

**UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION**

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)	Docket No. 52-011-ESP
)	
Southern Nuclear Operating Company)	ASLBP No. 07-850-01-
)	ESP-BD01
)	
(Early Site Permit for Vogtle ESP Site))	February 6, 2009

**SOUTHERN NUCLEAR OPERATING COMPANY’S REBUTTAL
TESTIMONY OF TOM MOORER CONCERNING EC 1.2**

Q1: Please state your name, address, and current occupation.

A1: My name is Thomas Claibourne Moorer. My business address is: 42 Inverness Center Parkway, Birmingham, AL 35242-4809. I am employed by Southern Nuclear Operating Company as the Project Manager for Environmental Support.

Q2: Have you previously provided written testimony in this proceeding?

A2: Yes. I submitted pre-filed written testimony on environmental contentions (“EC”) 1.2, 1.3, and 6.0.

Q3: What is the purpose of your testimony?

A3: The purpose of my testimony is to respond, on behalf of Southern Nuclear Operating Company (“SNC”), to certain materials submitted by Joint Intervenors on January 9, 2009, and revised on February 2, 2009, regarding EC 1.2.

Q4: To what materials submitted by Joint Intervenors regarding EC 6.0 are you responding?

A4: My response is directed at (a) “Joint Intervenors’ Revised Initial Written Statement of Position and Pre-filed Direct Testimony,” dated February 2, 2009; (b) “Revised Pre-filed

Direct Testimony of Shawn P. Young in Support of EC 1.2,” dated February 2, 2009, and Joint Intervenors’ exhibits referenced therein; (c) Revised Pre-filed Direct Testimony of Barry W. Sulkin in Support of EC 1.2,” dated February 2, 2009, and Joint Intervenors’ Exhibits referenced therein.

Q5: In A.11 and A.12 of his pre-filed direct testimony, Dr. Young states that the FEIS lacks sufficient field surveys and quantitative analysis to assess baseline habitat conditions, species diversity, and species abundance in the vicinity of the Vogtle site. In addition, he states that the FEIS discussion of direct, indirect, and cumulative impacts of entrainment and impingement is inadequate and relies on incorrect assumptions. Do you agree with these assertions?

A5: No. The conclusions in the FEIS are based almost entirely on field study data that has been analyzed both quantitatively and qualitatively to establish baseline conditions and relate the impacts of impingement and entrainment to those conditions. Dr. Young’s assertion that “incorrect assumptions” were used is also unfounded. I assume that he is referring to the use of a conservative “uniform distribution” assumption to put the impacts of entrainment on the drift community in perspective, and if so, this assumption was discussed in detail in the January 9, 2009 direct testimony of Dr. Coutant and myself.

Q6: Dr. Young asserts that the FEIS does not provide sufficient data to substantiate conclusions regarding the impacts of entrainment of the fish species in the Middle, Lower, and estuarine Savannah River in the vicinity of the Vogtle site. Do you believe that the FEIS conclusion is adequately supported?

A6: Yes. In A.13 of his pre-filed direct testimony, Dr. Young cites studies and survey data from the Academy of Natural Sciences of Philadelphia (“ANSP”) work that was done in support of the Department of Energy (“DOE”) Savannah River Site (“SRS”). He concludes that these studies are not an “adequate indicator of the construction and operational impacts on the fish species in the Middle, Lower, and estuarine Savannah River.” Dr. Young provides detailed information such as life history stages of fish species, migration timing, life history distribution, and population numbers and implies that without this very specific, highly specialized research data one could not use the ANSP studies even as an “indicator” of construction and operational impacts. However, not only is the ANSP data valid, Dr. Young fails to acknowledge that in addition to the ANSP studies which have been conducted since the 1950’s and continue today, the FEIS utilizes a large number of additional studies, including studies by Paller, Marcy, Wiltz, Nichols and others to reach conclusions on entrainment, impingement, and the aquatic species baseline. He implies that the FEIS conclusions were based strictly on ANSP studies, when, in fact, the ANSP studies were only one element of a multi-disciplined approach used in the FEIS. In addition, Dr. Young provides no information about the relevance of the information that he claims is missing from the conclusion reached in the FEIS.

Q7: In A.14 of his pre-filed direct testimony, Dr. Young states that “[t]he early life stages of fish are the most susceptible to entrainment because they have limited capacity for avoidance. Many fish species eggs and larvae are found in the river drift.... Since fish eggs and larval fish have limited capacity for avoidance, they are

inherently vulnerable to entrainment.” Is this new information that is not considered in the FEIS entrainment analysis for Plant Vogtle?

A7: No. The Vogtle FEIS at 5-32 clearly states that all fish eggs and larvae within the influence of the intake structure are assumed to be drawn into the plant and to experience 100% mortality. As such, the ability, or lack thereof, of an organism to avoid being entrained is irrelevant. The assumption of 100% mortality for entrained organisms and uniform distribution of drift organisms results in an overestimation of impacts and renders Dr. Young’s discussion of fish egg and larval motility moot for the FEIS.

Q8: In A.15 of his pre-filed direct testimony, Dr. Young indicates that not all of the larval fish that are part of the Savannah River drift community are capable of avoiding the predicted water intake velocities and further states that many of the endangered or important fish of the Savannah River cannot endure a water intake velocity of 1 foot/second. Do you believe that Dr. Young’s concern valid?

A8: No. Dr. Young’s conclusion is moot based on the response to the previous question, but he also deliberately attempts to mislead the Board with his use of a quote from page 5-30 of the FEIS. Dr. Young claims that, “The FEIS at 5-30 states ‘species and life stages evaluated in various studies could endure a velocity of 1 ft/sec.’ However, many of the endangered or important fish of the Savannah River cannot endure that water intake velocity.” He then cites the Robust Redhorse as an example. However, the full paragraph on page 5-30 of the FEIS to which Dr. Young attributes his quote states the following: “A second factor, the intake through-screen velocity, greatly influences the rate of impingement of fish at a facility. The higher the through-screen velocity, the

greater the number of fish impinged. EPA has established a national standard for the maximum design through-screen velocity of no more than 0.5 ft/sec. (66 FR 65256). EPA determined that species and life stages evaluated in various studies could endure a velocity of 1.0 ft/sec, **and then applied a safety factor of two to derive the threshold of 0.5 ft/sec.**” (emphasis added) On page 5-31, the FEIS also states that the flow velocity along the intake canal would be approximately 0.1 ft/sec at the maximum intake withdrawal rate at the minimum river operating level of 78 ft MSL. It is this 0.1 ft/sec velocity that would impact larval fish entering the intake canal, including the robust redhorse, not the 0.5 ft/sec through-screen velocity. The 1 ft/sec rate is not relevant to Plant Vogtle at all, even though Dr. Young implies that it is.

Q9: Do you agree with Dr. Young that the lumping of larval fish categories creates inadequacies in the FEIS?

A9: No. The FEIS conclusion is based on an assumption that all fish eggs and larvae that enter the intake canal will be entrained into the plant and will suffer 100% mortality. The FEIS does not give any credit for larval mobility and thus, the swimming ability of larvae is moot relative to the FEIS conclusion on entrainment. This assumption adds additional conservatism to the FEIS conclusion.

Q10: Why was a uniform drift distribution assumption used to assess impacts?

A10: It is clear from the available data, including the studies cited by Young, that the drift community in the Savannah River is not distributed uniformly, but the use of the uniform distribution assumption is appropriate, reasonable, and conservative in evaluating the

entrainment impacts of the Vogtle intake. SNC explains in the Environment Report (“ER”) and the Staff explains in the FEIS that the distribution of drift organisms is not uniform. However, a uniform drift distribution assumption was used in the FEIS because it provides a relatively simple and conservative mechanism for use in evaluating the entrainment effects of water withdrawal on a water body. This assumption is commonly used in performing section 316(b) assessments, and a detailed discussion of the bases for the assumption and why it is conservative and reasonable is provided in the pre-filed direct testimony of Dr. Coutant and myself.

Q11: In A.18 and A.19, Dr. Young states that the data and analysis in the FEIS is inadequate to substantiate the conclusion that the impact of entrainment on the ichthyoplankton community in the vicinity of the Vogtle intakes is SMALL. Does he present any data or other information that supports his assertion?

A11: No. Dr. Young focuses his response on criticizing the use of the uniform distribution assumption. He uses material out of context to illustrate his points and a close examination of the FEIS text indicates that he has misconstrued the meaning of the certain sections to align the information with his assertions. For example, Dr. Young makes reference to the NRC Staff’s “illogical use of oxbow population data,” which he states is not relevant to the analysis of the mainstream ichthyoplankton community. The reference on page 2-82 of the FEIS says, “Specht (1987) reported that American Shad were the dominant taxa in the ichthyoplankton assemblage (primarily as eggs) in the river. They were not as abundant in the oxbows, creeks, or intake canals on the Savannah River Site indicating that the primary location for spawning was the river.” However, Dr.

Young does not acknowledge that on the previous page (2-81) of the FEIS, the NRC Staff states: “Ichthyoplankton studies from the Savannah River Site in 1984 – 1985 showed that larval densities in the oxbows (all of which were connected to the river at both ends but with current velocities that were usually too low to measure) were significantly greater than in the river, suggesting that oxbows may be important spawning areas. Species composition in the oxbows was dominated by gizzard shad and threadfin shad. The dominant species in the river was the American shad, although gizzard shad, threadfin shad, and crappie were also abundant (Specht 1987). Studies of the vertical distribution of larvae in the river showed an absence of significant differences between top and bottom samples, except for one transect. Egg densities exhibited significant differences between top and bottom at over half of the transect sites. In all cases, bottom densities were higher than the top densities (Paller et al. 1986).”

As this quote indicates, the Staff’s reference to oxbows was merely to point out that American shad spawned in the river and that other species, including shad species, used oxbows significantly as spawning areas as well. The discussion of the uniform distribution assumption in my and Dr. Coutant’s pre-filed direct testimony explains in detail the spawning behaviors of Savannah River fish and the egg and larval composition expected in the Savannah River water column. Dr. Young does not provide any information that casts doubt on the FEIS conclusion.

Q12: In A.21 of his pre-filed direct testimony, Dr. Young states that the FEIS should include an analysis of flows ranging from normal to Drought Level 4 in order to analyze entrainment effects. Is it necessary to analyze this range of flows?

A12: No. Drought Level 4 has never occurred on the Savannah River, and other drought levels occur infrequently. Regardless, as a conservative approach, the FEIS includes an evaluation of river flows through Drought Level 3 and also includes evaluations of both 3,000 cfs and 2,000 cfs as surrogates for Drought Level 4 – flows which are well below any of the drought flows experienced at Plant Vogtle. *See Exhibit SNC000053.* Even at these low levels, the FEIS concludes that the SMALL impact relative to water use remains valid. In addition, low flow events traditionally occur in the fall, a time of year when spawning does not occur and eggs and larvae are not present in any significant quantity. Also, it is relevant that the EPA’s own guidance for analyzing these very entrainment effects provides that the analysis should be based upon the annual average river flow, not a hypothetical minimum. EPA indicates that at flows less than 5% of the annual average flow, the facility should not have significant impacts associated with operation of the intake. This fact is not the sole support for the FEIS’s conclusion (as suggested by Joint Intervenors), but it does add to my confidence in the FEIS conclusion.

Q13: In A.27 of his pre-filed direct testimony, Dr. Young addresses the mortality rates of different species of fish at certain temperatures. Does this raise questions about the FEIS evaluation of thermal impacts?

A13: No. While it is true that certain species suffer mortality at certain temperatures (as addressed by Mr. Tony Dodd and Mr. Matt Montz in their rebuttal testimony to EC 1.2), another important factor is the amount of time that these fish travel through this “mixing zone.” At most, the travel time is a few seconds for most organisms, and this brief “exposure time” results in less of an impact than is indicated by Dr. Young. The

information provided by Mr. Dodd and Mr. Montz indicates that even at extremely elevated temperatures, drift organisms do not experience significant mortality until after several minutes of exposure. And, again, the most likely occurrence of higher temperature plumes (late summer) does not coincide with the spring/early summer peak of the presence of ichthyoplankton in any event.

Q14: Does the FEIS comprehensively discuss the potential thermal impacts on vulnerable life history stages of fish?

A14: Yes. Section 5.4.2.3 of the FEIS addresses Aquatic Thermal Impacts and section 5.3.3.1 discusses the Cormix Model. However, there will be little to no effect on organisms due to the thermal plume because the water temperatures are too low to make an impact.

Q15: In A.11 of his pre-filed direct testimony, Mr. Sulkin states that “the FEIS obscures the fact that several scenarios result in withdrawals that exceed the 5% threshold of significance.” Do you agree with this statement?

A15: No. The EPA threshold of significance criteria is clearly defined in the EPA’s section 316(b) rule as being based on 5% of annual average flow, and Mr. Sulkin’s comparison of withdrawal rates at river flows less than the annual average flow of 8,830 cfs cannot be compared to EPA’s threshold. The EPA Requirements Applicable to Cooling Water Intake Structures for New Facilities under 316(b) (10 CFR 125.84(b)(3)(i)) states that the total design intake flow from all cooling water intake structures at a facility withdrawing from a freshwater river or stream must be no greater than five (5) percent of the source water body mean annual flow. EPA finds these proportional flow limitations to represent

limitations on capacity and location that are technically available and economically practicable for the industry as a whole. *Id.*

Q16: Mr. Sulkin states that the Staff's calculations in the FEIS selectively presents results and buries other, less convenient results in the text. Is this an accurate assessment of the Staff's analysis?

A16: No. In Chapter 7 of the FEIS, both flow and consumptive use data is presented in tabular format for normal flow through Drought Level 3. The NRC staff subsequently added the information associated with the 3,000 cfs and 2,000 cfs flows and included the information in narrative form only. The FEIS tables in Chapter 7 were not revised to include the additional flows. Mr. Sulkin's states that no flows less than 3,800 cfs (Drought Level 3) were presented in the tables. However, flows below 3,800 cfs, specifically 3,000 cfs and 2,000 cfs, respectively, were included in a narrative discussion following the tables. This is simply not a substantive obstacle to anyone's ability to accurately analyze the data. Mr. Sulkin also mentions that the withdrawal amounts increased when Revision 16 of the DCD was introduced. It should be noted that this increase was only 4 cfs, SNC informed the NRC of this change, and the NRC Staff determined that the impacts would still be SMALL.

Q17: In Joint Intervenors' Exhibit JTI000021, Mr. Sulkin analyzed the withdrawal rates for the Savannah River in accordance with several flow scenarios and also calculated the withdrawal rate at the hypothetical flow 957 cfs. Should this same analysis have been included in the FEIS?

A17: No. Mr. Sulkin introduced the 957 cfs value to represent what is normally referred to as the “unimpaired” flow set. This flow is apparently a theoretical flow representing what the lowest flow would theoretically be if all of the dams and other controls were removed from the system and the system operated in a natural state similar to the way it operated before the dams were constructed. I have not confirmed whether the 957 cfs value actually represents the low unimpaired flow, primarily because it has no bearing on any of the NEPA analysis.

Q18: When calculating the combined surface water withdrawal of all four Units at Plant Vogtle as a percentage of discharge, Mr. Sulkin states that operating all Units in normal mode would exceed the 5% threshold of significance at the flow rate of 3,100 cfs and suggests that the impacts should also be analyzed when the units are operating in maximum mode. Is this correct?

A18: No. First, as stated previously, the 5% EPA criteria is based on annual average flow. The purpose for considering the operation of all four units simultaneously is to evaluate cumulative impacts in accordance with NEPA. Chapter 7 of the FEIS addresses cumulative impacts. NEPA applies a rule of reason. An assumption that all four units would operate at the same time at the maximum rated withdrawal capacity is well beyond reasonable and likely would never occur.

It is also important to note that the 3,100 cfs value, and for that matter all of the flow values associated with the Drought Contingency Plan, should be applied as if they originate at Thurmond Dam, not the site. As such, a 3,100 cfs flow at Thurmond Dam would produce a 3,400 to 3,600 cfs flow at the site. This calculation is based on the 300 -

500 or more cfs of local inflow available between the dam and the Vogtle site. *See* Exhibit SNC000054 (providing, for comparison, releases from Thurmond Dam and flows at the Vogtle site). The FEIS uses the Thurmond Dam release by itself, as if there are no additional local inflows, which adds a considerable amount of conservatism to the evaluation. In fact, the local inflow value more than cancels the 173 cfs withdrawal associated with all four Vogtle units. Theoretically, the 2,000 cfs value evaluated at the Vogtle site in the FEIS is the same as applying a value of 1,500 – 1,700 cfs at Thurmond Dam. Flows have never been experienced this low on the Savannah River since the impoundments were completed.

Q19: Is the method used by the Staff in the FEIS an accepted scientific method?

A19: Yes. Mr. Sulkin coined the term “surrogate method,” as if the NRC staff had modified a standard method for analysis. It is important to note that it is common, accepted, and logical practice use percent withdrawal as an indicator of relative aquatic impacts. EPA certainly endorses this concept. *See* Exhibit SNC000055 (EPA Fact Sheet for Cooling Water Intake Structures) (stating that the quantity of water withdrawn is directly related to the number of organisms affected). Moreover, the NRC Staff’s flow analysis considers much more than just the percent of river flow. Although percent withdrawal is highly informative, the FEIS relies on several factors to reach its conclusions. For example, the technology employed is the undisputed Best Available Technology for reducing entrainment and impingement impacts. Mr. Sulkin’s use of the term “surrogate method” adds mystery to the discussion, but has no relevance to NEPA matters.

Q20: Are each of the exhibits referenced in this rebuttal testimony true, accurate and correct copies, and do they accurately portray the facts they purport to portray?

A20: Yes.

Q21: Does this conclude your testimony?

A21: Yes.

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AFFIDAVIT OF THOMAS C. MOORER CONCERNING SOUTHERN NUCLEAR'S
REBUTTAL TESTIMONY ON ENVIRONMENTAL CONTENTION 1.2

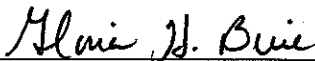
I, Thomas C. Moorer, do hereby state as follows:

1. I have read the foregoing prepared rebuttal testimony regarding environmental matters at the Plant Vogtle Site.
2. I attest to the accuracy of those statements, support them as my own, and endorse their introduction into the record of this proceeding. I declare under penalty of perjury that those statements, and my statements in this affidavit, are true and correct to the best of my knowledge, information and belief.



Thomas C. Moorer

Subscribed and sworn to before me
this 2nd day of February, 2009.



Notary Public