UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD PANEL

Before the Licensing Board:

G. Paul Bollwerk, III, Chairman
Nicholas G. Trikouros
Dr. James Jackson

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

PREFILED DIRECT TESTIMONY OF BARRY W. SULKIN

Q1: Please state your name and address.

A1: My name is Barry W. Sulkin, and my address is 4443 Pecan Valley Road, Nashville, Tennessee 37218.

Q2: What is your current profession?

A2: I am an environmental consultant.

Q3: What is your educational background?

A3: I received a Bachelor of Arts in Environmental Science in 1975 from the University of Virginia, where I was awarded a Du Pont Scholarship. I received my Masters of Science in Environmental Engineering in 1987 from Vanderbilt University, where I also attended on a full scholarship. My areas of study at Vanderbilt included chemistry, biology, limnology, and hydrology of streams and lakes.

Q4: What is your professional background?

A4: In 1976, I joined the Staff of what is now called the Tennessee Department of Environment and Conservation as a Water Quality Specialist, and continued to work for this agency for almost 14 years. I worked in the Chattanooga, Knoxville, and Nashville field offices and the central office of what is now called the Division of Water Pollution Control. I received on the job training in addition to formal education, in areas such as stream assessment. My duties included inspections and enforcement coordination for the water pollution programs, as well as work with the drinking water, dam safety, underground storage tank, and solid/hazardous waste programs. I also conducted investigations regarding fish kills, spills, and general complaints, including problems involving stream alterations and relocations. I was also involved in developing, implementing, and enforcing the state's Aquatic Resource Alteration Permit program, as well as activities related to the Corps of Engineers 404 permit program and the state's 401 certification component.

In 1985, I became state-wide manager of the Enforcement and Compliance Section for the Division of Water Pollution Control. In this capacity, I was responsible for investigating and preparing enforcement cases, supervising the inspection programs and permit compliance monitoring, and conducting special projects and field studies including water quality and assimilative capacity and permit modeling. While in this position I took an educational leave to obtain my Masters of Science in Environmental Engineering in 1987 from Vanderbilt University.

I returned to my position as manager of the Enforcement and Compliance Section in 1987, where I remained until mid 1990.

Since 1990, I have engaged in a private consulting practice specializing in water quality problems and solutions, regulatory assistance, National Pollutant Discharge Elimination System permits, stream surveys, and various environmental investigations primarily related to water. I have worked for many clients in my private practice over the past 18 years where I have been required to interact with state and federal environmental agencies.

Q5: Do you have a written summary of your education, employment, experience and background, and papers and presentations you have made over your career?

A5: My professional and educational experience is summarized in the curriculum vitae attached to this prefiled direct testimony as JTI000043.

Q6: What materials have you reviewed and actions have you taken in preparation for your testimony?

A6: I have reviewed excerpts of the Final Environmental Impact Statement (the "FEIS") (filed as NRC000001), the permit application and related documents submitted in this matter.

Q7: Have you given affidavits or declarations in support of or in connection with any of Joint Intervenors' contentions in this ESP proceeding?

A7: Yes, on November 12, 2007, I gave a declaration in support of Joint Intervenors' Response to SNC's Motion for Summary Disposition of EC 1.2, attached hereto as JTI000031.

Q8: What topics will be addressed in your testimony?

A8: I will discuss the extent of the potential environmental impacts of the proposed Plant Vogtle Units 3 and 4 cooling system intake and discharge structures on water use, water quality, and aquatic resources, in light of the Nuclear Regulatory Commission (the "NRC") Staff's analysis in the FEIS. I am testifying in support of Environmental Contentions 1.2 ("EC 1.2") and 1.3 ("EC 1.3"). EC 1.2 concerns the impacts of the cooling water intake and discharge on aquatic species. EC 1.3 concerns whether dry cooling is a reasonable alternative to the proposed wet cooling system given its potential impacts on aquatic species.

Q9: Please summarize your conclusion.

A9: I conclude that the FEIS's analysis of potential impacts is flawed and does not support a finding that impacts will be small. In turn, the discussion of alternative cooling systems is premised on the idea that alternative cooling systems need not be considered in detail because the FEIS had previously concluded that the impacts of the proposed cooling system would be small. Because there is no legitimate basis to find the impacts on aquatic species would be small, it is also illegitimate to eliminate dry cooling from further consideration.

Q10: Would you elaborate further?

A10: Both EC 1.2 and EC 1.3 challenge the methodology used by the Staff to estimate potential impacts of the proposed cooling system for the additional Units. I'll refer to this as the "surrogate method," for lack of a better term. The surrogate method uses withdrawal rate as a percentage of total flow as an indicator of potential impacts and is based on the assumption that impacts on aquatic resources are directly proportionate to the percentage of water being withdrawn. Rather than collecting data in the field, the surrogate method establishes a threshold of significance—in this case 5%—below which impacts are presumed to be small. In my opinion, the surrogate method has several significant weaknesses that undermine the conclusion that impacts to aquatic species will be small in this case.

Impacts of the Cooling System on Aquatic Species

Q11: Have you also reached any specific conclusions regarding the potential impacts of the cooling system on aquatic species?

A11: Yes, based on my analysis of the FEIS and supporting documents I've come to three conclusions:

(1) There is no scientific or regulatory basis for setting the threshold of significance for withdrawals at 5% of the total flow.

(2) Even assuming that 5% is the proper threshold, the textual and graphical presentation in the FEIS obscures the fact that several scenarios result in withdrawals that exceed the 5% threshold of significance.

(3) The methodology for estimating impacts employed by the Staff is inherently flawed and subject to manipulation.

Q12: What do you mean when you say that there is no scientific or regulatory basis for the 5% threshold?

A12: I mean that there is nothing in the FEIS that explains why the threshold is set at 5% in this particular case. I do not know if it is reasonable for the Staff to assume a uniform drift community. I do not know if it is reasonable for the Staff to assume that the level of impact is proportional to the rate of withdrawal across all possible river flows. I do not know if it is reasonable for the Staff to assume that impacts from withdrawing less than 5% would be small or insignificant. The FEIS does not provide a rationale for making any of these assumptions at this specific site. There is no data or site-specific information to justify setting the threshold of significance at 5% in this instance. On the other hand, I can tell you that the 5% threshold is not compelled by any statute or regulation.

Q13: If it's not based on ecological principles and not required by law or regulation, can you explain the origin of the 5% threshold?

A13: Yes, it is derived from the EPA's 2001 rulemaking implementing section 316(b) of the Clean Water Act for new facilities that use water withdrawn from rivers, streams, lakes, reservoirs, estuaries, oceans, or other waters of the United States for cooling purposes. If you look at the section of the FEIS discussing operational impacts on aquatic species—section 5.4.2—you can see where the 5% standard comes from. On page 5-30, the FEIS states that "EPA determined that limiting withdrawal to 5 percent of the source water body mean flow was technically achievable and economically practicable and that larger withdrawals may result in greater levels of entrainment," citing the Federal Register notice for the final 316(b) rule, which may be found at 66 Fed.Reg. 65256. Note that the EPA did not adopt a 5% threshold of significance in the final rule but merely remarks that 5% is technologically achievable and that greater levels of withdrawal would result in greater impacts. In fact, according to the EPA in 66 Fed.Reg 65277, the 5% threshold "reflects a policy judgment that a greater degree of entrainment reflects an inappropriately located facility." So, EPA determined that withdrawals *greater than 5% are inappropriate* and not that withdrawals less than 5% will only result in small impacts.

The EPA established a 5% *performance standard*, which represents the performance of the best technology available, but the rulemaking says nothing about the *potential impacts* of withdrawals less than 5%. Most assuredly, the 316(b) rulemaking is no support for setting a 5% threshold of significance at *this location* on the Savannah River—it is used entirely out of context in the FEIS.

Q14: Assuming that the threshold of significance is 5%, you also conclude that the presentation of the Staff's calculations in the FEIS is problematic?

A14: Yes, by presenting results selectively in several charts and burying other, less convenient results in the text, the FEIS obfuscates the potential impacts of the cooling water intake system. Specifically, FEIS Tables 5-1, 5-2, 7-1, and 7-2 do not present flows less than 3,800 cubic feet per second (cfs), Drought Level 3, when the actual Savannah River discharge has consistently been below 3,800 cfs since November 2007, and was recently reduced to 3,100 cfs. The FEIS text purports to analyze flows below Drought Level 3, at 3,000 cfs and 2,000 cfs, but – as I just mentioned – these results are not included in the Tables. Moreover, the discussion of these lower flows on page 5-9 is limited to consumptive use only, and does not consider total withdrawals. On page 7-6, the FEIS acknowledges that cumulative withdrawals of all four Units operating in "normal" mode would be 6.5% at a flow of 2,000 cfs, exceeding the 5% threshold of significance. In "maximum" withdrawal mode—e.g. the plant parameter envelope—this exceedence is far more dramatic.

In addition, the FEIS tables present the calculations based on the design control document ("DCD") Revision 15 water withdrawal figures instead of the revised figures from DCD Revision 16 (now Revision 17), which are slightly greater. And, Tables 7-1 and 7-2 purport to represent the cumulative withdrawal impacts of the new Units 3 and 4 combined with existing Units 1 and 2, but only consider the case of all of the reactors operating in “normal” mode and none in “maximum” mode.

Each of these problems with the FEIS’s analysis works to minimize the potential impacts. Taken together, they skew the results of the analysis in favor of finding the impacts small or insignificant.

Q15: Did you recalculate the withdrawal rate as a percent of flow?

A15: Yes, I ran the same calculations as the Staff did in the FEIS, but I used the DCD Revision 16 withdrawal figures across the entire plant parameter envelope. In my calculations, I did not assume that all four Units would operate at “normal” mode for the purpose of determining cumulative withdrawals, as did the Staff. I recalculated total withdraws and consumptive use, as a percentage of total Savannah River discharge under the same scenarios as the Staff—Average Conditions (8830 cfs), Drought Level 1 (4200 cfs), Drought Level (4000 cfs), Drought Level (3800 cfs). In addition, I calculated withdrawal and consumption use rates using the actual recent discharge at the Thurmond Dam (3,100 cfs), lower flow rates of 3000 cfs and 2000 cfs, and Drought Level 4, the hypothetical unimpaired minimum flow if there were no dams or reservoirs (957 cfs). All of these calculations may be found in Table 1 of JTI000021.

Q16: How did you calculate Drought Level 4 when the Staff claims that it is undeterminable?

A16: At Drought Level 4, there is no conservation storage remaining in the upstream reservoirs to augment natural base flow and the release from Thurmond Dam equals the inflow. In other words, in the Drought Level 4 scenario, the Corps of Engineers has *run out of water in the upstream reservoirs* to augment the natural unimpaired flow. The Final EIS for the Plant Vogtle Units 1 and 2 license renewal, NUREG-1437, Supplement 34, issued in December 2008, located in JTI000022, reports on page 4-13 that "the hypothetical minimum flow volume in the river during the most extreme drought is projected to be 957 cfs (SNC 2006a), but this estimate was based on river conditions before the construction of the reservoirs." Because the Corps of Engineers operates the upstream reservoirs as run-of-the-river projects with no flow augmentation under Drought Level 4 conditions, the 957 cfs hypothetical minimum reported in the license renewal EIS is the Drought Level 4 flow.

Q17: Where did you get the withdrawal figures you used in your calculations?

A17: In its comments on the Draft EIS (ML073620401), located in JTI000025, Southern reports the DCD Revision 16 withdrawal and consumption figures. The changes between Revision 15—used by the Staff to calculate Tables—and Revision 16 result in higher surface water and consumptive use for Units 3 and 4 at both normal and maximum operation. At normal operation, water withdrawal increases from 82.9 cfs (53.5 mgd) to 86.5 cfs (55.8 mgd), and at maximum operation, the surface water withdraw increases from 128.8 cfs (83.1 mgd) to 136.2 cfs (87.9 mgd). Consumptive use increases from 62.2 cfs (40.1 mgd) to 64.9 cfs (41.9 mgd) at normal operation, and from 64.4 cfs (41.6 mgd) to 68.1 cfs (44.0 mgd) under maximum conditions. I understand that Westinghouse recently submitted Revision 17 to the DCD; however, I am not aware of whether the water use and consumption figures have been further refined in the most recent revision. I have not had an opportunity to check the figures from DCD Revision 17 and recalculate the results if there have been any changes.

Q18: How did you calculate the total withdrawal (normal and maximum) of the 2 proposed Units as a percentage of Savannah River discharge?

A18: Using the higher Revision 16 withdrawal figures, I calculated the total withdrawal (normal and maximum) from the two proposed Units as a percentage of discharge under each of the flow scenarios discussed previously. The results are presented in Table 2 of JTI000021 under the column labeled "DCD Rev. 16". The FEIS calculations are in brackets to the right of my recalculated percentages. Under average flow conditions, there is almost no difference between the Staff's calculation (Revision 15) and mine (Revision 16). However, at the current discharge rate (3,100 cfs), I calculate withdrawal to be 2.8% with both Units operating in normal mode, and 4.4% if both Units are operating in maximum mode. Withdrawals begin to exceed the 5% threshold of significance under the Low Flow Rate (b) (2,000 cfs) and the maximum withdrawal scenario. Under the hypothetical minimum flow conditions (957 cfs), maximum withdrawal from the 2 new Units is 14.2% of river discharge.

Q19: How did you calculate the consumptive use (normal and maximum) of the 2 proposed Units as a percentage of Savannah River discharge?

A19: Using the higher Revision 16 consumptive use figures, I calculated the consumptive use (normal and maximum) for the 2 proposed Units as a percentage of discharge under each of the flow scenarios discussed above. The results are presented in Table 3 of JTI000021, along with the Staff's FEIS percentages. As you can see, my calculations track with the Staff's, indicating that there is little difference between DCD 15 and DCD 16 with regard to consumptive use. However, the Staff did not compute results for maximum use under the current or low-flow scenarios. At the hypothetical minimum flow of 957 cfs, the normal and maximum consumptive use for the two Units is 6.8% and 7.1%, respectively.

Q20: How did you calculate the cumulative surface water withdrawal (normal and maximum) of Units 1 through 4.

A20: Using the higher DCD Revision 16 withdrawal figures, I calculated the combined surface water withdraw (normal and maximum) of Units 1, 2, 3, and 4, as a percentage of discharge under each of the flow scenarios discussed previously. I used 176.5 cfs as the combined normal withdrawal of Units 1 through 4. I calculated this figure using 90 cfs for Units 1 and 2, as cited in Table 7-1 of the FEIS, and 86.5 cfs as the normal withdraw for Units 3 and 4 under DCD Revision 16. Notably, the FEIS completely omits analysis of combined maximum surface water withdraw for Units 1 through 4, presenting only normal withdrawal percentages of Units 1 through 4. I derived a figure of 261 cfs for the combined maximum withdrawal, using 125 cfs as the maximum withdrawal for Units 1 and 2 and 136.2 cfs as the maximum withdrawal for Units 3 and 4. The results are presented in Table 4 of JTI000021. As you can see, all four Units operating in normal mode would exceed the 5% threshold of significance at current flow rates (3,100 cfs), and would exceed 18% at the theoretical minimum flow. With all four Units operating in maximum mode, cumulative withdrawals would be 6.2% at Drought Level 1, 8.4% under current flow conditions, and 27.3% at the theoretical minimum flow.

Q21: Do you agree with the Staff's decision to analyze and discuss cumulative impacts of the four Units operating in normal operation mode only, and disregarding maximum mode?

A21: No, I do not. The Staff's decision to ignore the maximum combined withdrawal scenario is an example of the skewed presentation of the data that I alluded to earlier. By disregarding maximum mode entirely, FEIS Table 7-1 leaves the reader with the impression that cumulative withdrawals will not exceed the 5% threshold of significance, when that is clearly not the case. In addition, the Staff's explanation of the decision to exclude the maximum case, in footnote a on page 7-6 of the FEIS, is nonsensical. In my opinion, this methodology is faulty for several reasons. First, all four Units operating at maximum withdrawal represents the plant parameter envelope that bounds the potential impacts of operating four Units at the VEGP site. Second, even if it is extremely unlikely that all four Units will operate at maximum withdrawal, the Staff's analysis disregards maximum withdrawals entirely. In other words, the FEIS fails to consider scenarios where one or more of the reactors is operating in maximum mode while the remainder are in normal mode. Third, even short term maximum withdrawal conditions can result in significant cumulative impacts on water resources and aquatic species.

Q22. Are the withdrawal figures for Units 1 and 2 in Table 4 of JTI000021 actual or as designed?

A22: In Table 4 of JTI000021, I use 90 cfs as the combined withdrawal rate for Units 1 and 2, which is the figure provided by the Staff in Table 7-1 of the FEIS. I believe this is the normal water withdrawal rate as designed. However, the final FEIS for the license renewal of Units 1 and 2 reports actual water use at Units 1 and 2 in May 2006. In that month, the average daily withdrawal was 103.8 cfs (67.2 mgd), which is somewhat higher than the withdrawal rate that I used in Table 4 in JTI000021.

Q23: Does the cumulative withdrawal rate for all four Units, as a percentage of total flow, change if you use the actual withdrawal figures for Units 1 and 2?

A23: There is a slight change because actual withdrawals in May 2006 were approximately 14 cfs greater. However the percentage change is small because a 14 cfs increase in withdrawal rate is tiny in comparison to the river flow. In Table 5 of JTI000021, I calculated cumulative withdrawal as a percentage of total flow using the actual withdrawal figure for Units 1 and 2, combined with the DCD Revision 16 withdrawal rate for Units 3 and 4. As you can see, the difference between the Staff's results in Table 7-1 and mine are small; however, as the rate of flow in the river declines, the impact of the 14 cfs discrepancy in withdrawal rates becomes more pronounced. Unfortunately, the Staff did not calculate cumulative withdrawal percentages for river flow below 3,800 cfs. Even though the difference is slight, using actual withdrawal figures results in exceeding the 5% threshold of concern at Drought Level 3.

Q24: Would you please explain what you mean when you say that the "surrogate method" is inherently flawed and subject to manipulation?

A24: The problem with the surrogate method is that it is based entirely on estimate, assumption, and speculation. I already mentioned several assumptions underlying the use of withdrawal percentage as a method of estimating impacts on aquatic species. There are also other less obvious ways in which the surrogate method can be manipulated. For example, the Staff presumes that the discharge rate from Thurmond Dam is equivalent to the rate of flow at the Plant Vogtle site. If there were no withdrawals or discharges, you would expect the Savannah

River to gain in flow as you proceed downstream. However, this may or may not be the case on the Savannah River because there are several major withdrawals and discharges between Thurmond Dam and the Vogtle site. Moreover, the flow at the Vogtle site will decrease in the future as upstream municipal water supply withdrawals increase.

Q25: Does the Staff's analysis account for future reductions in flow due to increasing municipal withdrawals?

A25: It does in a sense, but not explicitly. As I've discussed, the Staff did some calculations of the withdrawal percentage at 3,000 cfs and 2,000 cfs, but unfortunately did not make such calculations under all operating scenarios, nor did the Staff report these low flow results in the FEIS Tables. It may be reasonable to use 2,000 cfs as a lower bound for estimating potential future flow at the Vogtle site, but the FEIS should be consistent in calculating flow percentages for all of the different withdrawal and use scenarios and flows. The other problem with the surrogate method is that it does not capture the time dimension—the frequency of extremely low flows and their duration. Simply calculating the percent withdrawn from a theoretical minimum flow tells us very little about the potential impacts on biological systems over time.

Q26: Are there other examples of how the surrogate method may be manipulated?

A26: Another example of imprecision in the calculations comes from whether historical flow data is used to determine the flow. The EPA determined that withdrawals exceeding 5% of the mean flow may indicate an inappropriately located facility. Is that the mean of the unimpaired flows—i.e. the mean flow if there were no reservoirs? Or is it the mean of the entire period of recorded flows, both pre- and post-impoundment? Or should it be the mean of only the post-impoundment flows, since they represent the managed river that we have today? The mean in 2008 was approximately 3,600 cfs because the discharge from Thurmond Dam was limited to 3,600 cfs due to the drought. In the FEIS, the Staff examined potential future minimum flows under the Corps' Drought Contingency Plan. Again, using an annual mean flow says very little about the instantaneous conditions encountered by aquatic species in the river.

Q27: How does the "surrogate method" account for cumulative impacts of multiple withdrawals in one area?

A27: It does not. The surrogate method is derived from a passing statement in the preamble to the final 316(b) rule; it was meant to be a rule of thumb, not a regulatory standard. As such, it does not address what to do in a situation where there are several withdrawals already occurring in the area. The FEIS uses the surrogate method to quantify the cumulative withdrawal of the new Units in combination with the existing Units, but does not quantify other withdrawals nearby.

Q28: Are there other withdrawals that should be included in the cumulative impacts analysis?

A28: Yes. The FEIS mentions several major withdrawals on page 7-5, but does not analyze the cumulative impact of these withdrawals in combination with the proposed Units 3 and 4. On that same page, one of the reasons cited for the conclusion that impacts would be small is that "other nearby surface water users consume less water than the VEGP site would with the proposed two new Units." I really don't know what to make of this statement. In cumulative impacts analysis we are concerned with the *total impact of all of the withdrawals* combined with the new Units; the fact that other nearby withdrawals are less than Plant Vogtle with the new Units is irrelevant.

The surrogate method presumes that impacts of withdrawals can be quantified by looking at the rate of withdrawal as a percentage of the total flow. If you accept the surrogate method as valid, then it should be applied consistently to all nearby withdrawals. Interestingly, the recently completed EIS for the Vogtle Units 1 and 2 quantifies cumulative withdrawals of two nearby withdrawals, in addition to the new and existing Vogtle Units. According to that EIS at 4-52-4-53:

> VEGP Units 1 and 2 at a permitted withdrawal rate of 127 cfs; SCE&G's D Area Powerhouse at 44.3 cfs; SCE&G's Urquhart Station at 82.6 cfs; and VEGP proposed Units 3 and 4 at 127 cfs (NRC 2007). These four users are expected to incur a total withdrawal of 380.9 cfs. As discussed in Section 2.2.2, the average flow volume in the Savannah River at Augusta is 9,157 cfs (Gotvald et al. 2005), and the expected low flow volume during drought periods is 3,800 cfs (UGA 2006). Therefore, the total withdrawal from the four largest users in the vicinity of VEGP is expected to range from 5 percent of the normal volume to 12 percent of the low flow volume.

Q29: Why are the withdrawal figures from the license renewal EIS so different from those found in the ESP FEIS?

A29: I don't know. This is another example of the inherent unreliability of the surrogate method. The license renewal EIS reports the *permitted* withdrawal rate of Units 1 and 2 (127 cfs), while the ESP FEIS uses the normal withdrawal rate as designed (90 cfs). The ESP FEIS reports the D-Area Powerhouse *consumptive use* is 68.4 cfs, not the 44.3 cfs reported in the license renewal EIS. Similarly, the ESR FEIS says the Urquhart Station *consumptive use* is 127.5 cfs, as opposed to the 82.76 cfs in the license renewal EIS. The license renewal EIS uses 127 cfs as the withdrawal rate for Units 3 and 4, while the ESP FEIS uses the designed normal withdrawal rate of 83 cfs. These EIS's were produced contemporaneously with information provided by a single applicant—SNC. I can't provide any explanation for the discrepancies. Nor can I explain why one EIS quantifies cumulative withdrawals while the other does not.

In accordance with 28 U.S.C. § 1746, I state under penalty of perjury under the laws of the United States of America that the foregoing is true and correct.

Executed on January 9, 2009.

Executed in Accord with 10 C.F.R. 2.304(d)
Barry Wayne Sulkin
4443 Pecan Valley Rd.
Nashville, Tennessee 37218
Phone: (615) 255-2079
Email: sulkin@hughes.net