the Applicant's motions for summary disposition of the admitted contentions, the Applicant and the Joint Intervenors presented arguments concerning the technical feasibility and costs of a dry cooling alternative for the AP1000 reactor design at the VEGP ESP site. The Staff has not evaluated the technical feasibility or precise costs of using dry cooling for the AP1000 design at Vogtle and takes no position regarding the merits of either the Joint Intervenors' or the Applicant's testimony concerning technical feasibility. Instead, the Staff has relied on the rationale presented in this testimony and in the

FEIS. However, because both filings occurred before the FEIS was completed, the Staff was familiar with the general arguments presented by both of the other parties. The Applicant and Joint Intervenors appeared to agree that compared to the proposed wet-tower design, dry cooling would A) require more land, B) cost more to implement, and C) decrease the operating efficiency of the plants. The Staff thus understands the other two parties to dispute the magnitude of these impacts, but not their existence.

Q. 15. How did the Staff decide whether to consider dry cooling in more detail in the FEIS?

A. 15. (LWV) Section 9.4.1 of the ESRP states:

> The depth of the analysis should be governed by the nature and magnitude of proposed heat dissipation system impacts predicted by the reviews of ESRP Chapters 4.0 and 5.0. If adverse impacts are predicted, the reviewers should coordinate in identifying and analyzing means to mitigate these impacts. The proposed system with any verified mitigation schemes (i.e., measures and controls to limit adverse impacts) should be the baseline system against which alternative heat dissipation systems are compared. The nature and adversity of the remaining unmitigated impacts for this baseline system should establish the level of analysis required in the review of alternative systems. This should permit staff evaluation and conclusions with respect to the environmental preference of these alternatives. When no adverse impacts have been predicted for the proposed system and the system will comply with the requirements of the CWA, the reviewer should conclude that there are no environmentally preferable heat dissipation-system alternatives.
>
> Exhibit NRC-10 at 9.4.1-5.

Based on the Staff's assessment that all the heat dissipation system related impacts in Chapters 4.0 and 5.0 of the FEIS were SMALL and the Staff's assessment that there would be some adverse impacts with the subject alternative (dry cooling), the Staff determined that there are no preferable heat dissipations systems. Exhibit NRC-1 at 9-27.

Q16. Why did the Staff not consider dry cooling in more detail in the FEIS?

A16. (MTM, LWV) From the perspective of assessing impacts to the aquatic biota, the Staff concluded that impingement and entrainment losses due to operation of the proposed intake, and station thermal and chemical discharges, even under low flow river conditions,

would only have at most a SMALL impact on aquatic organisms. *Id.* at 5-39. Additionally, water use and water quality impacts would also be SMALL. A SMALL impact is defined in Section 1 of the FEIS on page 1-4 as "environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource." *Id.* at 1-4.

Consistent with ESRP Section 9.4.1, the depth of the Staff's system design alternatives analysis was governed by the nature and magnitude of proposed heat dissipation system impacts predicted by the reviews of FEIS Chapters 4.0 and 5.0. The Staff determined in Chapters 4 and 5 that the impacts to water resources from the proposed wet cooling tower system were SMALL. If the Staff had instead reached a conclusion that water-related impacts were greater than SMALL, the Staff would have identified and analyzed alternatives in greater depth.

In other words, the impacts from the proposed cooling system provided the baseline against which impacts from alternative heat dissipation systems were compared. The nature of the water impacts that the Staff analyzed for this baseline cooling system (SMALL) established what depth of analysis was required in the review of alternative cooling systems. As further described in Chapter 5 of the FEIS, the Staff determined impacts would be SMALL for the proposed system because of the availability of water in the Savannah River to meet the consumptive and nonconsumptive requirements of the closed-cycle cooling system and to assimilate effluents under both normal conditions and even under drought conditions. This SMALL impact and the fact that several disadvantages of the dry-cooling alternative were identified provided the basis for the Staff's concluding that the identified alternative heat dissipation-system alternative would not be environmentally preferable to the proposed wet cooling system.

II. Impacts to Aquatic Resources

Q17. The admitted contention refers to the appropriateness of a dry cooling system given the presence of "extremely sensitive biological resources." Is the Staff familiar with that term?

A17. (MTM) Yes. The Staff is familiar with the term. It appears in the U.S. EPA's December 18, 2001 rulemaking entitled "National Pollutant Discharge Elimination System; Regulations Addressing Cooling Water Intake Structures for New Facilities; Final Rule." Exhibit NRC-35. Section V.C. of the December 18, 2001 rulemaking states:

> Although EPA has rejected dry cooling technology as a national minimum requirement, EPA does not intend to restrict the use of dry cooling or to dispute that dry cooling may be the appropriate cooling technology for some facilities. This could be the case in areas with limited water available for cooling or waterbodies with extremely sensitive biological resources (e.g., endangered species, specially protected areas).

Id. at 65,282.

Q18. What does the Staff believe the EPA meant in establishing this category of aquatic biota?

A18. (MTM) The construct "extremely sensitive biological resource" is mentioned only once in the 91 page rulemaking. It is not defined in the *Federal Register* notice and is not a term that is commonly used elsewhere in evaluating impact. The State of California does refer to a category of "sensitive biological resources"; however, I believe the use of that category, in an official context, is limited to the State of California. The December 18, 2001 U. S. EPA rulemaking does provide two general examples of extremely sensitive biological resources they are: "endangered species" and "specially protected areas." *Id.* at 65,282. It is not clear whether these examples refer to just Federally-protected endangered species or Federally-protected threatened and endangered species and/or state protected species. It is also unclear if the examples given are all inclusive or whether there are other categories or examples of

extremely sensitive biological organisms. In my opinion, the U.S. EPA recognized that under certain limited situations where there are formally-protected species or habitat that potentially could be seriously harmed by operation of a water withdrawal system, or the consumptive use of the withdrawn water might remove or alter significantly the aquatic environment affecting protected or valued species, or that habitat critical to the existence of the species might be harmed, the use of dry cooling may be warranted. I believe "extremely sensitive biological resources" used by the U.S. EPA is a subset and a more restrictive category than the NRC Staff's concept of "important species."

Q19. Did the Staff in the FEIS identify species in the vicinity of the site that could be considered "extremely sensitive biological resources?

A19. (RHK, MTM) The Staff did not use the concept of "extremely sensitive biological resources" in its review. Instead, the Staff relied on the concept of "important species" as defined in Regulatory Guide (RG) 4.2 (Exhibit NRC-7 at 2-3, 2-4), Section 2.7 of the FEIS, and ESRP Section 2.4.2-7 (Exhibit NRC-9) to assess the impact from VEGP Units 3 and 4 on aquatic resources. For a more in depth discussion of "important species," see the Staff's response to Questions 10 and 11 in the testimony for Environmental Contention 1.2. Not all species identified by the Staff as "important" would be considered "extremely sensitive biological resources." However, as we understand the concept all "extremely sensitive biological resources" would likely be considered "important." Therefore, the Staff in the FEIS did evaluate the potential impacts to any other species that might be considered "extremely sensitive biological resources" and concluded that the impacts, if any, would be minor. Exhibit NRC-1 at 5-36 to 5-37, 5-41 to 5-42.

There are no specially protected aquatic areas in the vicinity of the VEGP site that could be adversely affected by operation of two additional units. The only Federally protected aquatic species occurring in the vicinity of the VEGP site is the shortnose sturgeon, *Acipenser brevirostrum*. The Joint Intervenors identified two species present in the Savannah River that

they claim would qualify as “extremely sensitive biological resources.” Those are the endangered shortnose sturgeon and the State of Georgia endangered robust redhorse, *Moxostoma robustum*. The robust redhorse is not afforded Federal protection under the Endangered Species Act. However, both the shortnose sturgeon and the robust redhorse are considered by the NRC Staff to be “important species” and potential impacts to these two species as a result of the operation of two additional units at the VEGP site using wet closed-cycle cooling are discussed in the FEIS. *Id.* at 5-36, 5-41 to 5-42.

Q20. Has the Staff identified any species since the publication of the FEIS that would be considered an ”important species” and would they likely be adversely affected by operation of the proposed VEGP units 3 and 4?

A20. (RHK) In the FEIS, the Staff identified the Atlantic sturgeon (*Acipenser oxyrinchus*) as a species of concern. *Id.* at 2-89. This statement was based on information provided by NMFS in its letter dated October 24, 2006, in response to NRC’s letter dated October 12, 2006, requesting a list of endangered, threatened, candidate and proposed species. Exhibit NRC-18. However, the Atlantic sturgeon’s Federal listing status was changed from “species of concern” to “candidate species” on October 17, 2006. 71 Fed. Reg. 61,022, 61, 023. While being a candidate species affords no legal protection under the Endangered Species Act, the Atlantic sturgeon should have been included in the FEIS under the definition of “important species” as provided in ESRP 2.4.2. Exhibit NRC-9 at 2.4.2-6.

The Atlantic sturgeon is known to inhabit the Savannah River in the vicinity of the VEGP site and has a life history that is similar to that of the shortnose sturgeon (*A. brevirostrum*) in that it is anadromous, has adhesive eggs that are deposited on the bottom substrate, usually on hard surfaces, and the larvae tend to stay near the bottom until the yolk sac is fully absorbed, at which time they move downstream to rearing grounds in the estuarine waters. Exhibit NRC-25 at 3, 4. The potential for impact of an adult or juvenile sturgeon from impingement and thermal discharges at the proposed VEGP site is low because the older juveniles and adults are large

fish that can easily avoid impingement and the size of the thermal plume is small enough that they can avoid the plume. The potential for entrainment is also low because the eggs are demersal and adhere to hard surfaces and the larvae tend to stay near the bottom. *Id.* at 4. Thus, the Staff concludes that the Atlantic sturgeon will not be adversely affected by the proposed VEGP units.

Q21. The Joint Intervenors identified the shortnose sturgeon (SNS) and the robust redhorse (RR) as extremely sensitive biological resources. How did the Staff assess the potential for impact to these two species due to the operation of two additional units at the Vogtle site?

A21. (RHK, MTM) The Staff looked at the distribution and life history of the robust redhorse and the shortnose sturgeon in the middle Savannah River and evaluated potential impacts due to plant operation. The Staff determined the susceptibility of the species to impingement, entrainment, and thermal effects. The susceptibility of the robust redhorse to impingement, entrainment and thermal effects is discussed in section 5.4.2.6 of the FEIS. Exhibit NRC-1 at 5-36. The susceptibility of the shortnose sturgeon to impingement, entrainment and thermal effects is discussed in Section 5.4.3.2 of the FEIS. *See Id.* at 5-41, 5-42. Impacts to shortnose sturgeon are discussed more with regard to impingement and entrainment in the response to questions 24, 30 and 33 of the Staff's testimony for Environmental Contention 1.2.

The Staff in Section 5.4.2.6 of the FEIS concluded that the potential for impact to the robust redhorse from entrainment and thermal discharges would be minor because the nearest spawning area was located about 25 RM upstream of the VEGP site, the eggs develop in gravel and the larval fish remain in the gravel until all yolk material has been absorbed. *Id.* at 5-36. In addition, the adult robust redhorse has been observed to stay primarily in the main channel as they move up and downstream. Exhibit NRC-17 at 1148, 1152. Further, although not explicitly

stated in the FEIS, the adult robust redhorse is a large fish that can easily avoid impingement and the size of the thermal discharge plume is small enough that it can avoid the plume.

No shortnose sturgeon larvae or robust redhorse larvae were identified in the entrainment sampling that was performed by Southern during the impingement and entrainment sampling program that was received by the Staff after the publication of the FEIS. Exhibit NRC-30 at 23, 25, Appendix D.

The Staff in Section 5.4.3.2 of the FEIS concluded that the potential for impact of the shortnose sturgeon is small from entrainment and thermal discharges because the eggs are demersal and adhere to hard substrate and are thus less likely to be entrained into the cooling water system than eggs of other species. Exhibit NRC-1 at 5-41, 5-42. In addition, the embryos (age 1-8 days old) tend to stay near the bottom and seek cover and young juveniles (greater than 40 days old) spend most of the time swimming on the bottom. Exhibit NRC-46 at 172, 179, 180. Further, shortnose sturgeon larvae collected in rivers (as are Atlantic sturgeon larvae) were found in the deepest water, usually within the channel rather than in the area near the intake where they would be more susceptible to entrainment. *Id.* at 180. Further, the identified spawning grounds for the shortnose sturgeon are located downstream of the site at RM 111-118 and upstream at RM 171-172. Exhibit NRC-47 at 695. Collins and Smith reported a probable spawning site between RM 111 and 142. Exhibit NRC-24 at 485. In comparison, the VEGP units 3 and 4 intake structure is approximately at RM 151. Further, although not explicitly stated in the FEIS, the shortnose sturgeon is a large fish that can easily avoid impingement. In addition, the size of the thermal plume is small enough so that the shortnose sturgeon can avoid the plume.

A biological assessment (BA) was prepared for the shortnose sturgeon because it is a Federally-listed endangered species. The BA was forwarded to the National Marine Fisheries Service (NMFS) Southeastern Regional Office for its review and concurrence. NMFS

concluded in a letter that was received by the U.S. NRC after the FEIS was published; that this proposed action is unlikely to adversely affect shortnose sturgeon. Exhibit SNC000022 at 4.

Q22. In light of the above, why is the Staff's analysis in the FEIS sufficiently detailed to predict impacts on important species like the redhorse?

A22. (MTM) ESRP 2.4.2 states that "the type of data and information needed will be affected by site- and station-specific factors, and the degree of detail should be modified according to the anticipated magnitude of potential impacts." Exhibit NRC-9 at 2.4.2-2. The Staff considered the distribution, abundance, relevant life history data and past sampling and assessments in the river system for each of the "important species" and then assessed the potential impacts that the design, location and operating parameters of the structures, systems and components of the VEGP Units 3 and 4 cooling water system would have on the populations of the important fish and shellfish. If the distribution, abundance, relevant life history, or past data collected in the Savannah River did not identify a causal link to a particular impact category (impingement, entrainment, or thermal effects) that could result in a population level impact to that species, then a SMALL impact was predicted.

For example, the robust redhorse is a large fish and relatively strong swimmer and could easily avoid the thermal plume and impingement on the intake screens. Exhibit NRC-1 at 5-36. No robust redhorses have been impinged on the screens at VEGP Units 1 and 2 during the impingement sampling program. Exhibit NRC-30. The species is a prolific spawner and spawns over habitat unlike that found in the vicinity of the site. The station will take only a small percentage of the flow in the river. Impingement and entrainment losses related to operation of all four units at the site will not result in a detectable impact to the population, nor is the species likely to be affected by the thermal discharge; therefore, the Staff has enough information to predict that any impact to the species will be minor. Exhibit NRC-1 at 5-36.

Q23. As part of that determination, did the Staff find that the proposed cooling system would have significant adverse impacts to any important species, including the shortnose sturgeon and the robust redhorse?

A23. (RHK) No. The Staff determined that the potential for impact to the state-listed robust redhorse from entrainment, impingement, and thermal or chemical discharges would be minor as discussed in Section 5.4.2.6 of the FEIS on page 5-36 and that for the robust redhorse and all other aquatic biota the impacts from operation would be SMALL. Exhibit NRC-1 at 5-39. The Staff also determined that the impacts to the shortnose sturgeon would be SMALL, as discussed in Section 5.4.3.2 of the FEIS. *Id.* at 5-41, 5-42. It is the Staff's opinion that because the impacts to important species are SMALL, the impacts to any extremely sensitive biological organisms will also be SMALL since, as discussed in the response to Question 19, as the Staff understands the concept, "important species" would include all "extremely sensitive biological resources." These impacts are also discussed in detail in Questions 24 and 33 in the Staff's testimony for Environmental Contention 1.2.

III. Conclusions

Q. 24 Please summarize the impacts to aquatic resources from the proposed design and from a dry cooling system.

A24. (MTM)The Staff determined that impacts from the wet tower system on aquatic resources would be SMALL. The Staff also found that a dry cooling system would largely eliminate those impacts.

Q. 25 Given that the impacts to shortnose sturgeon and robust redhorse could, in theory, be rendered even smaller by using a dry cooling system, why did the Staff not therefore view dry cooling as the preferred option?

A25. (MTM, LWV) The Staff determined that operation of VEGP Units 3 and 4 would result in the mortality of fish and shellfish due to impingement and entrainment of organisms from the withdrawal of cooling water and mortality due to thermal effects related to the station

discharge. *Id.* at Section 5.4.2. However, the Staff found that the overall impact to aquatic resources due to the operation of two additional units at the VEGP site would be SMALL. This conclusion is discussed in more detail in questions 25, 26, 33 and 53 of the Staff's testimony for Environmental Contention 1.2. A SMALL impact is defined in the FEIS as "environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource." *Id.* at 1-4. The Staff acknowledges that the use of dry cooling would eliminate all or almost all of the mortality associated with station operation including any mortality or morbidity to the shortnose sturgeon, the robust redhorse, other "important species," and the Atlantic sturgeon. The Staff, however, found that a further reduction in mortality and morbidity was unnecessary for these species since impacts at the population level would be undetectable. NEPA does not require the selection of the most preferable alternative, and in this case the wet cooling and dry cooling tower alternatives are predicted to have the same level of impact on the Savannah River population for both the shortnose sturgeon and robust redhorse as well as the other "important species" and the Atlantic sturgeon.

Additionally, the Staff's assessment of impact to the shortnose sturgeon was confirmed by the National Marine Fisheries Service Southeastern Region (NMFS SERO). On January 25, 2008, the Staff forwarded a Biological Assessment related to the two additional units planned for the VEGP site to NMFS SERO. In a letter dated August 11 2008, NMFS SERO found that the construction and operation of two additional units at the VEGP site is not likely to adversely affect the shortnose sturgeon. Exhibit SNC000022. This completed the Staff's Endangered Species Act consultation responsibilities for this facility.

Further, as discussed in Section I of our testimony, the Staff determined impacts would be SMALL for the proposed system because of the availability of water in the Savannah River to meet the consumptive and nonconsumptive requirements of the closed-cycle cooling system and to assimilate effluents under both normal conditions and even under drought conditions.

This SMALL impact and the fact that several disadvantages of the dry-cooling alternative were identified provided the basis for the Staff's concluding that the identified dry-cooling alternative would not be environmentally preferable to the proposed wet cooling system.

Q26. Given the above answers, is the Staff required to do a more in depth analysis of cooling alternatives? And why is the Staff's analysis of the dry cooling alternative sufficient to satisfy 10 CFR 51.45(b)(3)?

A26. (All) No, the Staff is not required to provide a more in-depth analysis of cooling alternatives. The Staff followed the guidance given in ESRP 9.4.1 and described the alternative cooling system in the FEIS and determined that a dry-cooling system would not be preferable to the proposed wet tower system for VEGP Units 3 and 4. Exhibit NRC-1 at 9-26.

This analysis is sufficient to satisfy 10 CFR 51.45(b)(3), which states:

> (3) Alternatives to the proposed action. The discussion of alternatives shall be sufficiently complete to aid the Commission in developing and exploring, pursuant to section 102(2)(E) of NEPA, ''appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources.''

The Staff, in Section 9.3 of the FEIS, identifies and discusses alternative cooling technologies and discloses the associated potential impacts of such alternatives. *Id.* at 9-24 to 9-27.

Q27. Does this conclude your testimony?

A27. (All) Yes.