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# NUCLEAR REGULATORY COMMISSION

Title: Southern Nuclear Operating Company

Docket Number: 52-011-ESP; ASLBP No. 07-850-01-ESP-01

Location: Augusta, Georgia

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1 UNITED STATES OF AMERICA

2 NUCLEAR REGULATORY COMMISSION

3 + + + + +

4 ATOMIC SAFETY AND LICENSING BOARD PANEL

5 + + + + +

6 HEARING

7 ----------x

8 In the Matter of: :

9 SOUTHERN NUCLEAR OPERATING : Docket No.

10 COMPANY : 52-011-ESP

11 : ASLBP No. 07-

12 (Early Site Permit for : 850-01-ESP-

13 Vogtle ESP Site : BD01

14 ----------x

15 Monday, March 16, 2008

16 Doubletree Hotel Augusta &

17 Convention Center

18 2651 Perimeter Parkway

19 Augusta, Georgia

20 BEFORE:

21 G. PAUL BOLLWERK, Chair, Administrative Judge

22 NICHOLAS G. TRIKOUROS, Administrative Judge

23 DR. JAMES F. JACKSON, Administrative Judge

24

25

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1 P-R-O-C-E-E-D-I-N-G-S

2 8:32 a.m.

3 JUDGE BOLLWERK: Let's go ahead and go on
4 the record, please.

5 Good morning. Today this Nuclear
6 Regulatory Commission Atomic Safety and Licensing
7 Board is here to conduct a hearing on contested
8 matters in a proceeding for the potential issuance of
9 a nuclear power reactor early site permit or ESP in
10 accord with Subpart A of Part 52 of Title 10 of the
11 Code of Federal Regulations, also referred to as the
12 CFR.

13 An ESP, which is a special type of NRC
14 permit is categorized as a partial construction permit
15 under Section 52.21 of 10 Code of Federal Regulations.
16 Its issuance, however, does not authorize an
17 applicant to construct a nuclear power reactor.
18 Rather, the focus of an ESP is the suitability of the
19 proposed site for such a facility.

20 As we noted in our issuances of December
21 15, 2008 and February 4, 2009, in accord with the
22 procedure set forth in Subpart L of Part 2 of Title 10
23 of the CFR the Board will receive testimony and
24 exhibits and question witnesses concerning matters at
25 issue regarding the August 2006 application of

1 Southern Nuclear Operating Company, or Southern, for
2 an ESP for two new nuclear power reactors designated
3 as Units 3 and 4. These reactors, which would employ
4 the Westinghouse Electric Corporation AP-1000 advanced
5 passive pressurized water reactor certified design
6 would be located at the existing two unit Vogtle
7 electric generating plant site near Waynesboro,
8 Georgia.
9 Specifically in this contested hearing the
10 Board will receive regarding three discrete National
11 Environmental Policy Act, or NEPA related contentions
12 or challenges to the efficacy of the Southern ESP
13 application and the associated NRC staff final
14 environment impact statement that were jointly raised
15 by several groups, including the Atlanta Women's
16 Action for New Directions, the Blue Ridge
17 Environmental Defense League, the Center for a
18 Sustainable Coast, Savannah Riverkeeper and the
19 Southern Alliance for Clean Energy.
20 These issues concern: The impacts of the
21 proposed facility's cooling system on Savannah River
22 aquatic resources; the need to implement a dry cooling
23 system as a design alternative to the currently
24 proposed wet closed cooling system for the facilities,
25 and; the impacts of dredging the Savannah River to

1 permit reactor components to be barged to the proposed
2 new facilities during construction.
3 Before we begin with the parties opening
4 statements on these matters, I'd like to identify the
5 members of this licensing Board.
6 To my right is Judge Nicholas Trikouros.
7 Judge Trikouros, a nuclear engineer, is a full time
8 member of the Atomic Safety and Licensing Board panel.
9 To my left is Dr. James Jackson. Judge
10 Jackson is also a nuclear engineer, and a part time
11 member of the panel.
12 My name is Paul Bollwerk. I'm an
13 attorney, a full time panel member and the Chairman of
14 this licensing board.
15 And I should mention that this licensing
16 board is, as are all licensing boards appointed under
17 the Commission's rules, an independent entity. We are
18 part of the Nuclear Regulatory Commission appointed by
19 the Commissioners. We are not part of the NRC staff.
20 The NRC staff is a separate entity and they will be
21 presenting their side of this case. And as three
22 independent judges we will be listening to their
23 presentations as well as those of the applicant and
24 the intervenor with respect to the admitted
25 contentions here today.

1 Also at this point I'd like to have the
2 counsel representatives for the parties identify
3 themselves for the record. Why don't we start
4 applicant Southern, followed by the NRC staff and then
5 the joint intervenors.
6 And I'll turn to Southern first.
7 MR. BLANTON: Your Honor, Stan Blanton for
8 Southern Nuclear.
9 Here at counsel table with me I have
10 Leslie Allen and Grady Moore and Kathryn Sutton.
11 JUDGE BOLLWERK: All right. Thank you.
12 MR. MOULDING: Judge Bollwerk, my name is
13 Patrick Moulding representing the NRC staff and with
14 the NRC's Office of the General Counsel.
15 With me are Jody Martin and Sarah Price,
16 also of the Office of the General Counsel.
17 JUDGE BOLLWERK: All right. Thank you very
18 much.
19 MR. SANDERS: Lawrence Sanders with the
20 Turner Environmental Law Clinic. We represent the
21 joint intervenors.
22 With me at the counsel table I have
23 Stephen Johnson and Teresa Porter. They are both third
24 year law students. And behind me I have Mindy
25 Goldstein, who is a staff attorney at the Clinic.

1 JUDGE BOLLWERK: All right. Thank you very
2 much.
3 We're glad to have you with us today.
4 We have a brief meeting here yesterday to
5 go over some administrative matters. And as you can
6 tell, these microphones are fairly hot, as the saying
7 goes. So be aware that as you're speaking among
8 yourselves as we are already, when the little red
9 light is on that means you're on. And there is a mute
10 button, which I just did, to mute. Make sure that
11 that's on if you're having some kind of a side
12 discussion. Just a word to the wise. Or everybody
13 here in the room will hear it.
14 This is a great sound system we've put
15 together, but it does pick up fairly low noises. So
16 you just be aware of that.
17 All right. In addition, before we begin
18 with the substantive matters before us today there's
19 several items that I'd like to bring to the attention
20 of those attending today's proceeding.
21 As I noted earlier, the hearing scheduled
22 to be conducted the next three or four days in this
23 facility is on contested matters raised by the joint
24 intervenors relative to the Southern ESP application.
25 In accord with Nuclear Regulatory Commission

1 regulations and the Atomic Energy Act beginning next
2 Monday, March 23rd at 8:30 a.m. in the auditorium at
3 the Augusta Technical College, Waynesboro Burke
4 Campus, 216 Highway 24 South in Waynesboro, Georgia
5 this Board is scheduled to conduct a so called
6 mandatory or uncontested hearing regarding the
7 Southern ESP application. During that hearing, which
8 is scheduled to last through Wednesday, March 25th,
9 the Board will receive evidence intended to help it
10 determine whether with respect to those safety and
11 environmental matters associated with Southern ESP
12 application that are not the subject of the contested
13 issues raised by joint intervenors, the NRC staff
14 performed an adequate Atomic Energy Act and National
15 Environmental Policy review of the Southern ESP
16 application and made findings relative to that review
17 with reasonable support in logic and fact.
18 In contrast to the contested hearing being
19 held this week as the only parties to the ESP
20 mandatory hearing, the NRC staff and applicant
21 Southern are slated to make presentations to the Board
22 regarding the sufficiency of the Southern ESP
23 application and the staff's final Environmental Impact
24 Statement and Safety Evaluation Report with a
25 particular focus on several subject matter areas,

1 including:

2 Water use impacts;

3 Radiological impacts;

4 Environmental impacts of alternatives;

5 The limited work authorization and site

6 redress plan that are part of the ESP;

7 The deferral of any issues from the ESP

8 proceeding to the ongoing combined license process;

9 Seismic evaluation;

10 Groundwater impacts on safety related

11 structures;

12 The site emergency plan;

13 Severe accident mitigation design

14 alternatives;

15 Proposed NRC staff conditions on the early

16 site permit, and;

17 The impact on the ESP application of

18 pending Revisions 16 and 17 to the AP-1000 design

19 certifications.

20 Those who might be interested in any of

21 these subjects are invited to attend these mandatory

22 hearing sessions next week in Waynesboro, which are

23 open to the public.

24 Attendance as well as participation by the

25 public is welcome at two sessions being conducted by

1 the Board next week in conjunction with the mandatory
2 hearing.
3 Under Section 2.315(a) of Title 10 of the
4 Code of Federal Regulations presiding officers are
5 authorized to entertain oral limited appearance
6 statements from members of the public. These
7 statements, which are transcribed and placed into the
8 official docket of the proceeding, are intended as an
9 opportunity for members of the public to express their
10 views about and may help the Board and/or the parties
11 in their consideration of the issues in a licensing
12 proceeding both with respect to the contested and
13 uncontested or mandatory hearing aspects of the
14 proceedings.
15 On Sunday afternoon, March 22, 2009
16 beginning at 3:00 p.m. and again on Monday evening,
17 March 23rd beginning at 7:00 p.m. at the Auditorium of
18 the Augusta Technical College, Waynesboro Burke Campus
19 in Waynesboro the Board and these parties will be
20 present to listen to statements by members of the
21 public who may have concerns about either the
22 contested or mandatory aspects of the ESP proceeding
23 or about the pending March 2008 Southern application
24 for a combined license or COL to construct and operate
25 Vogtle Units 3 and 4, which is the subject of a

1 contested issue regarding the details provided in the
2 Southern plan for storing low level radioactive waste
3 in light of the recent closure of the Barnwell, South
4 Carolina low level waste facility which is also
5 pending before the members of this Board.
6 If anyone here today is interested in
7 making a limited appearance statement on Sunday
8 afternoon or Monday evening in Waynesboro and you have
9 not preregistered to do so, I would urge you to see
10 during our break our law clerk Wen Bu, who is sitting
11 over here on the side. And we will include you on a
12 list of pre-registered speakers for either session.
13 So, again, if you're interested in making
14 a limited appearance statement, you might be here
15 today and you want to pre-register, Ms. Bu will be
16 glad to do that for you.
17 As a final preliminary matter, I would
18 note that today we will be utilizing some technology
19 in the hearing room that will, I hope, add the Board
20 and the parties in conducting a more efficient
21 proceeding, at least after we work the bugs out of I'm
22 sure.
23 We're here today for the first time
24 officially implementing some of the technology that
25 was developed originally for the recently convened

1 high level waste repository licensing proceeding,
2 namely, the digital data management system, or DDMS as
3 we refer to it.
4 The DDMS is our attempt to digitize both
5 the video and documentary record of a evidentiary
6 proceeding and make it accessible and useable to the
7 Board and the litigants in a courtroom setting. One of
8 the things that we'll be doing with the DDMS is during
9 this proceeding is marking the parties' exhibits
10 electronically rather than using an ink stamp or
11 labels, as is customary in most judicial hearings.
12 This may involve some interchange between the Board
13 and our information technology technicians sitting
14 here over to the right.
15 Also, each of the parties has been
16 provided with a laptop computer with which via a
17 wireless broadband internet hookup they should be able
18 to keep track of the status of the various exhibits as
19 well as search for and view any of the materials that
20 currently reside in the docket of this proceeding.
21 Additionally, we'll be recording the
22 proceeding which the parties will have available to
23 them via the DDMS after the hearing for, among other
24 things, making any transcript corrections.
25 Further, we anticipate using display

1 technology as part of the evidentiary presentations.
2 You can see the display screen over here. Which
3 hopefully will make the information we will be
4 discussing with the parties' witnesses more accessible
5 and understandable to those in the audience today.
6 While I would be surprised if we're able
7 to use all this technology without a hitch, as I
8 mentioned before, I'm hopeful that by the close of
9 this hearing and next week's mandatory hearing, during
10 which we'll also use the DDMS, the advantages of a
11 more technology approach to hearing data management
12 will be obvious to the parties and the public
13 observers of the proceeding.
14 All that being said, we are ready to turn
15 to the substance of today's case after dealing with
16 one more administrative matter. And I would note that
17 this is my cell phone right here. I'm turning it off.
18 All right? And I'm going to stick it in my pocket.
19 And I'm not going to turn it on again until we are in
20 a recess.
21 I would request that everyone else do the
22 same thing with his or her cell phone, or at least put
23 it on vibrate. If you put your phone on vibrate and
24 it goes off while we're in session and you wish to
25 answer, you'll have to leave the room before you have

1 your conversation.

2 We appreciate everyone abiding by this

3 protocol at anytime this hearing is in session.

4 Unless the participants have anything at

5 this point they need to bring to the Board's

6 attention, let's begin with Southern's opening

7 statement regarding their position on the three

8 matters that are before the Board in the context of

9 the contested portion of this ESP proceeding.

10 MR. BLANTON: Your Honor, Stan Blanton for

11 Southern Nuclear. I do have one administrative matter

12 that I need to bring up.

13 JUDGE BOLLWERK: Okay.

14 MR. BLANTON: And I've mentioned this to

15 both counsel and to the Board's law clerk, and it does

16 relate to some of our documents that are filed on the

17 DDMS. One of our witnesses, Mr. Dodd, produced a

18 report that's Southern Nuclear Exhibit 4 which is an

19 interim report of the impingement entrainment study

20 that was done on Units 1 and 2 during the past year.

21 Mr. Dodd just this last week completed that study and

22 finalized the report. In finalizing the report he

23 found two calculations that are in the report and

24 included in his testimony, or the result of which are

25 included in his testimony that need to be corrected.

1 It's in answer 12 of his testimony. And
2 the calculation in question is his extrapolation of
3 the data collected into a projection of an annual
4 entrainment rate and a 95 percent confidence level
5 upper entrainment rate -- excuse me. Impingement rate,
6 not entrainment rate. Impingement. The difference is
7 not material, it would change a number in the report.
8 For him to swear based on his current understanding
9 when he filed the testimony he thought the number
10 right. Now he does not think the number is right. So
11 I'm asking the Board, really, whether you would rather
12 him just correct that on the record when his testimony
13 and report are offered or would you rather -- we have
14 a DVD with the updated number here with us and we can
15 provide that to the DDMS now and save time when we put
16 the witnesses on, if that's the Board's preference.
17 JUDGE BOLLWERK: Let me just turn to Mr.
18 Wilkie and see if there's any problem with taking the
19 revised testimony. All right.
20 And I take it the materials you're
21 prepared to give to the court reporter would have the
22 revised testimony with it?
23 MR. BLANTON: Yes, sir.
24 JUDGE BOLLWERK: Okay. Let's go ahead
25 then and since Mr. Wilkie thinks he can go ahead and

1 handle the revised electronic version, we'll go ahead
2 and do it that way then, if that's acceptable to you
3 all. That way we won't have to revise the record and
4 it will be completed as its submitted.
5 MR. BLANTON: We have it right here, and I
6 can even give it to him now I can wait until --
7 JUDGE BOLLWERK: Do you want it now or you
8 want -- why don't you hold the copy for the court
9 reporter at this point. And if you got a got a copy
10 for Mr. Wilkie, why don't you give him that and he can
11 go ahead and start working that.
12 I don't want to confuse the court report
13 by giving him things before we get moving forward.
14 MR. BLANTON: All right. Thank you, Your
15 Honor.
16 JUDGE BOLLWERK: Thank you. And I take
17 it, obviously, as you mentioned you all talk about
18 this and there's no problems from anybody's
19 perspective in terms of the staff or the joint
20 intervenors is what I heard you say?
21 MR. BLANTON: Nobody expressed one to me.
22 JUDGE BOLLWERK: Okay. Fine. Thank you.
23 All right. Appreciate you bringing this
24 to our attention. This is a new process, obviously,
25 and when we get the electronics involved it gets a

1 little more complicated in one way. But hopefully
2 it'll be a cleaner record than the --
3 MR. BLANTON: I apologize. And we've been
4 struggling with it, as you know, Your Honor.
5 JUDGE BOLLWERK: We talked with you about
6 it a little bit on Friday, right? So, okay.
7 MR. SANDERS: Your Honor, we have a couple
8 of similar minor editorial issues with one of our
9 answers as well. And I think we would appreciate
10 being able to do the same thing. And we will talk with
11 the other parties and make sure that they're on board
12 and understand what we're doing before we offer it.
13 JUDGE BOLLWERK: Okay. And what
14 witnesses? Is this today or probably later?
15 You're going to need to come up to a
16 microphone. We can't hear you.
17 MR. SANDERS: Yes, there was an issue with
18 -- I think this is really minor and isn't going to
19 make a difference. But the staff substituted
20 witnesses at the last moment and we had a few
21 questions on rebuttal that just sort of referred to,
22 you know, in answer so-and-so Ms. Caverly said X and
23 what do you think of that? And now it's really not
24 Ms. Caverly. Do we need to change that or is it good
25 enough?

1 JUDGE BOLLWERK: Do you think you can
2 change it? Is it a problem for you?
3 MR. SANDERS: We could. We have the
4 equipment here. We could definitely do it.
5 JUDGE BOLLWERK: Let me again turn to Mr.
6 Wilkie. All right.
7 MR. SANDERS: Okay. We will get that
8 changed.
9 JUDGE BOLLWERK: Okay. And that, again,
10 relates to which contention, I'm sorry? 1.3 or 1.2?
11 MR. SANDERS: 1.2? 1.2 and 1.3.
12 JUDGE BOLLWERK: Now the question is going
13 to become we're probably looking at admitting that
14 testimony, oh, probably this afternoon?
15 MR. SANDERS: I think, you know, again
16 this probably is a very small editorial change. So we
17 could probably fix it pretty quick.
18 JUDGE BOLLWERK: Okay.
19 MR. SANDERS: And get Mr. Wilkie a digital
20 copy.
21 JUDGE BOLLWERK: Okay. All right. Well,
22 let's try to do that. If it becomes a logistical
23 matter, let us know. Okay.
24 All right. Anything else administrative at
25 this point anyone has? All right. Then let's turn

1 then to Southern. And I think you all, we gave each of
2 the parties 15 minutes to sort of making an opening
3 presentation dealing with these three contentions to
4 tell us whatever you'd like us to know about your
5 position relative to the contentions.
6 Mr. Blanton, I'll turn to you then.
7 MR. BLANTON: Thank you, Your Honor, and
8 good morning.
9 Southern Nuclear will present evidence in
10 this contested proceeding that will establish that
11 the0 environmental record developed by Southern
12 Nuclear and the staff on this ESP includes a
13 reasonable discussion of the relevant environmental
14 issues raised in the joint intervenors' three
15 contentions.
16 The evidence will show that the
17 contentions are unsubstantiated and that the ESP, at
18 least as to these contentions, is due to be issued.
19 As the Board and the parties are aware
20 this really involves a question of the Commission's
21 obligations under the National Environmental Policy
22 Act. NEPA requires a federal agency, such as NRC,
23 before it takes a federal action to take a "hard look"
24 at environmental issues. That hard look requirement
25 is informed by rule of reason. That rule of reason

1 includes several principles that have been enumerated
2 by the Commission in prior cases, including that not
3 every environmental impact that could possibly result
4 from an action has to be evaluated. Only reasonably
5 foreseeable impacts of federal actions are within the
6 scope of NEPA. Only feasible alternatives to the
7 proposed action are required to be evaluated. And
8 remote and speculative or inconsequentially small
9 impacts or experimental or first of a kind
10 alternatives are not required to be evaluated.
11 In addition, substantial weight is given
12 to the preferences of private applicants in cases such
13 as this one to issues such as facility design and site
14 selection.
15 In short, under NEPA there's a requirement
16 to ensure that the Agency makes a reasonable
17 discussion of relevant issue. It does not convert
18 every federal action into a research project to
19 satisfy every question that the opponents of the
20 project can think of.
21 In addition, the record in this proceeding
22 will provide a basis for the Board to supplement the
23 FEIS issued by the staff as to any issues where the
24 Board feels that the discussion in the FEIS could be
25 improved with additional data.

1 Turning to the contentions themselves.
2 The first contention that we'll address today is
3 Contention 1.2, which deals with aquatic impacts and
4 specifically the adequacy of the analysis of the
5 impingement, entrainment and thermal impact discussion
6 in the FEIS of the operation of proposed Vogtle Units
7 3 and 4.
8 Now the joint intervenors have not
9 contended or presented any evidence that the
10 conclusions reached by the staff in the FEIS are
11 incorrect. Rather, the contention alleges that
12 Southern Nuclear or the staff should have conducted
13 more or different analyses, used more conservative
14 assumptions or analyzed different or more severe
15 conditions of the aquatic environment where the plant
16 is to be located.
17 There are no real material facts in
18 dispute. This contention is a controversy between
19 expert witnesses of all the parties and a difference
20 of opinion that the Board will need to sort through.
21 Our evidence will show that the
22 environmental report submitted by Southern Nuclear and
23 the data in the FEIS and the findings are thorough,
24 conservative and certainly a reasonable evaluation of
25 these impacts.

1 Our witnesses, Dr. Charles Coutant and Tom
2 Moorer, for example, will demonstrate in their
3 testimony the reasonableness of the discussion in the
4 environmental report and the FEIS of the aquatic
5 impacts of Vogtle Units 3 and 4, including the
6 specific issues raised by the joint intervenors, which
7 includes: Species identification and composition; life
8 stage information, and; the assumptions used to
9 evaluate the impacts on the aquatic community in the
10 Savannah River.
11 In particular, the assumptions regarding
12 river flow will be addressed. And I'd like to spend
13 just a second talking about river flow.
14 The FEIS evaluates the impacts of the
15 intake and discharge of the plant on a river flow of
16 3700, I think, cubic feet per second and tests the
17 sensitivity of those findings at river flows of 3,000
18 cubic feet per second and 2,000 cubic feet per second
19 on the Savannah River. Those are extremely low,
20 extremely conservative river flows.
21 What I want to mention is you're going to
22 hear a lot of testimony in the next three days about
23 river flows. And what you need to keep in mind is that
24 the Savannah River from the Thurmond Dam to the site
25 of the plant runs about 90 miles. The river flows

1 along that 90 mile stretch are different. So when you
2 hear about a flow at the Thurmond Dam, that flow out
3 of the Thurmond Dam results in a different flow at the
4 site of the plant.
5 So in other words, in this last December
6 when the Corps of Engineers reduced the river flow at
7 the dam to its record low of 3100 cubic feet per
8 second, the flow at the site, at the Waynesboro gauge
9 stayed at about 4200 cubic feet per second. So when
10 you hear the testimony from the different witnesses
11 about river flows and the severity of different
12 conditions in the river, you need to know at what
13 gauge that river flow is being measured in order to
14 understand what impact that has at the site as opposed
15 to somewhere else on the river.
16 In addition to the issues raised by the
17 joint intervenors our witnesses will discuss the
18 intake design of Vogtle 3 and 4, which is also the
19 intake design is very benign environmentally. The
20 closed cycle cooling system uses -- or withdraws 98
21 percent less water than a once through systems, it
22 employs low velocity screens and employs weir walls
23 and other design features that minimize impingement of
24 fish.
25 In addition to the information in the

1 FEIS, Southern Nuclear because of issues raised about
2 the impact of Unit 1 and 2 in the contention,
3 performed an impingement and entrainment study over
4 the last year of Units 1 and 2 which involved taking
5 impingement and entrainment samples, and our witnesses
6 will testify about those. The results of those
7 studies show that the FEIS over predicts the number of
8 fish impinged and organisms entrained by the Unit 1
9 and 2 cooling system, which will be very similar to
10 the Unit 3 and 4 cooling system.
11 In addition to that we took measurements
12 of the thermal plume which indicate that the estimates
13 in the FEIS using the CORMIX model are also
14 conservative. That the discharge from Units 1 and 2 is
15 very low, and almost not noticeable in the Savannah
16 River when measurement was taken last September.
17 The next contention we'll address is dry
18 cooling. The contention asserts that the discussion
19 of dry cooling in the Environmental Impact Statement
20 is insufficient given the potential presence of
21 "extremely sensitive biological resources in the
22 Savannah River."
23 The facts in dispute on this contention
24 are whether there are indeed extremely sensitive
25 biological resources in the vicinity of the site of

1 the plant and the feasibility of dry cooling. As I
2 mentioned a minute ago, NEPA does not require
3 evaluation of infeasible alternatives.
4 Our evidence regarding extremely sensitive
5 biological resources will again come from Dr. Coutant
6 who has studied the literature regarding species
7 composition, spawning and sensitive habitats in the
8 area of the Savannah River. And he's also studied the
9 results of Mr. Dodd's and Mr. Montz' study of Unit 1
10 and 2, including their sampling of organisms and fish
11 impinged. And Dr. Coutant has concluded that while
12 there is at least one listed species that has been
13 noted in the Savannah River, there are not critical
14 habitat areas, no sensitive spawning areas in the
15 vicinity of the site. And that the migration patterns
16 of the short-nose sturgeon, which is the only listed
17 species, are not affected by the discharge from Units
18 1 and 2 and would not be impacted by additional
19 discharge from Units 3 and 4 because of the small
20 nature of the plume and the small temperature
21 difference.
22 This leads Dr. Coutant to conclude that
23 aren't any extremely sensitive biological resources in
24 the vicinity of the site which eliminates the need to
25 further address dry cooling under the contention as

1 admitted.

2 In addition to Dr. Coutant's testimony,
3 we'll produce testimony from Mr. Jim Cuchens who will
4 testify about the technical feasibility of dry cooling
5 as applied to a large nuclear power plant that
6 utilizes a triple cell low back pressure such as the
7 AP-1000.

8 Like the EPA in its 316(b) and like the
9 FEIS, and like the FEIS in other cases, Mr. Cuchens
10 finds that there are substantial performance and
11 reliability penalties associated with the application
12 of dry cooling to a low back pressure turbine. And
13 that the application of a high back pressure turbine
14 such as used in smaller combined cycle or coal plants
15 that do use dry cooling is not practical in this
16 application. In fact, utilization of dry cooling in
17 connection with a nuclear power plant, which has not
18 been done anywhere for a large scale plant in the
19 world to our knowledge or based on the evidence, would
20 be the first of a kind experimental application that's
21 not required to be evaluated under NEPA.

22 In addition to that, the addition of dry
23 cooling to the AP-1000 would violate the
24 standardization principles inherent in Part 52 and the
25 AP-1000 standard design and be extremely costly to the

1 point where it's not a feasible alternative.

2 The last contention that we will address

3 in this hearing are the impacts or potential impacts

4 of dredging the Savannah River navigation channel by

5 the Army Corps of Engineers for the purpose of

6 permitting barge traffic to the site to deliver

7 components. Whether or not this dredging will occur,

8 the evidence will show is speculative at this point.

9 The applicant and its contractor have indicated that

10 barge delivery is its preferred method of delivery of

11 components to the site. We don't argue that. We would

12 rather use barge than any other form of delivery.

13 The Corps of Engineers has indicated that

14 until it does its own NEPA analysis and until it

15 receives funding from Congress to do that dredging

16 that no dredging will occur, however. That funding

17 has not been forthcoming to date. And we have other

18 ways of delivering components to the site if that

19 dredging does not occur. So the development of the

20 project is not dependent on barge delivery and

21 therefore dredging.

22 Nevertheless, because the Board admitted

23 the contention and desires additional information, we

24 have evidence from three gentlemen who are employed by

25 Westinghouse and its contractors, Mr. Neubert, Mr. Bos

1 Smith and Mr. Dave Scott who actually performed a
2 survey for the contractor to determine roughly the
3 amount of dredging that might be required in order to
4 accomplish barge delivery on the Savannah River. They
5 conducted this study unrelated to the contention back
6 in the summer of 2008. And what they did is Mr.
7 Scott, who is a marine surveyor, did a sonar analysis
8 of the bottom of the Savannah River from the harbor to
9 the site and analyzed the width of the channel and the
10 depths at which some dredging would be necessary in
11 order to get the barge that would be required to
12 deliver components to the site up to the river to the
13 site.
14 Contrary to the estimate of 600,000 cubic
15 yards of material that's alleged or stated in the EIS,
16 or the 2 million cubic yards that's alleged by the
17 joint intervenors witnesses, the study performed by
18 Mr. Scott and Mr. Smith and Mr. Neubert resulted in
19 36,000 cubic yards of material. Orders of magnitude
20 less material.
21 Based on that small amount of dredging,
22 which is less -- I think Mr. Scott would testify that
23 that's less than would be necessary to build a dock or
24 boat slip on the river. Dr. Coutant has analyzed both
25 the locations and the amount of material to be

1 dredged, and has concluded that the impacts of that
2 dredging would be very small.
3 Again, this testimony and evidence is
4 available for the Board to put in its findings and
5 supplement the FEIS if it deems that necessary.
6 In short, I'm out of time. We believe our
7 evidence our show will find that the contentions are
8 unsubstantiated and we'll ask the Board to move that
9 way.
10 Thank you.
11 JUDGE BOLLWERK: Thank you, sir.
12 All right. Mr. Moulding, are you up for
13 the staff?
14 MR. MOULDING: Yes.
15 JUDGE BOLLWERK: All right.
16 MR. MOULDING: Thank you, Judge Bollwerk.
17 The NRC staff appreciates the opportunity
18 to appear before the Board to present its case on the
19 three environmental contentions.
20 For the reasons discussed in its testimony
21 and exhibits, the staff's position is that the joint
22 intervenors' contentions are without merit. The
23 staff's environmental review as documented in the
24 staff's final Environmental Impact Statement complies
25 with the requirements of the National Environmental

1 Policy Act and with the NRC's environmental
2 regulations.
3 This morning I will briefly describe the
4 basis for the staff's position and explain why they
5 support a decision by this Board to deny each of the
6 contentions. Before doing so, however, I would like
7 to emphasize a few principles of NEPA that shape what
8 the Board will be deciding in this hearing.
9 Under NEPA, the NRC is required to take a
10 hard look at the environmental impacts of a proposed
11 action as well as reasonable alternatives to that
12 action. However, this hard look is tempered by a rule
13 of reason that requires agencies to address only
14 impacts that are reasonably foreseeable, not ones that
15 are remote and speculative. Because the purpose of
16 NEPA is to disclose expected environmental impacts,
17 NEPA does not require consideration of worst-case
18 scenarios, but rather the impacts that may reasonably
19 result from the action under consideration. For this
20 reason NEPA does not call for certainty or precision,
21 but rather an estimate of the anticipated impacts.
22 As the Commission has stated, our Boards
23 do not sit to fly speck environmental documents or to
24 add details or nuances. When the EIS on its face
25 comes to grips with all important considerations,

1 nothing more need be done.

2 The staff's expert witnesses and evidence
3 will confirm for the Board the staff has taken the
4 required hard look at the environmental impacts of the
5 proposed action and that the FEIS has indeed come to
6 grips with all important considerations. Contrary to
7 the intervenors' claims, the staff's environmental
8 review has relied on appropriate information and data,
9 has analyzed impacts and alternatives in the level of
10 detail required by NEPA and has reached well supported
11 conclusions about the impacts of the proposed action.

12 With these principles in mind I will
13 address the key issues raised by each contention.

14 Contention 1.2 challenges the adequacy of
15 the staff's analysis of the direct, indirect and
16 cumulative impacts of the proposed cooling system
17 intake and discharge structures on aquatic resources.
18 Specifically, it alleges that the staff inadequately
19 analyzes those impacts associated with impingement and
20 entrainment as well as with thermal discharge.

21 In support of the staff's position on
22 Contention 1.2 the staff is presenting a panel of five
23 expert witnesses. Dr. Christopher Cook and Mr. Lance
24 Vail will testify regarding the staff's review of
25 hydrology including the selection of flows and the

1 thermal plume analysis.

2 Dr. Michael Masnik, Ms. Rebekah Krieg, and
3 Ms. Nancy Kuntzleman will testify regarding the
4 staff's analysis of impacts on aquatic biota.

5 In their testimony on this contention the
6 intervenors have criticized certain studies that the
7 staff considered in the FEIS and have argued that more
8 site specific data is needed. However, the staff will
9 show that it followed staff guidance and considered
10 numerous reliable data sources. And that the studies
11 criticized by the intervenors were both appropriate to
12 consider and were simply among many that the staff
13 reviewed.

14 The sources consulted by the staff were
15 more than sufficient to identify the aquatic resources
16 in the vicinity of the site and to enable the staff to
17 evaluate the environmental impacts of the proposed new
18 units.

19 The staff will also show that additional
20 sampling data obtained by the applicant since the FEIS
21 was completed further confirmed the staff's
22 conclusions.

23 The intervenors also criticized the
24 staff's use of a uniform drift distribution assumption
25 in evaluating impacts of entrainment of organisms by

1 the proposed cooling system. They argue as well that
2 the staff does not provide enough information about
3 the life history data of individual aquatic species.
4 However, the staff will show that assuming uniform
5 distribution of the drift organisms in the river is in
6 fact a conservative method for determining impacts.
7 This is because this approach would likely over
8 estimate how many organisms will be entrained.
9 The staff also properly considered
10 relevant life history information of important species
11 as instructed by staff guidance. The important
12 species specifically considered by the staff include
13 the federally endangered short-nose sturgeon and the
14 state listed Robust Redhorse. The staff determined
15 that this life history information indeed supports its
16 findings of small impacts.
17 The intervenors have claimed that the
18 staff used the percentage of the Savannah River flow
19 withdrawn by the plant cooling as the sole basis for
20 determining what entrainment impacts would be. They
21 also claim that the staff then disregarded this
22 approach when percentages went above a certain
23 threshold.
24 To the contrary, the staff has considered
25 the percentage of water withdrawn by the Vogtle units

1 as just one of several relevant factors. Those
2 include the use of closed cycle cooling, the design
3 and location of the cooling system intake canal and
4 structure, life history data of important species and
5 the result of historic sampling studies in the
6 Savannah River. The staff has not treated any
7 particular percentage of river withdrawal as a simple
8 threshold for determining whether impacts would be
9 small.
10 In Contention 1.2 the intervenors have
11 also challenged the range of Savannah River flows that
12 the staff evaluated. However, the staff considered an
13 appropriate and conservative range of flows. These
14 included not just the normal average flows of 8,830
15 cubic feet per second, but also low flows down to 3800
16 cubic feet per second that account for the releases of
17 water under drought conditions.
18 The Thurmond Dam is the primary control on
19 flows in the section of the Savannah River where the
20 Vogtle site is located. Therefore, the staff used
21 measured flow at the Dam as a reliable and
22 conservative basis for estimating what flows would be
23 at the Vogtle site.
24 Moreover, the nearly four year data record
25 from the Waynesboro gauge, a newer flow gauge located

1 at the Vogtle site, shows that the Savannah River flow
2 passing near the site is consistently higher than at
3 Thurmond Dam, including during periods of drought.
4 These data confirm that the staff's use of
5 the Thurmond Dam flows as a surrogate for estimating
6 the river flow passing the Vogtle site is a
7 conservative approach. In particular these data
8 confirm that the staff's evaluation of 3800 cubic feet
9 per second for the Savannah River flow remains
10 conservative for estimating what impacts on the
11 Savannah River would be from operation of the new
12 units during periods of low flow.
13 Yet to provide additional context for its
14 conclusions in the final EIS, the staff evaluated
15 extremely low river flows of 3,000 and 2,000 cubic
16 feet per second, flows below the lowest observed at
17 the Waynesboro flow gauge at the Vogtle site. The
18 staff determined that the impacts of plant operation
19 under these extremely low flow conditions would still
20 be small.
21 The intervenors nevertheless argue that
22 the staff should consider even lower river flows, what
23 they described as the theoretical minimum flow for the
24 river. However, this very definition indicates that
25 such flows would represent a worst case scenario. An

1 analysis of such river flows is neither necessary nor
2 appropriate for use in a NEPA analysis.
3 Even given the present drought conditions,
4 the staff considered flows analyzed in the FEIS to be
5 representative of conditions at the Vogtle site.
6 Finally, in Contention 1.2 the intervenors
7 challenged the staff's analysis of thermal discharge
8 impacts from the proposed new units. In particular,
9 the intervenors argued that the staff analysis does
10 not account for temperatures at which early life
11 stages of certain species may experience some
12 mortality. However, even after applying a range of
13 conservative assumptions, the staff's analysis shows
14 that the mixing zone that would result from the
15 combined discharge of the existing and proposed units
16 still would be small compared to the width of the
17 river. The staff used the industry standard CORMIX
18 model to determine the size of the thermal plume, that
19 is the mixing zone where water temperature would be
20 more than 5 degree Fahrenheit above the ambient stream
21 temperature. For this analysis the staff
22 conservatively assumed the lowest ambient stream
23 temperature, the highest combined discharge in a
24 single discharge point and drought level 3 low flow of
25 3800 cubic feet per second at the site.

1 This conservative analysis resulted in a
2 mixing zone that was 97 feet long and 15 feet wide at
3 a point where the river is approximately 312 feet
4 wide. The staff determined that the mixing zone would
5 not result in a thermal block for aquatic species and
6 that the potential loss of eggs and larvae passing
7 through the mixing zone would be only a small
8 percentage of the total number of organisms passing
9 the site.
10 Additionally, the short time that it would
11 take for organisms to pass through the plume would
12 limit those losses. Accordingly, impacts to fish
13 populations would be minor and undetectable.
14 Therefore, the intervenors' challenge regarding
15 thermal impacts for operation of the new units is
16 without merit.
17 For these reasons the FEIS both identifies
18 and adequately considers the impacts of the proposed
19 cooling system intake and discharge structure on
20 aquatic resources. It does so with respect to
21 impingement, entrainment and thermal effluent
22 discharge. Furthermore, in these respects the FEIS
23 adequately considers the cumulative impacts of
24 operations of all four Vogtle units, the two existing
25 units as well as the two proposed.

1 Contention 1.3 challenges the staff's
2 analysis of alternative cooling systems. Specifically
3 the joint intervenors argue that the NRC must review
4 dry cooling in greater depth. However, the staff's
5 analysis in the FEIS with respect to dry cooling
6 technology is adequate and complies with NEPA and
7 applicable staff guidance.
8 In support of the staff's position on
9 Contention 1.3 the staff is presenting a panel of four
10 expert witnesses. Dr. Cook and Mr. Vail will testify
11 regarding the staff's review of system design
12 alternatives. Dr.
13 Masnik and Ms. Krieg will testify regarding the
14 staff's analysis of impacts on important species.
15 In analyzing heat dissipation
16 alternatives, the staff follows the guidance in
17 Section 9.4.1 of the Environmental Standard Review
18 Plan. In this case, the proposed heat dissipation
19 system is a closed-cycle wet cooling system. In
20 analyzing the dry cooling alternative, the staff
21 recognized that such a system would largely eliminate
22 impacts on aquatic biota. However, for reasons also
23 described in the staff's testimony on Contention 1.2,
24 the staff concluded that the proposed cooling system
25 would have only small environmental impact. The staff

1 also found that a dry cooling system would have some
2 disadvantages with respect to land use, fuel use,
3 spent fuel transport and spent fuel storage.
4 Indeed, both the applicant and joint
5 intervenors' testimony acknowledge that a dry cooling
6 system at Vogtle would use more land than the proposed
7 wet cooling system and would result in some loss in
8 efficiency in the form of an energy penalty.
9 Consistent with staff guidance the staff
10 concluded that because the proposed cooling system
11 only produced small environmental impacts these
12 disadvantages of dry cooling made it appropriate to
13 conclude that dry cooling would not be environmentally
14 preferable to the proposed wet cooling system.
15 Therefore, the staff is not required to discuss dry
16 cooling in greater detail.
17 Contention 1.3 specifically challenges the
18 analysis of dry cooling because the intervenors assert
19 that extremely sensitive biological resources, or
20 ESBRs, are present in the vicinity of the Vogtle site.
21 Specifically, joint intervenors point to the Robust
22 Redhorse and short-nose sturgeon as examples of ESBRs.
23 The staff did not use the term ESBR in the
24 FEIS, but the staff believes that its concept of
25 important species would encompass all species that

1 would be defined as ESBRs. The staff considered both
2 the Robust Redhorse and the short-nose sturgeon to be
3 important species and it analyzed impacts to them both
4 in the FEIS.
5 As also described in the staff's testimony
6 on Contention 1.2, the staff found that impacts to all
7 aquatic resources from the operation of the proposed
8 cooling system would be small, including for those
9 species likely to be considered ESBRs. Because the
10 impacts from the proposed system are so minor any
11 further reduction in impacts resulting from the use of
12 dry cooling system would be undetectable at the
13 population level. Given this small impact, and the
14 fact that there are several disadvantages to the dry
15 cooling alternative, the staff correctly determined
16 that dry cooling was not environmentally preferable
17 and did not need to be discussed in greater depth.
18 Contention 6 challenges the staff's
19 analysis of impacts associated with potential dredging
20 of the Savannah River Federal Navigation Channel.
21 Specifically, the joint intervenors argue that the
22 staff's finding that impacts related to such dredging
23 could be moderate is inadequately supported.
24 In support of the staff's position on
25 Contention 6 the staff is presenting two panels of

1 witnesses. From the U.S. Army Corps of Engineers Mr.
2 William Bailey, Ms. Carol Bernstein, Mr. Lyle
3 Maciejewski and Mr. Stanley Simpson will testify
4 regarding matters within the Corps' knowledge and
5 authority. For the staff, Dr. Cook, Ms. Krieg, Ms.
6 Kuntzleman, Mr. Mark Notich and Mr. Vail will testify
7 the staff's decision to discuss impacts from the
8 potential dredging action in the FEIS as well as well
9 as the basis for the staff's conclusion.
10 NEPA requires the staff to analyze
11 cumulative impacts associated with the action under
12 review. It also requires analysis of any other
13 connected federal actions. However, for several
14 reasons any potential dredging of the federal
15 navigation channel is not a connected action.
16 First, the staff did not consider such a
17 dredging project to be necessary for the NRC's action
18 in granting an early site permit. Nor did the staff
19 assume that such dredging was certain to occur. The
20 staff recognized that barging was not the only means
21 for components to be transported to the Vogtle site.
22 Also, from discussions with the Corps the staff
23 believed that under higher Savannah River flows
24 barging of components would be feasible even without
25 dredging: This is, Southern could wait until higher

1 flows occur in response to the Corps' established
2 flood control practices. Channel dredging was thus not
3 necessary to enable barging.
4 Just importantly, no application or plan
5 to conduct such dredging of the navigation channel is
6 before the NRC or before the Corps, as the Corps'
7 prefiled testimony has confirmed. As the staff
8 explained, without any details from such a plan a
9 quantitative evaluation was not possible
10 Furthermore, at the time a formal plan is
11 developed or an application submitted for approval of
12 such a project, that action would be reviewed by the
13 Corps pursuant to that agency's regulatory guidelines.
14 However, based upon receipt of public comments on the
15 draft EIS regarding the potential need for dredging of
16 the federal navigation channel, the staff did include
17 a qualitative discussion in the FEIS of environmental
18 impacts expected to be associated with such dredging.
19 The staff found that cumulative impacts to
20 aquatic resources from the construction of a proposed
21 reactor units and dredging of the federal navigation
22 channel could be moderate. This analysis appropriately
23 reflected the limited information available and the
24 uncertainty as to the scope of dredging if it were
25 eventually to be undertaken. Thus, the staff's

1 analysis discloses impacts to the extent reasonably
2 possible.
3 For all these reasons potential dredging
4 of the navigation channel does not constitute a
5 connected action under NEPA. Therefore, the staff was
6 justified in evaluating the potential environmental
7 impacts as cumulative impacts rather than as direct
8 impacts of the NRC's action.
9 Potential dredging of the navigation
10 channel is neither necessary for the NRC action, nor
11 is it reasonably foreseeable.
12 Furthermore, any such dredging would be an
13 action independent of the proposed ESP. It would need
14 to be authorized under the jurisdiction of the Corps,
15 and the Corps would be required to perform an
16 independent NEPA review of the impacts of that
17 project. Thus, the staff's analysis in the FEIS with
18 respect to such dredging is both adequately supported
19 and consistent with NEPA requirements.
20 For these reasons the staff submits that
21 its environmental review, as documented in the FEIS,
22 complies with the requirements of NEPA. Accordingly,
23 the joint intervenors contentions should be denied.
24 Thank you.
25 JUDGE BOLLWERK: All right. Thank you,

1 sir.

2 Mr. Sanders, and I think you all are going

3 to divide your time in a certain way? Maybe you want

4 to tell us that up front?

5 MR. SANDERS: Yes. I think Mr. Johnson and

6 Ms. Porter are going to divide their time equally in

7 half and Mr. Johnson will speak first.

8 MR. JOHNSON: Good morning, Your Honors.

9 My name is Stephen Johnson and along with

10 Ms. Terry Porter we'll be giving the opening statement

11 on behalf of the joint intervenors.

12 Now the purpose of this opening statement

13 is to outline the reasons why Southern Nuclear

14 Operating Company should be denied an early site

15 permit for the two proposed reactors at the Vogtle

16 site. To this end Ms. Porter and I will be addressing

17 the studies and conclusions made by the staff and

18 Southern in regards to the environmental impacts of

19 the proposed units.

20 We will briefly discuss why these studies

21 are inadequate and their conclusions flawed.

22 I will be discussing Environmental

23 Contention 1.2 and 1.3. And Ms. Porter will then

24 discuss Environmental Contention 6.0.

25 In regards to Environmental Contention 1.2

1 and 1.3, there are two major flaws in this permit
2 application.
3 First, the staff denied the use of
4 sophisticated and thorough scientific methods in
5 preparing the Environmental Impact Statement. And as a
6 result, the impact statement contains inaccurate over
7 generalizations that minimize the entrainment,
8 impingement, thermal plume and wet cooling impacts of
9 the Vogtle site.
10 Secondly, the supplemental material
11 provided by Southern for this hearing does not cure
12 the defects in the Environmental Impact Statement.
13 Thus, there's no basis for this Board to take a hard
14 look and conclude the environmental impacts of the
15 proposed units will be small.
16 In regards to the Environmental Contention
17 1.2 the analysis of impingement entrainment of thermal
18 effluent discharge contained in the Environmental
19 Impact Statement is inadequate to ensure that the
20 Agency will be able to make an informed decision and
21 not act on incomplete information. Now the examples
22 that illustrate this adequacy are numerous.
23 First, the Environmental Impact Statement
24 lacks sufficient field surveys and quantitative
25 analysis to establish adequate baseline habitat

1 conditions to assess the ecological conditions,
2 species diversity and species abundance in the
3 vicinity of plant Vogtle.
4 Now Southern will try to introduce
5 evidence or will try to introduce studies to cure this
6 inadequacy, however Southern's biweekly studies which
7 occurred over a span of a few months are simply
8 insufficient to analyze the species near plant Vogtle.
9 A second example is that the Environmental
10 Impact Statement makes an inaccurate assumption of a
11 uniformly distributed drift community in assessing
12 impingement and entrainment impacts. Thus, to conclude
13 that entrainment and impingement mortality rates will
14 be directly proportional to this hypothetical drift
15 community could severely under estimate both the
16 actual composition of the drift community and the
17 rates of impingement and entrainment mortality.
18 And yet a third example is that the
19 Environmental Impact Statement lacks sufficient data
20 and analysis to support its conclusion that the fish
21 and shellfish located in the vicinity of the Vogtle
22 site are adapted to survive the abrupt changes created
23 by the hydraulic zone of influence. Southern and the
24 staff rely upon all assumptions that the fish and
25 shellfish inhabiting the Savannah River are pre-

1 adapted to tolerate such abrupt changes. In actuality,
2 certain species cannot survive such variations.
3 And finally, the Environmental Impact
4 Statement does not provide sufficient data and
5 analysis of thermal stress and mortality for the fish
6 species located in the middle lower estuarine Savannah
7 River. By not considering those river conditions
8 likely to occur, the Environmental Impact Statement
9 focuses on an overly conservative river conditions
10 which minimize the actual thermal impacts to aquatic
11 biota.
12 Moving on to Contention 1.3, NEPA requires
13 analysis of alternatives to be sufficiently complete.
14 In this case the analysis of dry cooling is woefully
15 inadequate. The staff erroneously concludes the
16 impacts of a wet cooling system would be small. And
17 then based on this incorrect assumption, concludes
18 that only a cursory review of alternatives is
19 required.
20 We are arguing that the impacts are
21 potentially greater than small, and accordingly a more
22 in depth analysis of alternatives is required.
23 Moreover, to the extent that any analysis of
24 alternatives was conducted, that analysis was
25 incomplete and incorrect.

1 Now the examples that illustrate this
2 inadequacy have been previously mentioned in my
3 discussion of Environmental Contention 1.2.
4 Also, the staff in determining the
5 withdrawal rate of the wet cooling system employed a
6 flawed methodology, which our experts characterize as
7 a surrogate method, for lack of a better term. This
8 flawed method uses a withdrawal rate as a percentage
9 of the total flow to determine the potential impacts
10 of the wet cooling system. Rather than actually
11 collecting data from the field, the staff's surrogate
12 methods simply establish a threshold of significance,
13 5 percent in this case, and then concluded any
14 withdrawal under 5 percent would result in a minor
15 impact.
16 The flaws in using this surrogate method
17 are that several scenarios would result in withdrawals
18 exceeding 5 percent. And, this method is inherently
19 flawed and subject to manipulation.
20 Since the staff employed a flawed
21 methodology to conclude the impacts of the wet cooling
22 system to be minor, it was wrong then of the staff to
23 undertake a cursory analysis of a dry cooling
24 alternative. If such an analysis had occurred, the
25 staff would have concluded a dry cooling system to be

1 feasible.

2 For the foregoing reasons, Southern's

3 permit application should be denied for a failure to

4 meet those requirements advanced by NEPA.

5 Now Ms. Porter will discuss Environmental

6 Contention 6.0.

7 Thank you.

8 JUDGE BOLLWERK: All right. And you may

9 want to take that microphone, or Mr. Sanders'

10 microphone and sort of point it towards you. There we

11 go.

12 MS. PORTER: Okay. Thank you. Good

13 morning, Your Honors.

14 My name is Terry Porter. And as Stephen

15 said, I will be discussing Environmental Contention

16 6.0 on behalf of joint intervenors.

17 The evidence joint intervenors present

18 today will demonstrate two things. First, the Nuclear

19 Regulatory Commission has an independent obligation to

20 assess the environmental impacts stemming from its

21 issuance of the early site permit to Southern Nuclear

22 Operating Company. And second, the FEIS prepared by

23 the Nuclear Regulatory Commission staff and the

24 evidence that Southern will introduce at this hearing

25 does not meet NEPA's hard look requirement. For these

1 reasons, in addition to those mentioned by Stephen,
2 joint intervenors request that the Board deny the
3 early site permit requested by Southern.
4 Now the Nuclear Regulatory Commission has
5 an independent obligation to assess the environmental
6 impacts stemming from its issuance of the early site
7 permit to Southern. As you know, NEPA requires the
8 Nuclear Regulatory Commission to take a hard look at
9 the environmental impacts of proposed actions.
10 The purpose of NEPA and the hard look
11 requirements is simple. The Nuclear Regulatory
12 Commission must know what environmental impacts
13 construction and operation of Units 3 and 4 will have
14 on the environment before it issues an early site
15 permit or a limited work authorization.
16 Now we know that dredging is a part of
17 this early site permit and the limited work
18 authorization. The permit application itself provides
19 that Southern wants to barge the nuclear reactor
20 components to the plant Vogtle site. Southern's
21 experts will testify that barging the nuclear reactor
22 components is the most cost efficient means of getting
23 them to the plant site. And finally, perhaps most
24 indicative of Southern's intent to barge, is the fact
25 that the plant Vogtle Units 3 and 4 site plans include

1 a haul road and a barge slip.

2 In order to barge its nuclear reactor
3 components to the plant Vogtle site, Southern wants to
4 use a navigation channel that has not been used for
5 navigation in 30 years. A federal navigation channel
6 that the U.S. Army Corps it has no plans of opening
7 for general navigation.

8 This dredging that will have to occur if
9 Southern wants to barge its components to the plant
10 Vogtle site is not separate or apart from the early
11 site permit. In fact, the FEIS states that there will
12 be dredging. The staff says now that they only
13 included that in response to public comment, but it
14 was there because it's in the plans.

15 The environmental impact stemming from
16 dredging the federal navigation channel are exactly
17 the type of impacts that NEPA requires agencies to
18 take a hard look at. In fact, they're exactly the
19 type of connected action the CEQ regulations discuss.

20 Now Southern will tell you that there
21 hasn't been a formal request or a funding allocated
22 for the dredging project and for these reasons the
23 Nuclear Regulatory Commission doesn't have to look at
24 the impacts of dredging. The problem with this
25 argument is that NEPA isn't triggered when there is a

1 formal request. It's triggered when an agency is
2 going to take a major federal action. Here NEPA's been
3 triggered. Dredging is connected to the major federal
4 action of the issuance of the early site permit.
5 Therefore, the Nuclear Regulatory Commission has an
6 independent obligation to take a hard look at the
7 environmental impacts of dredging.
8 Now Southern might also say that dredging
9 is not sufficiently defined and that's why the Nuclear
10 Regulatory Commission does not have to investigate the
11 environmental impacts of dredging. This argument
12 misses NEPA's point. The idea of NEPA is to disclose
13 and analyze impacts of an agency's action. Saying that
14 an action isn't sufficiently defined begs the
15 question: When are you going to define it? It's time
16 now.
17 This is the early site permit and limited
18 work authorization, this is the time when the Nuclear
19 Regulatory Commission will have the final word on
20 these two issues. And NEPA requires that the Nuclear
21 Regulatory Commission define its action and then
22 analyze and disclose the environmental impacts of
23 those actions.
24 Finally, Southern might tell you that the
25 staff doesn't need to look at the environmental

1 impacts of dredging because the Corps has jurisdiction
2 over dredging.
3 The CEQ regulations contemplate and
4 provide for processes that allow for agencies who do
5 not have jurisdiction over certain areas, like the
6 Nuclear Regulatory Commission in this case, to
7 complete Environmental Impact Statements for areas not
8 in their jurisdiction, like the federal navigation
9 channel in this case. Because dredging is within the
10 Corps' jurisdiction doesn't mean that the Nuclear
11 Regulatory Commission can pass on its obligation to
12 independently assess the impacts of the Corps.
13 Now we know that the Nuclear Regulatory
14 Commission needs to address the impacts of dredging in
15 the federal navigation channel because on September
16 12, 2008 the NRC entered into a memorandum of
17 understanding with the Corps. This MOU was created to
18 ensure that issues of environmental assessment were
19 not pushed off. In fact, this memorandum of
20 understanding states that the NRC will now evaluate
21 the effects of the entire projects and will serve as
22 the lead federal agency responsible for conducting the
23 NEPA analysis for construction or expansion of nuclear
24 power plants.
25 Ultimately we know that Southern wants to

1 barge its components to the plant Vogtle site and that
2 the barging will require dredging of the navigation
3 channel. This means that the Nuclear Regulatory
4 Commission and this Board must assess the
5 environmental impacts of dredging now before it issues
6 the early site permit or limited work authorization.
7 Today Southern will introduce supplemental
8 material that they claim will allow this Board to take
9 a hard look at the environmental impacts of dredging.
10 These studies, however, provide limited information
11 and over simplified ecological concepts.
12 First, Southern will say that the staff's
13 conclusion that the impacts of dredging will likely
14 will be moderate is correct because Southern only
15 plans to dredge 36,000 cubic yards of sediment from
16 the federal navigation channel. The problem with this
17 number is we don't know if it's correct. The Corps
18 hasn't embraced the number and instead has said it
19 need to do more studies to see if 36,000 cubic yards
20 is really all the sediment that must be removed before
21 Southern can barge the federal navigation channel.
22 Second, Southern will introduce evidence
23 to supplement the Environmental Impact Statement,
24 including studies of Dr. Coutant, who addressed the
25 environmental effects of dredging on the mussel

1 population in the federal navigation channel. Dr.
2 Coutant's report is exemplary of the inadequate
3 studies that Southern is trying to pass off as
4 investigations into the environmental impacts of
5 dredging.
6 There are at least 14 mussels in the
7 Savannah River that are species of concern, or else
8 threatened or endangered species. Dr. Coutant in
9 declaring that the dredging necessary would have
10 minimal effects on the mussel population did not even
11 look to where the dredging would occur and where the
12 endangered and threatened mussel species are to see if
13 that dredging is necessary and would directly impact
14 these mussels.
15 In concluding that relocation of mussels
16 was one way to reduce impacts of dredging on mussel
17 species, Dr. Coutant also failed to address the
18 results of a study that found that relocation of
19 mussel species leads to a 100 percent mortality rate.
20 Southern didn't look at studies from the
21 Savannah River. Instead they used studies from other
22 bodies of water. These studies don't address the
23 impact of snag removal and benthic organisms and
24 mussels. The studies don't address the effects of
25 sediment contamination or sediment removal on river

1 ecology.

2 Southern's incomplete studies failed to

3 address exactly the types of things that NEPA's hard

4 look requires of agencies.

5 In conclusion, we know that the Nuclear

6 Regulatory Commission's own memorandum of

7 understanding, that it has an independent obligation

8 to assess the environmental impacts of dredging and

9 that even after Southern presents supplemental

10 analysis, this Board isn't armed with the types of

11 information required of it by NEPA to take a hard look

12 at the environmental impacts of construction and

13 operation of the Units 3 and 4.

14 Consequentially, joint intervenors request

15 that the Board deny the early site permit requested by

16 Southern.

17 JUDGE BOLLWERK: All right. Thank you very

18 much.

19 We appreciate the statements of all the

20 counsel representatives for the parties by giving the

21 Board an overview, I think, as well as the members of

22 the public are here what we're going to be talking

23 about and hearing over the next three to four days.

24 At this point we would be ready to swear

25 in our first witnesses. And I believe there's an

1 agreement among the parties relative to Mr. Notich,
2 we'll go ahead and deal with him first, I think, in
3 terms of the FEIS. That was the agreement of the
4 parties, I believe.
5 We've been going a little over an hour.
6 I'm thinking perhaps we could put Mr. Notich as well
7 as maybe get the applicant's four witnesses and let go
8 ahead and let them be seated. We'll take a brief
9 recess, let you all do that.
10 Maybe you can give the court reporter the
11 copies of the CDs that you need to.
12 And then we'll come back and swear them in
13 and move from there. And I think we'll deal with Mr.
14 Notich first and then the four witnesses for Southern.
15 And again, I have to explain to folks.
16 Originally there was some talk about dealing with --
17 first a Southern panel and then there were two
18 individual witnesses dealing with them somewhat
19 separately. I think the Board after looking at it
20 decided we'd prefer to have all the Southern witnesses
21 that we're doing with the other parties on at one
22 time, simply because if there's any information that
23 we get from one witness and we might need to talk to
24 another witness about it, it made more sense to have
25 them all sitting there rather than bringing them back

1 and forth. So that's what we're going to do.

2 So at this point if there's no questions

3 from the parties about the administration at least up

4 to this point, let's go ahead and take a ten minute

5 break until about five until 10:00. About quarter

6 till.

7 Let's go ahead and take a break until

8 quarter till. And we'll come back then and start with

9 our first witnesses.

10 Thank you very much.

11 (Whereupon, at 9:35 a.m. off the record

12 until 9:47 a.m.)

13 JUDGE BOLLWERK: All right. We're back

14 from our break.

15 But before we swear in the first witness I

16 would like to take a moment to provide a brief

17 explanation of the hearing process that will be used

18 over the next week to obtain information from the

19 parties and their witnesses. Because it is somewhat

20 different than something that you might see if you

21 went to a typical federal or state adjudicatory

22 hearing.

23 In accord with the changes to the NRC's

24 rules of practices that became effective in February

25 2004 this proceeding is being conducted under the

1 rules in Subpart L of Part 2 of Title 10 of the Code
2 of Federal Regulations. Those rules govern what is
3 referred to as an informal hearing as opposed to a
4 hearing under Subpart G of the Agency's rules that
5 govern the conduct of formal hearings.
6 One of the important distinctions between
7 a Subpart L and a Subpart G proceeding or an informal
8 versus a formal hearing is the questioning of party
9 witnesses during an oral hearing, which is what we're
10 going to be doing today. Under the formal Subpart G
11 process after a witness's prefiled direct and rebuttal
12 testimony is entered in the record along with any
13 supporting evidentiary exhibits counsel for the other
14 parties generally are afforded an opportunity to cross
15 examine the witness. This is a process with which
16 most of us are very familiar if we watch the TV shows
17 such as "Law and Order." Indeed, this generally
18 adversarial process of questioning other parties'
19 witnesses is a hallmark of the formal hearing process.
20 To be sure in an NRC formal Subpart G
21 proceeding with party cross examination of witnesses
22 the judges will interpose questions from time-to-time,
23 on the whole however, the parties have the basic
24 responsibility for developing the record relative to
25 the questioning of witnesses.

1 If the formal process can properly be
2 labeled as an adversarial process, for the informal
3 Subpart L process a different regiment applies that
4 could best be labeled as inquisitorial. Once a
5 witness has prefiled direct and rebuttal testimony and
6 any supporting evidentiary material have been
7 submitted for the record, all questioning of witnesses
8 is done by the members of the licensing Board.
9 Counsel representatives for the parties do
10 not ask questions of the witness during the hearing.
11 Prior to the hearing the parties are afforded on a
12 confidential basis several opportunities to suggest
13 questions to the licensing Board regarding the
14 prefiled direct and rebuttal testimony of the
15 witnesses, proposed questions that will be put on the
16 public record of this proceeding once the Board issues
17 its initial decision on the matters at issue.
18 Moreover, the parties will have an
19 opportunity from time-to-time during this proceeding
20 to suggest additional witness questions to the Board
21 relative to the testimony that's been provided to in
22 response to the Board's questions. Nonetheless, in
23 contrast to the formal Subpart G process in the
24 informal Subpart L proceeding the principal
25 responsibility for developing the record through oral

1 questioning of witnesses rests with the licensing
2 Board rather than the parties.
3 That in a nutshell is a process we'll use
4 this week for the contested hearing. I would note,
5 however, that during a prehearing conference on
6 January 28th of this year I provided a word of caution
7 to the parties about this process that I will now
8 repeat both for their benefit as well as the benefit
9 of the members of the public who may be with us today.
10 In connection with any particular
11 contention or issue that's the subject of this week's
12 hearing, do not ascribe any particular significance
13 one way or the other to the number and types of
14 questions the Board directs any particular witness or
15 witness panel as compared to any other witness or
16 witness panel. Trying to draw any conclusions about
17 how the Board perceives the testimony of a witness or
18 witnesses on a particular matter based on the number
19 and types of questions the Board asks is not fair to
20 the witness, to the party that sponsored the witness
21 or to the Board.
22 In questioning any particular witness or
23 group of witnesses the Board is engaging in a process
24 of trying to create a record that will provide us with
25 information that we need to reach a fair and

1 reasonable determination relative to the issues before
2 us for a decision, which may require more or fewer
3 questions of any particular witness in any particular
4 instance.
5 With that said, let's begin with our first
6 witness. And giving the preceding recitation I note
7 with a certain irony that the Board will not be
8 directing many, if any, questions to this witness
9 because he's simply here to put a piece of evidence,
10 evidentiary material into the record as an initial
11 matter.
12 So let me turn then to the NRC staff.
13 And I should mention, again, I think the
14 general process we've laid out, I take it that you've
15 given the court reporter a CD, a compact disk, with
16 the testimony of this witness. We will be binding
17 that into the record. And as we go through that
18 process we will make reference both to the file name
19 of the exhibit, and I will also have a reference to a
20 DDMS item ID which will help us as well as putting
21 together the DDMS record.
22 With respect to all the witnesses, we will
23 swear you in first. You would need to raise your
24 right hand. And as I ask you whether you are going to
25 affirm your testimony, you would obviously need to

1 give an oral response of yes or no. Hopefully, yes
2 would be the answer I think your counsel and
3 representatives would prefer to hear, as well as the
4 Board frankly. But again, you need to make an oral
5 response so that the court reporter has it on the
6 record.
7 All right. Then I guess we can begin with
8 the staff witness then.
9 MR. MOULDING: The staff would like to
10 call Mr. Mark D. Notich as its first witness.
11 JUDGE BOLLWERK: All right. Mr. Notich,
12 if you would, please raise your right hand. Do you
13 swear or affirm that the testimony you will give in
14 this proceeding is the truth, the whole truth and
15 nothing but the truth?
16 MR. NOTICH: Yes.
17 JUDGE BOLLWERK: All right. Then I'll
18 turn to staff and we can go ahead and get the evidence
19 in.
20 MR. MOULDING: The purpose of Mr. Notich's
21 testimony is to enter the staff's final Environmental
22 Impact Statement into the record. We've done so by
23 submitting a piece of testimony from Mr. Notich. And
24 so I was going to ask him to affirm that testimony at
25 this time.

1 Mr. Notich, are you familiar with the
2 testimony entitled "Prefiled Direct Testimony of Mark
3 D. Notich Sponsoring NUREG-1872 Into Hearing Record,"
4 which is dated January 9, 2009 and has been provided
5 to the court reporter in electronic format under file
6 name Vogtle ESP Notich testimony?
7 MR. NOTICH: Yes.
8 JUDGE BOLLWERK: All right. And, sir, you
9 can see the testimony if you need to take a look at it
10 I think as well as the monitor in front of you. All
11 right.
12 MR. MOULDING: And, Mr. Notich, do you
13 affirm that this testimony as well as your attached
14 statement of professional qualification was prepared
15 by you and is true and correct to the best of your
16 knowledge and belief?
17 MR. NOTICH: I do.
18 MR. MOULDING: Thank you.
19 JUDGE BOLLWERK: All right then. Having
20 heard the statement of the witness and having heard
21 him affirm his testimony, the Board will then have
22 this testimony bound into the record as if read as
23 DDMS Item ID 55901. Will that work? All right.
24 (Notich Direct Testimony (DDMS-55901) to
25 be inserted at this point)

January 9, 2009

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 Electric Generating Plant ESP Site) | ) | |

PREFILED DIRECT TESTIMONY OF MARK D. NOTICH
SPONSORING NUREG-1872 INTO HEARING RECORD

Q1. Please state your name and job title.

A1. Mark D. Notich. I am a Senior Project Manager in the Nuclear Regulatory Commission's ("NRC") Office of New Reactors, Division of Site and Environmental Reviews. A statement of my professional qualifications is attached hereto.

Q2. Please describe your responsibilities in connection with the Staff's review of the Plant Vogtle early site permit application.

A2. As the NRC Project Manager for the environmental review of the Southern Nuclear Operating Company ("Southern" or "Applicant") application for an early site permit ("ESP") at the Vogtle Electric Generating Plant ESP site near Waynesboro, Georgia, I was responsible for overseeing the preparation of NUREG-1872, the "Final Environmental Impact Statement for an Early Site Permit (ESP) at the Vogtle Electric Generating Plant Site," August 2008 ("FEIS") and the Errata to the FEIS dated September 3, 2008.

Q3. In that capacity, do you hereby sponsor the introduction of the FEIS and the Errata into the record of this proceeding?

A3. I do.

Q4. Does this conclude your testimony?

A4. Yes

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) | ) | |

AFFIDAVIT OF MARK D. NOTICH CONCERNING PREFILED TESTIMONY
ON ENVIRONMENTAL CONTENTION EC 6.0 AND SPONSORING NUREG-1872

I, Mark D. Notich, do declare under penalty of perjury that my statements in *NRC Staff Testimony of Mark D. Notich, Anne R. Kuntzleman, Rebekah H. Krieg, Jill S. Caverly, and Lance W. Vail Concerning Environmental Contention EC 6.0* and in *Prefiled Direct Testimony of Mark D. Notich Sponsoring NUREG-1872 Into Hearing Record*, as well as in my attached statement of professional qualifications are true and correct to the best of my knowledge, information, and belief.

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

_____
Mark D. Notich

Executed at Rockville, Maryland
This 9th day of January, 2009

Mark D. Notich
STATEMENT OF PROFESSIONAL QUALIFICATIONS
UNITED STATES NUCLEAR REGULATORY COMMISSION
Washington, D.C.

I am currently employed as a Senior Project Manager in the Office of New Reactors, U.S. Nuclear Regulatory Commission (NRC). I have been employed by the NRC since October 2005. I am currently assigned as the Environmental Project Manager for the development of the Environmental Impact Statement for the Early Site Permit (ESP) application for the Vogtle Electric Generating Plant (VEGP), submitted by Southern Nuclear Operating Company (SNC).

I hold a Bachelor of Science in Agricultural Chemistry from the University of Maryland (1978).

As the Environmental Project Manager for the Vogtle ESP, I have been deeply involved in all planning and management activities for pre-application activities, the acceptance review for the Plant Vogtle Environmental Report (ER), public meetings, meetings with State and federal agency stakeholders, site visits, review of SNC's ER, development of Requests for Additional Information (RAIs), and development and publication of the Draft and Final Environmental Impact Statements for the ESP. I also oversee the activities of the team specialists from Pacific Northwest National Laboratory (PNNL) and serve as the Technical Monitor for tracking the financial and technical progress of the contractor's task.

I have also supported the following NRC activities:

- Review of the Grand Gulf ESP and Clinton ESP Draft EISs by reviewing and commenting on assigned sections
- Review and comment on the Appendices for the North Anna ESP EIS
- Development of the format for the North Anna ESP Supplemental EIS
- Review and comment on the Historic and Cultural Resources section of the Vermont Yankee (VY) License Renewal Supplemental EIS (SEIS)
- Review of pre-application activities at the North Anna Plant and at the V.C. Summer Nuclear Power Station

Prior to joining the NRC, I served as a Senior Environmental Scientist for Advanced Technologies and Laboratories (ATL) International, Inc. from July 2000 to September 2005. I was the Deputy Project Manager/QA Manager for the Savannah River Dose Reconstruction Task for the Centers for Disease Control and Prevention (CDC) contract with responsibility for overseeing and managing the completion of project tasks, adherence to project schedules, and coordinating the preparation of the project's final report. I also served as Task Manager for the preparation of an Environmental Impact Statement for the Louisiana Energy Services Uranium Enrichment Facility in Hartsville, TN, supported the revision and updating of several NRC Regulatory Guides, and served as Task Manager for the development of an Environmental Assessment for the Re-

licensing of the General Electric- Morris Operation (GE-MO) Independent Spent Fuel Storage Installation (ISFSI) and a Generic Environmental Assessment for the Re-licensing of Wet and Dry Storage ISFSIs. I also supported the development of numerous Environmental Impact Statements for the U. S. Department of Energy (DOE) including the Programmatic EIS for the Disposition of Radioactively Contaminated Scrap Metal and the Hanford Site Solid Waste Environmental Impact Statement.

From May 1987 to June 2000, I was a Senior Environmental Scientist for Tetra Tech NUS. I supported the development of several Environmental Impact Statements including an EIS for ship breaking and recycling in the United States and a Preliminary Environmental Impact Statement (PEIS) for the U.S. Department of Defense's Strategic Defense Initiative's Ballistic Missile Defense Program and of the Spent Nuclear Fuel Environmental Impact Statement for DOE's Idaho National Environmental Engineering Laboratory. I also provided senior technical review for DOE's New Production Reactor Environmental Impact Statement.

From September 1978 to May 1987, I was a Senior Analytical Chemist and Project manager supporting numerous environmental analyses and assessment projects for Hittman Ebasco Associates, Inc.

1 JUDGE BOLLWERK: All right. Then I think
2 there are several exhibits that are associated with
3 the testimony?
4 MR. MOULDING: For Mr. Notich's testimony
5 there is a single exhibit, Exhibit NRC000001 that Mr.
6 Notich will be sponsoring into evidence.
7 JUDGE BOLLWERK: All right. And I believe
8 that was submitted for the record in five parts, if
9 I'm correct in that?
10 MR. MOULDING: Yes, sir.
11 JUDGE BOLLWERK: And I think we advised
12 the parties that because of that we were going to mark
13 it in the DDMS as five different pieces of evidentiary
14 material. And if you would, let's go ahead -- let me
15 just see Mr. Wilkie here can bring it up. Have to be a
16 little patient here because we're doing this over a
17 broadband signal and it takes a couple of seconds
18 especially on a large piece of evidence like this to
19 bring it up.
20 And this is just going to be the first of
21 them, right? First of five? Okay. All right.
22 Why don't we go ahead and have that one
23 identified for the record, please.
24 MR. MOULDING: Mr. Notich, do you
25 recognize the document that's being displayed here?

1 MR. NOTICH: Yes.

2 MR. MOULDING: Could you please identify

3 it for the record?

4 MR. NOTICH: Yes. This is the final

5 Environmental Impact Statement for an early site

6 permit at the Vogtle Electric Generating Plant Site

7 Volume 1.

8 JUDGE BOLLWERK: All right. And this is

9 part one of five. Then the record should reflect that

10 the first part of the final Environmental Impact

11 Statement for the Vogtle facility Exhibit NRC00001A is

12 identified for the record.

13 (Whereupon, the document was marked for

14 identification as Exhibit NRC00001A.)

15 JUDGE BOLLWERK: Let's go ahead and

16 identify all five parts of it and then we'll have them

17 all moved into evidence.

18 MR. MOULDING: Judge Bollwerk, would you

19 like the witness to identify each separate portion?

20 JUDGE BOLLWERK: If he could, yes, just

21 very briefly. It may take us a second here again

22 because they're large documents to bring them up.

23 Do you recall what the breakout point was

24 for that, what parts of the EIS were? That may be the

25 one difficulty here. 2 starts with 5.0. So that must

1 have been parts 1 through 4.

2 MR. MOULDING: Right. I believe the first

3 portion is the introduction of the FEIS through

4 Chapter 4.

5 JUDGE BOLLWERK: All right. Let's move to

6 the next part then. And that was -- you all are going

7 to have hold things. I think you're moving a little

8 bit too fast for me here. Can we go back to that one?

9 That part was NRC Exhibit 00001B, which is

10 the staff's final Environmental Impact Statement

11 beginning at Section 5.0. And that should be marked

12 for identification.

13 (Whereupon, the document was marked for

14 identification as Exhibit NRC00001B.)

15 JUDGE BOLLWERK: All right. We now have --

16 okay. That's number 2. All right.

17 Let's go to number 3 if we could. All

18 right. And you want to go ahead and identify that

19 briefly?

20 MR. MOULDING: Mr. Notich, can you

21 identify this portion of the exhibit?

22 MR. NOTICH: Yes. This is the final

23 Environmental Impact Statement for an early site

24 permit at the Vogtle Electric Generating Plant site

25 Appendices A through J, which is Volume 2.

1 JUDGE BOLLWERK: All right. Then let's go
2 ahead and have NRC Exhibit 00001C identified for the
3 record please. (Whereupon, the document was
4 marked for identification as Exhibit NRC00001C.)
5 JUDGE BOLLWERK: All right. And then that
6 one please.
7 MR. MOULDING: Mr. Notich, can you please
8 identify this portion of the exhibit?
9 MR. NOTICH: Yes. This is the modified
10 Appendix F of the final Environmental Impact
11 Statement.
12 JUDGE BOLLWERK: All right. The record
13 should note that NRC Exhibit NRC00001D has been marked
14 for identification. (Whereupon, the document was
15 marked for identification as Exhibit NRC00001D.)
16 JUDGE BOLLWERK: And the fifth part
17 please.
18 MR. MOULDING: And, Mr. Notich, can you
19 identify this final portion of the exhibit?
20 MR. NOTICH: Yes. This is the errata sheet
21 to the final Environmental Impact Statement.
22 JUDGE BOLLWERK: All right. Then the
23 record should reflect that NRC Exhibit NRC00001E has
24 been marked for identification.
25 (Whereupon, the document was marked for

1 identification as Exhibit NRC00001E.)

2 JUDGE BOLLWERK: And then let's go ahead,

3 and if you would, please, let's make the motion and

4 we'll move it into evidence.

5 MR. MOULDING: Judge Bollwerk, the staff

6 moves to admit these exhibits into evidence.

7 JUDGE BOLLWERK: All right. Any objections

8 from the parties? All right, hearing none then the

9 record should reflect that NRC Exhibits NRC00001A,

10 NRC00001B, NRC00001C, NRC00001D, NRC00001E are

11 admitted into evidence.

12 (Whereupon, the documents identification as

13 Exhibits NRC00001A through E were received

14 into evidence.)

15 JUDGE BOLLWERK: Anything further for this

16 witness?

17 MR. MOULDING: No, Your Honor.

18 JUDGE BOLLWERK: All right, sir. Then you

19 are excused. You remain sworn and are subject to

20 being recalled by the Board. Thank you, sir. We

21 appreciate it.

22 MR. NOTICH: Thank you.

23 (Whereupon, the witness was temporarily

24 excused.)

25 JUDGE BOLLWERK: All right. Let me then

1 turn to Southern. And I believe the way that you all
2 presented the -- why don't we go ahead and deal with
3 the testimony both the direct and rebuttal for Mr.
4 Dodd and Mr. Montz and then we'll move to the other
5 two witnesses individually since the testimony was put
6 in as individuals.
7 What I'd like to do is go ahead and have
8 the testimony and the direct and rebuttal put in, then
9 we'll deal with the exhibits that deal with each one
10 of those testimonies. And then we'll go to the next
11 witness and then the next witness. And then we'll have
12 it all in evidence.
13 MR. BLANTON: Yes, sir, Your Honor. Mr.
14 Moore is going to handle that.
15 MR. MOORE: Yes. Thank you. This is
16 Grady Moore for the applicant.
17 First, I'd like to introduce you to Mr.
18 Dodd and Mr. Montz, know who they are on the panel.
19 JUDGE BOLLWERK: Right.
20 MR. MOORE: Mr. Dodd's on your right.
21 He's an environmental specialist for Georgia Power
22 Company focusing on fisheries, biology and aquatic
23 ecology.
24 And Mr. Montz is immediately to his right.
25 He's an environmental specialist for Southern Nuclear

1 Operating Company responsible for technical staff
2 questions responding to those questions for the ESP
3 preparation.
4 So if we can have their Revised Direct
5 Prefiled Testimony brought up on the screen, that will
6 identify that.
7 JUDGE BOLLWERK: Let me go ahead and swear
8 them in here real quick and then--
9 MR. MOORE: Just them or all four of them?
10 JUDGE BOLLWERK: Well, we can swear all
11 four of them at one time, that shouldn't be a problem.
12 Gentleman, if you would raise your right
13 hands, please? Do you swear that the testimony you
14 will give in this proceeding, swear or affirm that the
15 testimony that you will give in this proceeding is the
16 truth, the whole truth and nothing but the truth.
17 ALL: Yes, we do.
18 JUDGE BOLLWERK: Respond verbally. Let's
19 go ahead down the line, maybe that's the easiest way.
20 MR. MONTZ: Yes, I do.
21 MR. DODD: Yes, I do.
22 DR. COUTANT: Yes, I do.
23 MR. MOORER: Yes, I do.
24 JUDGE BOLLWERK: Thank you, gentlemen.
25 MR. MOORE: Okay. So we should continue

1 with their direct prefiled testimony if we can show
2 that to them. The file name for that Dodd-Montz
3 Revised 1.2 Direct Testimony.
4 JUDGE BOLLWERK: You need the DDMS ID
5 number? I have it here in front of me if that would
6 help? Oh. That's bad. Okay.
7 I'll tell you what we're going to do then.
8 Do you think you want to try to restore it or do you
9 want -- all right. Technology is wonderful when it
10 works.
11 It would be the direct testimony of Mr.
12 Dodd and Montz, 59838 is the ID number I have.
13 MR. MOORE: This is the testimony that we
14 just, before the opening statements identified with
15 the revision, the correction. So I don't know if that
16 changes anything about the ID number you're
17 discussing.
18 JUDGE BOLLWERK: Let's see, the ID number
19 I gave you is the correct one, right, for the revised
20 testimony? Okay.
21 MR. MOORE: Okay. We have it.
22 I'd like to ask Mr. Dodd and Mr. Montz if
23 they recognize this document as their prefiled
24 testimony?
25 MR. DODD: I do.

1 MR. MONTZ: Yes, I do.

2 MR. MOORE: Okay. We're going need you to

3 affirm this testimony in accordance with the Board's

4 previous order. Would you like me to read that

5 statement for them?

6 JUDGE BOLLWERK: If you would, please.

7 MR. MOORE: Yes. Okay. So I'm going need

8 you to confirm to the Board with a verbal response if

9 this statement is true: That the testimony entitled

10 Southern Nuclear Operating Company's Testimony of

11 Anthony Dodd and Matt Montz concerning EC 1.2 and

12 dated January 9, 2009 corrected March 16, 2009 which

13 has been provided to the court reporter in electronic

14 format under file name Dodd-Montz Revised 1.2 Direct

15 Testimony was prepared by you or under your

16 supervision and direction and is true and correct to

17 the best of your knowledge and belief?

18 MR. DODD: Yes, it is.

19 MR. MONTZ: Yes, it is.

20 JUDGE BOLLWERK: All right.

21 MR. MOORE: We'd like to move to admit

22 that in, please?

23 JUDGE BOLLWERK: Okay. Any objection from

24 anyone? All right. There being none, then the Direct

25 Testimony of Mr. Dodd and Mr. Montz as described by

1 counsel should be entered at this point into the
2 record as if read as DDMS item ID 59838.
3 (Dodd-Montz Direct Testimony (DDMS-59838
4 to be inserted at this point)
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Corrected on: March 16, 2009
Originally Filed on: January 9, 2009

**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)** | ) | **January 9, 2009** |

**SOUTHERN NUCLEAR OPERATING COMPANY'S TESTIMONY OF ANTHONY DODD AND MATT MONTZ CONCERNING EC 1.2**

Q1. **Please state your name(s) and address(es).**

A1. My name is Anthony Ray Dodd (ARD). My business address is: 5131 Maner Road, Smyrna, GA 30080.

My name is Matthew Thomas Montz (MTM). My business address is: 42 Inverness Center Parkway, Birmingham, AL 35242.

Q2. **Please state your current employer, position, and responsibilities.**

A2. (ARD) I am employed by Georgia Power Company as an Environmental Specialist. I accepted this position in August of 2007, and my focus is Fisheries Biology and Aquatic Ecology. In this position, I am responsible for conducting routine monitoring and management of power company resources that involve aquatic biological resources associated with reservoirs of FERC permitted hydroelectric dams and tail waters. I also monitor state waters that may be affected by Company infrastructure development needs. In addition, I manage special projects dealing with issues of assessment of fisheries and other natural resources, including freshwater aquatic macroinvertebrate communities, mussel fauna, and coastal estuarine resources. Specifically, I conduct field investigations

of potential power plant impacts to aquatic resources at fossil fuel and nuclear electric production facilities.

(MTM) I am employed by Southern Nuclear Operating Company as an Environmental Specialist, and I have held this position since November of 2006. In this capacity, I am responsible for responding to NRC technical review staff questions related to the Early Site Permit and Combined Construction and Operating License applications and for completing and submitting the environmental permits required for new plant construction and operation. In addition, I worked with the Nuclear Development Organization in preparing the Environmental Reports for these applications.

Q3. **Please describe your education and prior experience.**

A3. (ARD) I earned a Bachelor of Science degree in Marine Biology from Troy University. I have over 25 years of experience in the environmental field, specializing in aquatic biology. Prior to joining Georgia Power Company, I worked as a Senior Biologist for Geosyntec Consultants, Inc., from August 2000 to August 2007. In this position, I conducted and supervised fisheries-related investigations in freshwater and estuarine environments throughout various parts of the southeastern United States. I am a licensed State and Federal permit holder for the collection of protected species of freshwater fish species, and I am well-versed in fish collection methodologies, including hydroacoustics sampling, species identification, and quality control and quality assurance measures. During my career, I have held positions as an aquatic ecologist involved primarily in

fisheries investigations with environmental services firms based in Georgia. *See* Exhibit SNC000002 (Anthony R. Dodd Curriculum Vitae).

(MTM) I earned a Bachelor of Science degree in Biology from Samford University and a Master of Science degree in Environmental Management from Samford University. I have over 12 years of experience in the field of environmental biology. Prior to joining Southern Nuclear, I worked as an Environmental Specialist for Southern Company Services, Earth Science and Environmental Engineering from 1999 to 2006. In this position, I managed aquatic environmental monitoring programs for Mississippi and Gulf Power Companies and spent time working in the areas of water chemistry, benthic macro invertebrate studies, and effluent toxicity testing. I also conducted assessments of water quality conditions of southern estuaries and rivers to determine the impacts associated with the withdrawal and discharge of cooling water at seven electric generating facilities in Mississippi and Florida. During my career, I have participated in field collection of air, water, and soil samples, as well as the evaluation of those samples for possible environmental impacts. *See* Exhibit SNC000003 (Matthew T. Montz Curriculum Vitae).

Q4. **What is the purpose of your testimony?**

A4. (ARD/MTM) The purpose of this testimony is to describe the methods and results of the studies conducted in 2008 on the Savannah River near Plant Vogtle and at the Plant Vogtle Units 1 & 2 intake structure, which were designed to assess aquatic impingement and entrainment, and discharge of the thermal plume.

Q5. **Please describe the impingement and entrainment studies.**

A5. (ARD/MTM) The impingement and entrainment ("I & E") studies characterize rates of impingement and entrainment of all detectable life states of fish at Plant Vogtle's Unit 1 & 2 make-up water intake structure as a means to infer a technically valid assessment of anticipated I & E rates for the similarly designed intake structure for the proposed Plant Vogtle Units 3 & 4. Impinged fishes are those captured and removed from intake water by means of the intake structure traveling screen system, which utilizes 3/8 – inch size mesh metal screening panels. Entrained fishes include early life stages including eggs and larvae of varying stages of development that are entrained through the traveling screens and subsequently entrained through the length of the facility cooling system via intake flows. Mortality of impinged and entrained fishes at Plant Vogtle is assumed to be at the one hundred percent level, consistent with assessment guidance precepts included in Section 316(b) of the Clean Water Act.

The I & E studies are comprised of three primary tasks, including the collection of (1) samples of the ichthyoplankton (fish eggs and larvae) community of the Savannah River (intake source water) upstream and near Plant Vogtle's intake canal; (2) samples of the entrained (inside the intake canal) ichthyoplankton community; (3) samples of impinged fishes collected by the traveling screen system.

All I & E work to date has been, and is currently being, conducted in a manner of quality assurance in a high standard of care consistent with widely practiced and standard scientific methods.

Q6. **What has been your role with respect to conducting the I & E study at Plant Vogtle?**

A6. (ARD/MTM) We met and worked together with Nuclear Regulatory Commission staff and Dr. Chuck Coutant to develop the I & E sampling program for the Plant Vogtle make-up water intake structure.

(ARD) With one co-worker, I conducted each of the I & E sampling events and provided taxonomic identifications for the impingement samples. I collected, preserved, handled, and shipped entrainment samples under chain of custody to the contracted taxonomic laboratory. I summarized the methods, interpreted the sampling data, and compiled bi-weekly trip reports to document the progress of the I & E sampling programs.

(MTM) I reviewed and assessed the bi-weekly trip reports to monitor the progress of the I & E sampling programs and also coordinated any support that may be required at the plant while Tony Dodd conducted the sampling.

Q7. **Please describe how the process for collecting this I & E data was developed.**

A7. (ARD/MTM) This process began with meetings and discussions between Chuck Coutant, Tony Dodd, and Matt Montz. This group developed a study program that is based on similar studies that other plants conducted in order to comply with section 316(b) of the Clean Water Act for existing intake. The general description was recorded by Georgia Power's Environmental Field Services Staff, led by Mr. Tony Dodd. The sampling began on March 10, 2008.

<u>Impingement Monitoring</u>

Q8. **Please describe the time frame of the impingement monitoring.**

A8. Since March of 2008, Georgia Power Company staff biologists have been conducting bi-weekly impingement sampling at the VEGP cooling water intake structure. The monitoring is currently scheduled to end in February of 2009. This time frame allows for the collection of a representative sample of the potentially impacted fish community. Analysis of the results of a year-long study will encompass seasonal changes in the fish community, such as migratory behavior and peak recruitment.

Q9. **Please explain the process of conducting monitoring events.**

A9. Monitoring events are conducted twice per month, which results in representative, half-monthly samples. Each monitoring event is divided into two 12-hour sample periods, representing "day" and "night" samples. During sampling, the traveling screens and screen wash are run at the beginning of each sampling event, to initially clean the screens of any impinged organisms, and again after the 12-hour day and night samples. A nylon-mesh sample insert net is suspended below the screen wash discharge within the existing steel-frame trash basket to collect all debris from the screens, including any impinged fish. *See* Exhibit SNC000006 (Photo depicting impingement sampling apparatus/insert net as mounted in the screen wash pit). After each 12-hour collection period (or periodically, depending on debris load), the collection basket is removed and screen wash contents are sorted by GPC biologists to identify any impinged fish. Any fish collected are identified to species level, measured and weighed either in the field or at GPC's lab in Smyrna, Georgia. The results are recorded on data sheets for each 12-hour "day" and "night" period. To date, the information recorded from the field data

sheets has been compiled into a report. [Detailed results of the impingement study are compiled in the Interim Impingement Report.] *See* Exhibit SNC000004 (Interim Report of Fish Impingement at the Plant Vogtle Electric Generating Plant (January 2009)).

Q10. **What is the current status of the collection of impingement data at VEGP?**

A10. Impingement monitoring is currently being conducted at VEGP river water intake. As of December 19, 2008, 20 of the 24 planned impingement monitoring events have been completed. The current draft report includes results for those sampling events.

Q11. **How many organisms have been collected during the impingement monitoring events?**

A11. Through December of 2008, a total of 146 fish, nine crayfish, and two freshwater shrimps have been collected from the Plant Vogtle intake structure.

Q12. **What are the conclusions of the impingement report dated January 2009?**

A12. The report summarizes results for ten months (March through December) of the 12-month study. The results indicate that the impingement rate is very low and poses an insignificant impact to the Savannah River fishery resource. The ten-month sample is comprised of 19 species of fish and two species of crustaceans representing 10 taxonomic families weighing a total of 865.2 grams (1.9 pounds). Impinged fish species represent eight fish families with Centrarchidae (sunfishes) being the most abundant (58.6 percent by number and 47.5 percent by weight). The most common individual species found during the sampling events include spotted sunfish (38.9 percent), hogchoker (10.8 percent), and white catfish (8.9

percent). These species are common to the region. No State or Federal-listed species were collected.

Most (56.9 percent) of the impinged organisms were collected during night time periods. The rate of impingement exhibited no statistically significant correlation with trends in variation of pumping rate, river stage, water temperature, or local precipitation. When the results are mathematically expanded from single sample event results into half-monthly samples, representative of full-time intake pumping, the cumulative impingement rate over ten months is 2,421 fish weighing approximately 30.1 pounds and 3,882 fish weighing 44.9 pounds at the 95% Upper Conference Limit. Plant Vogtle's Unit 1 & 2 ten-month impingement mortality effect on the fish population of the Savannah River is likely, highly insignificant even when considering the addition of a second similar intake structure for Vogtle Units 3 & 4.

Entrainment Monitoring

Q13. **Please describe the entrainment study at VEGP.**

A13. Entrainment monitoring was conducted at the VEGP cooling water intake structure to quantitatively estimate the numbers of ichthyoplankton entrained by cooling water withdrawals. The entrainment study was performed during the spring and early summer (March - July) of 2008. This period was sampled because it represents the most biologically productive time period of the year for fish, when the occurrence of planktonic (drift) fish eggs and larvae is most prevalent in the middle Savannah River. Entrainment sampling was performed once every two weeks from March through July of 2008. The study included

sampling in the Savannah River upstream and beyond the influence of the intake in order to assess population attributes of the site-specific ichthyoplankton community. [Detailed results of the entrainment study are compiled in the Final Entrainment Report.] *See* Exhibit SNC000005 (Entrainment Assessment at the Plant Vogtle Electric Generating Plant (October 2008)).]

Q14. **Please describe the process by which the data was collected.**

A14. Ichthyoplankton samples taken from the intake canal were collected through the use of submersible pumps. The sample water was pumped through 500-micron mesh-size plankton nets suspended in 55-gallon drums stationed at the top of the intake canal bulkhead. *See* Exhibit SNC000007 (Photo depicting entrainment sampling apparatus mounted at the edge of the intake canal). The target sample volume was between $75m^3$ (cubic meters) and $100m^3$ of water. Source water ichthyoplankton samples were also collected with 500-micron mesh size plankton nets, as towed from a boat *See* Exhibit SNC000008 (Photo depicting individual conducting entrainment sampling via boat-mounted plankton net sampler on the Savannah River). Each background sampling station (left bank, center channel, and right bank) was sampled at one-meter depth intervals to the maximum available depth. Total water column sample time averaged about 20 minutes per station event. The mean target sample volume for the background samples was approximately $100m^3$ of water.

Q15. **How was the data analyzed and processed beyond field sampling?**

A15. Ichthyoplankton samples from both source water and canal waters were collected at 6-hour intervals and then composited into one 12-hour "day" and one 12-hour

"night" sample. Samples were preserved with 5% formalin, packaged under chain of custody, and shipped to Normandeau & Associates for enumeration and identification down to the lowest practical taxon. Laboratory taxonomic results were forwarded to Georgia Power by the first of September 2008.

As source water and entrainment sampling was conducted from beginning to end of the bulk drift season, that result was assumed to be representative of the annual drift. Several steps were used in the calculation of an annual entrainment rate. Field-sampled organism density collected during each half-monthly sampling event was adjusted by the appropriate multiplier to reflect actual measured daily facility intake volumes. These daily entrainment rates, assumed to be representative of all days occurring between half-monthly sampling events, were summed to yield half-monthly entrainment rates. Half-monthly rates were then summed to yield the annual entrainment rate. The diversity and abundance of species entrained by the intake structure were compared to the numbers and species collected in the Savannah River (upstream of the intake) during the same time period.

Source water data bracketed the beginning and end of the drift season, effectively representing annual entrainment. To calculate the annual entrainment estimate, the daily entrainment rate (number of organisms per 1000 $m^3$) was established based upon the result of each half-monthly entrainment sampling event result from the intake canal. Daily entrainment rates based on entrainment sample volumes were scaled by the appropriate multiplier to reflect actual daily make-up water intake volumes. These daily entrainment rates were then summed to yield

half-monthly entrainment rates. Half-monthly entrainment rates were summed to yield an annual rate.

The diversity and abundance of species entrained by the intake were compared to the numbers and species collected in the Savannah River upstream from the intake during the same time period.

Q16. **Why were samples in the Savannah River collected differently from the samples collected in the intake canal?**

A16. Different methods were used because the velocities of the water in the intake canal were too low to use a plankton net, as learned during the initial sampling event. The alternative method of pumping entrained water via submersible pump was used to accommodate the prevailing, sluggish hydraulic conditions in the canal, as well as the physical constraints of sampling the canal by boat. [*See* Exhibit SNC000009 (Photo depicting approach view of the canal and pump house) and Exhibit SNC000010 (Photo depicting view of the outer intake canal at the Savannah River). These photos show views of the intake canal from each end. The scenes capture typical quiescent conditions in the canal encountered during the study owing to prevailing river flows. The emergent sediment catchment sheet piles are visible in both photos.] This includes the bulkhead high side walls and the sheet piling located near the mouth of the canal, which prevented boat access for the purpose of entrainment sampling. Also, due to operations safety and operational concerns, no sampling apparatuses of any kind were permitted behind the traveling screens or inside the inlet conduit.

Q17. **How many samples were collected during this period?**

A17. A total of thirty-six ichthyoplankton samples were collected during the study period. A total of twenty-five individual specimens comprised of three fish species and four taxonomic families were collected via pumped entrainment samples. The most abundant entrainment sample species was yellow perch (40 percent), while yellow bullhead and pirate perch accounted for 4 percent each. Among the unidentified taxa, members of the Catostomidae (suckers; 20 percent) and Centrarchidae (sunfishes; 16 percent) were the most dominant.

No eggs were observed in the entrainment samples, indicating their likely "settling out" of the water column between the mouth of the canal and the head of the intake structure, due to sediment catchment. The most abundant entrained life stage was post-yolk-sac larvae, which represented sixty-eight percent of the samples. No organisms were collected during two of the nine entrainment sampling events. During the entire entrainment study period, mean per-event egg and larval density was approximately 11.3 organisms per 1000 $m^3$. The estimated daily entrainment rate is 1,302 organisms, while the estimated daily drift rate (source water drift abundance) in the Savannah River is 312,039 organisms. This result indicates that no significant impact is occurring to the Savannah River fishery due to the entrainment effect from Plant Vogtle.

Q18. **Does this say anything about the drift community?**

A18. Yes. The drift community in the middle Savannah River is comprised of a relatively diverse and abundant species assemblage comprised of eggs and larvae, including migratory species such as herrings and striped bass. The results of this study demonstrate that an insignificant number of organisms are actually being

entrained, as compared to the quantity of organisms that flow past the intake structure on a regular basis and remain directly unaffected by the intake structure.

Q19. **What are the conclusions of the Final Entrainment Report dated October 22, 2008?**

A19. The results of the study indicate that the entrainment rate at Vogtle Units 1 & 2 is low compared to the abundance of source water egg larval drift in the Savannah River. Entrainment sampling indicated a paucity of organisms in canal intake waters during the season of peak egg and larval abundance in source water. Most entrainment sample organisms were collected at night. The density of entrained organisms was 11.3 organisms per 1000 $m^3$ of intake flow or 1,302 fish eggs and larvae per day for the study period based on actual intake flow.

About 3.4 times more fish species were collected in source water samples than entrainment samples. Most source water sampled eggs and larvae were collected at night time. Peak fish egg and larval abundance in source water was detected between April 23rd and May 8th of 2008. This time period was marked by relatively high numbers of egg, yolk-sac, and post-yolk-sac life stages of Cyprinidae (minnows) and American shad. Empirical observation of river flow vs. source water egg and larval drift during the study period clearly demonstrated an abrupt decline in drift abundance following the end of the elevated springtime flows and the beginning of sustained low summer flows. The density of the source water organisms was calculated at 403.6 organisms per 1000 $m^3$. This resulted in a mathematically expanded drift rate of approximately 312,039

organisms per day, as based upon gauged daily river flows during the study period.

Entrained species were also represented among the list of source water taxa collected. No protected fish species were encountered in source water or entrainment samples.

Plant Vogtle's mean daily make-up water intake pumping flow represents approximately 2.1 percent of the mean daily flow in the Savannah River during the study period.

Hydraulic Zone of Influence Determination

Q20. **Please describe any other surveys that were conducted at VEGP.**

A20. On May 7, 2008, Southern Company personnel completed a hydraulic zone of influence ("HZI") survey at the existing VEGP intake structure. This survey was requested by Southern Nuclear to complement the I & E surveys. This type of study is typical of the suite of studies performed in association with impingement mortality characterization studies following CWA section 316(b) guidance. The purpose of this survey is to measure the extent of the HZI. This is achieved by measuring and recording deviations in the magnitude, direction, and velocity of river flow, as influenced by intake water withdrawal. The survey result provides an indication of the I & E potential of aquatic organisms near the mouth of the canal.

Q21. **What data was collected?**

A21. The portion of the Savannah River adjacent to the cooling intake canal was surveyed in both the upstream and downstream direction over a sufficient distance

using a boat-based Acoustic Doppler Current Profiler ("ADCP"). ADCP data (broad-band acoustic echo information) was collected by navigating the boat parallel to the shoreline, which resulted in defining the maximum extent of hydraulic influence by intake withdrawal. The first ADCP transect was established within ten feet of the intake canal. Ten other transects were sequentially placed at ten-foot intervals away from the intake canal ending at mid-channel. The boundary demarcating the area of greatest extent of hydraulic influence from VEGP was determined when the occurrence of water velocities and vectors were unrelated to the VEGP intake structure.

Q22. **Please describe the conditions of that survey.**

A22. During typical cooling operations, two of the four available cooling water intake pumps are in operation. When the ADCP survey was conducted, three cooling water intake pumps were operating. During the May 7, 2008 survey, the intake flow was calculated at 71.2 MGD, or 110 cfs (56% of full capacity). Additionally, at the time the survey was conducted, the average flow on the Savannah River was 4,482 cfs. A total of six transects were performed to measure and document the Savannah River flow (three prior to the survey and three after the survey). The river flows varied by less than two percent (4,443 – 4,506 cfs) during the monitoring event.

Q23. **Please state the findings regarding the area of hydraulic influence on the Savannah River.**

A23. Based on the intake and Savannah River flows during the May 7, 2008 survey, the VEGP zone of hydraulic influence occupied an area of 1.10 acres, which includes

the entire VEGP intake canal and a small portion of the Savannah River. The portion of the HZI extending into the Savannah River beyond the mouth of the canal accounted for 0.14 acres (or about 13 percent) of the total HZI. Therefore, the HZI was only detectable in the river out to a distance of approximately 50 feet from the mouth of the intake canal (or about 13 percent of the total distance across the river channel and proximal to the mouth of the canal).

Thermal Plume

Q24. **Were any measurements made to characterize the thermal plume?**

A24. Yes. GPC and APC staff members recorded measurements in the river at, and in the vicinity of, the VEGP discharge pipe with a combination of gear types.

Q25. **What was the purpose of this study?**

A25. The purpose of this study was to map the physical size of the VEGP's thermal discharge plume via high resolution hydraulic measurements as well as its temperature characteristics, via high resolution, under typical cooling tower operations with Units 1 and 2 in operation and during a period of stable river flow/stage conditions. The mapping result was compared with the existing CORMIX model representation for validation.

Q26. **Please explain this process.**

A26. Two gear types, deployed by boat, were used to record water temperatures and ADCP acoustically derived data to develop a three-dimensional ("3-D") computer model of the thermal plume.

A calibrated Hydrolab Surveyor (multi-array water quality analyzer instrument) was used to record water temperature at half-meter depth increments, at several

locations (vertical water column profiles) placed along seven transects that mark and bracket the area of the thermal discharge. In the Savannah River, two ambient (background) transects were located upstream of the discharge; whereas, each included five vertical profile locations representing near left bank (facing upstream), one-quarter distance out from left bank, at mid-channel, one-quarter distance from right bank, and near the right bank. The five remaining transects positioned at, and downstream of, the discharge pipe included one additional vertical profile at approximately 1/8 of the distance out from the left bank.

An ADCP was deployed in the same area as thermal transects and along more (24 vs. 7) transects placed on and between the temperature transects to measure the size of the plume in high detail based on acoustically derived hydraulic measurements.

Both ADCP and water temperature data were electronically synthesized with a 3-D computer model to graphically illustrate the spatial effects of hydraulics and temperature characteristics of the thermal plume.

Q27. **What data was collected?**

A27. High resolution temperature data (degrees Celsius) was collected from a total of 40 vertical profiles along the seven established transects and electronically recorded.

The ADCP data was collected continuously from the 24 cross-sectional transects. This electronically recorded data consisted of complete river channel profiles of digitized, broad-band acoustic echo information containing details of magnitude,

direction, and velocity of water column currents enabling hydraulic demarcation of the thermal plume.

Q28. **How was this data analyzed?**

A28. Temperature and ADCP data were entered and processed in SURFER software (version 8.03), which can produce two or three-dimensional illustrations. Color-coded contour maps (in 0.5 meter layers) of water temperature were created using a geo-statistical gridding method (kriging) to mathematically interpolate quantitative information for unknown geographical points positioned between geographically known points of information (calculation of gradients), resulting in a smooth contour map. The depth averaged water current vector data generated by the ADCP was also processed in SURFER and gridded separately to complement the temperature model in the form of a smooth, color-coded contour map depicting the shape and size of the thermal plume. The models/graphics provided information that visually differentiated discharge-associated temperatures from ambient river temperatures as well as the shape and size of the thermal plume. *See* Exhibit SNC000011 (Images from Thermal Study depicting river water temperature).

Q29. **Please describe the results of this measurement.**

A29. The temperature resulting from the thermal discharge (sourced at the cooling tower basins) accounts for a temperature differential very similar (less than one degree Celsius) from prevailing ambient river temperatures. It is significant that ambient temperatures, measured in a large area (2,400 feet in length) on the opposite of the river and including a point located upstream of the discharge, were

as warm or warmer than water temperatures associated with the thermal discharge itself. Overall, the result indicated that the warmest water in the study area occurred at the river surface along the far shoreline likely due to solar radiation. The data indicated that the thermal discharge plume occupies a small zone (approximately 100 feet long by 75 feet wide) located immediately downstream of the discharge pipe/outfall.

Depth averaged water velocity data delineated an area with water velocities higher than the ambient river velocity located immediately downstream of the outfall. Further downstream, beyond the discharge outfall, three localized areas of river occurring at approximately 250, 700, and 1000 feet were characterized by currents occurring at velocities swifter (about 0.7 feet/second faster) than ambient river water. The overall study result indicated the presence of a relatively small zone of detectable difference between discharge and ambient temperatures with observable indications of hydraulic effect and ultimate mixing between the discharge and ambient water column hydraulics at distances much greater downstream from the outfall than detected by temperature alone.

**Q30. Are true, accurate and correct copies of each of the reports heretofore referenced in your testimony attached to this pre-filed written testimony, and do they accurately portray the facts they purport to portray?**

A30. Yes.

**Q31. Are true, accurate and correct copies of each of the photos heretofore referenced in your testimony attached to this pre-filed written testimony, and do they accurately portray the facts they purport to portray?**

A31. Yes.

**Q32. Does this conclude your testimony?**

A32. Yes.

1 MR. MOORE: Now we'd like to admit their
2 rebuttal testimony. I think that's how you want to do
3 it. That file is called Dodd-Montz 1.2 Rebuttal
4 Testimony, if you could find that and we can show it
5 to them.
6 JUDGE BOLLWERK: All right. I believe it's
7 up.
8 MR. MOORE: Yes. Thank you.
9 Okay. Please look at this document that
10 you see on the screen, do you recognize that as your
11 rebuttal testimony in this matter?
12 MR. DODD: Yes, I do.
13 MR. MONTZ: Yes, I do.
14 MR. MOORE: Well then I again I need you
15 to respond for the Board to this statement about your
16 testimony. That the testimony entitled Southern
17 Nuclear Operating Company's Rebuttal Testimony of Tony
18 Dodd and Matt Montz concerning EC 1.2 and dated
19 February 6, 2009 which has been provided to the court
20 reporter in electronic format under file name Dodd-
21 Montz 1.2 Rebuttal Testimony was prepared by you or
22 under your supervision and direction and is true and
23 correct to the best of your knowledge and belief?
24 MR. DODD: Yes, it is.
25 MR. MONTZ: Yes, it is.

1 MR. MOORE: We'd ask that this be
2 admitted, please.
3 JUDGE BOLLWERK: All right. Any
4 objections? There being none, then the testimony of
5 Mr. Dodd -- the prefiled Rebuttal Testimony of Mr.
6 Dodd and Mr. Montz as described by counsel shall be
7 entered into the record as if read as DDMS ID 59126.
8 (Dodd-Montz Rebuttal Testimony (DDMS-59126
9 to be inserted at this point)
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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 TONY DODD AND MATT MONTZ CONCERNING EC 1.2**

Q1: **Please state your name(s), address(es), and current occupation.**

A1: My name is Anthony Ray Dodd. My business address is: 5131 Maner Road, Smyrna, GA 30080. I am employed by Georgia Power Company as an Environmental Specialist. My name is Matthew Thomas Montz. My business address is: 42 Inverness Center Parkway, Birmingham, AL 35242. I am employed by Southern Nuclear Operating Company as an Environmental Specialist.

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

A2: Yes. We submitted pre-filed written testimony on environmental contention ("EC") 1.2.

Q3: **What is the purpose of your testimony?**

A3: The purpose of this testimony is to respond, on behalf of Southern Nuclear Operating Company ("SNC"), to the testimony of Shawn P. Young regarding EC 1.2 that was submitted by Joint Intervenors on January 9, 2009 and revised on February 2, 2009 ("Young Direct Testimony").

Q4: **In A.19 of his pre-filed direct testimony, Dr. Young states that "[t]he most effective method to determine current ichthyoplankton species composition, distribution, and**

**vulnerability to entrainment in the vicinity of the VEGP site is an ichthyoplankton-net collection." Was the 2008 SNC study conducted in accordance with Dr. Young's recommendations?**

A4: Yes. The methods employed in the SNC study were substantially consistent with those described by Dr. Young. Dr. Young states that "[i]chthyoplankton collections should be conducted at equal intervals from riverbank to riverbank, surface to bottom." *See* Young Direct Testimony at A.19. SNC did this. SNC conducted surface to bottom collections in the Savannah River at one meter depth intervals, based on available depth, along a cross-sectional transect with sampling locations established approximately 30 feet from the left (Georgia) bank, at mid-channel, and 30 feet from the right (South Carolina) bank. *See* Exhibit SNC000005. Dr. Young states that ichthyoplankton collections should be conducted "during a stratified sampling period occurring day and night." *See* Young Direct Testimony at A.19. SNC did this. The SNC study collected samples during 12-hour day and 12-hour night sample periods in order to assess the diel attributes of ichthyoplankton drift at Plant Vogtle. SNC specifically designed the entrainment study to be consistent with similar studies performed at other facilities and collected data sufficient to complete the analysis of impacts required under NEPA.

The primary differences between those sampling methods Dr. Young suggested and the SNC survey are the frequency of sampling and the use of submersible pumps to collect samples in the intake canal. Dr. Young suggests that ichthyoplankton studies be conducted several times per week during each month of the year. SNC conducted its sampling twice per month (bi-weekly), which provided for a detailed assessment of the entrainment rate at Plant Vogtle, based on a level of effort consistent with many other

studies of this type. The bi-weekly sampling provided a clear trend of ichthyoplankton (drift) abundance including times of peak abundance and attenuation consistent with literature-based expectations of spawning season timing for species of the area. More frequent sampling is neither standard nor necessary.

Also, the method of sampling intake canal water with a submersible pump system and plankton nets was necessary due to actual site conditions. The prevailing, sluggish hydraulic conditions that exist in the canal, as well as the physical constraints of sampling the canal by boat, made the pump system the appropriate collection choice. The use of the pump system is a scientifically accepted collection technique. *See* Exhibit SNC000052 (Fisheries Techniques, Second Edition. 1996. Eds. B. Murphy and D. Willis. Fisheries Techniques. American Fisheries Society, Bethesda, MD).

Dr. Young's testimony regarding appropriate impingement and entrainment sample methodologies and the need for site specific field studies and quantitative analysis was provided prior to his knowledge of SNC's 2008 impingement and entrainment study. The study performed at Plant Vogtle in 2008 should adequately address Dr. Young's concerns.

Q5: **Do you agree with Dr. Young's statement that the Hydraulic Zone of Influence ("HZI") study conducted by SNC in support of this proceeding does not provide sufficient data and fails to consider the sufficient range of flows necessary to adequately assess the impact? (*See* Young Direct Testimony at A.23.)**

A5: No. When the HZI determination was conducted at Plant Vogtle on May 7, 2008, Unit 1 was operating at 100% of its generating capacity, Unit 2 was operating at 98.1% of its generating capacity, and the cooling water intake structure was operating in its normal

pumping configuration. During normal (i.e., plant at full load) operation of the intake structure, one pump operates for each unit (two pumps total); a third pump operates intermittently as needed to adjust cooling tower basin water levels and for waste dilution; and a fourth pump is kept in standby should one of the other three pumps require maintenance. The 56% capacity to which Dr. Young refers in his pre-filed direct testimony is simply the ratio of the daily withdrawal rate reported by Plant Vogtle for Units 1 and 2 (71.24 MGD) for May 7, 2008, to the theoretical limit of all four pumps operating at full design capacity (127 MGD). On the day the HZI determination was conducted, the plant operated three of the four cooling water intake pumps, which is the normal mode of operation at full power generation.

Regarding Dr. Young's assertion that an insufficient range of flows were analyzed, the HZI was characterized during a period of prolonged drought that was, at a minimum, representative of average river flows during 2008 under normal cooling water withdrawal rates. Savannah River flows averaged 4,482 cfs on the day the HZI determination was conducted. For 2008, the average daily flow in the Savannah River at Plant Vogtle was approximately 4,950 cfs (USGS, http://waterdata.usgs.gov/nwis/). *See* Exhibit SNC000053 (average calculated from daily numbers in tables). From January 22, 2005 to December 31, 2008, the average daily flow in the Savannah River was 7,173 cfs, or about 44.7 percent greater than the 2008 average flow. *See* Exhibit SNC000053 (average calculated from daily numbers in tables).

Q6: **Dr. Young discusses the temperatures at which several species of larvae and eggs suffer mortality and asserts that the water temperatures near Plant Vogtle would lead to an increase in their mortality. Is that correct?**

A6: No. Dr. Young is quick to point out that sturgeon and striped bass eggs and larvae suffer mortality when water temperatures reach or exceed 75°F (eggs) and 85°F (larvae). Dr. Young fails, however, to discuss the water temperatures at which spawning occur. He also fails to take into consideration Plant Vogtle's discharge permit limit requiring that cooling water discharge temperatures be no greater than 5°F over ambient (as discussed in FEIS Section 5.3.3.1). For example, sturgeon spawning takes place when water temperatures are between 48°F and 57°F. *See* Exhibit JTI000013. Similarly, striped bass spawn when water temperatures are between 63°F and 66°F. *See* Exhibit JTI000014. However, during this time, the Plant Vogtle discharge can be no greater than 5°F over ambient, which is well below the temperatures that would impact the eggs and larvae of these species.

Additionally, Dr. Young fails to mention the importance of exposure time when discussing egg and larvae mortality due to increases in water temperature. For example, in his testimony, Dr. Young quotes Fay et al., 1983 (JTI000015), which says, "Most early striped bass life stages show significant elevated mortality when exposed to rapid changes in water temperature (such as that in a thermal discharge plume)." On page 25 of that document, the next sentence states, "Eggs were able to sustain 15°C (27°F) temperature elevation for 4-60 min, but an elevation of 20°C (36°F) above acclimation temperature killed all eggs in 2 min." These temperatures and exposure times are well beyond any of those conservatively predicted in the FEIS. Based on the velocity of the Savannah River, the small size of the thermal plume, and the small increase in temperature (<5°F over ambient), the time of exposure to fish larvae and eggs traveling through the discharge plume is measured in seconds, not minutes.

Q7: **Does Dr. Young consider all factors relevant to the impact of the thermal plume?**

A7: No. Dr. Young fails to recognize the limited potential for impacts from the plume due to its buoyant nature and its overall, limited spatial aspect. Because the plume is warmer than ambient waters, it is also more buoyant than the surrounding water. Additionally, based on both the CORMIX model discussed in the FEIS and the thermal study conducted by SNC (*See* Exhibit SNC000011), the plume is limited in areal size relative to the channel width overall. The buoyant nature of the plume restricts it to the upper portions of the water column over a relatively short distance – a distance where the warmest portion of the plume occurs as it initially dissipates heat. Consequently, the majority of the water column in the overall footprint of the plume, and thus the majority of larval drift, is influenced less by plume temperature. Early information provided in the FEIS further supports this limiting effect, in that at least one important species of consideration, American shad egg distribution, is expected to be concentrated along the bottom of the water column. FEIS at 2-81. Thus, it would drift under the largest, warmest portion of the plume characterized by temperatures consistent with the <5°F over ambient temperature stipulated in Plant Vogtle's discharge permit.

Q8: **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?**

A8: Yes.

Q9: **Does this conclude your testimony?**

A9: Yes.

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 |

AFFIDAVIT OF ANTHONY R. DODD CONCERNING SOUTHERN NUCLEAR'S REBUTTAL TESTIMONY ON ENVIRONMENTAL CONTENTION 1.2

I, Anthony R. Dodd, 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.

Anthony R. Dodd

Subscribed and sworn to before me
this 4th day of February, 2009.

Notary Public

EDWARD PERRY THOMAS
Notary Public
Cobb County
State of Georgia
My Commission Expires Jun 21, 2011

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 |

AFFIDAVIT OF MATTHEW T. MONTZ CONCERNING SOUTHERN NUCLEAR'S REBUTTAL TESTIMONY ON ENVIRONMENTAL CONTENTION 1.2

I, Matthew T. Montz, 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.

Matthew T. Montz

Subscribed and sworn to before me
this 3rd day of February, 2009.

Notary Public

NOTARY PUBLIC STATE OF ALABAMA AT LARGE
MY COMMISSION EXPIRES: Apr 28, 2011
BONDED THRU NOTARY PUBLIC UNDERWRITERS

1 MR. MOORE: And I think it was your
2 preference to go ahead and --
3 JUDGE BOLLWERK: Let's go ahead and deal
4 with the exhibits for the direct and rebuttal
5 testimony. Yes, if we could, please.
6 MR. MOORE: Okay. Then I'd ask that file
7 SNC000002, and I think I may often refer to these
8 just by their last number if that's okay with the
9 Board.
10 JUDGE BOLLWERK: That's fine.
11 MR. MOORE: So SNC-2. Let's look at that
12 one.
13 JUDGE BOLLWERK: Scroll down a little bit
14 so that we can see it. There we go.
15 MR. MOORE: Mr. Dodd, this is entitled
16 Anthony R. Dodd curriculum vitae. Do you recognize
17 this as a document that's referenced in your
18 testimony?
19 MR. DODD: Yes, I do.
20 MR. MOORE: Does it appear to be a true
21 and correct copy of this CV that's referenced in your
22 testimony?
23 MR. DODD: Yes, it is.
24 MR. MOORE: Then I'd ask that this be
25 marked.

1 JUDGE BOLLWERK: All right. The record
2 should reflect then that SNC Exhibit 000002 is marked
3 for identification.
4 (Whereupon, the document was marked for
5 identification as Exhibit SNC000002.)
6 MR. MOORE: Then let's have SNC-3, please?
7 Mr. Montz, can you see this document
8 that's entitled Matthew T. Montz CV?
9 MR. MONTZ: Yes.
10 MR. MOORE: Is this the document that's
11 referenced in your testimony?
12 MR. MONTZ: Yes, it is.
13 MR. MOORE: Does it appear to be a true
14 and correct copy of your CV?
15 MR. MONTZ: Yes.
16 MR. MOORE: I'd ask that this be marked as
17 Exhibit SNC-3 and admitted.
18 JUDGE BOLLWERK: All right. Then the
19 record should reflect that SNC Exhibit 000003 has been
20 marked for identification.
21 (Whereupon, the document was marked for
22 identification as Exhibit SNC000003.)
23 MR. MOORE: And the next would be SNC-R-4,
24 R00004. And this is the report with the numbers in it
25 that we just discussed added in in the testimony. So

1 now it has the corrected numbers in it so they match
2 up.
3 Can you read that number at the top there?
4 I can't make it out. Thank you. Now I can see it.
5 All right. Mr. Dodd and Mr. Montz, this
6 is a document entitled "The Interim Report of Fish
7 Impingement at the Plant Vogtle Electric Generating
8 Plant, dated from January 2009. And it's identified as
9 SNCR00004. I'd like to ask you if this is the document
10 that's referenced in your testimony?
11 MR. DODD: Yes, it is.
12 MR. MONTZ: Yes, it is.
13 MR. MOORE: And does it appear to be a
14 true and correct copy of that report?
15 MR. DODD: It does.
16 MR. MONTZ: Yes.
17 MR. MOORE: Then we'd ask this to be
18 marked and admitted, please.
19 JUDGE BOLLWERK: All right. Then SNC
20 Exhibit SNCR00004 shall be marked for identification.
21 (Whereupon, the document was marked for
22 identification as Exhibit SNCR00004.)
23 MR. MOORE: And now if we could have
24 SNCR00005? Okay. We have it up. Thank you.
25 Mr. Dodd and Mr. Montz, this is a document

1 on the screen that's entitled -- let's move down to
2 the titles so they can see that. Entrainment
3 Assessment at the Plant Vogtle Electric Generating
4 Plant, dated from October 2008. Is this the document
5 that's referenced in your testimony?
6 MR. DODD: Yes, it is.
7 MR. MONTZ: Yes, it is.
8 MR. MOORE: And does it appear to be a
9 true and correct copy of that report?
10 MR. DODD: Yes.
11 MR. MONTZ: Yes.
12 MR. MOORE: Then I'd ask for this to be
13 marked.
14 JUDGE BOLLWERK: All right. Then the
15 record should reflect that SNCR00005 as identified by
16 counsel is marked for identification.
17 (Whereupon, the document was marked for
18 identification as Exhibit SNCR00005.)
19 MR. MOORE: And next I'd ask for SNC-6.
20 And you can see the title for that, and let's turn
21 onto the next page is a photograph. For the exhibit
22 is that it is a photo depicting impingement sampling
23 apparatus insert net as mounted in the screen wash
24 pit. Move us back to that photo and I'll ask you all
25 to look at this photo, Mr. Dodd and Mr. Montz, and ask

1 if this is the photograph that's referenced in your
2 testimony.
3 MR. DODD: Yes, it is.
4 MR. MONTZ: Yes, it is.
5 MR. MOORE: And is it a true and correct
6 copy of that photograph?
7 MR. DODD: Yes.
8 MR. MONTZ: Yes.
9 MR. MOORE: I'd ask that this be marked.
10 JUDGE BOLLWERK: All right. Then Exhibit
11 SNC000006 as identified by counsel is marked for
12 identification.
13 (Whereupon, the document was marked for
14 identification as Exhibit SNC000006.)
15 MR. MOORE: Now SNC-7. This is another
16 photograph. Mr. Dodd and Mr. Montz, please look at
17 this. This is entitled Photo Depicting Entrainment
18 Sampling Apparatus Mounted At the Edge of the Intake
19 Canal. Is this the photograph that's so referenced in
20 your testimony?
21 MR. DODD: Yes, it is.
22 MR. MONTZ: Yes, it is.
23 MR. MOORE: Is it a true and accurate
24 representation of what it purports to represent?
25 MR. DODD: Yes.

1 MR. MONTZ: Yes.

2 MR. MOORE: I'd ask that this be marked.

3 JUDGE BOLLWERK: All right. Then Exhibit

4 SNC000007 as identified by counsel is marked for

5 identification.

6 (Whereupon, the document was marked for

7 identification as Exhibit SNC000007.)

8 MR. MOORE: Now SNC-8, please. This is

9 also a photograph. The Exhibit is entitled Photo

10 Depicting Individual Conducting Entrainment Sampling

11 Via Boat Mounted Plankton Net Sampler on the Savannah

12 River. So Mr. Dodd and Mr. Montz, is this the

13 photograph that is referenced in your testimony?

14 MR. DODD: Yes, it is.

15 MR. MONTZ: Yes, it is.

16 MR. MOORE: And does it appear to

17 accurately represent what it purports to represent?

18 MR. DODD: Yes.

19 MR. MONTZ: Yes.

20 MR. MOORE: I'd ask that this be marked.

21 JUDGE BOLLWERK: All right. Then Exhibit

22 SNC000008 as identified by counsel is marked for

23 identification.

24 (Whereupon, the document was marked for

25 identification as Exhibit SNC000008.)

1 MR. MOORE: Three more exhibits for these
2 two witnesses, Your Honor.
3 SNC-9 next, please.
4 JUDGE BOLLWERK: I should mention these
5 are coming up sideways. If we need to use them for any
6 reason, we'll flip them around so you can see them up
7 and down.
8 MR. MOORE: Yes.
9 JUDGE BOLLWERK: But I appreciate you
10 staying with it. They just happened to come up that
11 way and it's probably not worth flipping them at this
12 point.
13 MR. MOORE: I think I saw they were
14 turning their heads appropriately to make the
15 identification.
16 JUDGE BOLLWERK: Yes, that would work,
17 too. Yes. However it's best to see them right.
18 MR. MOORE: Thank you.
19 Okay. SNC-9 here's another photograph.
20 It's entitled Photo Depicting Approach View of the
21 Canal and Pump House. And, again, this one's rotated
22 to the side, but I think you -- I'm going to ask if
23 you can anyway, identify that this photograph is the
24 one that's referenced in your testimony?
25 MR. DODD: Yes, it is.

1 MR. MONTZ: Yes.

2 MR. MOORE: Thank you.

3 And does it represent what it purports to

4 represent accurately?

5 MR. DODD: Yes.

6 MR. MONTZ: Yes.

7 MR. MOORE: Thank you.

8 I'd ask this be marked.

9 JUDGE BOLLWERK: All right. Then the

10 record shall reflect that Exhibit SNC000009 has been

11 marked for identification.

12 (Whereupon, the document was marked for

13 identification as Exhibit SNC000009.)

14 MR. MOORE: SNC-10, please.

15 A photo again, this one entitled Photo

16 Depicting View of the Outer Intake Canal at the

17 Savannah River.

18 And Mr. Dodd and Mr. Montz, is this the

19 photograph that's referenced in your testimony?

20 MR. DODD: Yes, it is.

21 MR. MONTZ: Yes, it is.

22 MR. MOORE: And does it accurately

23 represent what it purports to represent?

24 MR. DODD: Yes.

25 MR. MONTZ: Yes.

1 MR. MOORE: I'd like this to be marked,
2 please.
3 JUDGE BOLLWERK: All right. Then the
4 record should reflect that SNC Exhibit 000010 is
5 marked for identification.
6 (Whereupon, the document was marked for
7 identification as Exhibit SNC000010.)
8 MR. MOORE: Can we see SNC-11, please?
9 Okay. We have that up.
10 This exhibit is a series of four, I
11 believe, we can go through and look at it, Images From
12 the Thermal Study Depicting River Water Temperature.
13 And that's the title of the exhibit. If we can flip
14 through those and give Mr. Dodd and Mr. Montz a chance
15 to see them.
16 I'd ask if you can affirm that this is the
17 series of images referenced in your testimony?
18 MR. DODD: Yes, it is.
19 MR. MONTZ: Yes, it is.
20 MR. MOORE: And do they represent a true
21 and correct copy of what they intend to show?
22 MR. DODD: Yes.
23 MR. MONTZ: Yes.
24 MR. MOORE: Then I'd ask this be marked,
25 please.

1 JUDGE BOLLWERK: All right. Then the
2 record should reflect that Exhibit SNC000011 as
3 described by counsel is marked for identification.
4 (Whereupon, the document was marked for
5 identification as Exhibit SNC000011.)
6 MR. MOORE: Okay. We need to move SNC-52,
7 which was an exhibit associated with the rebuttal
8 testimony from Mr. Dodd and Mr. Montz.
9 JUDGE BOLLWERK: I believe there were two
10 rebuttal exhibits, is that correct?
11 MR. MOORE: Yes, sir.
12 JUDGE BOLLWERK: 52 and 53?
13 MR. MOORE: 52 and 53
14 JUDGE BOLLWERK: All right.
15 JUDGE BOLLWERK: I take it this is another
16 large file, is that the --
17 MR. MOORE: Okay. Thank you. It's up.
18 This SNC-52. It's entitled Fisheries
19 Techniques Second Edition and it gives the authors of
20 the report. And I'd like you all to look at this
21 document and let the Board know if this is the
22 document that's referenced in your testimony?
23 MR. DODD: Yes, it is.
24 MR. MONTZ: Yes, it is.
25 MR. MOORE: Does it appear to be a true

1 and correct copy of that document?

2 MR. DODD: Yes.

3 MR. MONTZ: Yes.

4 MR. MOORE: I'd like this to be marked,

5 please.

6 JUDGE BOLLWERK: All right. The record

7 shall reflect that Exhibit SNC000052 as identified by

8 counsel is marked for identification.

9 (Whereupon, the document was marked for

10 identification as Exhibit SNC000052.)

11 MR. MOORE: And now SNC-53, please. This

12 is a somewhat lengthy file as well.

13 JUDGE BOLLWERK: If we were in our hearing

14 room in Rockville this would be coming up faster. But

15 we're, again, doing this over a broadband connection.

16 MR. MOORE: Thank you. It's up.

17 You can see on your screen the title of

18 this is exhibit is Daily Average Discharge, USGS

19 Savannah River Near Waynesboro, Georgia. And in the

20 middle there is an identification number for our

21 gauge.

22 You can go to the next page and just

23 scroll through a couple of those pages. There's

24 graphs and then some raw data and tables.

25 I'd like to ask you, Mr. Dodd and Mr.

1 Montz if this is the document that's referenced in
2 your testimony?
3 MR. DODD: Yes, it is.
4 MR. MONTZ: Yes, it is.
5 MR. MOORE: Does it appear to be a true
6 and correct copy of that document?
7 MR. DODD: Yes.
8 MR. MONTZ: Yes.
9 MR. MOORE: Then we'd also like that
10 marked.
11 JUDGE BOLLWERK: All right. Let the record
12 reflect that Exhibit SNC000053 as identified by
13 counsel is marked for identification.
14 (Whereupon, the document was marked for
15 identification as Exhibit SNC000053.)
16 JUDGE BOLLWERK: And I believe that's
17 everything.
18 MR. MOORE: Those are all the exhibits
19 sponsored by Mr. Dodd and Mr. Montz. I would like to,
20 presuming I need to do so, move to admit them.
21 JUDGE BOLLWERK: Right. And you'd said
22 that before. And let's turn to the parties, anyone
23 have any objection to the admission of any of these
24 exhibits? All right. Hearing none. Then I'm going to
25 try to get these all in but abbreviate them somewhat.

1 SNC Exhibits 2, 3, SNCR00004, SNCR00005.
2 SNC-6, 7, 8, 9, 10, 11 and 52 and 53 are admitted into
3 evidence.
4 (Whereupon, the documents identified as Exhibits
5 SNC000002, 3, SNCR00004, SNCR00005.
6 SNC000006, 7, 8, 9, 10, 11 and 52 and 53
7 were received into evidence.)
8 MR. MOORE: Thank you.
9 JUDGE BOLLWERK: And then I think we
10 should turn to -- yes, next witness.
11 MR. MOORE: Yes. Let us ask for the
12 submission of Dr. Coutant's Prefiled Direct Testimony,
13 which is in a file name Coutant 1.2 Direct Testimony.
14 And I don't believe that I introduced Dr.
15 Coutant yet. So I'd just like him to identify himself
16 so you can see who he is on the panel. He is a doctor
17 of biology with a focus on ecology, retired from Oak
18 Ridge National Laboratories and is now a private
19 consultant.
20 Okay. His testimony is on the screen.
21 First I'd like to ask Dr. Coutant, do you
22 recognize this document as your prefiled testimony in
23 this matter?
24 DR. COUTANT: Yes, I do.
25 MR. MOORE: Then I need to have you affirm

1 you in the same manner that you heard Mr. Dodd and Mr.
2 Montz. So can you respond please for the Board to this
3 statement? That the testimony entitled Southern
4 Nuclear Operating Company's Testimony of Dr. Charles
5 Coutant concerning EC 1.2 and dated January 9, 2009
6 which has been provided to the court reporter in
7 electronic format under file name Coutant 1.2 Direct
8 Testimony was prepared by you or under your
9 supervision and direction and is true and correct to
10 the best of your knowledge and belief?
11 DR. COUTANT: I do so affirm.
12 MR. MOORE: Okay. Then we would like to
13 see his rebuttal testimony and have him do the same
14 for that. That's the file name Coutant 1.2 Rebuttal
15 Testimony.
16 JUDGE BOLLWERK: Why don't we go ahead and
17 move that one in, the direct first.
18 MR. MOORE: Pardon me?
19 JUDGE BOLLWERK: Why don't we go ahead and
20 put the direct in.
21 MR. MOORE: Excuse me. Thank you, Your
22 Honor.
23 Yes, I'd like to move that this be
24 admitted.
25 JUDGE BOLLWERK: All right. Any objections

1 from the parties? Hearing none, then the Direct
2 Testimony of Dr. Coutant as described by counsel will
3 be admitted into the record as if read at this point
4 as DDMS item ID 58905.
5 (Dr. Coutant Direct Testimony (DDMS-58905)
6 to be inserted at this point)
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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)** | ) | **January 9, 2009** |

**SOUTHERN NUCLEAR OPERATING COMPANY'S TESTIMONY OF DR. CHARLES COUTANT CONCERNING EC 1.2**

## I. WITNESS BACKGROUND

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

A1: My name is Charles Coe Coutant. I am a retired Distinguished Research Staff Member of the Oak Ridge National Laboratory, Oak Ridge, Tennessee. My combined business and home address is 120 Miramar Circle, Oak Ridge, TN 37830-8220. I now serve as a private consultant on matters of aquatic ecology and fisheries biology.

**Q2: Please summarize your educational and professional qualifications.**

A2: My professional and educational experience is summarized in the curriculum vitae (CV). *See* Exhibit SNC000012 (Dr. Charles C. Coutant Curriculum Vitae). I received a Ph. D. in Biology (focus on ecology) from Lehigh University in 1965. I have conducted thermal effects and other cooling water studies since 1959. For 5 years post doctorate, I studied thermal effects on aquatic life of the Columbia River in Washington. At the Oak Ridge National Laboratory, since 1970, I have conducted individual research on thermal effects, entrainment and impingement on aquatic life, led a team of scientists studying these power plant cooling issues

(for which I have numerous publications listed in my CV), participated in preparation of NEPA Environmental Impact Statements for nuclear power plants for the U.S. Atomic Energy Commission, later the Nuclear Regulatory Commission (NRC), in which issues related to thermal, entrainment and impingement impacts were analyzed (Palisades, Shoreham, Indian Point), as well as for several hydropower facilities (for the Federal Energy Regulatory Commission, FERC). I also have participated in the development of national water quality criteria for temperature (National Academies and the Environmental Protection Agency, EPA) and the interagency (NRC & EPA) implementation document for the thermal effects Section 316(a) of the Clean Water Act. I have assisted numerous electricity generators with aquatic environmental licensing issues, including Virginia Power (now Dominion) with its North Anna Nuclear Power Plant. I have served on several task forces to develop biological criteria for environmentally benign siting, design and operation of power station cooling-water facilities. I helped develop the NRC NEPA implementation rules in my role as a participant in preparation of the initial EISs for the Atomic Energy Commission Division of Regulation (predecessor to NRC). This preceded the formal NRC guidelines now in place.

**Q3: Please describe your professional activities.**

A3: My professional activities have included active participation in the American Fisheries Society, the dominant professional society for fisheries scientists and managers in North America. I served as President of the Society in 1996-1997, after several years of membership on the Governing Board. I was also President of the Water Quality Section, the Tennessee Chapter, and the Southern Division. For many years I was an active participant in the literature review committee of the Water Pollution Control Federation (now Water Environment Federation), producing annual reviews of thermal effects literature. I have served on panels of

the American National Standards Institute and the American Nuclear Society developing environmental standards for cold shock and entrainment, and of the American Society of Testing and Materials for containment transport models. I am also a member of the Ecological Society of America, in which I was an officer of the Applied Ecology Section. I have served as an advisor to international agencies with respect to power station cooling-water impacts (Germany, Sweden, Canada, New Zealand, International Atomic Energy Agency (IAEA), and Unesco). The IAEA and Unesco activities resulted in reference manuals for siting, design and operation of steam power stations to minimize detrimental aquatic environmental impacts. As a result, I have considerable familiarity and experience with evaluating and considering aquatic impacts from impingement and entrainment and from thermal discharge of cooling water systems.

**Q4: Are you familiar with Environmental Impact Statements ("EIS") prepared for compliance with the National Environmental Policy Act ("NEPA")?**

A4: Yes; I am familiar with NEPA EISs, both in general and specifically those prepared by the NRC.

**Q5: What is the basis of your familiarity with NEPA EISs?**

A5: I have participated in the NEPA EIS process since 1971 and in predecessor environmental impact assessments for nuclear power stations since 1967. From 1967-1969, I was the lead aquatic ecologist at Battelle-Northwest (managing contractor for the Atomic Energy Commission's [AEC] Hanford Laboratories) in evaluations of fisheries and other aquatic impacts of proposed alternative nuclear power station sites in the Pacific Northwest. With the 1971 Calvert Cliffs decision that extended the AEC's EIS responsibilities to include non-radiological impacts, I worked with AEC's regulatory staff as a staff member of the AEC's Oak Ridge National Laboratory to develop implementation guidelines and topics for evaluation, including

thermal, entrainment and impingement impacts of the cooling system. I was lead author of aquatic assessments for AEC's EISs for Palisades and Shoreham nuclear power stations in the early 1970s, which were contracted to Oak Ridge National Laboratory. I also participated at that time in preparing EISs for Indian Point 2 and 3. I participated in peer reviews of EISs prepared for other existing or proposed power plants for the AEC and its successor regulatory agency, the Nuclear Regulatory Commission. Most of my AEC/NRC EIS contributions were accompanied by testimony before Atomic Safety and Licensing Boards. These assessments were a valuable complement to the biological research my team and I were conducting on these topics at Oak Ridge National Laboratory.

In the 1980s and 1990s, I participated in ecological analyses of hydropower plants for EISs by the Federal Energy Regulatory Commission, including the Susitna Project in Alaska, the Skagit River Project in Washington state, and Ohio River hydropower development. These EISs were contracted to the Oak Ridge National Laboratory in a manner similar to that used by the AEC/NRC. I also participated in EISs for Department of Energy facilities. More recently, I participated in resolution of aquatic ecological issues related to another Early Site Permit (North Anna additional units) on behalf of the company, Dominion Nuclear North Anna LLC.

**Q6: Are you familiar with Southern Nuclear Company's ("SNC's") ESP application for Vogtle Units 3 & 4?**

A6: Yes.

**Q7: Have you reviewed the Petition for Intervention and supporting documents filed in this proceeding?**

A7: Yes.

**Q8: Are you familiar with Contention EC 1.2?**

A8: Yes. I reviewed the Petition for Intervention, SNC's and the Staff's Responses, the Board's Order admitting EC 1.2 and all of the filings and supporting documents related to the Motion for Summary Disposition of EC 1.2. As admitted, EC 1.2 now reads:

*The ER fails to identify and adequately consider direct, indirect, and cumulative impingement/entrainment and thermal effluent discharge impacts of the proposed cooling system intake and discharge structures on aquatic resources.*

**Q9: Are you familiar with the Vogtle site?**

A9: Yes.

**Q10: Have you visited the Vogtle site?**

A10: Yes, on March 19, 2008, I spent the entire day at the site.

**Q11: Please describe your visit.**

A11: I flew into Augusta, Georgia, on the afternoon of March 18 and met with SNC staff (Matt Montz, Tom Moorer and others) in the evening to discuss the site visit the next day. We drove from Augusta to the Vogtle site early on the morning of March 19, where we met Tony Dodd of the Georgia Power Environmental Lab, who was conducting the field studies on entrainment and impingement and later the thermal plume monitoring. Mr. Dodd showed me the entrainment sampling nets in their storage location on the site. We visited the intake canal and pump house, and we observed the river itself, which is a single channel with muddy soil banks a few feet high studded with riparian vegetation. We could see the Department of Energy's Savannah River Site (SRS) property across the river and observed the proximity of that site to Plant Vogtle.

**Q12: What is the purpose of your testimony?**

A12: I will testify regarding the sufficiency and adequacy of the EIS. Specifically, I will testify regarding the general purpose of an EIS (based on my personal experience as both a writer and a reviewer), use of an EIS by the NRC, acceptability of available data for the proposed site (especially data from the Department of Energy's Savannah River Site across the Savannah River from Vogtle), the reasonableness of SNC's and NRC's impact analyses and the value of the present Vogtle units as evidence of small impacts. I will refute the assertions made by the Intervenors, specifically those made through their expert, Dr. Shawn Young. I am providing separate testimony regarding EC 1.3 and EC 6.0.

## II. NRC REQUIREMENTS APPLICABLE TO PREPARATION OF EISs

**Q13: Please describe your understanding of NRC regulatory requirements and any related NRC guidance applicable to the preparation of an EIS.**

A13: The general purpose of an EIS under the National Environmental Policy Act of 1969 (NEPA; Public Law 91-190) is to assist a federal agency in making a reasoned estimate of the environmental consequences of a significant decision or so-called "major federal action." In this case, the major federal action is the proposed issuance of an Early Site Permit. Indeed, such a decision often involves federal licensing of a project. The intent of NEPA is to ensure environmental input into federal decision-making. The intent is not to require conclusive scientific evidence for every question.

The overall federal EIS process is overseen by the Council on Environmental Quality (CEQ), which monitors for technical and legal adequacy of EISs produced by federal agencies such as the NRC. Both CEQ and NRC have implementing rules, which explain how to make estimates of environmental impacts. CEQ rules are found at 40 CFR part 1500. For NRC, these

rules are in 10 CFR Part 51, specifically 10 CFR 51.70 and 51.71, and NUREG 1555, for example, is NRC's standard environmental review plan. Throughout my participation in scoping and writing EISs, it has been consistently clear that absolute certainty about environmental impacts is not required by NEPA, nor by CEQ or NRC implementing regulations.

**Q14: Does the NRC or CEQ specify the scientific methods or analyses required to be used in the estimation of the environmental impacts of a project?**

A14: No. Neither CEQ nor NRC stipulates what methods are to be used in the estimation of environmental impacts of a project. The NRC's guidance (NUREG 1555 at 6) states simply: "The methods to be used for analysts and staff judgments are objective and based on sound analytical procedures." The operative criterion is whether the agency has considered the relevant and pertinent information within adequate procedures and processes (Gerrard 1993). This criterion has been established over years of peer, administrative, and judicial reviews, in some of which I have been a participant. Although NEPA EISs rest on readily verifiable facts, they contain heavy doses of scientific opinion about both facts and the methods used to arrive at them. For the NRC, the goal is to provide "a reasonable estimate of the impact to a resource" (NRC Review Standard RS-002). It is left to staff judgment what method is used to make a reasonable estimate.

**Q15: In your view, is the use of existing data sources appropriate when preparing an EIS?**

A15: Yes. The intent of NEPA, expressed in the NRC implementation rules (NUREG-1555, for which I helped develop predecessor documents in the 1970s), is to require the synthesis of relevant and pertinent environmental information, often derived from sources other than the project applicant (Caldwell 1993). The clear intent of NEPA is to draw upon science as an

informant and corrective for public policies impacting on the environment. NEPA requires a systematic, integrated, interdisciplinary use of sciences and information that could reveal the probable effects of the agency's action that significantly impact the environment. Reliance on data collection performed by reputable agencies and organizations, whose methods can be assessed with the results, is just as valid an approach to a NEPA analysis as an applicant performing its own studies. Importantly, in many disciplines, the recency of such data is not particularly significant. Accordingly, even though a prior study would by definition pre-date a new, applicant-performed study, this may have little or no bearing on the usefulness or validity of the data.

**Q16: In your opinion, is it appropriate to synthesize data collected for other purposes into a "model" for the specific project when preparing an EIS?**

A16: Yes. Much scientific information that is relevant and pertinent to evaluating environmental impacts of any project is developed for other purposes. In my view, a unique attribute of an environmental impact analyst is an ability to see the broad picture from information with many origins. Most of the papers in the book *Environmental Analysis: The NEPA Experience* (Hildebrand and Cannon 1993) reflect application of information from a wide variety of sources to environmental impact analysis. Even when an applicant obtains site-specific environmental data, these data need to be evaluated in the context of scientific understanding obtained from many sources. Most EISs aggregate existing information into "models" that are used to make predictions about the environmental impacts of a proposed action (e.g., Stalnaker 1993, Adams et al. 1993). Some models are sophisticated, computerized calculation schemes whereas other models are simply professional opinion about how systems

work (e.g., Bruns et al. 1993). No matter which model is used, it is important for the EIS analyst to have visited the site to place the diverse information into a geographical and spatial context.

**Q17: Are reasonable estimates ever appropriate in preparing an EIS?**

A17: Definitely. In my experience, some environmental attributes important for carrying out environmental impact analyses are too variable for detailed, empirical data to be directly useful, and thus reasonable estimates based on a broader context are not only proper, but are essential. Typically, EISs use generalizing assumptions, such as uniform distribution at a conservative density, for analyses that are relevant and pertinent, although not precisely matching actual field data. The purpose is to test whether reasonable assumptions indicate a sufficiently large environmental impact for continued concern. In my experience, this is a common and accepted method of assessing impacts or effects in almost any ecological discipline, and it is an appropriate methodology for a NEPA analysis.

## III. REVIEW OF THE EIS FOR VOGTLE UNITS 3 & 4

**Q18: Have you reviewed the EIS prepared for Vogtle Units 3 & 4?**

A18: Yes; SNC asked me to review the NRC's EIS, its supporting documentation in the form of relevant literature, other scientific and fisheries-management literature, SNC's Environmental Report and SNC's and the staff's responses to the Board's Requests for Additional Information.

**Q19: In your opinion are the analytic methods used in the EIS for Vogtle objective and based on sound analytical procedures?**

A19: Yes.

**Q20: What is the basis for your opinion?**

A20: The EIS appropriately relies on generally accepted scientific information. The analysis is consistent with that which I would have done and the conclusions are reasonable and supported. In my opinion, scientific information developed by the Department of Energy's Savannah River Site, by the Academy of Natural Sciences of Philadelphia in its periodic biological surveys of the Savannah River since the 1950s, by the Georgia and South Carolina departments of wildlife and fisheries, US Fish and Wildlife Service, US National Marine Fisheries Service, the US Geological Survey, and by independent investigators successfully meets the "general acceptance test" of available information for use in an EIS. In the aggregate, these data are highly representative of the current aquatic conditions at the Vogtle site. The NRC has appropriately conducted independent calculations of effects of Vogtle Units 3 & 4 operation and combined Vogtle Units 1-4 operation on aquatic resources, such as characterizing the amount of water withdrawal and entrainment at the intake (e.g., EIS at 5-9) and the physical dimensions of the thermal plume using the CORMIX model (EIS at 5-17). The EIS uses the appropriate combination of summarizing available relevant literature from multiple sources, conducting independent calculations of key impact features, and developing informed professional judgment concerning the results of the analyses.

**Q21: What is your opinion regarding the adequacy of the analysis in the EIS?**

A21: The EIS describes an analysis that is thorough, uses standard methods, and is consistent with the level of detail that the estimated impacts warrant.

**Q22: What is the basis of this opinion?**

A22: As I have responded above, the guidance for NEPA EISs by NRC and CEQ points to an evaluation that identifies the relevant types of impact that could occur, assembly of relevant and scientifically acceptable information from available sources, use of reasonable

analytical methods appropriate for the type of impact, and a reasoned judgment of whether the impact is SMALL, MODERATE or LARGE. In my independent review of available data, some of which goes beyond that cited specifically in the EIS, I have affirmed the appropriateness of the literature cited in the EIS and the conclusions reached by NRC staff. The guidance does not specify that each identified risk for impact be analyzed in fine detail with extensive field studies at the site of the proposed project. The EIS provides appropriate discussion for the low level of impacts that the analysis determined. In my experience, decision-makers have sought plain-language presentations in EISs that summarize the analyses with minimum unnecessary detail and technical jargon. I believe that the EIS by the NRC staff accommodates this desire. The data I reviewed is the type of data I would use to reach the conclusions required by NEPA.

**Q23: How is SNC's operating experience at Vogtle Units 1 & 2 relevant in estimating anticipated environmental impacts of Units 3 & 4 on the Savannah River?**

A23: The apparent lack of significant aquatic environmental impacts from Vogtle Units 1 & 2 provides a commonsense indication of similarly small impacts for the proposed Units 3 & 4. The proposed new units would use the same EPA-approved closed-cycle cooling employed at Units 1 & 2.

As noted in the ER, EPA pre-approval of a technology generally implies acceptability of the small residual impacts. *See* Exhibit SNC000001 (Environmental Report for Southern Nuclear Operating Company's Vogtle Early Site Permit Application) at 5.3-1, *citing* 40 C.F.R. § 125.94(a)(1)(i). I have personally been involved with EISs of power stations with once-through cooling for which the preferred alternative by the regulatory agencies and the environmental groups was ultimately the closed-cycle cooling system already used at Vogtle Units 1 & 2 and proposed for Units 3 & 4.

Although detailed entrainment and impingement studies were carried out at Units 1 & 2 only this past year, *see* Exhibit SNC000005 (Entrainment Assessment at the Plant Vogtle Electric Generating Plant (October 2008))) and SNC000004 (Interim Report of Fish Impingement at the Plant Vogtle Electric Generating Plant (January 2009)), some pertinent types of impact would have been evident earlier if they had occurred in any event. For example, if significant numbers of impinged fish had been observed by screen-maintenance personnel, they would have been reported in accordance with NRC reporting rules; they were not seen and reported. No significant changes in aquatic populations that one might reasonably attribute to a cooling water system at Vogtle have been observed in periodic biological surveys of the river by DOE contractors at the Savannah River Site, the Georgia and South Carolina departments of natural resources, other agencies or universities. Therefore, SNC's citation in the ER and NRC's citation in the EIS of the apparently benign cooling system at Vogtle Units 1 & 2 is, in my judgment, a valid basis for concluding that the anticipated scope of environmental impacts of the proposed Units 3 & 4 on the Savannah River would be small or minor.

**Q24: Did your visit to the Vogtle site shape your opinion of your review of the EIS?**

A24: Yes. It is helpful to view the actual character of the site to be able to assess the information and analysis in an EIS and other literature in context. Units 1 & 2 were operating at the time of my visit, and I was able to observe many of the actual bases for the issues raised by intervenors, including the intake and discharge structures, the proximity to the SRS, and the flow of the river. Specifically, I was shown the entrainment sampling nets in their storage location on the site, and Tony Dodd demonstrated how they operated and how samples were taken. We visited the intake canal and pump house for Units 1 & 2, which are similar to those for the

proposed Units 3 & 4. We observed the collection basket containing debris from the routine screen washings over the several days prior to our visit. The plant staff conducted a screen wash typical of what is done for impingement sampling, but no additional fish were collected.

As we walked around the intake canal, we discussed at length the difficulty of sampling plankton at that location with its slow water velocities that prevent the use of the plankton nets used in the river. I agreed that a pumped sample would be appropriate and that safety concerns mandated it be done from the top of the steel pilings that lined the canal. We observed the canal entrance with its debris boom at the surface and sill at the bottom designed to prevent water (and organism) withdrawal from the very bottom of the river (although the sill itself was not visible underwater).

From the vantage point of the intake structure at the mouth of the canal, we observed the river itself, which is a single channel with muddy soil banks a few feet high studded with riparian vegetation. I understand that this was typical of the river through the Vogtle property. We could not see the thermal discharge plume from this vantage point because of the large amount of shoreline vegetation. We also walked through some of the site outside the generating station to view the general terrain.

In general, my observations were consistent with the analysis and conclusions which were presented in the EIS.

## IV. RESPONSE TO CONTENTION EC 1.2

**Q25: Do you agree with the assertion that the ER/EIS fails to identify and adequately consider direct, indirect and cumulative impacts of the proposed cooling system intake and discharge structures on aquatic resources?**

A25: No.

**Q26: Please state the basis for your conclusion.**

A26: The iterative process of the NRC staff's data gathering and analysis, including the SNC's ER, NRC staff questions, and supplemental submissions by SNC has ensured that the direct, indirect, and cumulative impacts have been addressed specifically in the EIS. In my opinion, the EIS covers these topics in plain language and sufficiently completely. For direct impacts to water resources (including the cumulative impacts of both existing and proposed units and other water users), see EIS at 5-5 through 5-21, and EIS Section 7 (at 7-19 through 7-25). For indirect impacts to aquatic ecological resources, including cumulative impacts of both existing and new units, see EIS at 5-29 through 5-37 and summary at 5-38 to 5-39, with cumulative impacts at 7-19 through 7-25. In each case, the EIS (in the typical format) provides the background information and calculations in Section 2 (water resources at 2-17 through 2-44; ecological resources at 2-72 through 2-95). SNC has carried out several field studies prior to this hearing to further expand our understanding of the likely scale of impacts and to confirm the low levels of impacts as concluded in the EIS. Recall that the objective of an EIS is to provide a summary of relevant analyses and reasoned professional judgments about the types and severity of impacts that could affect the federal action (in this case, the issuance of an Early Site Permit), not to provide a detailed treatise on aquatic resources and potential impacts I cannot identify anything additional which would be necessary to make the analysis suitable for that purpose or would change NRC's conclusions reached in the EIS.

**Q27: In your opinion, does plant design have any effect on aquatic impacts?**

A27: Yes. From a scientific standpoint, design features of the cooling system and water intake can minimize mortalities to aquatic organisms from impingement on intake screens

and entrainment through the cooling system to generally accepted low levels. A fair amount of my career has been devoted to developing biological design criteria for power plant cooling systems, through research, analyses, reviews, and development of design and operation standards (see my professional activities, above and in my CV).

As noted in the ER (with supplements) and in the NRC's EIS, closed-cycle cooling of itself greatly reduces potential for mortalities. In contrast to an open-cycle, once-through cooling system used at many power stations, the closed-cycle cooling system chosen for the proposed Vogtle units will reduce water withdrawal (and thus the numbers of drifting organisms entrained) by more than 95 percent. This reduction is greater than the Environmental Protection Agency's previously proposed guidelines of 60-90 percent reduction (draft § 316(b) Phase II Rule, now stayed in favor of Best Professional Judgment).

The plant's proposed intake screens are to be located in an offshoot canal perpendicular to the Savannah River, similar to Units 1&2, where flow velocities are generally below 0.5 ft/sec, the EPA criterion for protection against impingement (to which I contributed; Coutant et al. 2000). A submerged weir in the intake impedes benthic fish from entering the intake canal. The plant includes many of the biological design criteria that the research program I headed at Oak Ridge National Laboratory sought to identify. The NRC staff, in the EIS, identifies the aquatic biota potentially at risk, using studies of riverine biota carried out by the Academy of Natural Sciences of Philadelphia and other contractors of the SRS, as well as other federal and state agencies. Thus, in my professional opinion, the design features of the cooling system make significant mortalities of Savannah River biota from entrainment and impingement unlikely, and lessen the need for further site-specific biological studies. The assessments and conclusions

provided by SNC in its ER and supplements and by the NRC staff in the EIS are scientifically appropriate and sufficient to satisfy the requirements of NEPA.

**Q28: On what information does the EIS rely to conclude that impacts from impingement and entrainment will be small?**

A28: The EIS relies on studies done for the existing plant's EIS and Clean Water Act 316(b) compliance in the 1980s; other prior research on impingement and entrainment in the river reach such as that sponsored by the SRS; use of closed cycle cooling at Vogtle; information on river dimensions and flows at Vogtle; design features of the existing and proposed units including low intake canal velocity, low thru-screen velocity, design of intake canal including bottom weir; results of reports to NRC pursuant to App. B. of the Environmental Protection Plan for Units 1 & 2; site visit on March 8, 2007 and March 19, 2008, and impingement and entrainment studies that had begun at the time of preparation of the EIS. Taken together, these support the conclusion that impacts will be small.

**Q29: How does the weir affect impingement or entrainment?**

A29: As described in the drawings of the intake (EIS at 3-10), the weir would be an elevated boundary between the river and the intake canal. The weir would prevent water and organisms flowing along the river bottom from entering the canal except by rising above the weir. It is presumed that bottom-dwelling fish and invertebrates would be reluctant to rise above the weir and enter the intake. This should reduce the number of fish susceptible to impingement that would enter the intake canal. It may also reduce the number of drifting organisms such as fish eggs and larvae and invertebrates that may be concentrated in bottom waters according to the studies in the Vogtle vicinity by SRS's Paller (1984, 1985, 1986, 1990, 1992 and 1995) and by Nichols (1983). As discussed with NRC on the site visit, the physical integrity and

effectiveness of the weir have not been measured at the Unit 1 & 2 intake but remain appealing for the proposed units based on general principles. The results seen in the SNC 2008 field studies suggest some mechanism, likely the weir, is effective for excluding many drifting organisms seen in river samples.

## V. RESPONSE TO SPECIFIC BASES OF CONTENTION EC 1.2 REGARDING BASELINE AQUATIC DATA

**Q30: Does the EIS include information related to the life history stages that occur near the Vogtle site?**

A30: Yes. In section 2.7.2.1 where major aquatic ecosystem components are described (at 2-74 through 2-81) and the life cycles of important fish species are summarized (at 2-81 through 2-93).

**Q31: Is it necessary to present more detailed data in an EIS on fish life history stages that occur near the proposed facility, migration timing of each species' life history, distribution patterns in the immediate vicinity of the plant, and population numbers, as asserted most recently by Dr. Young in his November 13, 2007 Affidavit (page 3, ¶ 6 and 8)?**

A31: Although this level of detailed, site-specific information can be useful in refining estimated impacts of a proposed facility which are determined to be MODERATE or LARGE, it is not a required part of the text of an EIS. "[T]he degree of detail should be modified according to the anticipated magnitude of the potential impacts." (NUREG-1555 at 2.4.2-2). The NRC in its guidance summarizes the Council of Environmental Quality's guidance that an EIS should "emphasize the issues that are significant and reduce emphasis on other issues and background material" (NUREG-1555 at 4). Provision of an encyclopedia of this information for each of the 95 local fish species listed by Marcy (2005) and in Table 2-7 of the EIS would be burdensome

for a reader of a decision document like an EIS and would not be helpful. This is particularly true where the impacts are SMALL. General life-history information on the most-relevant species of fish can be obtained from standard references and research literature (especially for nearby locations) and applied to the local situation by knowledgeable analysts preparing the EIS.

Moreover, the EIS does provide information of the sort desired by Dr. Young, largely from literature references to local studies by others (as is allowed by NUREG-1555 at 2.4.2-3). Relative abundances of fish species are provided from studies by the Academy of Natural Sciences of Philadelphia (ANSP) at several locations near the Vogtle facility (e.g., EIS at 2-80). Dominance of the river ichthyplankton by American shad eggs and larvae and gizzard shad and threadfin shad from the oxbow spawning areas is indicated from literature references (EIS at 2-21). Information on vertical distribution of drifting eggs is provided where available (EIS at 2-81). Details of local life history, population sizes and relevance to occurrences at the Vogtle site are given for major species American shad (EIS at 2-82), and striped bass (EIS at 2-84), and species of concern robust redhorse (EIS at 2-88) and shortnose sturgeon (EIS at 2-89). I can tell from the EIS that NRC considered the life history stages in reaching its conclusions and that they reached the appropriate conclusions. I agree with the authors of the EIS that the provided information is sufficient for a reasonable assessment of likely impacts on the NRC scale of SMALL, MODERATE or LARGE (EIS at 1-4). It is apparent to me that life histories were considered and the conclusions reached are consistent with the analysis I would have done.

**Q32: In your opinion, has the EIS and its supporting ER relied disproportionately on studies by the ANSP for the Savannah River Site and given them too much weight in lieu of special studies by the applicant or others at the Vogtle location (as opined by Dr. Young in his November 13, 2007 Affidavit, page 7, ¶ 17 and 18)?**

A32: No, I do not believe the ANSP studies were used inappropriately or given too much emphasis.

**Q33: What is the basis for your opinion?**

A33: The long-term studies by the ANSP for the Savannah River Site (since the 1950s) are a valuable resource of information about the Savannah River ecosystem. They provide empirical data on many aquatic life forms, including fish. When I visited the Vogtle site, the nearby location of the SRS relative to Vogtle and to the ANSP sampling locations was apparent. The research plan for establishing the baseline for the Savannah River near Vogtle would be nearly the same as for the SRS. In other words, it is very helpful to any analysis of impacts from Plant Vogtle to have the benefit of the SRS data.

But these studies were just one source of information used in the EIS. Other relevant literature was used extensively, as referenced in the EIS. For example, discussions of American shad (EIS at 2-82), striped bass (EIS at 2-83), and shortnose sturgeon (EIS at 2-89) used data from management agencies such as the NOAA National Marine Fisheries Service, Atlantic States Marine Fisheries Commission, and Georgia Department of Natural Resources as well as literature publications from individual authors associated with a variety of institutions. These documents collectively provided much of the information on the affected aquatic ecosystem of the middle Savannah River and near the Vogtle facility. I reviewed these and other pertinent documents in my independent review. *See* Exhibit SNC000013 (Literature References for EC 1.2 Testimony by Dr. Charles C. Coutant). Certainly, they provide a broader perspective of the river ecosystem than would have been obtained by only detailed surveys at the existing Unit 1&2 location and the site proposed for Units 3&4.

**Q34: Do you agree with the EIS that the Savannah River at the Vogtle site is "unremarkable," that is, not an especially important habitat for fish and aquatic life, as contested by Dr. Young (November 13, 2007 Affidavit ¶29)?**

A34: Yes, I agree with this evaluation.

**Q35: On what basis do you agree?**

A35: Although, as Dr. Young asserts, all reaches of a river are important to some extent for the "river continuum" of geomorphic processes that continually occur and the organisms living in the river, the NRC guidance (NUREG-1555) requires the identification of *especially important* habitats for both desirable and nuisance species. The EIS correctly identifies the river near Vogtle as a migratory corridor, including the upstream migrations of adult anadromous fishes and the downstream drift and migration of early life stages. It also describes resident species of fish and invertebrates (e.g., freshwater mussels). These features are characteristic of most coastal plain rivers. I understand the staff's use of "unremarkable" was to convey a response to the NRC guidelines to the effect that the staff did not identify other special characteristics of the river reach near the Vogtle facility that demanded detailed attention, such as specific spawning beds, nursery areas, mussel beds, or macrophyte beds. During my site visit, I witnessed the river to be in general accord with the staff's characterization.

Also, at the request of SNC, I conducted an independent literature review of the middle Savannah River and its key biological resources to assure myself that the reach near Vogtle is not a critically important habitat. I retrieved primary scientific literature and management documents (such as resource planning documents by the US Fish and Wildlife Service and US National Marine Fisheries Service) that could form a basis for my opinion. *See* Literature

References for EC 1.2 Testimony. None of these documents identified the Vogtle reach as especially important except for migrations and local movements.

**Q36: Do you agree with Dr. Young's assertion that the EIS does not quantify or describe systematically the species composition and habitat in the vicinity of the intake and cooling structures, including shortnose sturgeon, American shad and blueback herring?**

A36: No.

**Q37: What is the basis for your conclusion?**

A37: As noted above, the EIS describes the aquatic ecology of the site for both aquatic communities (at 2- 72 through 2-81) and important species (at 2-81 through 2-93). There are no critical habitats as designated by FWS or Essential Fish Habitat designated by NMFS (EIS at 2-85). Shortnose sturgeon (EIS at 2-89 through 2-93), and American shad (EIS at 2-82) are described as are other important species such as striped bass (EIS at 2-83 through 2-85), American eel (EIS at 2-82 through 2-83) and robust redhorse (EIS at 2-88 through 2-89). The species are grouped according to reasons for importance, including commercial and sports importance and threatened or endangered status. Quantitative data are given when available (e.g., locations of peak numbers of striped bass eggs and larvae; EIS at 2-84). While blueback herring was not discussed separately, in my opinion, this is not a significant omission, because its life history and environmental sensitivity are similar to American shad. As noted in answer to a previous question, it is my opinion that without question the essential information is given for estimating the general magnitude of effect on NRC's scale of SMALL, MODERATE, or LARGE, as required in NRC guidance for NEPA assessments. Further, as stated above, it is clear to me that the information relied on and presented in the EIS is highly representative of the

current conditions at the Vogtle site. This is true even though some of the information was centered, for example, across the river at SRS.

## VII. RESPONSE TO SPECIFIC BASES OF CONTENTION EC 1.2 REGARDING IMPINGEMENT/ENTRAINMENT AND THERMAL IMPACTS

**Q38: Do you agree with Dr. Young's assertion that the EIS should have included empirical data (i.e. field studies) on the existing units' impact on the level of mortality from impingement and entrainment?**

A38: No.

**Q39: What is the basis for your conclusion?**

A39: While it is always nice to have "more data," such field studies are not required when there are other sources of information representative of the conditions at the site that are available for conducting a reasonable analysis. A considerable amount of existing data was available to the NRC already. As noted in the EIS (at 2-93), the NRC does not impose monitoring requirements for aquatic impacts. This responsibility falls to the EPA and states under the NPDES program of the Clean Water Act. They did not require such monitoring. The NRC merely requires notification of "unusual or important environmental events" such as fish kills or impingement events. There were no such notifications. In my opinion, the analysis is sufficiently complete without "more data" and the conclusions reached are proper.

**Q40: Do you agree with Dr. Young's assertion that the EIS does not include data on mortality rates from seasonal field studies on impingement and entrainment at the existing structures?**

A40: Yes, but this is not a flaw in the EIS analysis because such additional studies were not essential to assess the impacts for the purposes of NEPA. Also, the EIS (at 2-94) includes

recognition of field studies by SNC in 2008 on entrainment and impingement. Data from these studies was not available for the EIS, but they are provided for this hearing (appended to the testimony of Matthew Montz and Tony Dodd). The field studies by SRS personnel and contractors provided data on a nearby location that is adequate for the EIS.

**Q41: Are you familiar with the 2008 field studies by SNC?**

A41: Yes. At SNC's request, I worked with their staff and Tony Dodd of the Georgia Power Environmental Lab to prepare a study plan to examine entrainment and impingement at the intake for units 1 & 2 and the adjacent river, as referenced in the EIS, e.g., at 5-31 and 5-32. The entrainment and impingement studies began in March 2008. The entrainment study was concluded in late July when all but occasional drifting early life stages had passed the site. The impingement study is continuing and will cover an entire year. As I noted in my description of the site visit (above), the studies benefited from scrutiny by NRC staff on the site visit in the initial stages of implementation. The studies of both impingement and entrainment are presented in reports which are attached to the testimony of Tony Dodd and Matt Montz.

**Q42: Have you reviewed these reports?**

A42: Yes.

**Q43: In your view, are these the result of legitimate scientific sampling and collection?**

A43: Yes. SNC staff, Tony Dodd of Georgia Power Environmental Lab and I developed a study plan to meet the scientific objectives and use scientifically justified sampling equipment and methods. The entrainment study sampled both the intake and the river at several locations to identify non-uniform distribution of drifting organisms in the source water. Mr. Dodd contracted with Normandeau Associates to identify and count the organisms in the

entrainment samples. Impinged fish were collected from the operating intake screens. Mr. Dodd and the staff of his lab identified the impinged organisms. The NRC staff evaluated and approved our study plan at the outset of the study. The study was conducted with strict quality assurance to ensure that it was, indeed, legitimate scientific sampling, collection, sample handling, and sample analysis.

**Q44: Can you summarize the entrainment sampling and its results?**

A44: The entrainment sampling and analysis consisted of two parts: (1) sampling the drifting fish eggs and larvae (ichthyoplankton) in the source water of the Savannah River at the Vogtle site, and (2) sampling for those same organisms in the water of the intake canal immediately upstream of the intake pumps for the cooling tower make-up water.

The source water of the river was sampled during the spring fish reproduction season, March 18-July 29, at two transects, one about 300 ft upstream of the present intake for Units 1 & 2, and the other another 0.3 mile upstream at the location of the proposed intake for Units 3 & 4. Each transect included a center-channel station and stations about 30 feet from each shore. Paired plankton nets were towed in the river current behind an anchored boat, starting near the bottom and progressing every 5-10 min to the surface at 1-meter intervals. The environmental conditions (e.g., river stage, temperature) were recorded for each sampling event. Densities of eggs and larvae were calculated from the counts in the samples and the amount of water filtered through the plankton net. The study showed a diverse assemblage of drifting early life stages, including 23 taxa groups with 16 of them identifiable to species. About 62% were eggs, with the remainder being yolk-sac or post-yolk-sac larvae. Unidentified minnows as a group were the most abundant over the entire sampling period followed by American shad and unidentified herring family (shads). Peak abundance was April 23 and May 8, with a few yearling or older

fish caught in early June through mid July. There were more organisms collected at night than in the day. American shad, a species of special interest, occurred nearly exclusively as eggs, with an early May peak in abundance. Unidentified species of darters were more abundant at the location of the proposed intake for Units 3 & 4 than near the Unit 1 & 2 intake. All densities were rather low, ranging from about 8 organisms per 1,000 m3 in late July to about 659 per 1,000 m3 in late April.

The intake canal ichthyoplankton was also sampled March through July essentially simultaneously with the river sampling. A pump collection system (water pumped from the canal was filtered through a plankton net) was needed there because the current velocities in the canal were too low to permit use of the plankton nets in the canal. Comparison of pump and net collections taken simultaneously in the river indicated that both methods were comparable when viewed in terms of types and numbers of organisms caught per unit volume of water. There were significantly fewer organisms in the canal water than in the river, and the taxa were different. Yellow perch yolk-sac and post-yolk-sac larvae were most abundant, occurring from mid March through April. A few sucker post-yolk-sac larvae (mid March to late April) and sunfish yolk-sac and post-yolk-sac larvae (mid June through late July) were also found. Most organisms were collected at night. Daytime egg and larval density varied from 0 (zero) organisms/1000 $m^3$ to approximately 18.1 organisms/1000 $m^3$ (late March). Nighttime density varied from 0.01 to 29 organisms/1000 $m^3$. For the entire study period, mean density in samples was approximately 11.3 organisms/1000 $m^3$. There were no listed species found.

The densities of early life stages of fish in the intake canal allowed calculation of the annual entrainment rate and comparison with the numbers of early life stages passing in the river. The study estimated that annually the Plant Vogtle Unit 1 & 2 intake removed 315,641 +/-

13,261 (95% confidence interval) organisms. Plant Vogtle's mean daily make-up water intake pumping flow (241,000 $m^3$) represented approximately 2.1 percent of the mean daily flow (11,402,000 $m^3$) in the Savannah River at Plant Vogtle based on flow records during the study period. Estimated daily entrainment rate is 1,302 organisms [eggs and larvae]) whereas the estimated daily source water drift abundance is 312,039 organisms.

**Q45: What do these entrainment results mean?**

A45: First, the numbers of organisms entrained, regardless of composition, is exceedingly small in relation to the numbers passing in the river. Second, the species composition of ichthyoplankton in the canal indicates that the river ichthyoplankton is not drawn into the canal in proportion to its occurrence in the river water or if it is, it is not entrained into the cooling water makeup flow. The results of this study through the full 2008 fish reproduction season fully support the EIS conclusion that the impacts of entrainment at the proposed intake for Units 3 & 4, designed similarly to that for Units 1 & 2, will be SMALL. Likewise, the study results, if doubled to represent both intakes operating, would show a cumulative impact that I believe is still SMALL.

**Q46: Can you summarize the impingement sampling and its results?**

A46: Screen wash from the intake structure traveling screen system was sampled twice per month from 10 March to the present. Samples were collected with a framed net (6 ft x 6 ft x 6 ft mesh bag) that intercepts screen-wash water entering the screen wash pit. The collection net is constructed of ¼-inch nylon mesh netting in order to ensure collection of any organisms that would have been collected on the 3/8-in-mesh traveling screen. Each impingement sampling event represents a 24-hr collection period split into two approximately equal 12-hr samples (yielding a day vs. night sample). The screens were rotated and the system flushed prior to the

measured sampling time. Fish and shellfish were separated from organic debris such as aquatic weed fragments, leaves, twigs, relict and sometime live shells of Asian clam. Sample organisms were then sorted by species, enumerated, weighed and measured.

The report provided results through December 2008, although the study is continuing until March 2009 (ten months of the intended twelve month study period has elapsed). A total of 146 organisms were collected, representing 21 taxa (19 fish and 2 crustaceans). No protected species were collected. Sunfishes were the most abundant fish family. The most numerically dominant individual species so far include spotted sunfish (38.9 %), white catfish (8.9 %), and hogchoker (10.8 %), mostly all young of the year. The two crustaceans include two specimens of the common shore shrimp and three specimens of a freshwater crayfish still unidentified to species level. Total biomass amounted to about 1.9 lb, with the sunfishes accounting for over half of the biomass. Two large fish (a gizzard shad and an injured black crappie) contributed disproportionately to the biomass. Slightly more than half of the impinged specimens were caught at night. The extrapolated impingement number for the 10-month period is 1,453 fish, with an upper 95% confidence level of 1,941. For biomass, the extrapolation is about 17.3 lb with an upper 95% confidence limit of about 23.3 lb.

**Q47: What do these impingement results mean?**

A47: Impingement occurs at a very low rate and consists mostly of a few young-of-the-year fish plus occasional large fish that already may be incapacitated. The impact for the 10 months of study through December 2008 fully supports the EIS conclusion that impingement risks of an intake for Units 3 & 4 designed similarly to that for Units 1 & 2 are SMALL. If the impingement study results were doubled to represent both intakes operating, it is my opinion that the EIS is still correct in estimating that the cumulative impact would be SMALL.

**Q48: In your view, is there any benefit to continuing the entrainment and impingement sampling year around?**

A48: There would have been no benefit from continuing the entrainment sampling because the well-known spring and early summer occurrence of drifting early life stages of the major fish species is complete by August. This was confirmed before the 2008 entrainment sampling was discontinued. However, impingement can occur at any time of year. Therefore, although it is reasonable to conclude impacts will be SMALL because there is no suggestion from past impingement observations that impingement impacts would be both highly seasonal and concentrated during the fall and winter, the impingement study is still planned to continue until March 2009.

**Q49: Do you agree with Dr. Young's assertion that the EIS does not include mortality rate data from SRS field studies on entrainment?**

A49: No.

**Q50: What is the basis for your conclusion?**

A50: Section 5-32 of the EIS includes this information.

**Q51: In your opinion, does the statement quoted by Dr. Young from Marcy et al. (2005) in item 19 of his November 13, 2007 Affidavit (at 8) provide a causal link between entrainment and impingement in cooling water and effects on fish populations in the middle Savannah River?**

A51: No, I do not believe it does.

**Q52: What is the basis of that belief?**

A52: The paragraph quoted is a general statement describing entrainment and impingement. The reference cited by Marcy et al. (2005) is Schubel and Marcy (1978), a book

on entrainment in which I was an author of chapters. The only linkage between Savannah River fish populations and entrainment or impingement along the river is the statement regarding the volumes of cooling water flows for the DOE Savannah River Site and Plant Vogtle. The quotation selected by Dr. Young does not provide any evidence of a causal link.

**Q53: Are Dr. Young's assertions valid regarding the need for on-site field studies of the riverine ichthyoplankton (fish eggs and larvae) in relation to impacts of entrainment in the Vogtle cooling system (Affidavit of November 13, 2007, pages 3-7, ¶ 7, 9, 10, 11, 15, 16)?**

A53: No. The information in the EIS provides an adequate basis for estimating impacts on the NRC scale of SMALL, MODERATE or LARGE (EIS at 1-4). The EIS uses the on-site studies for the operating permit for Units 1 and 2 of fish eggs and larvae by Wiltz (1983) and studies of macroinvertebrate drift by Nichols (1983) as well as several studies by Paller of fish eggs and larvae at the adjacent SRS. These studies identify distribution patterns of organisms and design features of the intake that minimize the likelihood of entrainment (EIS at 5-31). There is no reason to believe anything has changed that would affect the continued validity of this information.

However, the applicant has supplemented and validated the earlier literature on riverine ichthyoplankton and ichthyoplankton entrainment in the intake flow with field studies at and near the existing Units 1 & 2 intake and proposed Units 3 & 4 intake, as described above in response to Q 41-44 and referenced in the EIS (at 2-94). Riverine ichthyoplankton (including lateral and vertical distribution) and entrained ichthyoplankton were studied in the spring and summer 2008. A report is provided as an attachment to the testimony of Matthew Montz. This study provides additional information of the sort Dr. Young desires that could be used by the

Board and in the later stages of permitting by the NRC and Georgia (for NPDES permit). As noted above, the results of the entrainment study show that entrainment of ichthyoplankton from the river is actually less than the analysis in the EIS assumed.

**Q54: Are Dr. Young's assertions valid regarding the need for on-site field studies of the impingement on intake screens of the Vogtle cooling system (Affidavit of November 13, 2007, page 6, ¶ 14, 15)?**

A54: As with entrainment, the information in the EIS provides an adequate basis for estimating impacts (EIS at 1-4). Any large-scale impingement problem is generally highly visible at power stations because dead fish accumulate to nuisance proportions in trash collection baskets. This would have been seen at the Vogtle Unit 1 and 2 intake by maintenance personnel and reported to the NRC, but as the EIS indicates, it did not occur. However, the applicant has supplemented and validated the earlier literature on impingement with field studies at the existing Unit 1 & 2 intake, as described above in response to Q 41 and Q 46-47 and referenced in the EIS (at 2-94). Impingement has been sampled systematically since early Spring 2008 with an expected 1-year duration. A preliminary report is provided as an attachment to the testimony of Matthew Montz and Tony Dodd. This study already provides additional information of the sort Dr. Young desires that could be used by the Board and in the later stages of permitting by the NRC and Georgia (for NPDES permit). The results over spring, summer and fall confirm the estimation in the EIS that impingement at Units 1 & 2 is very low, amounting to few numbers and a small biomass, and that impingement at the proposed units would be similar.

**Q55: Do you agree with Dr. Young's assertion that the EIS does not address potential impacts on the aquatic drift community from the cooling system thermal discharges or discuss the thermal impacts on larval and juvenile American shad?**

A55: No.

**Q56: What is the basis for your conclusion?**

A56: The EIS estimates impacts to the drift community based on the minimal size of the thermal plume in relation to the river cross section and the low discharge temperatures, and judges the impact small for any organisms passing through the plume or needing to swim around it (EIS at 5-33). In my opinion, this is reasonable. Had the thermal plume covered a much larger percentage of the river with temperatures much more above ambient than expected, or had temperatures been within the range of lethal doses of temperature and duration of exposure for larval and juvenile American shad, then a more extensive analysis might have been justified for the EIS. To test the validity of the analysis in the EIS, I performed such a detailed analysis. I found from the scientific literature that, for example, it would take 30 minutes of exposure to water temperatures 12°F (6.7°C) above an ambient of 68°F (20°C) to cause 50% mortality. At the lower river flows and slower velocities prevalent in summer when the field studies were conducted, passage time through the plume at the measure velocities would be about 8 minutes with a maximum temperature rise of only a fraction of a degree C. Thus, the combination of temperatures and exposure time would not be sufficient to cause high-temperature mortality. At the higher river flows and channel velocities in spring when these larvae would be present, the travel times would be even faster and the durations of exposure shorter. Also, the temperatures (both ambient and thermal discharge plume) would likely be lower. Thus, I believe the extent of the analysis in the EIS was appropriate. Further information on the thermal plume from field studies is provided by SNC appended to the testimony of Tony Dodd and Matthew Montz.

**Q57: Was NRC's analysis of the thermal plume reasonable?**

A57: Yes. I believe that the NRC's analysis of the thermal discharge plume for the EIS is reasonable and appropriate. When heated water is discharged into a river, the effluent mixes with surrounding water in a "plume" that is spatially and temporally dynamic, and thus difficult to monitor in field studies. The accepted approach for environmental impact analyses, one established in the initial EISs I participated in for the AEC, is to use computer models based on effluent characteristics and physical principles to estimate the dimensions and concentrations of the progressively diluted constituents (temperature, chemicals) in the plume (Majewski and Miller 1979; IAEA 1980). For its ER, SNC used an EPA-approved mixing model, CORMIX, for its plume analyses. SNC followed the accepted approach of comparing the model's output of time-varying temperatures and chemical constituents in the plume to accepted dose-response data for representative organisms that might encounter the plume. The resulting estimates of no material mortality are reasonable, pertinent, and based on accepted approaches using verifiable methods. In my opinion, the NRC rightly accepted this analysis approach in its independent assessment for the EIS, and came to similar conclusions. However, to assure the Board that the model predictions of plume size and temperatures are reasonable, SNC conducted a field survey of temperature and water velocity at the thermal discharge from units 1 & 2. The study is addressed in the testimony of Tony Dodd and Matt Montz.

**Q58: Would you summarize the results of that study.**

A58: A monitoring study was undertaken by Mr. Dodd and co-workers in August 2008 to map the temperatures and water velocities in the plume from units 1 & 2. I participated in development of the study plan. Water velocities indicate the location of the momentum-driven effluent discharge path, whereas temperature elevations above the ambient river temperature are of particular interest for thermal impacts to organisms. The study was conducted in the summer

when the river flow was low and ambient river temperatures high. It was expected that the discharge temperature would also be high because both units were operating. As it turned out, the thermal discharge from the cooling tower basin was nearly equal to the ambient river temperature (the difference being less than a degree Centigrade). Both actual flow and temperature conditions were less severe than the more extreme values modeled in the EIS. Temperature rise above the river temperature immediately upstream was detectable in only a small zone, approximately 100 ft long by 75 feet wide immediately downstream of the outfall. Significantly, a large zone of water at temperatures as warm as the thermal plume was identified along the opposite shore extending about 2,400 feet downstream from a point upstream of the thermal discharge and extending fully across the river beginning about 700 feet downstream from the thermal discharge (see figures in the report). The warmest water was at the surface and along the far shoreline, indicating that the source of heat was solar radiation. Thus, at summer conditions of low flow and high ambient river temperatures, the actual warming of the river by the thermal plume was no greater (and apparently much less) than the natural solar heating.

Because the effluent temperature (as measured at the cooling tower basin) was close to the ambient river temperature, the plume could only be identified by velocities. Only a small thermal plume was discernable. A zone of velocities higher than the ambient river velocity was detected immediately downstream of the outfall (within about 25 feet). Beyond that point, there were patches of slightly higher velocity (fractions of a foot per second), one centered about 250 ft downstream of the outfall, one centered about 700 ft downstream, and a third about 1,000 ft downstream. The patches became broader, more in the center of the river, and with velocities less elevated from the surrounding water the farther downstream. They move downstream at about 2.5 ft/s amidst an ambient flow of about 1.8 ft/s, thus covering the surveyed reach of about

1,200 ft in about 8 minutes. My interpretation of these data is that the far-field thermal plume merges with the river water as pulses that move downstream with the river current and progressively mix with the ambient river water. Each pulse or patch is surrounded by water flowing at rates similar to the river upstream of the thermal discharge.

**Q59: What is the significance of this field study for the impacts of the thermal discharge on aquatic organisms?**

A59: The thermal distributions suggest that exposure to elevated temperatures in the plume would be no greater in midsummer than organisms already receive from natural warming of the ambient surroundings. The velocity distributions suggest that the plume is widely dispersed downstream and is mainly in the center channel rather than impacting the more biologically productive shorelines. Passage and cooling are rapid, almost certainly not providing durations of exposure to high temperatures sufficient to cause mortality in the river. For example, it would take 30 min exposure of striped bass larvae to temperature elevations of 15°F above ambient of 65°F (18.3°C) to cause mortality, (based on the scientific literature) whereas, as I estimated above, water and drifting organisms would pass through the entire surveyed plume in about 8 minutes. I believe this confirms the conclusions reached from the CORMIX modeling, from which the NRC determined the impacts would be SMALL.

**Q60: Do you agree with Dr. Young's assertion that the EIS should have included field studies on the existing units' thermal plume?**

A60: No.

**Q61: What is the basis for your conclusion?**

A61: As noted in answer to a previous question, it is not necessary to have site-specific field studies to make reasonable, scientific conclusions. This is especially true when the

estimated impact is small and the methods to estimate this impact level are reliable and based on sound information. The CORMIX model is EPA approved and reliable as long as the assumptions driving it are reasonable. In my opinion, the design of the discharge, discharge temperatures and configuration of the river ensure that the thermal plume is small relative to the river and heat dissipation (and temperature decline) rapid. This rapidly dissipating plume ensures that any organisms passing through it would experience only brief and non-damaging temperature transients. Furthermore, the plume would be even more rapidly dispersed during the normal spring-early summer seasons of ichthyoplankton abundance when river flows are normally high. SNC has conducted a field study which confirms the general size and shape of the plume to provide additional assurance for the Board (a summary is included in the testimony of Matthew Montz). I have reviewed the results and believe that the methods and conclusions are reasonable and appropriate.

**Q62: Is it appropriate for the EIS to consider the results from the NRC staff's visit on March 8, 2007 and March 19, 2008, during which larval fish sampling and screen basket cleanings were observed?**

A62: Yes. Site visits are important for an analyst to obtain a perspective of the facility in its geographic setting, and to put the proposals in context. I participated in such a site visit, as described above. These site observations are just one of the many sources of information considered in the EIS.

## VI. RESPONSE TO SPECIFIC BASES OF CONTENTION EC 1.2 REGARDING RIVER FLOWS AND UNIFORMLY DISTRIBUTED DRIFT COMMUNITY

**Q63: Do you agree with Dr. Young's assertion that the EIS does not calculate worst-case scenarios for quantifying entrainment or thermal impacts including the use of 7Q10 flow to analyze entrainment?**

A63: No.

**Q64: What is the basis for your conclusion?**

A64: The EIS considers "worst case" conditions in terms of actual low flows under the Corps' Drought Contingency Plan for the regulated Savannah River and selected low flows rather than 7Q10 calculations (i.e., the flow that would occur for 7 consecutive days once in 10 years) (EIS at 5-30 and 5-33). It uses the Drought Level 3 flow of 3,800 cfs and also uses a streamflow of 2,000 cfs, which is about half of that (Errata of September 3, 2008 for EIS at 5-20). The 7Q10 flows are rather meaningless in this situation because they are statistical calculations based on a long-term flow record, which does not exist for the Savannah River as it is now regulated by the Corps' dams. Having worked on regulated rivers where the flows are often quite different from historical unregulated flows, I consider the approach in the EIS of selecting an extreme low flow (e.g., Errata for EIS at 5-20) more reliable than a questionable 7Q10 under the regulated flow regime currently in place.

**Q65: Do you agree with Dr. Young's assertion that the EIS does not use maximum withdrawal rates from the existing units to analyze cumulative withdrawals?**

A65: Yes.

**Q66: Is this a problem with the NRC's analysis?**

A66: No. The cumulative impacts analysis is still reliable. Dr. Young says that impacts could be 7% and the analysis in section 7 on cumulative impacts estimates 6.5%. These differences would not change the conclusion. First, Dr. Young's figure is based on withdrawals,

whereas the EIS uses consumptive use totals for its calculations. Also, it is reasonable to evaluate impacts on more likely situations rather than an unlikely and largely hypothetical maximum. See EIS at 7-4 to 7-7. Simultaneous maximum withdrawal, by all four units, during record low flows, is not likely to happen in actual operation.

**Q67: Are the extremely low flows (Category 4) that Dr. Young asserts should have been used for analyses of impacts from entrainment and thermal discharges (Young Affidavit November 13, 2007, page 12, ¶16) likely to occur at times of the year when detrimental entrainment and thermal discharges are most likely?**

A67: No, the low river flows are not likely to coincide with high entrainment or risks from high temperatures.

**Q68: Why is this so?**

A68: The annual low flows occur in the fall of the year (EIS Figure 2-5). The record low flow cited by Dr. Young (3,220 cfs) occurred in December (EIS, at 2-16). In contrast, most entrainable life stages of fish and invertebrates (drifting eggs and larvae) are present in the spring and early summer months when river flows are usually high (as acknowledged by Dr. Young (Affidavit November 13, 2007, ¶ 27)). These eggs and larvae are mainly the products of spring migrations of marine or estuarine American shad, blueback herring, striped bass, and sturgeon species as well as spring spawning by several resident sucker species, freshwater shad species and sunfishes, as identified in earlier studies of drift organisms at the Vogtle site by Wiltz (1983) and Nichols (1983) noted above. These spring periods of drifting early life stages concurrent with high river flows has been documented both generally for most rivers and for the Savannah River in particular (e.g., Paller and co-authors' studies for the Savannah River site, cited in the EIS at 5-104). The field study conducted by SNC and discussed in response to Q44 documents

the spring pulse of entrainable life stages with the concurrent high river flows. For instance, peak organism density in river drift was observed, from April 23 to May 8 (Figure 4-1 of SNC's spring 2008 entrainment study; SNC 2008a). At this time, river flows fluctuated near 4,500 cfs even in this drought year (Figure 4-1). Many drift organisms passed when flows were as high as 8,000 cfs in mid April. The study also verifies the scientifically based assumptions by NRC staff in the EIS.

**Q69: Despite the low likelihood that Level 4 low flows would occur at times of high entrainment or high thermal risk, has the NRC staff included analyses of low-flow scenarios in the EIS below Drought Level 3?**

A69: Yes, it has.

**Q70: What analyses has it conducted and what are the results?**

A70: The NRC staff determined that it was conservative to use the 3,800 cfs Drought Level 3 flow in the EIS, but also considered river flows of 3,000 and 2,000 cfs, well below both the minimum flow for Drought Levels 1-3 in the current Drought Contingency Plan and also below 3,220 cfs, the record low flow cited by Dr. Young. At these flows, the maximum consumptive use would be 2.1% and 3.2% of river flow, respectively (EIS at 5-9). The EIS infers from runs for the CORMIX thermal plume model at 3,800 cfs and the calculated cross section of the river at the extreme low flows of 3,000 and 2,000 cfs that thermal plume dimensions for similar temperatures would still be a small percentage of the river and effects not significant (EIS at 5-38 and Errata at 5-20). I agree with this conclusion.

**Q71: Are the criticisms by Dr. Young (Affidavit November 13, 2007, ¶ 26, 28) and Mr. Sulkin (Affidavit November 13, 2007, ¶ 12) that water release data from J. Strom**

**Thurmond Dam are not completely accurate for the Vogtle site a reason for concern for estimates of the effects of entrainment and impingement or thermal discharge?**

A71: No, they are not a reason for concern with the analysis.

**Q72: Why are they not a concern?**

A72: The Savannah River between J. Strom Thurmond Dam and the Vogtle site is monitored by two USGS gauging stations, plus one at the Vogtle site, as detailed in the EIS (at 2-32). There is also a gauging station downstream of the Vogtle site. Regulation of flows for benefit of users such as the Vogtle facility can be monitored closely by the Corps and factored into their release schedules at J. Strom Thurmond Dam. Considering the accuracy of the USGS gauges in contrast to the accuracy of the releases at J. Strom Thurmond Dam (EIS at E-45), analyses in the EIS of river discharge data from these monitoring stations show that the releases at J. Strom Thurmond Dam are a reasonable surrogate for flows at the Vogtle site, despite some marginal water withdrawals and input from tributary streams and groundwater. I do not believe it is necessary for the EIS to require the flow data to be extremely precise and accurate, considering that almost all potential entrainment to drifting organisms would occur in spring when river flows are generally high and not when river flows are low.

**Q73: Are the scientific references cited by Dr. Young in support of his disagreement (Young Affidavit November 13, 2007, page 5, ¶ 12) with the NRC staff's assertion (Joint Affidavit ¶ 16) that fish and shellfish can adapt to varying flow regimes and velocities germane to the Vogtle ESP EIS?**

A73: No, they are not germane and instead are misleading.

**Q74: Why is this so?**

A74: The references deal almost exclusively with large changes in flows and velocities induced by dams. The impoundments inundate riverine habitat. The dams' variable hydropower releases create an alternating pattern of streambed scouring and dewatering by large-scale and intermittent changes in flows in tailwaters downstream of the dam, as well as cold summer temperatures from hypolimnetic discharges. These alterations of flow-velocity habitats (some go from no discharge to full river flow in a daily cycle) are of far greater magnitude than expected reductions of Savannah River flows by the proposed units 3 and 4 alone (2.6 to 4.0% change in river volume at 3,220 cfs according to Sulkin Affidavit of November 13, 2007 at ¶ 19) or cumulative effects of all four units (up to 7.9% change according to Sulkin). These figures from the intervenors are larger than those in the EIS (at 5-8 and 5-9); however, the EIS calculates effects based on consumptive use, while intervenors' calculations are based on withdrawals. Also, water extractions for the Plant Vogtle cooling systems are generally continuous rather than intermittent, yielding stable river flows of slightly reduced magnitude rather than the rapidly changing flows addressed in the articles cited by Dr. Young.

**Q75: In your opinion, what levels of river flow should be used in models to estimate the size and impact of the thermal plume in the vicinity of the Vogtle site?**

A75: For purposes of estimating impacts to drifting early life stages of fish, the most realistic flows to use would be those that occur during the drift period of March through July, when flows are generally high (EIS Fig. 2-5 at 2-19). It is helpful, however, to also use flows that represent low-flow conditions when the thermal discharge would be the largest proportion of the river flow, regardless of whether drifting organisms occur at that time. For estimating thermal impacts to less mobile bottom or shoreline organisms, it is generally most appropriate to use the low flows of summer when river temperatures are highest.

In my opinion, both should generally be used, and the ER and EIS did use both. One low-flow condition was 3,800 cfs, which was not the lowest flow on record, but representative of low flows for the Corps' Drought Contingency Plan. The EIS also assessed a flow nearly half of that, 2,000 cfs (Errata for EIS at 5-20). If the analysis indicates little or no biological impact to the hypothetical drifting or bottom organisms from these low-flow conditions (as it did), then one can be assured that the impacts at higher flows would also be acceptable. Although lower flows are theoretically possible, use of these flows would not change the conclusions reached, in my opinion, and it would not be useful to assess such unlikely hypothetical extremes.

**Q76: Do the water levels used in the EIS to model the thermal plume properly and accurately reflect expected impacts?**

A76: I believe they do.

**Q77: What is the basis for your opinion?**

A77: The river flows used in the analysis are highly representative of the range of flows at the Vogtle site.

**Q78: Is it appropriate for NRC to use estimates of a uniformly distributed drift community in the Savannah River?**

A78: Yes. This is a reasonable and conservative assumption for estimating entrainment impacts based on a large percentage of the fish populations. Rather than using spatially-and temporally-variable numbers of several entrainable species and life stages, such as one would find in most river surveys, an analyst usually takes a single high-end estimate of numbers, assumes them to be the same for all entrained water, and makes an evaluation of the scale of likely impact. The details of distribution would generally come into play only if a moderate to large impact appears to occur and further, more detailed, analyses are warranted.

This detail is not warranted for Plant Vogtle. The EIS concludes very clearly that the impacts are SMALL. As the EIS discusses (at 5-30 to 5-31), there are several design features of the cooling system at Vogtle (both existing and proposed units) that ensure that the numbers of drifting organisms entrained are actually less than what one would calculate from a uniform distribution and entrainment in proportion to water volume. These features are discussed below in response to Dr. Young's assertions concerning the studies of fish eggs and larvae and invertebrate drift by Wiltz and Nichols. Many fish species have eggs laid in nests or are adhesive and these eggs do not enter the drift. Drifting larvae of these and other species are known to be most abundant in back channels, oxbows and tributaries where spawning occurs and nursery areas are prevalent (see EIS at 2-81). The bulk of the drift in the main channel near the Vogtle site is composed of shad eggs and larvae.

SNC and NRC used existing evidence of spatial variability in drift densities to select a hypothetical, conservative uniform density for purposes of estimating impacts. SNC's and NRC's estimates of slight impact are reasonable based on this analytical approach. As a confirmation for the Board of the reliability of this approach, SNC has conducted an entrainment study in the river and in the Vogtle units 1 and 2 intake canal in spring and summer 2008, which is appended to the testimony of Mr. Montz. I have reviewed the report (as discussed above in response to Questions 44 and 45), which concludes that entrainment impacts to riverine ichthyoplankton would be very small and insignificant and I believe that these conclusions are appropriate and confirm the assessment in the EIS.

**Q79: Do you agree with Dr. Young's assertion that the EIS should have assumed non-uniform drift community distribution?**

A79: No. The assumption of uniform distribution of drift organisms is a common, conservative assumption that takes into account spatial variability. Rather than using field data with the usual complicating spatial and temporal variability, a hypothetical uniform value is taken for the first cut analysis to estimate the scope of impacts. This is conservative because, as the EIS states on 5-30 – 5-31, there are several design features of the intake that minimize the likelihood of entrainment, yet the EIS evaluated entrainment on the basis of a uniform density in the source water and entrainment in proportion to water withdrawal. Use of drift numbers in the source water for the analysis has proven to be especially conservative based on the results of the SNC's 2008 field studies, which showed the numbers of drifting organisms in the intake canal to be below the numbers in the river and to have a different species composition. With the low level of estimated impact on river drift organisms from this hypothetical case, it would not be necessary to refine the calculations further by using empirical data on spatial variability. This spatial variability, as measured in field surveys, would likely be transient and less reliable than a simplifying assumption of uniform (or average) distribution in any event.

Additionally, the distribution and abundance of planktonic organisms such as fish eggs and larvae in aquatic systems are prime examples of features that are notoriously variable. Sampling of the Savannah River near the Vogtle site has confirmed this variability (Paller et al. 1995). Even though Paller et al. were able to use statistical methods to account for variability in their fish egg and larval data, they acknowledge that field data could differ at other sampling times and places.

In sum, it is good and proper science to assume uniformity, and the conclusion that impacts to the drift community would be SMALL is reasonable and supported by the analysis in the EIS. A possible, more-detailed revision which might arise from assessing variability in the

densities (which would likely show less impact) would not be helpful for the purposes of the NEPA assessment.

**Q80: Have you reviewed the studies cited by Dr. Young for his assertion that the drift community in the vicinity of the Vogtle site was not uniformly distributed (by Wiltz and by Nichols)?**

A80: Yes. I have reviewed the two studies published in 1983, one by J. Wayne Wiltz and the other by M. C. Nichols.

**Q81: Do these studies negate the approach used in the EIS?**

A81: No. I disagree with the implication from Dr. Young that the assumption used in the EIS is invalid because of these studies. Instead, the EIS's conclusion that impacts will be SMALL is correct.

Wiltz studied egg and larval fish in the Savannah River at the Vogtle site in January through August 1974 in preparation for the Units 1 & 2 operating license. There were three transects for planikton nets, each with stations near the shorelines. He found differences between day and night and some differences between locations, but mostly differences in the seasonal timing of species occurrence (as is typical of coastal plain rivers). Collections on early dates were dominated by larvae of black and white crappie (panfish) and larvae of spotted sucker. American shad appeared in March and peaked in May. Although river discharge was not given, the sampling period was during the high-flow season. The author noted that eggs and larvae were rarely found in the intake canal samples. He stated that the intake velocity would be low enough that eggs and larvae would likely settle out in the intake canal and not be entrained. He stated that fish eggs tend to drift low in the water column. He did not recognize that there would

be a 1-ft-high weir at the bottom of the intake canal to minimize the entry of eggs and larvae that drift near the bottom.

Similarly, Nichols studied the drift of macroinvertebrates occurring 6 to 12 inches off the bottom near the river sides near the Vogtle site for a year in 1980-81, mostly finding aquatic worms and aquatic stages of insects with a scattering of mollusks and crustaceans. As is typical of drift of invertebrates in rivers, the numbers and taxa caught varied seasonally, by time of day, and among locations. High densities generally coincided with high river flows, as also is typical of invertebrate drift.

The EIS notes several design features of the intake that would minimize the entrainment of drifting fish eggs, larvae and bottom organisms (EIS at 5-30 to 5-32). These include: (1) closed-cycle cooling, which minimizes water use (and entrainment) compared to an open-cycle system, (2) low percentage of the river water being withdrawn, especially in the spring high-water months (January through May) when nearly all egg and larval drift occurs and there is the most invertebrate drift, thus affecting a small percentage of all drifting organisms, (3) an intake canal perpendicular to the flow of the river channel that has less likelihood of drawing in drifting organisms, (4) low intake canal velocity that allows drifters to settle and not be entrained in the cooling water, and (5) a 1-ft-high weir at the bottom of the intake canal entrance that is intended to minimize withdrawal of the deeper layers of the river that contain the highest concentrations of the drifting eggs, larvae and invertebrates.

In my opinion, the assumption in the EIS (at 5-31) that the drifting eggs, larvae and invertebrates in the river would be uniformly distributed and all vulnerable to entrainment in proportion to water withdrawal is almost certainly an overestimate rather than an underestimate

of true entrainment, based on the data and discussion in the papers by Wiltz and Nichols. This has been affirmed by SNC's 2008 drift studies.

**Q82: Is SNC000013, identified in this pre-filed written testimony, a true, accurate and correct copy of your Literature References, and does it accurately portray the facts is purports to portray?**

A82. Yes.

**Q83: Are the scholarly or learned journals, articles or treatises referenced in this pre-filed written testimony of the type commonly relied upon in your profession?**

A83. Yes.

**Q84: Does this conclude your testimony?**

A84: Yes.

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) | ) | January 9, 2009 |

AFFIDAVIT OF DR. CHARLES C. COUTANT IN SUPPORT OF SOUTHERN NUCLEAR'S PRE-FILED TESTIMONY ON ENVIRONMENTAL CONTENTION 1.2

I, Dr. Charles C. Coutant, do hereby state as follows:

1. I am a retired Distinguished Research Staff Member of the Oak Ridge National Laboratory. A statement of my professional qualifications is attached to the SNC pre-filed testimony to be submitted on January 9, 2009, in response to hearing issues identified by the Board.

2. I have read the foregoing prepared testimony regarding environmental matters at the Plant Vogtle Site.

3. 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.

Dr. Charles C. Coutant

ANGIE GRAY
STATE OF TENNESSEE NOTARY PUBLIC
ANDERSON COUNTY

Subscribed and sworn to before me this 23 day of December, 2008.

Notary Public

Comm exp 08/25/2010

1 MR. MOORE: Thank you.

2 Now we have on the screen your rebuttal
3 testimony. Do you recognize that document as the
4 rebuttal testimony filed in this matter?

5 DR. COUTANT: Yes, I do.

6 MR. MOORE: And can you respond to the
7 Board to this statement? That the testimony entitled
8 Southern Nuclear Operating Company's Rebuttal
9 Testimony of Dr. Charles C. Coutant on Environmental
10 Contention 1.2 and dated February 6, 2009 which has
11 been provided to the court reporter in electronic
12 format under file name Coutant 1.2 Rebuttal Testimony
13 was prepared by you or under your supervision and
14 direction and is true and correct to the best of your
15 knowledge and belief?

16 DR. COUTANT: Yes.

17 MR. MOORE: I'd move that this be
18 admitted.

19 JUDGE BOLLWERK: Right. Any objection from
20 any of the parties? Hearing none, then the rebuttal
21 testimony of Dr. Coutant shall be admitted into the
22 record as if read as DDMS item ID 59125.

23 (Dr. Coutant Rebuttal Testimony (DDMS-
24 59125) to be inserted at this point)

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 DR. CHARLES C. COUTANT ON ENVIRONMENTAL CONTENTION 1.2

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

A1: My name is Charles Coe Coutant. I am a retired Distinguished Research Staff Member of the Oak Ridge National Laboratory, Oak Ridge, Tennessee. My combined business and home address is 120 Miramar Circle, Oak Ridge, TN 37830-8220. I now serve as a private consultant on matters of aquatic ecology and fisheries biology.

**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 dated January 9, 2009.

**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. I am filing separate rebuttal testimony on EC 1.3 and EC 6.0

**Q4: To what materials submitted by Joint Intervenors regarding EC 1.2 are you responding?**

A4: My response is directed at (a) "Joint Intervenors' Revised Initial Written Statement of Position and Prefiled Direct Testimony," dated February 2, 2009; (b)"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; and (c) "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.

**Q5: Dr. Young states in A.10 that his testimony relates to impacts of entrainment/impingement and thermal discharge on aquatic species located in the Middle, Lower and estuarine Savannah River. Would the thermal plume or intake zone of influence extend to the Lower or estuarine Savannah River?**

A5: No, they would not. The estuary is 120 miles away from Plant Vogtle – The plant is located at mile 151 and the estuary begins downstream at mile 30. The implication that the proposed Vogtle facility's intake and discharge would have impacts from the site downriver into the estuary is an exaggeration.

**Q6: Dr. Young asserts in his testimony at A.11 and A.13 that the FEIS is inadequate because it lacks sufficient field surveys and quantitative analysis. Has the additional information on river ichthyoplankton, entrainment and impingement at the Vogtle site provided by SNC in this proceeding, which was anticipated by the NRC staff in**

**the FEIS (e.g., on page 2-94 and 5-32), contributed to the "field surveys and quantitative analysis" that Dr. young asserts are deficient?**

A6: Yes. The SNC's studies of river ichthyoplankton, ichthyoplankton entrainment into the intake canal, and impingement on intake screens that I referred to in my direct testimony (A.23, A.40-45, A.53) and presented as exhibits SNC000004 and SNC000005 provide quantitative data on species diversity and abundance. Although the ANSP studies listed in Dr. Young's A.13 provide an adequate basis for initial evaluations of impacts, the SNC's field studies in 2008 augment this information and provide additional detail.

**Q7: Are the causes of any population declines in certain species in the Savannah River system of direct relevance to evaluating impacts of Vogtle Units 3 and 4 and must they be articulated in the FEIS as Dr. Young suggests in A.12?**

A7: Causes for population declines should factor in the analysis only if the estimated impacts of the proposed facility would contribute a significant added source of mortality. For many species in decline, the causes are speculative and power plant entrainment and impingement are mentioned only among many other possible contributors. If entrainment, impingement or thermal discharges at the proposed Vogtle facility would have little or no impact on a species, as is the case, that species' population decline is not directly relevant and the hypothesized causes need not be articulated in any detail in order to evaluate impacts of Vogtle under NEPA.

**Q8: Does early life history that Dr. Young claims has not been considered by the FEIS in his answer to Q.14 include the location of spawning and the type of eggs?**

A8: Yes, it does. But the FEIS does include information on early life stages of several species in the Savannah River (e.g., pages 2-81 to 2-84 and 2-89 to 2-93). Dr. Young's general

concern over lack of evaluation of early life stages is not supported by available evidence. Several species, including shortnose sturgeon, Atlantic sturgeon, and several sucker species (including the Robust Redhorse) do not spawn near Vogtle but spawn nearly exclusively in localized areas of rocky substrate near Augusta, Georgia (*see* Exhibit SNC000051). Their eggs are adhesive and stick to the substrate, and thus would not be included in the ichthyoplankton drift at the Vogtle site. Larvae hatched from eggs attached at these locations would not generally drift in the ichthyoplankton the 30 miles from there to the Vogtle site, although a few have been collected in past studies (*e.g.*, FEIS at 2-90 to 2-93).

**Q9: Dr. Young testifies in A.14 that in general, fish eggs have no mobility and larval fish have very little mobility. Do the applicant's 2008 field studies of ichthyoplankton in the river and intake canal provide information relevant to this issue of fish larvae avoiding the water intake velocities?**

A9: Yes. A striking result of the ichthyoplankton field studies is the large difference between the numbers of organisms in the river drift (taken at several locations in the river) and the numbers in the intake canal. The canal numbers were markedly lower. As reported in Exhibit SNC000005, fish eggs and larvae in the source river water were 36.4 times more numerous than in entrainment samples (SNC000005 at 25). In addition, the river ichthyoplankton and entrainment samples had different species and life-stage composition. Whether this difference is caused by the avoidance abilities of the fish larvae, to the selective water withdrawal by the intake, or other causes is not clear. Regardless, the evidence strongly indicates that the proportion of ichthyoplankton in the water withdrawn is far less than that present in the river in general.

**Q10: Dr. Young cites to several studies to substantiate his claim that the assumption of uniform distribution and impacts being proportional to the amount of water withdrawn is flawed (*e.g.*, A.16, A.17, and A.18). Do these studies invalidate the FEIS analysis?**

A10: No. The use of simplifying assumptions such as uniform distribution of ichthyoplankton in the river and impacts being proportional to the amount of water withdrawn is common and accepted practice for estimating the scale of impact to be expected. These assumptions are generally conservative, that is, they assume a hypothetical case that is usually somewhat worse than actually occurs. When the estimated impacts from these conservative assumptions are small, then the analysis does not need to go further with more detailed and realistic numbers. The NRC staff's approach has been validated by the applicant's field studies in 2008, noted above and in previous testimony, which demonstrated that the entrained ichthyoplankton in the intake canal is actually much lower in abundance than found in the river. In other words, evidence shows the non-uniformity near the intake only serves to lower impacts.

**Q11: Is the ichthyoplankton field study conducted by SNC in 2008 materially the same as that recommended by Dr. Young in A.19 of his testimony?**

A11: Yes. The SNC ichthyoplankton study (Exhibit SNC000005) is very close to what Dr. Young recommended. Riverine ichthyoplankton was collected with plankton nets similar to those used in the studies he cites. Samples were taken at sites along the river's sides and in the center channel and from top to bottom. Day and night samples were taken. Although Dr. Young recommended sampling several times per week, the SNC study sampled once during two weeks per month (with duplicate samples), which I believe is

sufficient. The study did not cover each month of the year as recommended by Dr. Young, but was conducted only during the spring-early summer season when ichthyoplankton occurred (as demonstrated by occurrence in the field samples). Because of very low current velocities in the intake canal, the use of the net alone was demonstrated to be not feasible; therefore, a pump was used to raise water to a net alongside the canal (the same net used for the river samples, only submerged in a barrel). The pumped collections were calibrated to net-alone collections by sampling a common source in the river. Thus, SNC has provided the study essentially as proposed by Dr. Young in his Direct Testimony.

**Q12: Dr. Young testifies in A.20 that the FEIS lacks sufficient data and analysis to support its statement that fish and shellfish in the Savannah River in the vicinity of Vogtle are adapted to survival in varying flow regimes and velocities. Is it necessary for the FEIS to include such data and analysis?**

A12: No, it is not. It has been well recognized in the scientific literature for over a century that organisms dwelling in rivers are adapted to changing flows and velocities *(see*, for example, textbooks such as: T. T. Macan (1963) Freshwater Ecology, Camelot Press, London; G. V. Nicolsky (1963) The Ecology of Fishes. Academic Press, London; G. K. Reid (1961) Ecology of Inland Waters and Estuaries. Reinhold, New York).

**Q13: Do the literature sources cited by Dr. Young in A.20 in support of his contentions about human-caused sources of flow variability deal with situations comparable to that at Vogtle?**

A13: No, they do not. The references cited deal primarily with biological impacts to mussels and fish from flow changes from impoundments and with other species declines due to

human activities unrelated to flow. Exhibit JTI000016 (Vaughan and Taylor 1999) observed loss of mussel species downstream of mainstem and tributary reservoirs in Oklahoma. Exhibit JTI000017 (Ricciardi and Rasmussen 1999) deals with general extinction rates of North American freshwater fauna, and relates them to many sources of habitat change including pollution, land-use changes and flow regulation by dams. Exhibit JTI000018 (Cosgrove and Hastie 2001) relates the loss of a particular mussel species to "river engineering" in Scotland, particularly channel and bank modifications. Exhibit JTI000018 (Layzer and Scott 2006) deals with major changes in river mussels and fish in the Holston River, Tennessee, downstream of Douglas Dam affected by flow changes due to hydroelectric plant discharges and low dissolved oxygen content. These studies are, at best, peripheral to the points claimed by Dr. Young regarding impacts of flow changes due to the Vogtle facility. For those studies that did concern human-induced flows, discontinuous dam discharges are not relevant to evaluating impacts of the nearly continuous withdrawal of Savannah River water by the proposed Vogtle 3 & 4 cooling-tower facility.

**Q14: Does entrainment increase as river levels drop, as indicated by Dr. Young in A.22 of his testimony?**

A14: Generally, no. Ichthyoplankton abundance decreases in the river in mid-summer because fish reproduction ceases at the time when river flows generally decrease. So, although the percent withdrawal increases, there would be no expected increase in entrainment at that time.

**Q15: Is it your understanding that the NRC guidelines for environmental impact assessments requires staff to "consider all possible river conditions" as suggested by Dr. Young in A.27?**

A15: No. It would be impossible for any analyst to consider all possible river conditions. As provided for in the NRC guidelines, the FEIS evaluated a range of representative river flows.

**Q16: Would the lethal temperatures cited from the references listed by Dr. Young in A.27, (80-90°F) occur in the Savannah River during the spring and early summer when eggs and larvae of the ichthyoplankton are drifting past and possibly into the Vogtle thermal discharge plume?**

A16: No . The temperatures would not generally be that high at the time of year when most ichthyoplankton occur in the river. Temperatures in the 2008 ichthyoplankton study (SNC000005) reached this range only in mid June when most ichthyoplankton drift had been completed (Table C-1).

**Q17: In citing lethal temperatures for various fish species in his A.27, Dr. Young does not mention any duration of exposure. Is duration of exposure important for causing mortality?**

A17: Yes. It is well known that the lethal effects of high temperature are caused by a combination of exposure temperature and the duration of that exposure (*see*, for example, the Heat and Temperature chapter of the National Academy report Water Quality Criteria 1972 published by the Environmental Protection Agency in 1973). Temperatures well above the "lethal temperature" can be tolerated for brief periods, known as resistance times. In the studies cited by Dr. Young, Exhibit JTI00011 (Steir and Crance 1985) refers

to the 80.1° number as a long-term exposure temperature "unsuitable for hatching of eggs and eventual development of larvae"; Exhibit JTI000012 (Pardue 1983) also refers to a holding temperature for alewife and blueback herring, not a brief exposure. Exhibits JTI000013, JTI000014, and JTI000015 are not relevant because neither the shortnose sturgeon nor the striped bass spawn in the vicinity of Vogtle so their eggs and larvae are not present (see A.22 below).

**Q18: Do we know the exposure times of ichthyoplankton to elevated temperatures in the thermal plume of Vogtle Unit 1 & 2 (and by inference what they would be for the proposed Units 3 & 4)?**

A18: Yes, approximately. The thermal discharge enters the river as a high-velocity jet (21.8 ft/s; FEIS at 5-18), which induces rapid turbulent mixing with the surrounding ambient-temperature water. This rapid mixing causes the temperature of the discharged water to drop rapidly to near ambient temperatures, as I discussed in earlier testimony (A57-61). At a river flow velocity of 1.5 ft/s (FEIS at 5-17) the CORMIX model calculated that the maximum extent of the mixing zone to the 5°F temperature rise above ambient, under conditions causing the maximum temperature difference between ambient and discharge, would be 97 ft (FEIS at 5-18). At a river velocity of 1.5 ft/s, this distance would be covered in 65 seconds. Considering that the plume would be accelerated by the higher velocity of the discharge, the distance would be covered in much less time. Any ichthyoplankton mixed into the thermal plume along its length would receive a fraction of the maximum duration of exposure. Therefore, the duration of exposure to any potentially lethal temperatures in all likelihood would be too brief to cause mortality,

even assuming that temperatures in the plume were above the long-term lethal level at some points.

**Q19: Dr. Young cites data on lethal temperatures for eggs and larvae of several species in his A.27, including shortnose sturgeon and striped bass. Is it your understanding that shortnose sturgeon and striped bass spawn in the vicinity of Vogtle such that their eggs and larvae would be vulnerable to being drawn into the thermal plume?**

A19: No. As I have detailed in Exhibit SNC000051, shortnose sturgeon spawn on a limited amount of rocky substrate in the Savannah River near Augusta, Georgia (River Miles 179-190; Hall et al. 1991). Their eggs are adhesive (Crance 1986; JTI000013) and would not naturally drift the 30 miles to the Vogtle site. Larvae seek bottom crevasses near the spawning site upon hatching (Crance 1986; JTI000013), so they, too, would be unlikely to drift to the Vogtle site. No shortnose sturgeon larvae were collected in the 2008 SNC ichthyoplankton study (Exhibit SNC000005). Striped bass are known from several studies to spawn at the upper end of the Savannah River estuary, many miles downstream from Vogtle (Exhibit SNC000051). Thus, their eggs and larvae, which are prominent components of the ichthyoplankton at that location, would not be found near the Vogtle site. Striped bass eggs and larvae were not found in the SNC's 2008 ichthyoplankton study (Exhibit SNC000005).

**Q20: A considerable amount of Mr. Sulkin's testimony deals with Vogtle's water use and its relationship to river flows as a measure of impacts from entrainment of aquatic species (ichthyoplankton) at low flows, which flows he says (e.g., in A.14 of his testimony) are not sufficiently analyzed in the FEIS. Does entrainment of**

**ichthyoplankton into the intake or the mixing zone of the thermal discharge at Vogtle occur at the seasonal low flows or Drought Level 4?**

A20: No, they do not. The biological community of concern for entrainment into the intake or mixing zone of the thermal discharge, the ichthyoplankton, occurs in the Savannah River in the spring and early summer when flows generally are at seasonal highs. Ichthyoplankton do not occur in the low flows that generally occur at other times of the year. In the 2008 ichthyoplankton study (SNC000005), river flows were above 4,000 cfs until June and then gradually decreased to around 4,000 cfs thereafter (SNC000005 at Table B-2). The majority of ichthyoplankton had passed by June (*Id.* at Table C-1).

**Q21: Is it likely that ichthyoplankton will be present and impacted by flows of 2,000 cfs or less?**

A21: No. The biological community of concern for entrainment, the ichthyoplankton, occurs in the spring and early summer when flows generally are at seasonal highs. Using Mr. Sulkin's calculation in A.18 of his testimony that Unit 3 & 4 withdrawals begin to exceed the 5% threshold at 2,000 cfs at the maximum withdrawal scenario, it is unlikely that ichthyoplankton will be impacted by flows of 2,000 cfs or less.

**Q22: Mr. Sulkin calculates at A.20 of his testimony that cumulative withdrawals of Units 1-4 will begin to exceed 5% at normal operating mode at 3,100 cfs. Is it likely that ichthyoplankton will be present and impacted at these flows?**

A22: No, it is still unlikely.

**Q23: Mr. Sulkin criticizes the Staff's method of estimating impacts in A.25 because it "does not capture the time dimension – the frequency of extremely low flows and their duration." Is his criticism valid?**

A23: No. There is no indication that there will be a high frequency or long duration of low flows below 2,000 cfs at the Vogtle site in spring-early summer when ichthyoplankton are present. Thus, estimates of impacts would not change considering this information.

**Q24: Are the scholarly or learned journals, articles or treatises referenced in this rebuttal testimony of the type commonly relied upon in your profession?**

A24: Yes.

**Q25: Does this conclude your testimony?**

A25: Yes.

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 |

AFFIDAVIT OF DR. CHARLES C. COUTANT IN SUPPORT OF SOUTHERN NUCLEAR'S REBUTTAL TESTIMONY ON ENVIRONMENTAL CONTENTION 1.2

I, Dr. Charles C. Coutant, 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.

Dr. Charles C. Coutant

Subscribed and sworn to before me
this 9nd day of February, 2009.

4-10-12
Notary Public

WILLIAM J CARREJO
STATE OF TENNESSEE NOTARY PUBLIC
KNOX COUNTY

1 JUDGE BOLLWERK: And I believe there's a
2 couple of exhibits?
3 MR. MOORE: Yes, sir. We'd like to go
4 through those, please.
5 First is SNC-12 to be marked. Okay.
6 Thank you.
7 Dr. Coutant, here's your CV. Do you
8 recognize this document as the CV that you've
9 referenced in your testimony?
10 DR. COUTANT: Yes.
11 MR. MOORE: Does it appear to be a true
12 correct copy of your CV?
13 DR. COUTANT: It does.
14 MR. MOORE: We'd like this marked as
15 Exhibit 12 then, please.
16 JUDGE BOLLWERK: All right. Then the
17 record should reflect that SNC000012 is marked for
18 identification.
19 (Whereupon, the document was marked for
20 identification as Exhibit SNC000012.)
21 MR. MOORE: Next is SNC-13. This is the
22 exhibit identified as List of References Submitted in
23 Response to RAIs, which I think should be 15. So I
24 don't know if that's numbered -- is that numbered 13?
25 JUDGE BOLLWERK: There's a 13 and then

1 there's a 15.

2 MR. MOORE: I would like what on my list is 13,

3 and I'm afraid I can't tell on that screen if you have

4 13 or 15 showing. If I've said 15, I meant 13.

5 Apologize. Yes. Thank you very much.

6 Now we have what's on the screen is titled

7 Literature References For EC 1.2 Testimony by Dr.

8 Charles C. Coutant. Do you recognize this as the

9 document that's referenced in your testimony?

10 DR. COUTANT: I do.

11 MR. MOORE: And does it appear to be a

12 true and correct copy of that document?

13 DR. COUTANT: Yes.

14 MR. MOORE: And we'd like this marked as

15 number 13, please.

16 JUDGE BOLLWERK: All right. Then the

17 record should reflect that SNC Exhibit 000013 as

18 identified by counsel is marked for identification.

19 (Whereupon, the document was marked for

20 identification as Exhibit SNC000013.)

21 JUDGE BOLLWERK: Now time to --

22 MR. MOORE: Number 19 now.

23 JUDGE BOLLWERK: Oh, 19. One more. Okay.

24 I missed one. All right.

25 MR. MOORE: I'm afraid so.

1 JUDGE BOLLWERK: Oh, a couple of more.

2 MR. MOORE: Yes.

3 JUDGE BOLLWERK: One more. Okay.

4 MR. MOORE: Well there's --

5 JUDGE BOLLWERK: Two more?

6 MR. MOORE: More than one more.

7 JUDGE BOLLWERK: All right.

8 MR. MOORE: We're looking for 19.

9 Just a moment, Your Honor. This may be an

10 exhibit that's actually in connection with 1.3.

11 JUDGE BOLLWERK: That's my records

12 reflect. But I just want to --

13 MR. MOORE: Yes. I'm afraid my list

14 doesn't show that plainly. So I'm going to look at my

15 backup list just to be sure.

16 Your instincts were correct.

17 JUDGE BOLLWERK: Okay.

18 MR. MOORE: We do not at this time need to

19 see 19.

20 JUDGE BOLLWERK: All right.

21 MR. MOORE: However --

22 JUDGE BOLLWERK: And I don't see any

23 rebuttal exhibits from him either, so -- at least not

24 for this exhibit.

25 MR. MOORE: That's right. So those are

1 the exhibits and we'd like to move that they be
2 admitted, please.
3 JUDGE BOLLWERK: All right. Any objection
4 from either of the parties? Hearing none, then
5 Exhibits SNC-12 and 13 are admitted into evidence.
6 (Whereupon, the documents identified as Exhibits
7 SNC000012 and 13 were received into
8 evidence.)
9 MR. MOORE: I'd like to, when you're
10 ready, Your Honor, introduce the fourth witness in
11 this panel.
12 JUDGE BOLLWERK: All right. Proceed when
13 you're ready.
14 MR. MOORE: Okay. This is Mr. Moorer.
15 He's the project manager environmental for Southern
16 Nuclear Operating Company. He's responsible for the
17 preparation of the environmental report and the
18 environmental aspect of the licensing proceeding.
19 JUDGE BOLLWERK: All right. Let's deal
20 with his direct testimony first.
21 MR. MOORE: His direct testimony is under
22 the file Moorer 1.2 Direct Testimony. There. It's on
23 the screen.
24 So first of all do you recognize this as
25 the prefiled direct testimony in this matter, Mr.

1 Moorer?

2 MR. MOORER: Yes, I do.

3 MR. MOORE: And I'll ask you to respond to

4 the same inquiry regarding your testimony, ask you to

5 confirm it. That the testimony entitled Southern

6 Nuclear Operating Company's Testimony of Thomas Moorer

7 concerning EC 1.2, dated January 9, 2009 corrected

8 March 11, 2009 which has been provided to the court

9 reporter in electronic format under file name Moorer

10 1.2 Direct Testimony was prepared by you or under your

11 supervision and direction and is true and correct to

12 the best of your knowledge and belief?

13 MR. MOORER: I so affirm.

14 MR. MOORE: And I move that this be

15 admitted.

16 JUDGE BOLLWERK: All right. Then the

17 Direct Testimony of Thomas C. Moorer, I want to ask

18 any objections from the parties? Hearing none, then

19 the Direct Testimony of Thomas C. Moorer should be

20 admitted and bound into the record as if read with

21 DDMS ID number 59379,

22 (Moorer Direct Testimony (DDMS-59379) to

23 be inserted at this point)

24

25

Corrected on: March 11, 2009
Originally Filed on: January 9, 2009

**UNITED STATES OF AMERICA**
**NUCLEAR REGULATORY COMMISSION**
**BEFORE THE ATOMIC SAFETY AND LICENSING BOARD**

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|---|---|---|
| **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)** | ) | **January 9, 2009** |

**SOUTHERN NUCLEAR OPERATING COMPANY'S TESTIMONY OF THOMAS MOORER CONCERNING EC 1.2**

Q1. **Please state your name and address.**

A1. My name is Thomas Claibourne Moorer. My business address is: 42 Inverness Center Parkway, Birmingham, AL 35242-4809.

Q2. **Please state your employer, position, and current responsibilities.**

A2. I am currently employed by Southern Nuclear Operating Company ("SNC") as the Project Manager-Environmental. In that capacity, I am responsible for all environmental support activities for new plant and license renewal work for SNC. I was responsible for developing the Environmental Report filed by SNC as part of the Early Site Permit application for Vogtle Units 3 and 4 and all supporting activities. *See* Exhibit SNC000014 (Thomas C. Moorer Curriculum Vitae).

Q3. **Please summarize your education and professional qualifications.**

A3. I earned a Bachelor of Science degree in Environmental Science from Auburn University and a Bachelor of Science in Civil/Environmental Engineering from the University of Alabama. I have over 30 years of experience in the environmental field, including 18+ years of experience in environmental engineering, licensing, and regulatory compliance

in nuclear power. I have over 15 years of experience working in NEPA matters, including the development of Environmental Reports for Environmental Impact Statements supporting NRC licensing actions. I am heavily involved in the work of various industry groups, including EPRI, EEI, and NEI, and have both authored and co-authored numerous technical publications in the environmental field.

Since 2005, I have been responsible for all environmental support for new plants and license renewals, including development of the Environmental Reports ("ERs") for the Vogtle Early Site Permit ("ESP"), Combined Construction and Operating License ("COL") and License Renewal applications to NRC. I am responsible for interface with NRC for review of the ERs and subsequent EIS development, site audits and public meetings and for coordination with state and Federal agencies regarding ESP, COL, and License Renewal activities. Prior to 2005, I worked as the SNC Environmental Services Supervisor for over 15 years and managed the technical and regulatory support for permitting and environmental compliance in the areas of water, air, solid/hazardous waste, mixed waste, chemistry and hazardous materials for all three SNC plants. I have extensive NEPA experience, including the management of environmental support for the Plant Farley and Plant Hatch license renewals, as well as EPRI and NEI work associated with development of the NEI License Renewal Guideline. I worked with NRC on the development of the Generic Environmental Impact Statement ("GEIS") for license renewal. I also provided project management for numerous major environmental projects including technical studies to resolve NPDES permitting issues, wetlands and endangered species work, US Army Corps of Engineers permitting, and studies related to license renewal.

Q4. **What is the purpose of your testimony?**

A4. I will testify regarding preparation of the ER, *see* SNC000001 (Environmental Report for Southern Nuclear Operating Company's Vogtle Early Site Permit Application), as part of the ESP application for Vogtle Units 3 and 4 and regarding the analysis of aquatic impacts in the ER and the EIS. I am also providing separate testimony with respect to EC 1.3 and EC 6.0.

Q5. **What was your role in the preparation of the ESP Application?**

A5. I was responsible for the preparation of the Environmental Report (ER) and coordination of the environmental review process with the NRC staff. The ER was prepared at my direction and under my supervision by a contractor, Tetra-Tech, located in Aiken, South Carolina and a number of sub-contractors employed by Tetra-Tech to provide expertise in various disciplines. I reviewed the requirements identified in NRC guidance and in consultation with my staff and the contractor, assigned responsibility for development of draft sections of the ER in accordance with NRC requirements and guidance. Each of these draft sections was reviewed by me and by the Tetra-Tech project manager. After completion of all required sections, a draft ER was assembled and reviewed by me, my staff, and industry peers, and final comments were developed. A final version was produced, merged with the ESP application, and reviewed again for form and content prior to submittal.

I was also responsible for preparing responses to Requests for Additional Information (RAIs) from NRC, coordination of NRC and NRC contractor, and other regulatory agency site visits, public meetings, and development of comments on the draft Environmental Impact Statement (DEIS).

**Q6. Describe the NRC requirements and guidance for preparation of an ER.**

A6. NRC regulation 10 CFR 52.17(a)(2) specifies the contents of an environmental report for an ESP application and Regulatory Guide 4.2, Preparation of Environmental Reports for Nuclear Power Stations (Revision 2, July 1976; RG 4.2) provides guidance to applicants preparing environmental reports for nuclear power stations. The NRC's Standard Review Plans for Environmental Reviews for Nuclear Power Plants (1999; NUREG-1555) provides guidance for NRC staff to use when conducting environmental reviews of applications related to nuclear power plants. RG 4.2 is over 30 years old (July 1976) and NUREG-1555 is relatively new. Based on discussion with NRC staff and industry peers, SNC selected to rely primarily on NUREG – 1555 (ESRP) for guidance in establishing the format and content of its environmental report. SNC provided additional information and organization in the material presented, as deemed appropriate, when applying lessons learned from the first three ESP applicants. SNC also consulted NRC's Generic Environmental Impact Statement for License Renewal of Nuclear Plants (1996; NUREG-1437) for input in assessing the impacts of the new nuclear units on the VEGP site. SNC concluded that NUREG-1437 environmental issues, significance determination criteria, and significance conclusions could be relevant to the ESP environmental review. SNC indicated in its ER where it has applied NUREG-1437 to supplement assessment of VEGP environmental impacts.

Q7. **Do you agree with the assertion that the ER/EIS fails to identify and adequately consider the impacts of the proposed cooling system intake and discharge structures on aquatic resources?**

A7. No. The ER and subsequent information collected during site visits and through responses to the Staff's RAIs provide a clear assessment of the direct, indirect, and cumulative impacts associated with the proposed intake and discharge systems for Vogtle Units 3 and 4. The Vogtle ER and responses to RAIs provided more than a hundred references describing the baseline conditions of the Savannah River in the area near Vogtle. In addition, the Final Environmental Impact Statement (FEIS) and supporting documentation for Vogtle Units 1 and 2 (NUREG – 1085 issued by NRC in 1985) and used as a reference, provide valuable information about the baseline conditions of the aquatic community near Vogtle. The collection of data, studies performed, and SNC's submissions have ensured that the direct, indirect and cumulative impacts were appropriately addressed in the ER. The Staff's FEIS relied on the ER, consultation with regulatory agencies, and its own independent analysis in reaching the conclusion that aquatic impacts were SMALL. Both the ER and FEIS contain thorough discussions of aquatic impacts.

In preparing the ER, SNC considered and referenced the conclusions from studies conducted on once-through intakes at the Savannah River Site (SRS) relative to impingement and entrainment. These studies are very relevant to the Vogtle intake impacts analysis since the SRS intakes are located very near to the Vogtle intakes. The SRS studies concluded that at intake flows many times larger than those proposed for Vogtle, impingement and entrainment impacts remain small and do not result in any quantifiable impact to the fishery or the general aquatic community. Use of this data coupled with years of additional data on the background aquatic community near the site was an appropriate and bounding surrogate for individual site specific studies conducted

on the actual Vogtle Unit 1 and 2 intake. This approach used by SNC in the ER and subsequently by the Staff in its FEIS was appropriate and consistent with NUREG-1555. This is sufficient evidence to tell me, as a trained and experienced environmental professional, what the category of impingement and entrainment impacts would be. Moreover, this is a common approach to estimating impacts and consistent with the NEPA process.

Additionally, in order to confirm the assessment and conclusions in the ER, in 2008, SNC conducted site specific impingement and entrainment studies of the existing Vogtle intake. These studies, the results of which are attached to the joint testimony of Tony Dodd and Matt Montz, completely confirm the conclusions stated in the ER and FEIS relative to the impacts of impingement and entrainment for Vogtle Units 3 and 4 – that impacts were adequately considered and are SMALL.

Q8. **In your view, was the baseline aquatic data used to estimate impacts adequate?**

A8. Yes, the ER and subsequent responses to RAIs and material collected during site visits provide a clear, well documented assessment of the baseline aquatic community in the vicinity of plant Vogtle. The Savannah River, especially in the area near the SRS is one of the most frequently studied rivers in the southeastern United States. In addition to the Academy of Natural Sciences studies that began in the late 1950s and continue today, there are many other relevant studies cited in the ER and provided in response to RAIs that contribute to the wealth of information available for the Savannah River aquatic community. In turn, the Staff verified and used this information in assessing impacts in the FEIS. In my experience, the volume and quality of information available to establish the baseline of aquatic resources was more than adequate.

Q9. **In your opinion, was consideration of the ANSP studies for determining the aquatic baseline appropriate?**

A9. Yes, we relied on these studies because they represent an ongoing annual study with a fifty-plus year look at the area near the site performed by an extremely reputable organization of scientists. The ANSP studies began in the 1950s to assess the impacts of the Savannah River Site on the Savannah River. The ANSP studies included several sample sites proximate to the Vogtle site, including one that essentially coincides with the proposed location of the Unit 3 and 4 intake structure.

Notably, the ANSP studies were just one set of information SNC considered to create a comprehensive picture of the baseline aquatic conditions on the Savannah River near Vogtle. SNC provided over 125 reference documents as part of the ER submittal and more than one hundred references in response to RAIs. *See* SNC000015 (List of references submitted in response to RAIs). SNC also referenced the FEIS prepared for Vogtle Units 1 and 2. When coupled with the large body of additional information provided in the ER and FEIS the ANSP studies provide a conclusive, contemporary assessment of the baseline aquatic community near the Vogtle site. Additionally, NEPA encourages the use of available data to evaluate the effect of the proposed action on the environs near the site. There is no question that use of ANSP data was appropriate. In fact, it would not have been credible for the ER to ignore it.

Moreover, the NRC and state agencies concluded for Vogtle Units 1 and 2 that the operation of the intake did not produce a significant adverse environmental effect on the Savannah River and that no confirmatory studies were required. Recently, SNC conducted site specific impingement and entrainment studies on the Vogtle Unit 1 and 2

intakes to provide supplemental data for this proceeding. These studies confirm that very little impingement occurs and that entrainment is also comparably small, which is consistent with the conclusions from the Unit 1 and 2 FEIS. The ER for Vogtle Units 3 and 4 and the Unit 3 and 4 FEIS also reached this same conclusion.

Q10. **In determining impacts from entrainment and thermal discharges, explain the use of the uniform drift distribution.**

A10. In the ER and in subsequent responses to RAIs, SNC provides a discussion of the body of relevant data on the "drift" community near the Vogtle site. The drift community is characterized by free floating life stages of certain aquatic organisms such as eggs and larval fish. There are a number of species that inhabit the Savannah River and there is significant variance in their spawning behavior and characteristics of eggs and larval fish. For example, the diadromous striped bass, as well as the shad and herring species are prolific in the amount of eggs they produce and their eggs are released from spawning locations directly to the water column. Many of these eggs are lost due to predation and other natural phenomena and, because they float freely in the water column, they are potentially subject to the impacts of entrainment or the thermal plume. However, the large number of eggs produced ensures adequate reproduction rates. On the other hand, eggs of most game species such as bass and bream, and catfish are deposited in discrete "nests or beds" where they remain until they hatch. These eggs are also not normally found in the water column and are not normally subject to entrainment by water intakes. Sturgeon eggs are laid in the water column but are adhesive and demersal, meaning that they sink to the bottom and adhere to bottom substrate. Sturgeon are known to seek out certain types of substrate for their spawning, typically rock cobble bottom. The spawning

sites are well known and none occur near the Vogtle intakes. In order to provide a clear, conservative assessment of the entrainment impacts of Vogtle 3 and 4 on the Savannah River drift community, Southern Nuclear chose to assume that the "drift" was uniformly distributed throughout the water column and thus the drift from all species would be entrained equally. This assumption reasonably estimates the impacts of Vogtle Units 3 and 4 water withdrawal on those species that release their eggs, and larvae develop, in the water column. The assumption significantly overstates the impact to those species described above whose eggs and larvae are not normally present in the water column.

Basically, the assumption of a uniform drift community means that it is assumed these eggs are evenly spread out in the water column such that any x% of the water will contain x% of the drift community within it. The ER and FEIS also presume that all organisms entrained are killed. As such, the entrainment loss is assumed to be the percentage of river flow withdrawn by the Vogtle units. This assumption therefore has an additional conservatism related to the timing of fish spawn and the Savannah River flow regime. The large majority of spawning occurs between March and July when river flows are normally higher. The percentage of water withdrawn compared to river flow is normally lower during this period than the withdrawal (and entrainment) rate estimated in the ER, which was based on lower late summer/fall flows.

It is true that drift within the water column can vary and that it is influenced by channel morphology, flow, and other variables which can affect habitat or spawning locations. It is also true that a typical intake design impacts only a small part of the river channel, not the entire channel. The Vogtle intake is located in a relatively straight section of the river channel and is not near any creek, slough, or other morphological

feature. As such, no significant fish habitat exists within the area of influence of the intake structure. In addition, the bottom structure in the area has been characterized as a relatively sterile mixture of graded sand and is not well suited for spawning habitat for species which lay eggs in nests or beds. Therefore, due to the lack of spawning habitat for species which produce eggs into the water column, no significant concentration of drift is anticipated and the uniform distribution assumption remains conservative. There is no entrainment impact on the federally endangered shortnose sturgeon since no spawning areas are proximate to the Vogtle site, and the eggs and larvae remain in the spawning areas.

In a recent study conducted by SNC in 2008, using Acoustic Doppler technology, the area of influence in the Savannah River associated with the Vogtle Unit 1 and 2 intake is less than 10 percent of the channel volume. Since the study was done during a low flow period, the impact during normal flow periods would be even smaller. In consideration of this information along with the uniform distribution assumption, it is likely that the effect of the intake on entrainment is significantly overstated, making the assumption even more conservative.

Q11. **What river flows were used to determine impacts from impingement, entrainment and thermal discharges?**

A11. In the ER, impingement and entrainment effects are evaluated at the annual average flow of 8820 cfs, the 7Q10 flow of 3822 cfs and the Drought Level 3 flow of 3800 cfs. These represent the range of flows most likely to occur. *See* SNC000016 (USGS Charts depicting recent flows of Savannah River). Drought Level 4 Flow was not considered for two reasons. First, Drought Level 4 has never been experienced in the history of the

Savannah River system. Secondly, the Corps Drought Plan in place at the time the ER was submitted did not define a specific flow regime for Drought Level 4, but rather indicated that Drought Level 4 would consist of passing inflow from Lake Thurmond downstream. *See* SNC000017 (U.S. Army Corps of Engineers Savannah River Drought Contingency Plan (March 1989)). The Corps has indicated at that time that they were revising the Drought Level 4 triggers to more accurately define the Drought Level 4 flow regime. The recent draft of the Drought Plan released by the Corps defines the first step in Drought Level 4 as reducing discharge from Thurmond (Clarks Hill) Dam to 3600 cfs moving stepwise as the drought continued to a final position of passing inflow from Lake Thurmond (Clarks Hill). This flow regime is much more appropriate and will likely be adopted. Based on the USGS flow record, the lowest flows occur in late summer and fall. The low flow period typically does not coincide with the spawning period.

More conservatively, in the FEIS, NRC evaluates the annual average flow of 8820 cfs, the Drought Level 3 flow of 3800 cfs, and two additional flows of 3000 cfs and 2000 cfs. Recently, the USACE proposed a revised Drought Plan to better define Drought Level 4. *See* SNC000018 (FONSI for Drought Contingency Plan Update (August 2006)). Drought Level 4 is designed to maintain a 3600 cfs release from Thurmond (Clarks Hill) Dam as long as reservoir storage can support, followed by a step-wise transition to a point where releases will match reservoir inflow. Review of the substantial flow record indicates that the frequency and duration of flow values below 3600 cfs is extremely low. *See* SNC000016 (USGS Charts depicting river flows of Savannah River). The 3800 cfs flow associated with Drought Level 3 corresponds essentially to the 7Q10 flow of 3822 cfs. Single day flows below 3600 cfs are extremely rare and no extended periods at or

below this flow are known to exist. NRC's choice of 3000 cfs to represent an extreme low flow event is appropriate based on the flow record and the USACE Drought Plan. The 2000 cfs scenario seems excessively conservative as it is not supported by existing flow data. Regardless, NRC's evaluation confirms that even at the lowest of these flows, the conclusion of SMALL reached in the FEIS does not change. This information further supports the conclusions reached in both the ER and the FEIS that impacts from impingement, entrainment, and the thermal discharge are SMALL.

Q12. **Do you agree with Joint Intervenors' presumption that combined withdrawals which may exceed 5% of river flow invalidate the Staff's impacts conclusions?**

A12 No. The Joint Intervenors are wrong for two reasons. First of all, the Joint Intervenors imply that a 5% withdrawal rate represents a "cutoff" that determines whether or not impacts to the river and to aquatic communities should be considered SMALL. The 5 % criteria comes from EPA's "316(b)" standards, which sets 5% withdrawal rates as a trigger for additional steps. However, that standard is specifically based on the annual average flow of the river, not the lowest drought flows. Accordingly, it is not at all relevant to apply the 5 % criteria to extremely rare and essentially "worst-case" flow events for the assessment of withdrawal impacts.

Second, the FEIS already includes combined withdrawals in excess of 5%. In fact, the FEIS already considers withdrawal rates and flow conditions that are more extreme than those the Joint Intervenors argue should have been considered. Whereas the Joint Intervenors, through their experts, assert that flow reduction could reach 7 to 7.9%, the FEIS evaluates withdrawals of 173 cfs at flows of 2000 cfs, FEIS 7-4-6, which is a reduction of 8.7%. The FEIS includes the calculation of flow reduction based on

"consumptive use" in the text (*see* Table 7-2) and evaluates impacts at 6.5% reductions in flow. Although the Tables do not show the percentage flow reduction for withdrawal at the 3000 and 2000 cfs values, the 173 cfs maximum withdrawal value stated in Table 7-1 can be assessed at these values and the percent reduction in flow can be easily determined. For illustration purposes and in order to make an "apples to apples" comparison with Joint Intervenors example, I computed the values at 3000 and 2000 cfs and obtained a percent reduction in flow of 5.6 % and 8.7 %, respectively. The flow reduction of 7.9 % stated by the JI, would be bounded by the 8.7 % value which is derived from information contained in the FEIS and is also bounded by the NRC conclusion of SMALL in the FEIS. Accordingly, by any measure, the FEIS already evaluates possible rare flow reductions in excess of 5% and in excess of the amounts suggested by the Joint Intervenors for both withdrawal and consumptive use, and the conclusion of SMALL impacts remains unchanged.

Q13. **Do you believe that the EIS adequately considers impacts from impingement and entrainment on aquatic resources?**

A13. Yes. The background information on the baseline aquatic community is comprehensive, conservative, and supported by contemporary data. The assumptions about uniform distribution of drift organisms also are conservative and well supported. The Vogtle intake design is considered Best Available Technology (BAT) to minimize the effects of impingement and entrainment. This information is confirmed by studies conducted in 2008 on the Vogtle Unit 1 and 2 intake.

Q14. **Do you believe that the EIS adequately considers impacts from thermal discharges on aquatic resources?**

A14. Yes. The thermal impact from all four Vogtle units will be extremely small. The CORMIX runs discussed in the ER and the NRC FEIS confirm that the thermal plume will not have any significant impact on drift organisms or the Savannah River fishery. This information is further supported by 2008 field verification performed by SNC, addressed in the joint testimony of Tony Dodd and Matt Montz.

With regard to the potential for harm to the drift community from contact with the thermal plume, two facts are important. First, the maximum temperature associated with the plume occurs at the point of discharge. Since the maximum blowdown temperature is estimated at 91 degrees F, this temperature would impact only a very small area until it decayed below the 90 degree F Georgia Water Quality Standard. *See* Ga. Comp. R. & Regs. 391-3-6-.03(5). This area was estimated in the FEIS as 3 feet downstream by 7 feet wide (21 square feet). Assuming a river flow at low flow conditions of 3800 cfs, the river velocity of 1.5 ft/sec associated with this flow would result in exposure to a drift organism in the Savannah River to the 90 Degree F temperature for no more than 2 seconds. Since this is a bounding case, actual exposure would be significantly less. Drift organisms are normally present in the Savannah River in the spring and early summer months. Maximum temperatures would not occur during this time, adding additional conservatism to the ER and FEIS conclusion. The allegation that harm would occur to drift organisms as a result of exposure to the thermal plume is unfounded. The conclusion reached in the ER and FEIS regarding thermal impacts associated with the Vogtle discharge is based on sound, conservative information and is firmly supported by the data and literature.

Q15. **Are each of the exhibits referenced in this pre-filed written testimony true, accurate and correct copies, and do they accurately portray the facts they purport to portray?**

A15. Yes.

Q16. **Does this conclude your testimony?**

A16. Yes.

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) | ) | March 11, 2009 |

AFFIDAVIT OF THOMAS C. MOORER IN SUPPORT OF SOUTHERN NUCLEAR'S REVISED DIRECT TESTIMONY ON ENVIRONMENTAL CONTENTION 1.2

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

1. I have read the foregoing prepared 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

Thomas C. Moorer

Subscribed and sworn to before me
this 10 day of March, 2009.

Sharon Hudgins
Notary Public
My commission expires 6-9-09

1 MR. MOORE: Mr. Moorer has rebuttal
2 testimony as well. It's under the file Moorer 1.2
3 Rebuttal Testimony.
4 So first of all, Mr. Moorer, it's on the
5 screen. Do you recognize that as your prefiled
6 rebuttal testimony in this matter?
7 MR. MOORER: Yes, I do.
8 MR. MOORE: and I'm going to read the same
9 statement and ask you to affirm it. That the
10 testimony entitled Southern Nuclear Operating
11 Company's Rebuttal Testimony of Tom Moorer concerning
12 EC 1.2 and dated February 6, 2009 corrected March 11,
13 2009 which has been provided to the court reporter in
14 electronic format under file name Moorer 1.2 Rebuttal
15 Testimony was prepared by you or under your
16 supervision and direction and is true and correct to
17 the best of your knowledge and belief?
18 MR. MOORER: I so affirm.
19 MR. MOORE: I'd like to move that this be
20 admitted, please.
21 JUDGE BOLLWERK: All right. Any objections
22 from the parties? Hearing none, then Mr. Thomas C.
23 Moorer's Rebuttal Testimony shall be admitted and
24 bound into the record as if read as DDMS item ID
25 59380.

1 (Moorer Rebuttal Testimony (DDMS-59380) to
2 be inserted at this point)
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Corrected on: March 11, 2009
Originally Filed on: February 6, 2009

**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 1.2 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; and (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 is 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 intake 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 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 the pre-filed direct testimony of Dr. Coutant and myself 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 present results and bury 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 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 of 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 to 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.

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) | ) | March 11, 2009 |

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

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

1. I have read the foregoing prepared 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

Thomas C. Moorer

Subscribed and sworn to before me
this 10 day of March, 2009.

Sharon Hudgins
Notary Public

My commission expires 6-9-09

1 MR. MOORE: Thank you.

2 Mr. Moorer also sponsors a number of

3 exhibits that we'd like to go through and have marked.

4 First is Exhibit 1, which is also because

5 of, I believe, file size limitations, it has a number

6 of photographs in it.

7 JUDGE BOLLWERK: Right.

8 MR. MOORE: Is a multi-part exhibit. I

9 don't know if --

10 JUDGE BOLLWERK: Let's just pull up the

11 first part of that. I think we're going to speed up

12 the exhibit admission here a little bit.

13 MR. MOORE: I'm glad that you suggested

14 that.

15 JUDGE BOLLWERK: Can you pull up the first

16 part. Okay. Given this is a multi-part exhibit,

17 let's go ahead and identify the first part. This

18 actually has parts A through O, if I remember?

19 MR. MOORE: That's right.

20 JUDGE BOLLWERK: Which are how many --

21 that's how many different parts?

22 MR. MOORE: Fifteen?

23 JUDGE BOLLWERK: Fifteen? Okay.

24 MR. MOORE: Okay. Mr. Moorer, you can see

25 on the screen Exhibit SNC000001, but I believe it's

1 only the first part of that exhibit. Let's flip to
2 the next page of that.
3 For this exhibit, the title of it
4 identified as Environmental Report For Southern
5 Nuclear Operating Company's Vogtle Early Site Permit
6 Site Application. And at least from this portion of it
7 can you identify it as the document that's referenced
8 in your testimony.
9 MR. MOORER: Yes, it is.
10 MR. MOORE: And does it appear to be a
11 true and correct copy of the excerpts from the
12 environmental report?
13 MR. MOORER: It does.
14 MR. MOORE: Now this is item A of the 15
15 parts, there are items A through O, each of which are
16 just a continuation of the various parts of that
17 document.
18 MR. MOORER: Right, of the same one.
19 MR. MOORE: I'd like to go ahead and ask
20 that they all be marked as items A through O based on
21 Mr. Moorer's identification of the first part, if
22 that's okay.
23 JUDGE BOLLWERK: All right. That will
24 work.
25 Let's then have the record reflect that

1 the environmental report for the Southern Nuclear
2 Operating Company's Vogtle early site permit
3 application, which is and consists of a multi-part
4 exhibit with the numbers SNC00001A, 1B, 1C, 1D, 1E,
5 1F, 1G, 1H, 1I, 1J, 1K, 1L, 1M, 1N and 1O are all
6 marked for identification.
7 (Whereupon, the document was marked for
8 identification as Exhibit SNC00001A
9 through 1O.)
10 MR. MOORE: Thank you.
11 Do you need a moment for that?
12 JUDGE BOLLWERK: I think we can just move
13 them -- if you just want to move them into evidence.
14 MR. MOORE: Okay. I'll do that. I would
15 like to move that that be admitted into evidence.
16 JUDGE BOLLWERK: Any objections? All
17 right. Then SNC Exhibits 00001A, 1B, 1C, 1D, 1E, 1F,
18 1G, 1H, 1I, 1J, 1K, 1L, 1M, 1N and 1O are admitted
19 into evidence.
20 (Whereupon, the documents identified as Exhibits
21 SNC00001A through O were received into
22 evidence.)
23 MR. MOORE: We'd like to also have marked
24 some additional exhibits sponsored by Mr. Moorer.
25 First is SNC-14.

1 JUDGE BOLLWERK: All right. I think
2 probably he doesn't need to see them all. Let's just
3 go ahead and identify them. Have you identify them
4 for the record.
5 MR. MOORE: I'm happy with that, Your
6 Honor.
7 JUDGE BOLLWERK: And just if you can
8 identify them and we'll go ahead and move them in that
9 way.
10 MR. MOORE: Okay. SNC-14 is his CV.
11 JUDGE BOLLWERK: All right.
12 MR. MOORE: Which we'd like marked.
13 JUDGE BOLLWERK: Let's mark that as
14 SNC000014 marked for identification.
15 (Whereupon, the document was marked for
16 identification as Exhibit SNC000014.)
17 MR. MOORE: SNC-15 is a list of references
18 submitted in response to RAIs, I'd like that marked.
19 JUDGE BOLLWERK: SNC000015 is marked for
20 identification.
21 (Whereupon, the document was marked for
22 identification as Exhibit SNC000015.)
23 MR. MOORE: SNC000016 are USGS charts
24 depicting recent flows of the Savannah River. We'd
25 ask that be marked.

1 JUDGE BOLLWERK: All right. Let the
2 record reflect that SNC000016 is marked for
3 identification.
4 (Whereupon, the document was marked for
5 identification as Exhibit SNC000016.)
6 MR. MOORE: SNC000017 entitled U.S. Army
7 Corps of Engineers Savannah River Drought Contingency
8 Plan, and dated March 1989, we'd like mark.
9 JUDGE BOLLWERK: All right. Let the record
10 reflect that SNC000017 is marked for identification.
11 (Whereupon, the document was marked for
12 identification as Exhibit SNC000017.)
13 MR. MOORE: SNC-18 FONSI for Drought
14 Contingency Plan updated, dated August 2006 we'd also
15 like marked.
16 JUDGE BOLLWERK: All right. Let the
17 record reflect that SNC000018 is marked for
18 identification.
19 (Whereupon, the document was marked for
20 identification as Exhibit SNC000018.)
21 MR. MOORE: SNC-54. I have a comment on
22 this, a question, Your Honor
23 JUDGE BOLLWERK: All right. This is a
24 revised exhibit. This has got an R in it, from my
25 numbering.

1 MR. MOORE: Yes, it is. But it was
2 incompletely revised. You might want to look at this
3 one. I'll let you decide that.
4 JUDGE BOLLWERK: All right. Why don't you
5 go ahead and pull it up, if you would, Mr. Wilkie.
6 MR. MOORE: The title of the exhibit and
7 the title of the first series of data in the exhibit
8 should be reversed. In other words, the name of the
9 exhibit is just referencing the first series of data
10 in the exhibit, and the first series of data bears the
11 title that should explain what the whole exhibit
12 contains. And if we look at it, I think it'll be more
13 clear.
14 If you go to the second page of that
15 exhibit. At the top there this first part of the
16 exhibit is labeled Inflow Data Comparison of Thurmond
17 Dam With Flows At Vogtle, when in fact that first part
18 is just the flows at Vogtle. That should be the title
19 of the exhibit itself. Go back up to the title of the
20 exhibit, that's what should appear at the top of that
21 series of data we just looked at the flow at Vogtle,
22 and the title of this exhibit should say "This Exhibit
23 is a Comparison of Flows at Vogtle and At the Dam"
24 because there's other data further in the exhibit
25 which is the flows that releases from the Dam.

1 So we have a correction of that if you
2 want it, or if you just want my explanation to correct
3 the record sufficiently; then either is fine with us.
4 JUDGE BOLLWERK: I think probably your
5 explanation of the correction will be fine.
6 MR. MOORE: Okay. Then in that case we'd
7 like what is titled The Daily Mean Flow Measured at
8 Waynesboro Gauge, October 1, 2008 through February 5,
9 2009 to be marked as SNCR00054.
10 JUDGE BOLLWERK: All right. Let the record
11 reflect that Exhibit SNCR00054 is marked for
12 identification.
13 (Whereupon, the document was marked for
14 identification as Exhibit SNCR00054.)
15 MR. MOORE: And our final exhibit is 55,
16 which is an EPA Fact Sheet. That's also the title of
17 the exhibit. We'd like that marked.
18 JUDGE BOLLWERK: All right. Then the
19 record shall reflect that SNC000055 is marked for
20 identification.
21 (Whereupon, the document was marked for
22 identification as Exhibit SNC000055.)
23 MR. MOORE: And I move that those be
24 admitted.
25 JUDGE BOLLWERK: Any objections? Hearing

1 none, then SNC Exhibits R00054 and SNC000055 are
2 admitted into evidence.
3 (Whereupon, the documents identified as Exhibits
4 SNC000014-18, SNCR00054, SNC000055 were
5 received into evidence.)
6 MR. MOORE: Your Honor, those are the
7 testimonies and the exhibits of this panel, so we
8 would tender them for your examination.
9 JUDGE BOLLWERK: All right. Thank you very
10 much.
11 Having said that, I appreciate the
12 patience of the witnesses and counsel. I think we've
13 learned something about how we're going to do this in
14 the future, and that's how sometimes you learn things.
15 It can be a little painful, but I think we've all
16 figured something out here.
17 Okay. At this point then the witnesses
18 have been sworn. And their testimony has been
19 admitted. And the exhibits that accompany that
20 testimony have been admitted into evidence and they
21 are subject to questioning by the Board in accordance
22 with Subpart L.
23 And I'm going to turn to Judge Jackson and
24 see if he might have any questions.
25 JUDGE JACKSON: Thank you, Judge Bollwerk.

1 Good morning, everyone.

2 I've learned something already. Judge
3 Bollwerk warned that these microphones were very
4 sensitive. And a while ago I was just thinking about
5 saying something and the light came on. If you hear
6 anything strange out there, we're all trying to sit
7 very quietly.

8 JUDGE BOLLWERK: Probably thinking how
9 much longer is this going to take.

10 JUDGE JACKSON: In an attempt to keep our
11 questions organized, we'll try to begin by referring
12 our questions to each individual piece of testimony.
13 There'll be some crosscutting questions, I'm sure. But
14 we'll try to identify which testimony we're addressing
15 at any given time and start that way.

16 So I'd like to begin with a few questions
17 on the direct testimony of Mr. Dodd and Mr. Montz that
18 we just saw. And my first question relates to your
19 entrainment study, which was your Exhibit 5. And in
20 that exhibit you discuss how you started to make some
21 of your entrainment measurements at the mouth of the
22 inlet canal that we saw depicted in the pictures that
23 were entered. And that after that you've moved the
24 measurements, the entrainment measurements down into
25 the canal, and we saw a picture of the sampling going

1 over the side of the wall there.

2 So my first question is I would like to

3 ask one of you if you could expand on why this change

4 was made from measuring at the mouth of the canal

5 versus down in the canal?

6 MR. DODD: Yes, sir. This is Tony Dodd for

7 the applicant.

8 A little bit of background. The first

9 outing in attempting to collect an entrainment sample

10 we learned by trying to deploy plankton net, the same

11 kind we used out in the river for source water

12 sampling, that there wasn't enough velocity in the

13 canal very close to the intake screens to even

14 adequately sample with that gear.

15 So our very first outing, one of ten

16 planned outings, was just thwarted by this physical

17 condition of the intake canal.

18 The second outing in order to get a sample

19 our next logical fallback for the conditions we

20 thought there were to take this same plankton gear,

21 but pump water -- pump a sample from the mouth of the

22 canal where we could get the boat. And it was boat

23 mounted device. That one was met with some constraint

24 because there's a stop log mechanism at the opening of

25 the canal and the boat can't traverse past that. So

1 we ended up tying the boat off and sampling at the
2 mouth of the canal.
3 Maybe I could refer the panel to one of
4 our figures, one of our exhibits, to try to point out
5 where that was. This would be Exhibit -- let's see if
6 I can get to it here. Yes. Exhibit 10, SNC-10 if we
7 could turn to that, please.
8 JUDGE BOLLWERK: Would you like us to go
9 ahead and put that up? Can you put it up? Thank you.
10 MR. DODD: It might help to rotate that,
11 yes.
12 In the far ground we're looking at the
13 mouth of the intake canal where it meets the Savannah
14 River. And you can see the stop log, stop log gate
15 configuration out at the outer edge of the canal. And
16 this is what impeded our boat progress. There we go.
17 This is the stop log gate configuration
18 here.
19 We inspected the area visually before we
20 deployed the sampling equipment, which in this case
21 was a large volume pump which would -- we had an
22 intake hose if we go to one side of the boat, we'd
23 pump sample water from the desired depth. In this case
24 about mid-depth. Through the pump and then through the
25 net on the far side of the boat.

1 At this area that I'm pointing to now
2 based on visual appearance was simply an eddy. As
3 river flow comes down this direction--
4 JUDGE BOLLWERK: And the record should
5 reflect you've got a laser pointer and you're sort of
6 pointing at the left hand side of the photograph
7 coming toward the first opening in the --
8 MR. DODD: Yes.
9 JUDGE BOLLWERK: -- the small bridge that
10 goes across the inlet.
11 MR. DODD: Yes. Thank you.
12 And it appears to be an eddy where
13 currents stall and they're somewhat roiled. So we
14 opted to sample on the far side of the canal. We
15 continued further downstream to the far side of the
16 canal and there's an opening here by the stop log gate
17 where we could tie up the boat and deploy this pump
18 apparatus.
19 JUDGE BOLLWERK: And again the record
20 should reflect you're on the right hand side of the
21 inlet?
22 MR. DODD: Yes.
23 JUDGE BOLLWERK: With your laser pointer.
24 MR. DODD: And so we collected a sample on
25 that event. We sent that sample to the lab and it

1 wouldn't be processed for several more weeks. But
2 before returning two weeks later to sample again, we
3 gave this some thought about where we had sampled and
4 how well we thought we had collected a sample that
5 would be representative over the entrained community.
6 This area is also characterized by a
7 number of swirling currents and its eddied there. And
8 the whole idea of sampling, of course, was to capture
9 what we believe was a representative sampling of the
10 community that is entrained. In other words, by
11 definition an entrainment sample is material that not
12 only goes through the canal, but it's subject to the
13 plant's cooling system. It goes through the intake
14 structure, it's subjected to certain pumps and shear
15 stress and condenser tubing, et cetera, before it
16 exits the plant on the other side.
17 JUDGE JACKSON: By sampling this--
18 JUDGE TRIKOUROS: Mr. Dodd, how do those
19 eddies relate to the canal? Is there a relationship
20 to the canal or are they just eddies that happen to
21 exist at that location.
22 MR. DODD: Well, they're eddies that exist
23 at the location. The currents effectively, they sweep
24 past this area. Now this is subject to a hydraulic
25 zone of influence of course, too, in this area. But

1 there's a strong indication that many of the-- the
2 flux of the flow coming downstream actually sweeps
3 past the mouth of the canal.
4 JUDGE BOLLWERK: Right. And again you're
5 showing with your laser pointer sort of shifting from
6 left to right on the photograph in terms of the inlet?
7 MR. DODD: Exactly. And so there is an
8 eddying or a side effect, a frictional effect of
9 currents as they sweep past the canal. And so these
10 currents eddy up there.
11 The indication is for a sampling sake is
12 that if we collect a sample at that location, to be
13 scientifically objective I couldn't say for sure that
14 all of this sample material was entrained material.
15 But by coming further into the canal on the third
16 sampling event we had a little more assurance that
17 whatever we sampled from this area we could say a
18 little more confidently was headed towards the intake
19 structure and not confused or confounded by the
20 swirling currents and eddies here at the mouth of the
21 canal.
22 JUDGE BOLLWERK: And so with your laser
23 pointer you're drawing a distinction between the upper
24 right hand side near the inlet and then down further
25 in terms of actually coming down on the right hand

1 side of the jetty that runs from the inlet?

2 MR. DODD: Closer to the intake structure.

3 JUDGE BOLLWERK: To the intake structure.

4 Okay.

5 MR. DODD: Not only does the stop log gate

6 configuration kind of confound sampling there and

7 cause us some constraints for sampling, but there's

8 also -- I'll take the pointer. I'm going about

9 another 75 or 100 feet further inside the canal.

10 There's a second set of sheet piles that effectively

11 create a sediment catchment for the end of the intake

12 canal. And this area is characterized by a tremendous

13 reduction in velocity from what's out in the source

14 water just as it enters the canal.

15 And again for the sake of just being

16 technically objective, we though we'd have a better

17 chance of seeing a representation of the entrained

18 community here rather than any sample out here that

19 might be conflicted by these various currents and

20 eddies and so forth.

21 JUDGE BOLLWERK: Right. And again you're

22 showing with the laser pointer the difference between

23 the inlet where the river is and further in?

24 MR. DODD: Exactly.

25 JUDGE BOLLWERK: All right.

1 JUDGE JACKSON: So in your opinion you
2 could not collect more accurate data if you had stayed
3 out at the inlet or the mouth of the canal versus back
4 where you did most of this sampling? How could you
5 ensure yourself that perhaps part of the drift
6 community that had entered the inlet canal had not
7 somehow settled out because the flows are much lower,
8 as you just mentioned, as you get in there? So that
9 you know that what you sampled was an accurate
10 representation of what actually entered?
11 MR. DODD: Yes, I understand your
12 question.
13 There is -- settling of eggs and larvae
14 are expected when you have a decrease in velocity, as
15 we have here at this canal. And interestingly, it was
16 noted in the early studies at SRP across the river in
17 '74, '77 and even the studies of the '80s when they
18 studied entrainment effects that they noted the likely
19 settling of eggs and larvae in their canals as well.
20 In fact, during their sampling program had
21 noted that they were sampling species in the -- eggs
22 and larvae in the species in the intake samples -- or
23 rather, they had found fish -- they found fish species
24 living in the canal that they didn't detect eggs and
25 larvae in the intake structure. So they felt this was

1 an indication that there are fish living in there and
2 eggs and larvae in fact do settle out. And in their
3 sampling program they made no particular effort to
4 account for the eggs and larvae that settle out in the
5 early part of the mouth of the canal. And further
6 stated in their reports at the time that because they
7 settle out, they're not subject to entrainment, which
8 goes back to the working definition of entrainment.
9 Settling out, there may be an artifact of
10 the canal, but technically those organisms aren't
11 entrained through the cooling system. It was not
12 accounted for otherwise. And our study was conducted
13 in a consistent manner with that.
14 JUDGE JACKSON: Okay. Are you quite
15 confident then of the results where you sampled out in
16 the flow of the river and got an idea of the density
17 of organisms there and the drift population. And then
18 you measured back in the inlet canal and you could
19 calculate a fraction then, roughly, of what fraction
20 of that population drifting by would end up in your
21 inlet canal. And what's your bottom line on that?
22 What fraction based on these measurements and your
23 interpretation and analysis, what fraction end up in
24 the inlet canal?
25 MR. DODD: Yes, I am confident. Because

1 the study was conducted as were earlier studies in the
2 same area, in the same manner. Our measurements
3 indicated that the entrainment sample was
4 approximately -- the entrained community was
5 approximately 36.4 times less than the source water
6 community. So it's indeed a very, very small
7 percentage of source water community that gets
8 entrained.
9 JUDGE JACKSON: Okay. Let me ask you a
10 question then about what was entrained. In an answer
11 to question 17 in your direct testimony, I believe
12 it's on page 12, you identify some of the taxa that
13 you collected in your study. And some you said were
14 unidentified. Why were some of them not identified?
15 MR. DODD: In the realm of conducting
16 entrainment studies or studies of eggs, fish eggs and
17 larval drift it's not uncommon to have organisms that
18 are unidentifiable to species. And sometimes often to
19 only to family level.
20 It's a matter of being able to technically
21 identify an egg or a larvae to the lowest practical
22 taxon. It's the state-of-the-art, in other words.
23 JUDGE JACKSON: Okay. Did you collect any
24 Robust Redhorse?
25 MR. DODD: No, sir. We did not.

1 JUDGE JACKSON: How do you know that?
2 Could they be in this unidentified group possibly?
3 MR. DODD: We did collect species of the
4 Catostomidae, which is the family name for the
5 suckers. The Robust Redhorse is a member of that
6 family. But, frankly, there's not enough --I don't
7 know. Because Robust Redhorse is a relatively recent
8 discovery and there's still work being done on
9 identification of the larvae and eggs out of the
10 University of Georgia.
11 I don't know -- I honestly don't know
12 whether or not early life history taxonomists could
13 identify a Robust Redhorse egg from other Catostomidae
14 eggs.
15 JUDGE JACKSON: Yes. But your testimony
16 is then it was a state-of-art analysis and they went
17 as far as they could in terms of identifying them.
18 And in doing that, they did not identify any Robust
19 Redhorse?
20 MR. DODD: That's correct.
21 JUDGE JACKSON: Okay. I guess one more
22 question on the entrainment study. And you point out
23 in your report that your samples were taken between
24 March 2008 and February of 2009. And since this is
25 really taken under drought conditions and flow

1 conditions that may not be what you would describe as
2 average if you look back a number of years or decades,
3 do you think your results could have been in anyway
4 impacted so that they may not be applicable under
5 other conditions of higher flow and so are, are you
6 confident that they're generally applicable?
7 MR. DODD: I'm confident that they're
8 applicable. I have little doubt that there's always
9 change of some sort from year-to-year in fish
10 communities. And the drought now at the time we
11 sampled during the second consecutive year of extreme
12 drought in Georgia, record drought, undoubtedly that
13 has some effect on the fish community as it did
14 everywhere else in the southeast.
15 I'm confident what we sampled is
16 representative of the conditions that were afforded
17 that community.
18 This business about variation from season-
19 to-season and year-to-year it's evident in past
20 sampling on the Savannah River as well from Savannah
21 River plant studies. For example, in -- whether or
22 not there's a direct tie from the number of fish
23 impinged in this case, I'll use it as an example, to
24 the seasonal changes, that may be unclear. But the
25 numbers that were sampled in impingement and

1 entrainment did vary from period-to-period at the SRP
2 at the Savannah River plant as well. And to that
3 degree I'm confident what we collected is
4 representative.
5 JUDGE JACKSON: Okay. Thank you.
6 I'd like to go on and just ask a question
7 then about the impingement study. You projected based
8 on your sampling the number of fish that you would
9 anticipate would have been collected over a year or
10 ten months and had a projection of the number and the
11 total weight of fish.
12 To make sure I have that straight, what
13 was the total? How many fish and what would be the
14 total weight that you would expect based on these
15 measurements?
16 MR. DODD: Yes. The answer to your
17 question lies in the corrected testimony that we
18 submitted today. And the extrapolated number of
19 impinged fish, in other words assuming that the plant
20 operates 365 days a year extrapolating the samples
21 that we collected once every two weeks during that
22 year study, results in an impingement rate of 2,421
23 fish per year at an approximate weight of 30.1 pounds,
24 30.1 pounds of biomass.
25 JUDGE JACKSON: So the average size of

1 these fish, they must be very small?

2 MR. DODD: They are indeed. And we had

3 inserted in a table in the impingement report in the

4 latter portion of the report that describes the length

5 of -- length ranges of different species that were

6 impinged that we observed as specimens collected

7 during the study.

8 The average length is 69 millimeters or

9 less than about 3 inches.

10 The indication is that those are-- for the

11 most part are juvenile or early life stage fishes that

12 were impinged. And a point one could glean from that

13 is that in the wild many of those fish may suffer a

14 natural mortality before they reach stock size or size

15 of sexual maturity anyway. It's just a point to note.

16 It's not uncommon in my experience in sampling,

17 performing impingement studies at other plants here in

18 Georgia and South Carolina that most of our fish are

19 juvenile size. This was not terribly unexpected.

20 JUDGE JACKSON: Okay. I guess one last

21 question on how you interpret these results. When you

22 looked at entrainment you were able to make some

23 measurements of the drift population and then make the

24 measurements in the canal. In the case of impingement

25 you collected the fish and classified them, and

1 projected the total weight. And I'll admit that 30
2 pounds over a year doesn't sound like a lot. But I
3 just wondered since you don't really have a way to
4 measure that population, that you conclude that it
5 would be very minor. What kind of rationale do you
6 use then to show that 30 pounds is minor?
7 MR. DODD: Yes, sir. That's right, I do
8 conclude that it's minor. And it's based on just some
9 points of perspective.
10 For example, in 1988 there was data
11 collected for creel surveys in the Savannah River,
12 Savannah Basin. These were data that were contributed
13 by the State of South Carolina and State of Georgia.
14 And I think I want to refer to some notes I have here.
15 But in that study they reported angler harvest in 1988
16 in the Savannah River of 152,000 pounds fish. These
17 were fish that anglers went out and caught over the
18 course of a year. We compare that, of course, to the
19 30 pounds that we impinged, theoretically, under that
20 extrapolation.
21 Also in 1989 as reported by -- this was a
22 study that came out of the Savannah River Laboratory.
23 They reported 1989 commercial fish harvest of
24 approximately 12,081 pounds of fish, and that included
25 species of catfish even sturgeon at the time.

1 And also in the early '80s this was
2 summarized from, I think it was an SRP 1992 report,
3 where they reported anglers that collected 305,778
4 fish per year during the early 1980s. And I know
5 that's not a biomass estimate, that's a numbers of
6 fish. But those are tremendous numbers compared to
7 the 30 something pounds of fish that we would see
8 based on this sample.
9 JUDGE JACKSON: Okay.
10 JUDGE TRIKOUROS: Mr. Dodd, may I ask a
11 question? I'm not an aquatic biologist, but it seems
12 to me that simply the mass of fish is not an indicator
13 of the impact that the plant might have on the biology
14 of the river. It would seem to me that the smaller
15 fish in very large numbers who would never then grow
16 to the fish -- a fish could be the size that we're
17 talking about that anglers would catch would be much
18 more significant. Is that an incorrect assumption?
19 MR. DODD: Well, again, a majority of
20 those fish wouldn't survive -- based on what is just
21 generally known about life history of fishes and this
22 life of attrition that fish have from the time they
23 hatch to reaching an adult size, a only extremely
24 small percentage of them survive to that point anyway.
25 It is true that fish are very fecund.

1 They have a tremendous potential, spawning potential
2 to reproduce. One pair of Bluegill, for example, can
3 spawn out thousands of fish in a single season.
4 So I'm not sure I'm answering your
5 question exactly. But I don't know that's any more or
6 less significant that we have juveniles versus adult
7 fish impinged at the intake structure.
8 JUDGE TRIKOUROS: Well, let me rephrase
9 this. The fact that X number of pounds of fish are
10 caught by fishermen is not directly correlatable to
11 the weight of fish that you found, that you estimated
12 for a year of 30 pounds, because of the very small
13 size of these fish? Clearly there were many, many,
14 many fish involved to come up with 30 pounds, you
15 know, in this case, right?
16 MR. DODD: Well, yes, 2,451 fish based on
17 that estimate.
18 JUDGE TRIKOUROS: Yes.
19 MR. DODD: And maybe to couch that in
20 perspective, we know from earlier SRP studies right
21 across the river that from '74 through the mid-1980s
22 in three different study sequences in there the rate
23 of impingement at that structure or that facility
24 ranged from about 2600 fish per year to as high as
25 just over 7,000 fish per year. And the conclusions by

1 those scientists at the time after examining this
2 level of loss were words like:
3 The area near this facility, this is the
4 middle Savannah River, experienced small localized
5 area losses with no risk to the Savannah River;
6 No evidence to correlate operations with
7 fishery's trends;
8 Losses did not appear to have a
9 significant impact on Savannah River Fisheries, and;
10 Also in their own words "No basis to
11 conclude adverse effects."
12 And so the numbers we impinged, regardless
13 of the apparent relationship it might have to angler
14 success or fishes available for angling, represents an
15 extremely small number.
16 JUDGE JACKSON: I'd like to ask a question
17 about the thermal plume study. We saw, again, some of
18 the results projected. It's the following, it's my
19 understanding when this particular study was done the
20 ambient temperature of the river was fairly high and
21 it turned out that the temperature of the water coming
22 out of the discharge pipe was only about a degree
23 higher than the temperature of the river, is that
24 correct?
25 MR. DODD: Yes, sir. That's correct.

1 JUDGE JACKSON: And we saw those results
2 where you depicted a relatively small plume there.
3 And then you showed that a good part of the river had
4 a similar temperature near the surface that you said
5 was due to just solar heating, solar radiation.
6 I guess my question comes back to if you
7 look at the analysis in the FEIS and the results that
8 you had there, that was more of a situation where
9 there was like a five degree difference between the
10 discharge temperature and the ambient temperature.
11 And given those differences are you able to conclude
12 anything about the accuracy of the FEIS calculations
13 or the CORMIX code validity given that they were
14 somewhat different, quite different situations?
15 MR. MONTZ: This is Matt Montz for the
16 applicant.
17 In fact, if we want to pull up the
18 exhibit, that's SNC-11 are the images from the thermal
19 study.
20 JUDGE BOLLWERK: Do you want to bring that
21 up, please?
22 MR. MONTZ: The approximate size of that,
23 and that's on a roughly half degree isotherm, was
24 approximately 50 feet wide by 100 feet long. Now the
25 CORMIX model that was done in the FEIS projected a

1 plume that was approximately 15 feet wide by 97 feet
2 long. But that was for the five degree isotherm.
3 We don't even have a five degree isotherm
4 on this plot. The discharge, thermal discharge from
5 Vogtle was less than one degree higher than the
6 ambient water conditions at the time of this survey.
7 JUDGE JACKSON: Yes. I mean the conditions
8 were not different. My question just had to do whether
9 or not you could use that then to relate back to the
10 situation you had in the FEIS where you had analyzed
11 the plume with CORMIX and came up with those
12 dimensions or if this situation was enough different
13 where the temperature difference was really quite
14 small?
15 MR. MONTZ: Well, the assumption used by
16 the NRC in their analysis were very conservative.
17 They combined the intake and the discharge -- the
18 discharge structures from both Units 1 through 4 in
19 their analysis. And they also looked at extreme water
20 conditions; in other words the highest possible
21 discharge temperature from the plant and the highest
22 possible water conditions -- I'm sorry. For the five
23 degree isotherm it was the lowest recorded water
24 temperatures. And so there were some very extreme,
25 very conservative assumptions that were made in the

1 CORMIX analysis that are hard to equate to the actual
2 sampling we did out in the river.
3 JUDGE JACKSON: But there's nothing in
4 your sampling that would contradict the notion that
5 those calculations were very conservative or is there
6 anything that can support them?
7 MR. MONTZ: There's nothing in our thermal
8 study that would contradict the findings of the CORMIX
9 model.
10 JUDGE JACKSON: What about supporting the
11 CORMIX model?
12 MR. MONTZ: They certainly support the
13 CORMIX model, and that is a conservative model.
14 JUDGE JACKSON: Okay. Thank you.
15 JUDGE TRIKOUROS: But would you be able to
16 say in general that there would be no conditions of
17 either discharge flow rate, discharge temperature,
18 river flow rate or river temperature that would lead
19 to a condition that would be equal to or greater than
20 the CORMIX analysis?
21 MR. MONTZ: No, there would not be a
22 condition like that.
23 JUDGE TRIKOUROS: So under no
24 circumstances? So you're saying the CORMIX analysis
25 was conservative under all circumstances?

1 MR. MONTZ: Yes, sir.

2 JUDGE JACKSON: Those are the questions

3 that I had on the direct testimony.

4 Do you have anymore, Judge Trikouros?

5 JUDGE TRIKOUROS: Yes, I have a couple.

6 JUDGE JACKSON: Before we move to the

7 rebuttal.

8 JUDGE TRIKOUROS: The intake flow rate,

9 when you were doing your study over that period, was

10 it fairly consistent?

11 MR. DODD: Yes, sir. It was. That year

12 that we performed the study the average flow rate was

13 about 4,496 cfs, I think if my memory serves me

14 correctly. And the inflow rates for pumping -- that's

15 the river discharge. The inflow rates for pumping

16 that year average about 63 million gallons per day or

17 near the rated normal operational pumping capacity for

18 cooling inflow.

19 JUDGE TRIKOUROS: Under different

20 circumstances that intake flow rate could change

21 depending on how they're operating the plant, I guess,

22 at a given period of time?

23 Would you be able to say that your

24 conclusions are linearly proportional intake flow

25 rate? I mean, can such a statement be made? If the

1 intake flow rate doubled, would your effects double?

2 MR. DODD: As far as impingement or

3 entrainment?

4 JUDGE TRIKOUROS: I'm sorry, for

5 impingement and entrainment?

6 MR. DODD: Impingement and entrainment?

7 No, sir. We can't say that. And i say that based on my

8 observations of past studies. We haven't a particular

9 correlation related to river flow and impingement

10 rate. It's more tied to seasonal attributes,

11 possibly. And then in certain instances to temperature

12 effects. Some fish will succumb to temperatures and

13 become more susceptible to impingement

14 So, yes, I can't say that higher flow

15 necessarily would be a linear relationship, no.

16 JUDGE TRIKOUROS: So the answer is it's

17 not known? In other words, it might make it worse or

18 it might make it better? Is that the answer?

19 MR. MONTZ: Your Honor, this is Matt

20 Montz.

21 It's difficult to equate impingement rates

22 with flow rates. A better way to think about it is

23 it's through-screen velocities, the actual flow rate

24 through the screens. And as those increase,

25 impingement can increase. But it's really not a

1 condition of flow.

2 JUDGE TRIKOUROS: Just fundamentally, the

3 velocity would double if the intake net flow were

4 doubled, given it's a fixed area and that would be a

5 given, right?

6 MR. MONTZ: That's not necessarily true.

7 It is a fixed area, however we would increase flows by

8 using additional screen bays. And so that increased

9 velocity would be offset by additional screen area.

10 In other words, when we're only operating

11 two pumps, water is only flowing through those screens

12 for those pump bays. And as we bring on additional

13 pumps the water would flow through that additional

14 screen bay.

15 JUDGE TRIKOUROS: So I guess the basic

16 question is do you feel that your study is applicable

17 to all modes of planned operation?

18 MR. MONTZ: Yes, sir.

19 JUDGE BOLLWERK: I had a question for Mr.

20 Dodd. Let me go back to a point that was made.

21 You gave us some testimony about the

22 number of anglers at different points, what Savannah

23 River had in terms of their numbers, which are

24 certainly on the larger side compared to what you all

25 had. That may have been a different baseline to a

1 degree. I mean, did they get them all, is one way to
2 put it? I mean, if that substantially reduced what's
3 in the river, then maybe the 2,451 that you got is
4 relatively speaking a large number?
5 What's the baseline here or how do we know
6 what that baseline is compared to when those studies
7 were taken and what we have now?
8 MR. DODD: That's a good question. I
9 think -- and a way to address it is by looking at
10 other data. There are agencies who monitor the
11 Savannah River Fishery. For example, the Georgia
12 Department of Natural Resources routinely conducts
13 fishery surveys of the Savannah River and they monitor
14 that fishery.
15 To my knowledge, they don't produce a
16 population estimate, but they certainly make
17 management decisions based on relative abundance and
18 trends in relative abundance.
19 As recently as 2009 this year the Georgia
20 DNR Fisheries Group produced yet another fishing
21 prospectus for 2009. And this is for the Savannah
22 River below the new Savannah Bluff Lock and Dam.
23 Their fishery prospect --
24 JUDGE BOLLWERK: And what is that relative
25 to the plant? I'm sorry.

1 MR. DODD: Yes. That's about 30 river
2 miles upstream. Thirty-six river miles upstream. I
3 forget the exact number.
4 But their prospect, and they're clear to
5 state this, is based on the surveys that their
6 biologists do. They look at past fishing trends. They
7 look at available angler surveys. They have -- they
8 take a census of sorts of marine operators if they're
9 in the area to talk about fishing trends. And their
10 forecast for 2009, for this year, may give us an
11 indication of what the fishing in the fishery looks
12 like.
13 When thinking back about the changes over
14 time, if I may, I was going to pull up a summary of
15 their report that's available online, no less.
16 In it's Savannah River 2009 Fishing
17 Prospectus GDNR, Georgia Department of Natural
18 Resources, indicated that Bluegill and Red-Ear Sunfish
19 are abundant.
20 JUDGE BOLLWERK: Is this in the evidence?
21 Is this anything that anybody's marked up to this
22 point?
23 MR. DODD: No, sir. It's not. It's not.
24 Am I not allowed to reference this study.
25 JUDGE BOLLWERK: Well, in one sense, I

1 don't have a problem with it being referenced if we're
2 going to able to mark it as evidence. Do you have
3 electronically?
4 MR. DODD: I can provide it
5 electronically, yes.
6 JUDGE BOLLWERK: And how quickly could you
7 do that?
8 MR. DODD: Certainly today over the lunch
9 break.
10 JUDGE BOLLWERK: Okay. Maybe we'll look
11 at that.
12 Can we provide also a copy of that to the
13 intervenors?
14 MR. DODD: Yes. And I'd like to state
15 it's not the actual report, this is excerpted from the
16 Georgia DNR website.
17 JUDGE BOLLWERK: Okay.
18 MR. DODD: As cited in our report that I
19 have -- well, I'll back up by saying that when -- what
20 has been submitted into evidence today is our final
21 ten month report. When we submitted that during
22 prefiling there were still two month's of studies left
23 to go in the impingement study. We have since
24 finalized that impingement report into a 12 month
25 study.

1 This information that I'd like to present
2 here about the status of the Savannah River Fishery
3 today it's in that 12 month report that is available
4 for submission, should the Board choose to entertain
5 that.
6 JUDGE BOLLWERK: Okay. Let's do it this
7 way, why don't you go ahead and produce an electronic
8 version of that. Maybe you can give a copy, a paper
9 copy if need be to the staff and the intervenors. And
10 let's come back to this subject when we can have that
11 prepared.
12 MR. DODD: Yes.
13 JUDGE BOLLWERK: I don't want to have a
14 discussion of it when people haven't seen it. And
15 maybe the Board members want to look at it as well.
16 So --
17 MR. DODD: Okay.
18 JUDGE BOLLWERK: And at that point we'll
19 identify for the record if you look at it and you do
20 have any objections to it, we can deal with it that
21 way. But I don't want to get a bunch of discussion on
22 the record about a document that nobody's look at. So
23 does that sound like a fair way to proceed at this
24 point. Okay.
25 So we'll put this subject this back off,

1 but we'll come back to it.

2 Thank you.

3 JUDGE JACKSON: I'd like to move on then

4 to the rebuttal testimony that was submitted, prefiled

5 by Mr. Dodd and Mr. Montz. I just had one question,

6 and it relates to one of the Q&As in that prefiled

7 testimony. It was the answer to 6. And you were

8 discussing the temperatures during spawning season and

9 saying that the river temperatures were somewhat lower

10 then. And that in looking at the impact of the

11 thermal plume then because the river temperatures were

12 lower, the discharge temperature you point out cannot

13 be more than five degrees above the river temperature

14 which keeps during spawning season that maximum

15 temperature down.

16 The question is how does Southern ensure

17 that that actually happens? How is that monitored and

18 controlled?

19 MR. MONTZ: To my knowledge it's not

20 direct -- the discharge temperature is not directly

21 monitored in the river. It is a condition of the

22 NPDES permit that Unit 1 and 2 have. And a similar

23 CORMIX model was done for that.

24 JUDGE JACKSON: How do you know, though,

25 in the summer that you don't have conditions where

1 maybe you're discharging water that's ten degrees?

2 MR. MOORER: Can I add something to this?

3 I'm Tom Moorer for the applicant.

4 Regarding the Unit 1 and 2 thermal issue,

5 models as Matt said models were run for 1 and 2 as

6 well. And that was submitted as part of the 1 and 2

7 final environmental statement. And very similar to

8 the CORMIX models for 3 and 4 that you've seen in

9 evidence already, the models showed a very, very small

10 thermal effect from 1 and 2. Almost to the point

11 where you couldn't physically go out and measure the

12 plume.

13 And there was some initial verification

14 done, very similar to what we've done here for 1 and

15 2. But when that was submitted to the Georgia

16 Department of Environmental -- EPD, Georgia EPD, for

17 permitting under the NPDES program, the Georgia EPD

18 chose to not attach a monitoring requirement for

19 temperature because they felt that -- and I can't

20 really suppose -- I don't what they -- I can't say

21 exactly what they felt, but they did not attach a

22 monitoring requirement. And I assume that's because

23 the effect was so small, there was no need for one to

24 be there.

25 JUDGE JACKSON: Like I said, there hasn't

1 really been monitoring then. And would you anticipate
2 the same thing with the new Units 3 and 4.
3 MR. MOORER: I can't suppose what they do
4 for the new units. But I would assume that a physical
5 verification of the model might be appropriate. They
6 might do that. But I don't -- I don't think they might
7 take the same approach that they took last time with
8 regard to temperature. The temperature is so low
9 relative to the discharge in the summer in particular,
10 that it's just almost difficult to measure the effect
11 physically.
12 Now monitoring the temperature from the
13 outfall, again, the worst case results are documented
14 in the EIS, and I think it's 91 degrees is the maximum
15 blowdown temperature, design blowdown temperature. So
16 the effect is -- you know, would not exceed the water
17 quality standard of 90 degree theoretically, but by
18 one degree at the end of the pipe.
19 JUDGE JACKSON: So you see this five
20 degree limit as a permit issue then?
21 MR. MOORER: It certainly would be
22 addressed in the NPDES permit process; that's normally
23 the mechanism that's used. But for Unit 1 and 2 it was
24 not an issue. The models showed a very small five
25 degree plume as showed a small maximum plume.

1 So I guess my point is that the effect is
2 very small for 1 and 2.
3 JUDGE JACKSON: Do you have any follow-up
4 questions on that, Judge Trikouros?
5 JUDGE TRIKOUROS: So you don't have a five
6 degree -- I don't know what to call it -- an
7 environmental tech spec? But it would be a discharge
8 restriction that the discharge temperature would not
9 be greater than five degrees of the river water
10 temperature?
11 MR. MOORER: Again, Tom Moorer for the
12 applicant.
13 The state water quality standard has two
14 parts to it. It has a 90 degree Fahrenheit maximum
15 temperature after mixing. And a five degree delta-T
16 requirement. And I guess what I'm trying to say is
17 that the modeling that was done for 1 and 2, very
18 similar as the modeling for 3 and 4, showed that that
19 plume was so small that for 1 and 2 EPD chose not to
20 require end of pipe monitoring or periodic thermal
21 studies.
22 JUDGE BOLLWERK: And again, when was that
23 done? I'm sorry. When was the permit issued or when -
24 -
25 MR. MOORER: The FEIS was done in 1985, I

1 believe, the final EIS. The NPDES permit was granted -
2 - the first one was granted in that same time period
3 when the plant went operational and it's been revised
4 every five years since then.
5 JUDGE BOLLWERK: So the most recent one
6 was, if you know?
7 MR. MOORER: It's a little misleading
8 because the existing permit has been held in abeyance
9 because of a change the EPD's making from a point
10 source discharge model to a water quality based basin
11 wide management model. So the permit was not renewed
12 at the last time; it's been held. The existing permit
13 has been extended for several years until EPD gets
14 that program in place.
15 JUDGE BOLLWERK: And so as part of that
16 would they do anything that's going to affect the
17 particular measurements?
18 MR. MOORER: I'm not sure I understand
19 your question.
20 JUDGE BOLLWERK: I'm just saying, is there
21 anything that the -- I'm not stating it very clearly.
22 The process that you're undergoing, is it
23 going to have any impact on the measurements or the
24 permit, or what you're required to do or not required
25 to do?

1 MR. MOORER: The information that we've
2 developed for the CORMIX model as discussed in the
3 FEIS would be part of the information that would be
4 submitted to Georgia EPD to support the NPDES permit.
5 So they would evaluate that information and they may
6 ask additional -- for additional information. But they
7 will issue an NPDES permit based on that model run
8 relative to thermal.
9 JUDGE BOLLWERK: All right. And obviously,
10 for Units 3 and 4 obviously that hasn't been done yet?
11 MR. MOORER: No, sir. That has not been
12 done.
13 JUDGE BOLLWERK: Okay. And for 1 and 2 has
14 it been done recently? I guess that's my --
15 MR. MOORER: It was the last renewal was
16 up for renewal in 2005.
17 JUDGE BOLLWERK: All right.
18 MR. MOORER: And the permit has been
19 extended without renewal for the last three years
20 pending the change over by EPD to a new program for
21 their permitting. In other words, they're going to a
22 basin wide permitting strategy and they just extended
23 the permits as is until that strategy is in place.
24 JUDGE BOLLWERK: Okay. And as part of
25 that strategy, and I'll go back to where I think I was

1 going originally, is there anything else they're going
2 to require you to do relative to Units 1 and 2 that
3 would have an impact in terms of what we're talking
4 about here, the thermal?
5 MR. MOORER: I'm not aware of anything in
6 particular that's been identified that they would
7 require to retrofit on 1 and 2. I'm sure that they
8 would look at for 3 and 4, they would look at them
9 altogether. In other words, they would be looked at a
10 four unit site for permitting when 3 and 4 become
11 operational.
12 JUDGE BOLLWERK: And you obviously have to
13 have that permit in place before you can have your
14 authority to operate, at least under the state's
15 authority?
16 MR. MOORER: Yes, sir.
17 JUDGE BOLLWERK: And when would you
18 actually apply for the permit?
19 MR. MOORER: We anticipate the permit
20 would be applied for, probably two years before the
21 first goes operational. So 2014, 2015.
22 JUDGE BOLLWERK: All right. Thank you.
23 MR. MOORER: Thank you.
24 JUDGE TRIKOUROS: So there's testimony
25 that actually says there's a limit of five degrees is

1 incorrect? There is testimony that says there's a
2 five degree limit, and that five degree limit was sort
3 of implied rather than measured? There is no five
4 degree limit? There's an implied it will not ever get
5 greater, therefore one doesn't ever have to monitor
6 it? Is that --
7 MR. MOORER: Let me make sure I understand
8 your question.
9 Again, Tom Moorer for the applicant.
10 The five degree limit is a Georgia State
11 water quality standard that's based on the EPA water
12 quality standards. And, again, it has two parts. One
13 is a 90 degree maximum, 90 degrees Fahrenheit. And
14 then it has a five degree variation or delta-T limit.
15 And it's implicit in the permit requirements that you
16 cannot violate either of those requirements. And I
17 guess what I'm trying to suggest is that the permit
18 was issued without monitoring requirements because the
19 state felt that there was no need to monitor. The --
20 the effect was so small that monitoring really didn't
21 afford any additional information -- you know, there's
22 no -- no reason to monitor.
23 JUDGE TRIKOUROS: Right. So that for any
24 river flow and any discharge temperature, and
25 discharge mass flow rate, you would never violate the

1 five degree delta-T limit?

2 MR. MOORER: Again, if I understand your

3 question correctly, the models that were run for Unit

4 3 and 4, as Mr. Montz stated, were very conservative

5 and there was no scenario where -- for the model

6 scenarios that were run that violated either of those

7 permit requirements.

8 I feel like -- did I not answer your

9 question? I'm sorry.

10 JUDGE TRIKOUROS: Well, I think it's a

11 concern on the part of the intervenors that, you know,

12 there is a flow rate that might cause a thermal plume

13 issue. And I'm trying to explore this to understand

14 where the limitations are. And one would have to

15 assume that the EPD looked at all possible -- not just

16 one data at one point, but looked at all possible

17 variations and concluded that there's no need to

18 verify, if you will. I have to draw that assumption.

19 MR. MOORER: Yes, sir. And I think your

20 assumption is correct. They looked at a range of

21 flows. It wasn't a single flow. They looked at a

22 range of flows that included normal and low flows.

23 And those both were modeled and the results of that

24 model were reviewed. And they issued a permit based on

25 that information. And the permit did not have

1 monitoring requirement in it.

2 JUDGE TRIKOUROS: Thank you.

3 JUDGE JACKSON: That concludes the

4 questions that we have that relate to the rebuttal

5 testimony. I think we can go on then.

6 I'd like to next direct our attention to

7 the direct prefiled testimony of Mr. Moorer. I have a

8 few questions to start out.

9 Mr. Moorer, you state in your answer to

10 question 7 in your prefiled testimony. I believe it's

11 on page 5.

12 MR. MOORER: Yes, sir.

13 JUDGE JACKSON: The following. You say

14 "The staff's FEIS relied on the ER consultation with

15 regulatory agencies and its own independent analysis

16 in reaching a conclusion that aquatic impacts were

17 small. Both the ER and FEIS contained thorough

18 discussions of aquatic impacts." That's the quote.

19 I'd like to just explore a little bit the

20 notion of this thorough discussion which you clearly

21 agree needs to be part of this.

22 We're always involved with an issue of how

23 much is enough. And I'd like to ask you in your

24 opinion what is the minimum amount of information that

25 should be included in an cumulative impacts analysis

1 for it to meet this standard of a thorough discussion?

2 MR. MOORER: Well, Your Honor, again Tom

3 Moorer for the applicant.

4 I think the amount of information is

5 related to the impact that's looked at. In other

6 words, if you can with existing information, available

7 studies arrive at a conclusion that an impact is

8 small, then there really would be no reason to go do

9 exhaustive additional studies. If the preliminary

10 work that was done with the available information

11 showed that the impact could be moderate or large, I

12 think there would be an indication then that you might

13 need to do some additional work.

14 And in the case of Vogtle 3 and 4 the

15 information that was reviewed in the ER and in the

16 subsequent final environmental statement was based on

17 a large record of studies. And the conclusion that was

18 reached by the staff was that the impact was small. I

19 believe that the studies that were used were

20 applicable and that there was more than enough

21 information, as I stated in my testimony, to reach

22 that conclusion.

23 JUDGE JACKSON: Okay. In reaching the

24 conclusion that the impacts were indeed small, what

25 were the past and present and reasonably foreseeable

1 actions or activities that were included in the impact
2 analysis then?
3 MR. MOORER: If you're referring to the
4 cumulative impacts --
5 JUDGE JACKSON: Yes.
6 MR. MOORER: It looked -- yes, sir. It
7 looked at the -- all the withdrawals that were within
8 a reasonable distance, and that would have included
9 all the Savannah River Site withdrawals, the Area D
10 Power Station, the Urguhart Plant, the South Carolina
11 Electric and Gas Plant. And evaluated those in a
12 cumulative fashion to determine the effect of those
13 withdrawals on the river. And determined that those
14 withdrawals were not significant relative to the -- in
15 other words, they didn't add a significant cumulative
16 impact on top of the Vogtle impact.
17 JUDGE JACKSON: Okay. You think you've
18 done a good job of capturing the important
19 contributors or activities or impacts? How do you
20 know you haven't left something out?
21 MR. MOORER: I think we've done a good job
22 with it. Yes, sir. I think the Savannah River itself
23 is one of the large -- the most studied rivers in the
24 country, really, and certainly in the southeast.
25 There's a lot of data available on the Savannah River.

1 A lot of the data is proximate to the Vogtle site.
2 And most of it is very conclusive. It tends to
3 support -- in other words, one study supports the
4 next. There's not a lot of a -- in fact, I'm not
5 aware of anything out there that was an outlier that
6 said this finding is dramatically different from
7 another study. They all tend to build on each other.
8 JUDGE JACKSON: Okay. Well, I'd like to
9 go to question 7. Let me find it here. It's the
10 question we were in a little farther down. You stated
11 that the Savannah River Site, the SRS study is
12 concluded that at intake flows many times larger than
13 those proposed for Vogtle, impingement and entrainment
14 impacts remain small and do not result in any
15 quantifiable impact to the fishery or the general
16 aquatic community. Yet in Dr. Young in his rebuttal
17 testimony he stated that the SRS is consistently
18 reported as a cause of decline of Savannah River
19 aquatic species.
20 So we have on the one hand and the other.
21 How do you reconcile that contradiction.
22 MR. MOORER: Again, Tom Moorer for the
23 applicant.
24 I am familiar with Dr. Young's testimony.
25 And the study that we were -- or one of the studies

1 that we were referring to, in fact several of the
2 studies that we used to make the conclusion that we
3 state regarding impingement and entrainment in
4 particular are based on studies done on Savannah River
5 intakes. And as you said, the withdrawal rates are
6 substantially larger, on the order of almost an order
7 of magnitude larger. And the studies concluded that
8 the impacts were small from impingement and
9 entrainment.
10 And Dr. Young points out a reference in a
11 book by Marcy and others called *Fishes of the Middle*
12 *Savannah River*. And the paragraph that he points to
13 makes a statement, and I guess we can pull it up if
14 you'd like to see it. We can actually put it up on an
15 exhibit if you need. But just paraphrasing makes a
16 statement that the -- that power plants located on the
17 Savannah River, and he's referring to the Savannah
18 River Site plants as well as the Vogtle plant, have an
19 impact on the fishery. And in the next paragraph,
20 though, he refers to the very study -- one of the very
21 studies that we cite, and that's the Savannah River
22 Site Study that was done in -- by DuPont. And he says
23 that that study indicates that the impact from
24 impingement and entrainment is small.
25 So I think what-- what I concluded from

1 that was that there's a general statement that says
2 power plants have an impact on the fishery. I don't
3 think that anyone would argue that there is an impact.
4 I think the question is the magnitude of the impact.
5 And he states further in the same reference that the
6 impact associated with impingement/entrainment at the
7 Savannah River Site is small.
8 And it seems intuitive to me that a site
9 withdrawing 300,000 gallons a minute entraining based
10 on that, if you just used the method of percent
11 withdrawal, in other words the percent of withdrawal
12 ratio to the river flow, that the impact is
13 significantly larger with that and the impact was
14 still small.
15 So the intuitive conclusion is that the
16 impact from a smaller withdrawal such as Vogtle would
17 be commensurately smaller.
18 And I think the studies, if you look at
19 the studies and then look at the studies that Mr.
20 Montz and Mr. Dodd did, they just reaffirm that same
21 information that the entrainment/impingement impacts
22 associated with the Vogtle intake are small.
23 JUDGE JACKSON: Okay. Thank you, Mr.
24 Moorer.
25 A little follow-up on your answer to

1 question 8. You state "The ER in subsequent responses
2 to RAIs and material collected during site visits
3 provide a clear well documented assessment of the
4 baseline aquatic community in the vicinity of Plant
5 Vogtle."
6 There's also an issue, let's grapple with
7 the issue of how much is enough. Another issue is
8 what does "in the vicinity" mean? How close do you
9 have to be?
10 What do you mean when you say in the
11 vicinity?
12 MR. MOORER: Judge, I don't know if you
13 remember, in the prehearing we actually put a map up
14 that showed the proximity of the Savannah River Site
15 to the Vogtle site. And I don't know whether you
16 recall the map or not. But I could in my playing days
17 could have thrown a baseball from the Vogtle intake
18 and hit the Savannah River Site. I don't know that I
19 could do that now. But the site is, it seems to be
20 right across the river from the Vogtle site. And the
21 intakes are within two or three miles from the Vogtle
22 intakes.
23 So to me that's proximate. And, in fact,
24 some of the sample points, and I think maybe Dr.
25 Coutant could elaborate on this, from the SER studies

1 are located at areas that are actually on the -- you
2 know, they approximate areas on the Vogtle site.
3 They're really intended to look at the impacts
4 associated with Vogtle 1 and 2. So many of the
5 Savannah River Site studies monitor the same physical
6 areas that we would monitor for Vogtle.
7 JUDGE JACKSON: So how far upstream or
8 downstream do you think that a given species needs to
9 be looked at in order to be comprehensive? I mean,
10 are you thinking that within, like a quarter of a
11 mile, is that what you mean by "in the vicinity," or a
12 mile or two miles?
13 MR. MOORER: I think it's -- I think it's
14 larger than a quarter of a mile. But could I ask Dr.
15 Coutant maybe to comment on that? This is certainly
16 his area of expertise.
17 JUDGE JACKSON: Sure.
18 DR. COUTANT: Sure. Well, one perspective
19 is to look at the whole river system from essentially
20 Augusta down to the estuary and you can develop a
21 perspective of where things happen biologically within
22 that area such as spawning is primarily, for many of
23 the species, occurring in the Augusta Shoals which is
24 30 miles upstream.
25 With that sort of river-wide perspective,

1 then you can narrow down to the "vicinity of the
2 Vogtle site," which the Savannah River Site certainly
3 is. And Mr. Moorer suggested that many of the sample
4 locations that were used by the Academy of Natural
5 Sciences of Philadelphia that did work for the
6 Savannah River Site were literally within a few
7 hundred yards of some of the sites' spots that we're
8 interested in for Vogtle.
9 And then also the work done by the Georgia
10 and South Carolina Natural Resources Departments
11 include that vicinity.
12 So I think rather than focus on how many
13 yards upstream and downstream of the actual intake or
14 actual discharge, it's worthwhile to take a broader
15 perspective of the whole river system and where things
16 are happening. But certainly we do have data close to,
17 that is within a half a mile or so, certainly within a
18 mile or so of these Vogtle facilities.
19 JUDGE JACKSON: Okay. A quick question
20 that relates to your testimony in answer 10. You say
21 at one point "On the other hand eggs of most game
22 species such as bass, bream and catfish, are deposited
23 in discrete nests or beds where they remain until they
24 hatch. And these eggs are not normally found in the
25 water column and are not normally subject to an

1 entrainment by water intakes."

2 Could you expand on the basis for that

3 assertion? How do you know that's correct?

4 MR. MOORER: Since it's in my testimony,

5 I'll start but I'll ask Dr. Coutant if he might follow

6 me with his additional comments since this is an area

7 of expertise for him.

8 In reviewing the literature that we looked

9 at for impingement and entrainment-- I'm an engineer.

10 I'm not a biologist. I do have a degree in

11 environmental science as well. But in looking at it

12 it's fairly clear that there are certain types of

13 species -- there are basically threes that we

14 identified, three types of spawning behaviors.

15 There was what we called nesting or

16 discrete sites. And those are the game fish like the

17 bream, the bass, the catfish I think are in that

18 category.

19 The sturgeon actually lays its eggs on

20 substrate. And they're adhesive, so they stick to the

21 bottom to substrate of some type, either gravel bars,

22 a cobble structure of some kind. And they remain for a

23 while at that point in time. They're adhesive and

24 demersal, meaning that they sink and they stick.

25 And then third type is the type that

1 broadcasts into the water column. And those you would
2 expect to find in the water column.
3 And I guess the point I'm trying to make
4 in my testimony is that the uniform distribution
5 assumption is extremely conservative relative to those
6 species that nest. Because you would not expect to
7 find those eggs or larvae in the water column.
8 JUDGE JACKSON: Okay.
9 DR. COUTANT: Mr. Moorer is doing very
10 well for an engineer.
11 DR. COUTANT: As he says, there are many
12 types of fish that spawn in ways that simply don't
13 make their eggs and larvae available to be entrained.
14 The sunfishes, for example as he said, use nests.
15 They deposit their eggs in nests. They tend to the
16 young in the nest. And they just don't disperse in the
17 general water column.
18 Particularly the questions of the sturgeon
19 which were raised by the joint intervenors, these are
20 species that I mentioned earlier are spawning
21 considerably far from -- from the Vogtle site. They
22 spawn in the few available hard substrates that are in
23 the Savannah -- up in the Savannah River Shoals. The
24 eggs attach to the substrate. The larvae when they
25 hatch are bottom seekers. They tend to go right down

1 into the bottom substrate and don't drift willy-nilly
2 through the water column.
3 So there are many features of the biology
4 of reproduction of all of the assemblage of fish
5 species that we have out there that indicate that many
6 of these progeny are not going to be vulnerable to
7 entrainment. So we're really only dealing with those
8 broadcast spawners like the American shad that
9 specifically spawn in the water column, let their eggs
10 and larvae drift in the water column. So they're the
11 primary focus of the entrainment concern.
12 If that answers your question?
13 JUDGE JACKSON: Yes. Just when fish spawn
14 and in these beds, do you have some feeling for how
15 large a fraction of those eggs do adhere or stay near
16 the bottom? I assume they all don't.
17 DR. COUTANT: Pretty much all of them do.
18 In fact, the biological literature suggests that when
19 you get a nest that's disrupted, for instance, and the
20 eggs are dispersed, that those are essentially lost to
21 the population. That it's only when the eggs are
22 maintained within the nest and tended by the adult
23 fish that they actually survive.
24 Yes, so there's --
25 JUDGE JACKSON: So in your view these

1 spawning areas that are upstream, what 20/25 miles or
2 something like that, are really pretty isolated from
3 the inlet structure? You're not going to get hardly
4 any eggs, is that what you're saying?
5 DR. COUTANT: That's what I'm saying, yes.
6 Right. The progeny that come out of those spawning
7 beds in the Augusta Shoals pretty much stay there.
8 Some of them will drift. The sucker species will have
9 larvae that will drift. But 30 miles is a long
10 distance for something that was spawned up there to be
11 actually drifting by Vogtle. A few will. And a few
12 have been found. There are in fact -- you know, as
13 was indicated earlier, there are some sucker species
14 that are found in the samplings that were done in
15 2008. But these would be a minor constituent, a minor
16 part of what was spawned further upstream.
17 JUDGE BOLLWERK: Relative then -- I mean,
18 minor in one sense but when you're talking about
19 species that is endangered or has some survival
20 problems, does it become more of a concern even if
21 it's just a few?
22 DR. COUTANT: It could. But there --
23 there really isn't much substantiation that these
24 Robust Redhorse are the species that are coming down
25 by Vogtle.

1 JUDGE JACKSON: Okay. I guess just in
2 that same answer in answer 10 it's also stated that
3 there are no significant fish -- it says "No
4 significant fish habitat exists within the area of
5 influence of the intake structure." And I guess the
6 question is what do you mean by "significant habitat"?
7 MR. MOORER: Again, Tom Moorer for the
8 applicant.
9 I don't know if you recall when you all
10 visited the site you saw the intake structure, but the
11 intake structure for 1 and 2 is located on a very
12 straight stretch of river. There are no creeks or
13 slews or any indentations. The bank to the south for
14 probably a quarter of a mile is riprap with sheet
15 pile. You know, there's just very little available
16 habitat for -- in other words, the type of fish that -
17 - or the type of habitat that these fish would seek
18 out for spawning behavior based on, again, our review
19 of the literature. The area around the intake and in
20 fact out into the channel is a shifting sand
21 substrate, and that's actually identified in the FEIS,
22 that's discussed in the document as being a fairly
23 sterile type substrate and you wouldn't expect to see
24 spawning behaviors of nesting type spawners making
25 their homes in that type of substrate. They would

1 tend to seek out areas with more cover, maybe with
2 protection from flow; those kinds of things.
3 Dr. Coutant may want to add to that.
4 DR. COUTANT: No. I think you covered it
5 very well.
6 Usually when you're doing an Environmental
7 Impact Statement you look at the site and you look for
8 particularly biologically significant areas. And if
9 they're coincident and concurrent with the site that's
10 being developed. And usually you think of spawning
11 areas, particularly restricted migration zones, things
12 of this sort.
13 And I think the context that Mr. Moorer is
14 saying is that this a fairly nondescript, if you'll
15 allow me to use that word, reach of river that doesn't
16 appear to be particularly good for spawning or any of
17 the other life functions of the species that we're
18 concerned about.
19 It certainly is a migration corridor for
20 the fish that have to go up upstream and come back
21 downstream. But the width of the river is such that
22 that's not a restriction.
23 So it's not a particularly remarkable
24 stretch of river in terms of these biological
25 functions that one would be concerned about in

1 preparing an EIS. And I think that was recognized by
2 the staff in doing the EIS.
3 JUDGE JACKSON: Okay. That was the
4 questions I wanted to ask on the direct testimony of
5 Mr. Moorer. Are there any others on this testimony?
6 JUDGE TRIKOUROS: I have a few questions,
7 but why don't you finish the rebuttal and then --
8 JUDGE JACKSON: Okay. That's a direct
9 testimony. On the rebuttal testimony, my question in
10 that area is in question and answer 17. And you have
11 a statement in there, and I'd like to ask you what the
12 basis for your statement is that basically -- in fact,
13 that might be useful to just read 17 so we have the
14 backdrop for it, that I'm not just jumping in the
15 middle of a sentence.
16 It says: "In Joint Intervenors'
17 Exhibit...Mr. Sulkin analyzed the withdrawal rates for
18 the Savannah River in accordance with several flow
19 scenarios and also calculated the withdrawal rate at
20 the hypothetical flow of 957 cfs. Should this same
21 analysis have been included in the FEIS?"
22 And your statement is that: "No. Mr.
23 Sulkin introduced the 957 cfs value to represent what
24 is normally referred to as the 'unimpaired' flow
25 set.'' Did I get that right? Yes, unimpaired flow

1 set.

2 Kind of what's the basis for your

3 statement that using this unimpaired flow then has no

4 bearing on any of the NEPA analysis, which is

5 basically your answer to this question. What's the

6 basis for that.

7 MR. MOORER: Your Honor, again, Tom Moorer

8 for the applicant.

9 The unimpaired flow set, and again I say

10 that that was my assumption that that was his

11 characterization, I have done quite a bit of work on

12 some other river systems where they've looked at --

13 for example, there's work being done in the

14 Appalachicola-Chattahooche-Flint system. You might

15 have heard the water war term between Alabama, Georgia

16 and Florida. But in that system there's a lot of

17 modeling done on that system using the HEC models,

18 which are Corps of Engineers' driven model.

19 And in order to establish the model

20 baseline for the HEC models they have a flow set they

21 call the unimpaired flow set, which is designed to

22 represent the system before the dams were put in. It's

23 kind of a backfit, if you will, to represent an

24 uncontrolled situation where you had no dams

25 controlling flow either in floods or in droughts. And

1 they use that as a tool in the modeling. It's just one
2 input of a myriad of inputs that are used.
3 And I'm just assuming that he's referring
4 to the same thing when he calls that. And the reason
5 I qualified is I did not take the time to go back and
6 confirm that that indeed was what he was suggesting.
7 But if that is what he's suggesting, I mean he's
8 basically suggesting that we consider a situation
9 where you knock all the dams out and you go back to
10 the way the river system operated a 100 years ago. I
11 think in the context of NEPA that's clearly, in my
12 mind, beyond what NEPA would require. So I felt like
13 it was not relevant to this analysis.
14 JUDGE JACKSON: Okay. Thank you.
15 That was my only question. So if you have
16 others on either of these testimonies of Mr. Moorer,
17 then probably a good time to cover them.
18 JUDGE TRIKOUROS: Dr. Young in, I believe,
19 it was rebuttal question 1 referring to Mr. Moorer,
20 your D7 -- direct testimony question 7, indicated that
21 there's an absence of data on aquatic life stages.
22 And I guess my question is why wouldn't this be
23 required for kind of a thorough discussion of aquatic
24 impacts? You know, how would you respond to his
25 assertion that this is missing?

1 MR. MOORER: Your Honor, again, Tom Moorer
2 for the applicant.
3 I would like to also maybe suggest that
4 Dr. Coutant respond to this as well. I'll start and
5 let him pick up if that's acceptable?
6 Again, for a NEPA analysis and really if
7 you look at this type of entrainment impingement
8 analysis that process is consistent with EPA's 316
9 process, the 316(b) process that EPA uses to evaluate
10 the effects of intakes on river systems. And that
11 methodology, you know, suggests that you use indicator
12 type organisms. In other words, you don't have to
13 look at all -- every organism in the river system.
14 There are 95 fish, if I remember correctly, in the
15 Savannah River in the area of Vogtle. The EPA
16 methodology suggests that you, again as I spoke with
17 Judge Jackson momentarily a few minutes ago, the
18 process as we understand it is that you would use a
19 group of indicators and you would look at those. And
20 if you determined from that group that that the impact
21 was small, there's really no need to go any further
22 with that.
23 In other words, you're able to
24 characterize the NEPA impact with a reasonable subset
25 of the entire set. If the NEPA impact was determined

1 to be moderate or large, you would then go out and
2 gather more data.
3 And in this particular case if you look at
4 the plethora of data that's there, and there's a lot
5 and we mention -- actually mention numbers of studies,
6 there is a lot of information for this river system
7 available. And it just shows that, you know, in our
8 mind and I think in the staff's mind, they echo in the
9 FEIS, that the data is abundant and conclusive that
10 the impact associated with impingement/entrainment is
11 small. There was no need to go out and do additional
12 evaluations of every life stage and every part of the
13 cycle.
14 Dr. Coutant?
15 DR. COUTANT: Well, I certainly agree with
16 Mr. Moorer on that point. I would also add that I
17 don't believe, at least in my experience, NEPA doesn't
18 require on site at the moment kinds of field studies
19 to verify what is there. We have an abundance of
20 information from the general life history information
21 on the various fish species that are acknowledged to
22 be there, general scientific literature. We have the
23 work of the Georgia and South Carolina Departments of
24 Natural Resources on what the inventories are. And
25 from that we can extrapolate from general knowledge of

1 species abundance.

2 So either in direct evidence such as the
3 Academy of Natural Sciences' studies or inferred
4 evidence from general understanding of life cycles of
5 these species, we have an adequate basis in my opinion
6 to estimate what is out there or what should be out
7 there with which to do an analysis.

8 And Mr. Moorer's main point that the use
9 of key species is an appropriate approach is certainly
10 valid. That's certainly the approach we used in
11 316(a) for thermal studies, 316(b) for
12 entrainment/impingement studies all under the Clean
13 Water Act.

14 There's a long history of environmental
15 impact assessments dating back to the early '70s where
16 the use of key species or representative important
17 species, or however you want to call them, selecting a
18 few of the many species that are out there as your
19 indicators; that's certainly the precedent for most
20 analyses of this sort. And is certainly appropriate
21 in this case, too.

22 JUDGE TRIKOUROS: I just wanted to the
23 finish.

24 In that same testimony you used the term
25 "bounding," and in fact that the use of existing data

1 on the site is an appropriate and bounding surrogate
2 for new site specific studies. So you're what you're
3 saying is -- well, I guess it's the "bounding" is the
4 word that I'm having trouble with. Everything you
5 just said I might say, you know fine to with respect
6 to available data. But is it bounding data? Do you
7 feel that you've bounded? Does existing data bound?
8 DR. COUTANT: That's your words, not mine.
9 MR. MOORER: Yes. Let me -- since those
10 are my words, let me respond to it.
11 What I was referring to is the studies
12 that were done on Savannah River Site, in particular
13 the entrainment studies that were done on Savannah
14 River Site intakes with somewhere in the neighborhood
15 of about 300,000 gallons per minute of flow going
16 through a plant. And those impacts were quantified.
17 The studies are very specific about what was
18 collected. They did do river studies and collected,
19 you know, background samples and baseline samples and
20 correlated their data to the baseline.
21 And I guess what I'm suggesting when I say
22 "bounding," is that the withdrawals associated with
23 the Vogtle site are almost an order of magnitude less
24 than that amount. And it's intuitive to me that that
25 tends -- that that would be bounding from the

1 standpoint of ichthyoplankton entrained.

2 And I would also add that the study that

3 Mr. Montz and Mr. Dodd did that you've -- we've talked

4 about just a moment ago, very much confirms both the

5 studies from Savannah River Site as well as the work

6 that was done in the FEIS and the ER to entrainment.

7 So I think we've got a lot of things that are lining

8 up in supporting each other.

9 JUDGE TRIKOUROS: Is it 100 percent? Are

10 all the studies showing that this is not a problem?

11 Are there any outliers?

12 MR. MOORER: I'm not aware --

13 JUDGE TRIKOUROS: I don't know all the

14 studies.

15 MR. MOORER: I'm not aware of any

16 outliers, Judge.

17 JUDGE TRIKOUROS: Okay.

18 JUDGE BOLLWERK: I guess the thing that's

19 concerning me as I hear this is that, I mean you have

20 all these studies, and they're historical data, some

21 older some younger or newer. If you simply rely on

22 the studies, how do you catch trends? How do you know

23 if something's going on that you ought to be aware of,

24 that something is decreasing or increasing that you

25 need to be concerned about? How can you -- you know,

1 I don't want to use the word "fine tuning," but how do
2 you know there isn't something substantial that we
3 ought to be aware of if you're simply relying on
4 studies that have been done sometimes years ago?
5 MR. MOORER: Again, Tom Moorer for the
6 applicant.
7 I'm going to let Dr. Coutant respond. Let
8 me just say one thing real quick, though.
9 I think the -- with regard to trends,
10 there is quite a bit of information in the ER and the
11 EIS looking at the fishery in itself, looking at
12 trends for fish populations. There's quite a bit of
13 discussion about the striped bass and other types of
14 fish. The shad population is discussed in fairly good
15 detail in the FEIS. And I think that's one way that
16 trends are looked at is by looking at those overall
17 population estimates. The creel studies that are done
18 by the various agencies in South Carolina and Georgia.
19 So it's -- you know, it's not just looking
20 at those impingement/entrainment studies, but in a
21 broader sense looking at the overall kind of big
22 picture impact on the fishery.
23 DR. COUTANT: This is Dr. Coutant again.
24 I would certainly agree with that. And
25 there are agencies both at the state and federal level

1 that look at population trends specifically. And the
2 Atlantic States Marine Fisheries Commission is one
3 that looks at the adadromous species like the American
4 shad, the sturgeon. That's one of the things they're
5 charged with by law is to follow population trends.
6 And if my recollection is correct, there
7 are no remarkable downward trends of the species in
8 the Savannah River. These are agencies -- the
9 Atlantic States Marine Fisheries Commission especially
10 looks at trends not only in the Savannah River, but in
11 the other river systems up and down the coast. And
12 they compare the trends in these various rivers. And
13 the Savannah River is not held out as an example of
14 where the disastrously declining trend for any of the
15 species that we're concerned with.
16 So I think there's a fairly good
17 confidence that what we see in terms of the historical
18 record for the site studies or studies in the vicinity
19 of Vogtle and the Savannah River Site, and the studies
20 that our own folks did in 2008 are pretty well
21 representative of the conditions that you'd have over
22 a fairly long stretch of time.
23 I think the results are in aggregate.
24 It's information we can take with a good deal of
25 faith.

1 JUDGE TRIKOUROS: Mr. Moorer, in your
2 direct testimony question 9 you refer to these ANSP
3 studies. I don't remember what the acronym referred
4 to as this minute. But apparently these studies were
5 done over a fairly long period of time, perhaps even
6 back in to the 1950s or so. In any event, Dr. Young
7 in his rebuttal testimony question 3 refers back to
8 that. And he's saying that these studies were done
9 for three days per year in September. I guess every
10 September for 3 days for 50 years or so.
11 His claim is that this is not adequate.
12 How would you respond to that.
13 MR. MOORER: Again I'm going to ask to let
14 Dr. Coutant help me with this one. I'll start and let
15 him take up. That seems to be working pretty well.
16 Dr. Young asserts in his testimony that
17 the ANSP studies, which stands for Academy for Natural
18 Sciences Philadelphia, those studies, like you said,
19 began in the '50s. I think 1951. And they were
20 focused on the effect of the Savannah River Site
21 operation on the Savannah River. That was the purpose
22 of the studies. And there were many elements to them.
23 The work that he refers to about the three
24 days in the fall is correct for part of the studies.
25 That's true. They were actually done on looking at the

1 adult fish populations in the fall. And Dr. Coutant
2 can amplify on that some.
3 Those are certainly important studies.
4 They were ongoing for a period, you know, 50 more
5 years. I don't think there's anyway in the world we
6 would discount something like that. In fact, those
7 are very valuable studies. But they don't stand
8 alone. And I don't think we in anyway, nor does the
9 staff imply, that they stand alone. They are one of a
10 number of studies that support the overall assessment
11 that was done on this river system.
12 And we mention -- the numbers, if I
13 recall, there's over 200 cites on the aquatic ecology
14 subject alone in the ER and the FEIS. And that
15 includes, again, specific studies from the Savannah
16 River Site. I mentioned the DuPont study, I mentioned
17 McFarlane -- Bennett & McFarlane, Specht, Wilkes.
18 There's are just almost too many to count. And they
19 deal with all kinds of various aspects of this river
20 system. And taken in the aggregate they are more than
21 adequate to characterize this river system. And I
22 think we are very fortunate in that regard in that we
23 had access to an area of the Savannah River that's
24 been studied probably more than any area of a river in
25 the southeast. And these studies were done by very

1 reputable -- I think the Academy of Natural Sciences
2 Philadelphia is very reputable organization. The
3 University of Georgia has done a lot of work. DOE has
4 done a lot of work. And there's just numbers of them.
5 And I'll let Dr. Coutant maybe follow up
6 with some specifics about the ANSP studies. But I do
7 want to make the point that those were one of an
8 element, not by any means -- we're not suggesting and
9 in nowhere did we conclude those studies alone --
10 should stand alone.
11 DR. COUTANT: Coutant again.
12 The Academy study should be taken in the
13 context of the Academy's overall philosophy of how you
14 evaluate biological harm and ecological damager,
15 however you want to call it. And this is a philosophy
16 that's been developed primarily under Dr. Ruth Patrick
17 back in the '50s and '60s.
18 And the philosophy is that if you go into
19 an area at the end of the summer season, you see what
20 survived, what has reproduced, what has survived. You
21 see a population that reflects not only reproduction
22 but the dynamics of the system during the very active
23 summer system.
24 So their philosophy is that you can go in
25 a few day period with focused surveys on the various

1 biotic categories; fish of different groups,
2 invertebrates of different groups, plankton,
3 vitaplankton, zooplankton. They go in and do an
4 intensive survey as opposed to an extensive survey
5 over time. And by sampling at that time of year they
6 get an integration of the -- either the health or the
7 harm, if you want to look at it that way, of the
8 ecosystem.
9 So having taken that philosophy, which
10 they've applied to the Schuylkill River in
11 Pennsylvania and many other sites around the country
12 very successfully, they've been able to identify the
13 trends that we were talking about earlier. The
14 population trends in these various groups of biotic
15 categories. They've been able to identify the
16 indicators of biological health, ecological health
17 that they analyze for and are discussed in their
18 reports.
19 So it's -- in one sense you might look at
20 it as a negative that they only studied three days.
21 But out of those three days of survey they're
22 accumulating the kinds of information that they feel
23 are very important to evaluating ecosystem health.
24 JUDGE TRIKOUROS: Thank you.
25 JUDGE JACKSON: Are you aware of any

1 species that have changed significantly that would
2 bring the use of 20 or 20 plus year old data, you
3 know, into question? Anything that you're aware
4 that's occurred that's dramatic?
5 DR. COUTANT: There have been changes. And
6 one of the changes that I think we have recognized, is
7 that there have been losses of mussel, fresh water
8 mussel species. They highlight that in their report
9 that over the years since they've been doing their
10 surveys, which incidentally are primarily shallow
11 water surveys for the mussels, they've identified loss
12 of particular mussel species. And this is typical
13 throughout the southeast. It's not just happening in
14 the Savannah River or just at the Savannah River
15 location of Vogtle. But it's a chronic problem for
16 freshwater mussels in the southeast. But that's an
17 example of where they have found a trend over time of
18 loss of some of the mussel species. I forget the exact
19 numbers. But it's in some of some of their reports.
20 And I think it may be reported in some of our reports,
21 too.
22 JUDGE JACKSON: Okay.
23 JUDGE BOLLWERK: Let me just sort of
24 follow-up on the general question. Well, the way you
25 characterized that is sort of the particular studies

1 that were done there were sort of short bursts
2 designed to get a lot of information and very -- in
3 terms of the impingement -- the study that you all did
4 at the facility over the last couple of years, at
5 least the last year, how typical do you think -- for
6 instance, in the March through February time frame
7 that you were looking at, how typical was that in
8 terms of how the river stands in terms of the
9 precipitation and the flow during that period? Was it
10 --
11 DR. COUTANT: Well, actually, it was a
12 relatively low flow year in comparison with the
13 historical record. So the -- you know, in a sense
14 we're looking at a situation that's a little bit
15 abnormal because the flows were abnormally low, if
16 that was the thrust of your question.
17 JUDGE BOLLWERK: Yes. And would you expect
18 that to affect the study in terms of what you -- in
19 terms of trends or because it was low? Were certain
20 things low? Were certain things high? What was out
21 of whack, I guess, if that were --
22 DR. COUTANT: Well, I think if anything,
23 if you assume that the same number of fish are coming
24 upriver, say the American shad. The same number of
25 fish were coming up and spawning in a bit less water,

1 that you'd probably have a higher concentration of
2 eggs and larvae then you would if the same number of
3 eggs and larvae were diluted by twice the flow, say.
4 So in one sense it's -- the analyses would
5 be conservative for evaluating over the historical
6 record.
7 MR. MOORER: Your Honors, can I add
8 something to that real quick? Just a clarification.
9 I think it's important to understand one
10 of the things we did I think to look at this very
11 thing was we compared our studies to the Savannah
12 River Site studies that were done for
13 impingement/entrainment looking to see, you know, that
14 they correlated. And I guess Mr. Dodd and Mr. Montz
15 might can respond to that. But my recollection is
16 that they correlated fairly well with the existing --
17 the other studies.
18 MR. MONTZ: Yes, we did take a look at
19 those studies and found -- and found that species
20 composition in terms to those that were susceptible to
21 impingement/entrainment were very similar to those
22 species observed in the SRS studies.
23 Additionally, numbers and types of
24 icthyoplankton out in the river for the baseline
25 studies that they did back in the '70s were still very

1 similar to what we observed in our study in '08.

2 JUDGE TRIKOUROS: Are the intake canal

3 velocity distributions, are they fundamentally

4 independent of the river volumetric flow rate? In

5 other words, if the river were higher, would it be

6 more likely or less likely to entrain more fish in the

7 sense of velocity differences in the intake?

8 MR. MONTZ: I believe -- if I understand

9 your question, you're asking as river flows increased,

10 has the potential for entrainment increased?

11 JUDGE TRIKOUROS: Yes. Sort of with

12 respect to velocity distributions -- you had indicated

13 earlier in testimony that the velocity was the key

14 factor in this entrainment and impingement concern.

15 MR. MONTZ: Well, velocity is the key

16 factor in impingement. Withdrawal rates is the key

17 for entrainment.

18 JUDGE TRIKOUROS: So with respect to

19 impingement -- well, let me rephrase the question

20 then.

21 With respect to entrainment you're saying

22 that the velocity distributions in the intake would

23 have no impact at all? It would only be the intake

24 flow rate that would determine the velocity that would

25 determine the effect? And with respect to the

1 impingement you're saying that the -- that there would
2 be no impact of a higher volumetric flow of the river,
3 because that higher flow it would not alter the
4 velocities in the intake? Is that what I'm hearing.
5 MR. MONTZ: Higher river elevation would
6 decrease your through-screen velocity, which would --
7 if it's-- if it's directly connected, would decrease
8 your impingement rate.
9 JUDGE TRIKOUROS: So river flow rate would
10 effect the velocity in the intake canal?
11 MR. MONTZ: No. It would-- it would effect
12 the through-screen velocity. It would decrease
13 through-screen velocity.
14 MR. DODD: Can I -- this is Tony Dodd --
15 JUDGE TRIKOUROS: Oh, I see. You're
16 drawing a distinction between the screen velocity and
17 the velocity distribution in the intake canal?
18 MR. DODD: Just a point of clarification,
19 Your Honor. As the river stage rises over the intake
20 structure, there's a larger surface area exposed in
21 that pumping field. And so there's a relatively lower
22 through-screen velocity because the flow -- the
23 surface area of the water is spread over a larger
24 area.
25 JUDGE TRIKOUROS: So with respect to

1 impingement you would expect a river that had a more
2 normal flow pattern to be result in a less
3 impingement? Is that what I'm hearing you say?
4 MR. MONTZ: Yes, sir.
5 MR. DODD: Perhaps. And there are those
6 other seasonal variables; temperature that could
7 influence that, yes.
8 JUDGE TRIKOUROS: What about entrainment?
9 If the concentration, you testified I think Dr.
10 Coutant that the concentration would actually go down
11 because of the higher volumetric mass of water, volume
12 of water, and therefore you would expect not to
13 necessarily to see a worse entrainment? Am I correct?
14 DR. COUTANT: No, I think you're correct.
15 That if there's more water in the river for the same
16 amount of spawning activity, then the eggs and larvae
17 would be more diluted. And so for the same volume of
18 water that's coming in the intake canal, you would
19 have fewer organisms.
20 So, if-- you know, if you're wiping out
21 all the other variables, then I suspect that at the
22 higher flows you'd actually entrain fewer eggs and
23 larvae. Of course, there's a lot of other things
24 going on. too, that might complicate that. But I think
25 that's a valid conclusion.

1 JUDGE TRIKOUROS: So you're saying there's
2 no obvious reason to think that if you had done the
3 study in 2004, for example, where I believe there were
4 significantly higher flows, that you would see any
5 different conclusion?
6 DR. COUTANT: No, I think this was a good
7 time to do the study, if you will, because the flows
8 were low and probably the -- the numbers entrained and
9 impinged too perhaps, would be at the high side of
10 what you might have over a historical record, if you
11 had it.
12 JUDGE TRIKOUROS: So conversely with the
13 river flow should get worse, you would assume that the
14 impact on the entrainment and impingement would get
15 worse, or at least on entrainment?
16 DR. COUTANT: If you're following the same
17 trend line, that would be true. I'm not sure how much
18 worse it could get but if you were to extrapolate the
19 line downward, that would probably be true.
20 JUDGE TRIKOUROS: Yes, I don't know how
21 much worse the river flow might get. But we've
22 established that if it does, that it does have an
23 effect. So in the sense that if it does get worse,
24 that that would be an impact?
25 MR. MOORER: Your Honor, let me add one

1 thing real quick.

2 The staff in its EIS did look at lower
3 flow rates. They looked at -- actually looked at
4 3,000 and at 2,000 cubic feet per second. And 2,000
5 is an extremely high -- I'm not even sure that that's
6 even a realistic flow rate. It's very, very, very
7 low.

8 At the Vogtle site I think Mr. Blanton
9 explained the relationship between the Thurmond Dam
10 releases and the Vogtle site. And the Corps' Drought
11 Plan is administered through releases at the Thurmond
12 Dam. And the flows at the Vogtle site are typically
13 in the 400 to 600 cfs range higher than what you'd see
14 at the dam.

15 So 2,000 is a very, very, very low flow
16 and they concluded, again, that even at that very low
17 flow, it did not alter the conclusions relative to
18 impingement and entrainment or water usage.

19 JUDGE TRIKOUROS: Right. But however, it
20 is roughly half of the flow rate that you've -- that
21 that study was conducted under and we've just
22 concluded that it would have a negative impact on the
23 study results. So in other words, things would be
24 worse if the river were flowing at 2,000 relative to
25 the study. Now I don't know if that means it would be

1 twice as much impact. I mean, how do you--

2 MR. MOORER: No. I think theoretically

3 certainly what you're saying is true. I think that,

4 you know, again going back to NEPA. NEPA does not

5 presume a worst case analysis. And I believe 2,000 cfs

6 would be beyond worst case analysis.

7 JUDGE TRIKOUROS: And if I said it twice

8 or three times as much, would that still result in a

9 smaller -- in your opinion?

10 MR. DODD: In terms of --

11 MR. MOORER: Go ahead.

12 MR. DODD: Tony Dodd for the applicant.

13 In terms of the numbers of organisms we

14 saw entrained and impinged, in my opinion it would

15 still be a small impact. The basis for that is --

16 comes from information that's been done before at SRP.

17 For example, in those studies I referenced earlier

18 from the '70s through the '80s their entrainment rates

19 ranged from roughly 23 million to 28 million eggs and

20 larvae per year. Whereas, at Plant Vogtle under these

21 conditions the estimate is about -- even at the upper

22 confidence limit is under 600,000 eggs and larvae per

23 year.

24 JUDGE TRIKOUROS: Okay. Thank you.

25 JUDGE BOLLWERK: All right. Let me check

1 where you at in terms of the questions?

2 JUDGE JACKSON: I think what we've done is

3 we've kind of wondered into Dr. Coutant's testimony

4 because there was some overlap there. And so a lot of

5 the issues about using the database that you did to

6 work on the baseline and so on we've started to cover.

7 So as I looked ahead, I'd found that probably about

8 half of what we might want, we might have covered if

9 we had separated things better, have been done.

10 So as far as Mr. Moorer's testimony, I

11 think we've covered that and we've gotten a good start

12 on the next set. So if you wanted to hang in for 10

13 or 15 minutes, either that or we could come back. I'm

14 just kind of saying I think we can fairly quickly ask

15 our questions on Dr. Coutant

16 JUDGE BOLLWERK: Okay. Let me just say, I

17 think what we're looking at here is then possibly

18 finishing with Dr. Coutant and taking a lunch break,

19 allowing the parties to generate whatever questions

20 they have, anything else we might have the break and

21 then coming back and finishing up this panel.

22 JUDGE JACKSON: That probably makes sense.

23 I don't think we have much further.

24 JUDGE BOLLWERK: Right. That's fine.

25 JUDGE JACKSON: So we could shift gears

1 and get your direct testimony, Dr. Coutant. And I've
2 been trying to edit out some questions I had that
3 we've really already answered.
4 One I was looking at that might be a good
5 place to start would be your answer to question 27 in
6 your direct prefiled testimony. Let me find that.
7 DR. COUTANT: I have it.
8 JUDGE JACKSON: Okay. Down near the
9 bottom of the page on page 15 of your testimony you
10 state: "Thus, in my professional opinion, the design
11 features of the cooling system make significant
12 mortalities of Savannah River biota from entrainment
13 and impingement unlikely, and lessen the need for
14 further site-specific biological studies." And this
15 it the need for more specific detailed studies has
16 been a kind of a bone contention, so this might be a
17 good one to stop and ask a few questions on.
18 First of all, you used the term
19 "significant mortalities," and maybe that's a good
20 place to start. What do you mean, what do you
21 consider to be significant mortalities or
22 insignificant?
23 DR. COUTANT: Well, I think that in any
24 case when you're entraining or impinging as our 2008
25 studies show, you're going to have some mortality. I

1 don't think you can do anything in an ecosystem
2 without assuming you're going to do something to it.
3 The question is what's the magnitude of that and the
4 design of the facility such that it would tend to
5 minimize that?
6 You know, if you step back and take the
7 very large picture, the fact that the company is
8 planning to use closed cycle cooling to begin with,
9 reduces the potential morality that you might have
10 from an open cycle once through system by 95 to 98
11 percent. So you're withdrawing a whole lot less water
12 than you would with a conventional system to begin
13 with. So you're one step ahead at that point.
14 JUDGE JACKSON: Excuse me. It's probably
15 true that you could never build a once through system
16 anymore, is that correct?
17 DR. COUTANT: That's probably true, yes.
18 That's probably true. But sort of stepping your way
19 through here.
20 JUDGE JACKSON: Okay.
21 DR. COUTANT: Now the next thing is--
22 JUDGE BOLLWERK: Are there any other any
23 stations currently that power any kind of -- have one
24 through systems?
25 DR. COUTANT: I don't believe there are.

1 Well, the Savannah River Site, but they're mostly
2 shutdown now.
3 JUDGE BOLLWERK: Right. Right.
4 MR. DODD: Plant Kraft.
5 JUDGE BOLLWERK: I'm sorry.
6 MR. DODD: There's Plant Kraft downstream,
7 which is a fossil plant.
8 MR. MOORER: That's true.
9 MR. DODD: It's a once through cooling
10 facility.
11 MR. MOORER: As are the D Area Power House
12 and the Urguhart Station.
13 JUDGE BOLLWERK: The once through, okay.
14 DR. COUTANT: Okay. Well thinking back
15 through my progression --
16 MR. DODD: Okay. Sorry.
17 DR. COUTANT: That's all right. One thing
18 you do with your intake system to minimize the numbers
19 of organisms that are brought in, and the design of
20 the intake is such that they've built a weir at the
21 bottom of the intake which is designed partially for
22 sediment control and partially to restrict the number
23 of organisms that are found at the bottom of the river
24 from entering the intake canal.
25 For many -- I should backup. For many

1 organisms you have a vertically distribution. A lot
2 of organisms are bottom oriented; the sturgeons, the
3 catfishes, species like that tend to be oriented at
4 the bottom. So their weir provides a vertical barrier
5 to prevent them from coming into the intake. Some of
6 them could jump over, obviously, but it does restrict
7 in this situation, apparently. And it certainly is
8 effective elsewhere, too. It keeps the bottom
9 organisms from coming in great numbers.
10 Similarly, if you think of it from the
11 top, there's a weir so to speak from the surface. And
12 it showed up in the pictures that we saw earlier. For
13 organisms that tend to be surface oriented. It
14 prevents them from coming directly into the intake.
15 JUDGE JACKSON: Excuse me. Remind me
16 again how far that upper skimming weir extends down
17 into the water?
18 DR. COUTANT: My recollection was about
19 three feet. Correct me if I'm --
20 MR. DODD: Two to three feet.
21 DR. COUTANT: Two to three feet.
22 JUDGE JACKSON: Two to three feet? Okay.
23 DR. COUTANT: Yes. So what you're doing
24 with the design of this particular intake is you're
25 minimizing the surface oriented organisms and

1 minimizing the bottom organisms and so withdrawing
2 most of your water from the center of the water
3 column.
4 And then, of course, the other design
5 feature is to have a very low intake velocity. So, you
6 know, assuming that any fish larger than half an inch
7 probably is going to be able to swim against the very
8 low current if it did get withdrawn into the intake
9 canal, it could easily escape. So you have a minimal
10 entrapment, which is another word that's often used
11 for impingement. You have minimal numbers of fish
12 that would be entrapped in the intake canal.
13 And then, as Mr. Montz indicated, the
14 through-screen velocity is very low. Not only is the
15 velocity in the canal very low, but the through-screen
16 velocity is very low. So a fish if it did get to the
17 point of getting stuck up on the screen, would have an
18 easy chance of getting off the screen or probably
19 wouldn't get struck on the screen to begin with.
20 So in kind of stepping through this litany
21 of things that have been done at the Vogtle site to
22 minimize the impacts, my point in the testimony was
23 that we have a lot of design features that are
24 intended to minimize the damage. And one of the
25 things I've done over my career is look for what we

1 call biological design criteria that can be applied in
2 power plant design and construction. And I'm
3 impressed that the facility here has done many of
4 those things that over time we've recommended; low
5 velocities, you know barriers to minimize particular
6 types of organisms from coming in.
7 So not only is the site location, but the
8 design of the structure important.
9 JUDGE JACKSON: Okay. Let me get back to
10 significance then and maybe some of these features.
11 Concern over the short-nose sturgeon. I
12 guess passing by during the appropriate migration
13 periods. Do you have a special meaning for
14 significance when it comes to an endangered species or
15 would your definitions change? And would any of these
16 features, how would they impact, say, that particular
17 species?
18 DR. COUTANT: "Significance" is a word
19 that gets in trouble a lot, I must admit. Because
20 it's hard to define. It has to be defined in the
21 circumstances. And an example you use of the sturgeon
22 that are migrating past the site, the adults are
23 migrating upstream to the spawning ground, they're
24 migrating back down to the sea because they're
25 basically estuary organism as adults. And the young

1 after they've reared initially in the upper river,
2 have to migrate past the site to get down to their
3 estuary and nursery grounds.
4 And the question that you ask yourself
5 knowing that this migration has to go on in this
6 stretch of river where Vogtle is located is there a
7 reasonable likelihood that these critters are going to
8 be faced with, in this case, being entrained or
9 impinged in the intake. And the question of
10 significance I think in this case relates to the cross
11 sectional area of the river that's involved.
12 In plain words, the fish have a lot of
13 river that they can use without getting caught up in
14 the intake at all. The zone of influence for the
15 intake is really pretty small, whether you look at it
16 in terms of cross sectional area or volume of water
17 that's drawn into the intake.
18 So I think one of the measures that the
19 staff used, and certainly the measure that I've used
20 is in judging significance is whether there's a
21 reasonable likelihood that these fish are going to be
22 exposed to the kind of condition that would be harmful
23 to them. And personally I see plenty of river out
24 there for them to migrate in without being caught up
25 in the intake.

1 So therefore, I say nonsignificant in a
2 nonstatistical sense, I must admit.
3 JUDGE JACKSON: Okay. Well, I was just
4 focusing in on there might be a view of significance
5 if you looked at the whole population. Say, the whole
6 fish population. But then if you zero in on this
7 species that are of real concern, that's why I
8 mentioned the short-nose sturgeon or this Robust
9 Redhorse, then I'm assuming that you would want to
10 make sure that you had a tight definition of
11 significant. I mean, you wouldn't want -- I assume you
12 would like to avoid entraining or impinging any of
13 those species if you could. Is that --
14 DR. COUTANT: I certainly -- I certainly
15 agree with you on that. And in the case of the Robust
16 Redhorse there has been telemetry work done in the
17 Savannah River following the adults. They were -- the
18 fish were tagged at the spawning grounds in the
19 Augusta Shoals. And with radio transmitters, I
20 believe it was put on them.
21 And a few of the fish did come into the
22 Vogtle reach of river. So we know they are there, even
23 though in the studies they haven't been collected, per
24 se. But their habitat is the deep channel. And these
25 are where they were found in the tracking study were

1 in the very deep channel of the river.

2 So based on that information I think it's

3 a reasonable conclusion that they would not be

4 vulnerable to the shoreline more shallow area intake

5 of the plant.

6 So, you know, you're making sort of

7 general conclusion that the impact on the adult Robust

8 Redhorse probably is not significant. Because they

9 just aren't -- they don't occur in the location of the

10 intake even though they're in that reach of river.

11 JUDGE BOLLWERK: Right. You say they

12 haven't been into the intake itself, but they've been

13 in the river area, or did I misunderstand? I'm sorry.

14 DR. COUTANT: They've not been tracked

15 right in the intake. We can pull out the study and be

16 sure. But I think what the study showed was that they

17 were located at a point downstream of Vogtle. So

18 sometime between the time that they were tagged in the

19 Augusta Shoals area and where they were identified

20 with the telemetry downstream, they must have passed

21 the site. And that their habitat is the deep channel

22 where they've been tracked.

23 JUDGE JACKSON: Okay. And earlier we

24 talked about there have been no identification among

25 the larval fish or eggs of the Robust Redhorse, I

1 believe you stated that.

2 And in terms of this short-nose sturgeon I

3 believe I read in the testimony that you have not

4 collected any of that species in the impingement part

5 of the study. Is that correct?

6 MR. DODD: Yes, sir. That's correct. For

7 the both impingement and entrainment study we didn't

8 see any protected species at all.

9 JUDGE BOLLWERK: Right. So whatever the

10 undetermined suckers that you were --

11 MR. DODD: Right.

12 JUDGE JACKSON: Right. Okay. I think

13 that's that question. Let me see if there are -- okay.

14 I believe we've covered most of the questions from

15 your direct testimony one way or another. We kind of

16 wandered into them.

17 DR. COUTANT: A little sneaky, maybe.

18 JUDGE JACKSON: But I think I've gotten

19 information on most of the questions that I had.

20 Judge Trikouros, did you have any others?

21 JUDGE TRIKOUROS: No. I'm satisfied. Thank

22 you.

23 JUDGE JACKSON: Okay. Let me just take a

24 quick look then at your rebuttal testimony and see if

25 I saw anything there. I guess just a couple of quick

1 questions on your rebuttal testimony.

2 In one of your answers, it was the answer

3 to question 5. Yes, there it is. You state that

4 because the estuary is about 120 miles, I guess,

5 downstream from the Vogtle site that the proposed

6 plant's intake and discharge will not have any impacts

7 on the downriver estuary that far. I guess I'd just

8 like to ask a question. How do you assess that? How

9 do you know that that's true? What's that conclusion

10 based on?

11 DR. COUTANT: Well, I think one of the

12 implications on Dr. Young's testimony was that the

13 thermal plume might extend that far. And certainly it

14 would be unidentifiable physically at that distance.

15 And I think also, you know, throughout their testimony

16 they sort of imply that the whole area affected would

17 be between the plant and the estuary. And certainly

18 in my opinion most of any impacts that would occur

19 from the plant would be unidentifiable once you got

20 beyond a few miles downstream, even if that.

21 So to imply that we're having an impact as

22 far as the estuary, I think is probably not warranted.

23 JUDGE JACKSON: Okay. Just because you're

24 saying everything gets dissipated. But in terms of

25 cumulative impacts, you know, I think that was the

1 question. You wouldn't --

2 DR. COUTANT: Yes. I think that it would

3 be very difficult to identify even cumulative impacts

4 of the various facilities on the river at that point

5 and trace it back to the Vogtle site.

6 JUDGE JACKSON: Okay. I think we've

7 covered the other -- I think that one of the questions

8 had to do with the impact of being in this severe

9 drought season and trying to relate earlier studies to

10 drought conditions or conversely in situations where

11 you've done these field studies in drought conditions.

12 You know, how applicable are they when you get into

13 seasons where there's more rainfall. And I think

14 we've probably covered that in both directions. So, I

15 think we've hit most of the issues that I had.

16 DR. COUTANT: Okay.

17 JUDGE JACKSON: Judge Trikouros, did you

18 want to add anything or--

19 JUDGE TRIKOUROS: No, I'm fine.

20 JUDGE JACKSON: Okay. Let's see--

21 JUDGE BOLLWERK: I would suggest then that

22 maybe -- or we're actually a little bit beyond it, but

23 time to take a lunch break probably.

24 I think during that lunch break you are

25 going to generate the exhibit that we talked about and

1 provide it, I guess, a paper copy hopefully or in some
2 way to both the staff and the joint intervenors so
3 they can take a look at it. We'll deal with that when
4 we come back in terms of any additional discussion.
5 The Board may during the lunch break come
6 up with some additional questions. That's possible.
7 That's for this panel.
8 I would also ask that at this point if any
9 of the parties have additional questions for these
10 folks, if you could generate those during the lunch
11 period and give to us when we're done. We'll go
12 through those as well. That may require the need for
13 us to take a brief break to look through them. But
14 we'd like to get them when you come back.
15 It's now about five till 1:00. I'm trying
16 to think. If we do this until 2:15 does that give
17 everybody enough time? I recognize, I'm not sure, I
18 know there's a restaurant here in the hotel, some
19 places across the street that are fairly close.
20 Let's see if we can do it in that time
21 frame. If that doesn't work today, then we'll know
22 that we may need to give a little more time tomorrow.
23 But if everybody can come back by 2:15, we will
24 reconvene.
25 Let me just check one thing with the

1 intervenors. Is there any problem in terms of your
2 witnesses and their availability this afternoon and
3 tomorrow? I just want to make sure.
4 MR. SANDERS: No. They're here.
5 Mr. Sulkin just informed that he has to
6 leave tomorrow. His flight is at 5:40.
7 JUDGE BOLLWERK: Okay. I don't think it's
8 a problem.
9 MR. SANDERS: That was the only question.
10 JUDGE BOLLWERK: So he's definitely
11 available in the morning for instance if we were to go
12 longer.
13 MR. SANDERS: Yes.
14 JUDGE BOLLWERK: Okay. That's very good.
15 All right. Let's go ahead then and take
16 our lunch break. We'll come back at 2:15, hopefully.
17 Thank you.
18 (Whereupon, at 12:55 p.m. the hearing was
19 adjourned, to reconvene this same day at 2:19 p.m.
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4 A-F-T-E-R-N-O-O-N S-E-S-S-I-O-N
5 2:18 p.m.
6 JUDGE BOLLWERK: We're back from our lunch
7 break . We received a list of questions from the joint
8 interveners. Did the staff have any questions?
9 MALE PARTICIPANT: No, your Honor.
10 JUDGE BOLLWERK: All right, then we have
11 those. We're going to take a look at those and we
12 will probably take, once we've sort of finished up
13 with the testimony here, we'll take a break and
14 discuss them among ourselves and see what we feel are
15 appropriate to ask briefly and then come back. Let's
16 -- did you want to pursue your question or do you want
17 me to go ahead and deal with the matter. I guess
18 we're going to have another exhibit, SNC0000097, if
19 I've got the right number.
20 JUDGE JACKSON: I just have one question
21 if I can go ahead and ask that one.
22 JUDGE BOLLWERK: Absolutely.
23 JUDGE JACKSON: This is probably an
24 overarching question that I'll probably ask different
25 panels, but --

1 JUDGE BOLLWERK: You gentlemen are still
2 under oath, obviously. Whenever we take a break that
3 is certainly the case.
4 JUDGE JACKSON: Kind of a bone of
5 contention in these proceedings has been really the
6 level of detail that is appropriate and required to
7 satisfy the regulations. For example, the need for
8 life, detailed life cycle information, the need for
9 more spacial and temporal definition of fish or groups
10 of other organisms or whatever. So my overriding
11 question is, is the level of detail in the FEIS
12 consistent with other comparable FEIS's and basically
13 how do you know the level of detail is appropriate and
14 sufficient?
15 DR. COUTANT: Well, I can state, this is
16 Coutant. The short answer is, yes, I think the FEIS
17 does give the appropriate level of detail and the NRC
18 guidelines for how to do an EIS are pretty clear that
19 the amount of detail is to be commensurate with the
20 anticipated level of impacts and so you can ask,
21 "Well, how do you figure out what the anticipated
22 level of impacts are", and usually that's done with
23 what we call a screening study. It's pretty standard
24 practice to do an initial analysis and to use the
25 entrainment as an example, just make some simplifying

1 but usually conservative assumptions about the
2 resource you're talking about and then do a fairly
3 straightforward analysis without a lot of detail. And
4 with that kind of a screening analysis, you get an
5 idea and usually it's quite accurate of the scope or
6 scale of the impact you're talking about.
7 And in the particular case of entrainment,
8 by using that assumption of uniform distribution and
9 relationship of the concentration of the density of
10 organisms to flow, you came up with an initial
11 assumption or I shouldn't -- assumption, it's an
12 initial result that the impact is likely to be small
13 and with that at the screening level, then, you really
14 don't need all the details like the spacial and
15 temporal distribution of the individual plankton
16 organisms which would be a detail considerably beyond
17 what you'd need to make the initial estimate. It
18 wouldn't change the estimate if you did it in more
19 detail than the screening study.
20 And I think there are other cases where
21 you do an initial analysis. Another example is the
22 CORMIX model. You do a model of the temperature and
23 you realize that based on this modeling effort that
24 was certainly conservative and would give you the -- I
25 wouldn't call it the worst case but certainly a result

1 that would encompass most of other results and on the
2 basis of that, then you don't need the very detailed
3 other information that somebody else might say you
4 should have.
5 So I think the bottom line is that the
6 FEIS has done a good job, in my opinion, of doing the
7 analysis with the level of detail that's commensurate
8 with the anticipated impacts based on their screening
9 initial analysis.
10 JUDGE JACKSON: Would it be similar to
11 what a person would find if they looked at a number of
12 other power plant FEIS evaluations of aquatic impacts?
13 DR. COUTANT: Yes, that's sort of the
14 standard practice is to do this kind of screening
15 level analysis first and it's done with radiological,
16 it's done with other environmental impacts beside
17 entrainment. So, yes, it's fairly standard practice.
18 MR. MOORER: Judge, if I may add
19 something, Tom Moorer for the Applicant. We reviewed
20 a number of EIS's both existing EIS's for operating
21 plants including Vogtle, you know, 1 and 2 EIS, and we
22 also reviewed the first four ESP EIS's, the -- three
23 of them were done, as you are aware, with a plant
24 parameter envelope and I would -- I would state that
25 this EIS is a higher level of detail than those three

1 were in this particular area in particular.

2 JUDGE JACKSON: Okay, thank you.

3 JUDGE BOLLWERK: All right, anything

4 further then? Judge Trikouros, any questions at this

5 point? All right, at this point, why don't we go

6 ahead and deal with the matter of Exhibit which is now

7 going to become SNC000097. We were having a dialogue,

8 Mr. Dodd and I guess I'd ask you to go ahead and

9 generate an exhibit so that we could put this on the

10 record, and I take it you've given a copy to the DDMS

11 folks.

12 MR. DODD: Yes.

13 JUDGE BOLLWERK: Do you have paper copies

14 for anyone or are we just going to -- can we display

15 it, Andy? I don't know if that's --

16 MR. MOORE: Your Honor, here's the

17 electronic copy. If it's okay, I'll just walk over

18 and give that --

19 JUDGE BOLLWERK: Okay, fine.

20 MR. MOORE: And I have given the hard

21 copies to the staff and intervener's counsel. I have

22 additional copies if you'd like to see them.

23 JUDGE BOLLWERK: That would be good.

24 MR. MOORE: Can I --

25 JUDGE BOLLWERK: Yes, absolutely, come

1 forward, thank you. Thank you. All right, give us a
2 second to look this over. And do you have one more
3 copy by any chance?
4 MR. MOORE: I will get you one.
5 JUDGE BOLLWERK: All right. We need --
6 our law clerk would like to -- make sure we get a copy
7 for her as well.
8 MR. MOORE: Yes.
9 (Pause)
10 JUDGE BOLLWERK: All right.
11 MR. MOORE: Your Honor, I have that
12 additional copy now.
13 JUDGE BOLLWERK: Okay, if you could just
14 give it to Ms. Bu, I'd appreciate it. Thank you.
15 All right, let's go ahead and mark it for
16 identification first, and then we'll talk about its
17 admission and then we'll see where we go from there.
18 And there's the document. Mr. Wilke has put it up.
19 Would you like to identify it for the record, please?
20 MR. MOORE: Yes, I'll ask Mr. Dodd to tell
21 us what this document is, please.
22 MR. DODD: This document is a body of
23 information provided by the Georgia DNR, Department of
24 Natural Resources on its fishing prospect for the
25 Savannah River, 2009.

1 MR. MOORE: And was this the document that
2 you were referencing earlier during the discussion in
3 response to questions about your testimony?
4 MR. DODD: Yes, it is.
5 MR. MOORE: Does it appear to be a correct
6 copy of the -- it looks like a printout from a Georgia
7 website?
8 MR. DODD: Yes.
9 MR. MOORE: Based on that, we would like
10 to have this one marked as Exhibit 97, please.
11 JUDGE BOLLWERK: All right, let the record
12 reflect that Exhibit Number SNC000097, I think I've
13 got the right number of zeros in there, has been
14 marked for identification. It's identified as
15 described by counsel. It's actually a page from their
16 website, http://www.gofishgeorgia.com/. All right, do
17 you wish to move it into evidence?
18 (The document referred to was
19 marked as Southern Exhibit
20 Number SNC000097 for
21 identification.)
22 MR. MOORE: Yes.
23 JUDGE BOLLWERK: All right, and any
24 objections? Hearing none, then we will admit into
25 evidence Exhibit Georgia SN -- I'm sorry, Exhibit

1 Southern SNC000097.

2 (The document having been

3 previously marked as Southern

4 Exhibit Number SNC000097 for

5 identification was received in

6 evidence.)

7 JUDGE BOLLWERK: All right, Mr. Dodd, you

8 wanted to say something about this.

9 MR. DODD: Yes, Judge. It was in response

10 to your question, I think, which was, if I remember

11 correctly about how is it we -- maybe you could

12 rephrase the question for me. It was about gauging

13 the baseline --

14 JUDGE BOLLWERK: Right, what's the

15 baseline? In other words, I mean, the basis -- as I

16 said before, did Savannah River, you know, get a lot

17 of them or is there still something there to be fished

18 out and/or what is in the river at this point?

19 MR. DODD: Right, and the question was

20 directed towards -- or the answer was directed towards

21 answering that question. And we do not have a

22 quantitative record of the standing crop of fishes in

23 the Savannah River but we do have information like

24 this which is compiled by Georgia's Department of

25 Natural Resources Fisheries Group. In this case it's

1 a fisheries prospect. They do this every year based
2 on the surveys they do on the river, scientific
3 surveys as well as information from past fishing
4 trends, angling experience and other information
5 provided in the creel or maybe creel surveys. They
6 don't say that directly. They do say anglers and
7 marina owners provide information.
8 JUDGE BOLLWERK: What scientific surveys
9 do they do, if you know, and how do they do them?
10 MR. DODD: It's a standardized survey
11 that's conducted by the Department. Historically, it
12 was conducted in the spring and in the fall. Today, I
13 don't know if they conduct it at both seasons of the
14 year or not due to budget constraints, but that's
15 typically the way they do it. It involves
16 electrofishing, a technique that's commonly used by
17 resource managers to make standardized monitoring
18 surveys. It's a very effective way to build an index
19 of fisheries information and then year after year one
20 can examine the trend in those data.
21 JUDGE BOLLWERK: And how does that work,
22 you can --
23 MR. DODD: For electrofishing?
24 JUDGE BOLLWERK: Yes, please.
25 MR. DODD: Specifically, the technique is

1 to identify a sampling station or in this case maybe a
2 reach of the river. Often times, it's 500 meters
3 long, maybe as a standardized sampling location,
4 sometimes longer. And then the electrofishing boat is
5 designed to literally broadcast electricity into the
6 water. It stuns the fish. The crew members net the
7 fish up at the bow of the boat and once they retrieve
8 the fish, they put them in a live well. The fish wake
9 up from this stunned state of electro-tetany. The
10 biologists weigh them, measure them, record
11 information like species.
12 Maybe if they're a tagged fish for special
13 studies, they can record information on tags or
14 markers on the fish and then they release the fish
15 back into the river. And they come away with data
16 sheets with data from that event. And if they do that
17 year after year they develop a trend about fishery in
18 that spot assuming that to be representative of the
19 fishery at large.
20 JUDGE BOLLWERK: And when they stun them,
21 how wide an area are you talking about? I mean, I
22 take it is it bank to bank and so many yards wide?
23 MR. DODD: Well, typically a boat may be
24 16 to 18 feet long, maybe 20 feet long, a couple of
25 crew members and when they're electrofishing there are

1 one or more electrodes extended ahead of the boat,
2 maybe three to eight feet ahead of the boat on a
3 fiberglass boom and the area that's affected by the
4 electricity really depends somewhat on the system that
5 they're using for electrofishing as well as the
6 conductivity of the water that they're broadcasting
7 electricity into. Generally, it's within several feet
8 to several yards of the boat and under the boat.
9 JUDGE BOLLWERK: All right. We can
10 probably switch off of this, by the way. All right,
11 and do you know how they select the spots that they're
12 going to do this? I take it they do it the same
13 places every year or do they move around or --
14 MR. DODD: Historically, looking -- being
15 familiar with their data in several locations around
16 the state and several basins, their choices of
17 sampling location have changed through the years.
18 More than 15 years ago, stations were selected because
19 of habitat type, wanting to represent a diversity of
20 habitat. Sometimes, particularly in reservoirs,
21 selected just because that's where the biologists knew
22 it was a good place to fish, frankly. But in mor
23 recent years, the method for choosing a sampling
24 location is a little more sophisticated, sometimes
25 selected by random selection or stratified random

1 selection based on habitat type.

2 JUDGE BOLLWERK: All right, and then as

3 I'm reading this, it's -- these are fairly general

4 statements. It's good fishing, it's bad fishing,

5 things are plentiful. I mean, it's nothing -- this is

6 not a -- at least the way it's presented here, this is

7 certainly not numeric in any way or anything you could

8 read and say, "Oh, there are so many fish even within,

9 you know, around the boat". So --

10 MR. DODD: That's right and to speak to

11 that, it's written in a way to relay information to,

12 you know, to anglers at large, to lay people and not

13 burden them, really, with technical information. And

14 one can't glean quantitative information from this

15 because the angling public represents one of the most

16 important interfaces with our natural resource. This

17 language is generally couched in this way. And as one

18 reads through this document, the exhibit that we just

19 had up on the screen a moment ago --

20 JUDGE BOLLWERK: We can put it back up

21 again if you want.

22 MR. DODD: Sure, thank you. And I'm just

23 going to capture phrases from that.

24 JUDGE BOLLWERK: You may need to move it

25 down a little bit. Thank you.

1 MR. DODD: Phrases from that that tell us
2 something about the quality of the fishery based on
3 the technical surveys that underpin them. Again, this
4 is the Savannah River below New Savannah Bluff Lock
5 and Damn and that includes the area around Plant
6 Vogtle in this assessment. Terms in here, sentences,
7 "Redbreast sunfish and other sunfishes are also
8 present but not as plentiful as blue gill or red ear
9 sunfish, blue gill and red ear being abundant. Large
10 mouth bass population continues to be healthy",
11 implying that they've been looking at this over time
12 and they've seen the trend of a continued robust
13 population of large mouth bass, which is an angler's
14 favorite.
15 They do mention the drought conditions,
16 capturing the currency of this document, the temporal
17 nature of it. "The drought conditions have
18 contributed to slightly slower growth rates in fish
19 over the last few years, but a good numbers of large
20 fish are still present." And, of course, that's
21 indicating a preference that, you know, anglers would
22 like to see. These are the fish that have matured and
23 represent the top of the population structure.
24 They're available at stock size or larger.
25 Fishing this spring should be good as

1 water temperatures rise and water levels fall, typical
2 with the seasonal trend for fall and close. Fishing
3 for catfish is excellent in the Savannah River. And
4 another note here about striped bass. "Since 2005
5 stripers, a common name for stripe bass, greater than
6 27 inches have been open to harvest with a daily limit
7 of two per angler."
8 For years this fishery was shut down.
9 This next sentence captures a little bit of that. "The
10 number of striped bass and the number of legal sized
11 fish, those available for creel, have rebounded thanks
12 to the stocking program that began in the 1990s." The
13 stocking program, I'd like to mention, that was
14 necessary for recovery of striped bass owing to
15 discoveries that the Corps of Engineers tide gate
16 system at the back river in the lower Savannah River,
17 had impeded the success of these fish when it changed
18 the water quality regime leading into the `90s.
19 And 20 pound striped bass are common and
20 the occasional 40 to 50-pound striper results are
21 recorded. And again, this doesn't give us
22 quantitative information but I can tell you based on
23 my own experience something about the quantity of
24 fish. We talked earlier about how the number of fish
25 impinged at the Vogtle Units 1 and 2 is 2421 fish.

1 Well, about half of those are in the sunfish family or
2 Centrarchidae family. Many of those, 38 or more
3 percent, were by the impingement study, were in --
4 were shown to be spotted sunfish. I've done other
5 surveys on the river this last year unrelated to Plant
6 Vogtle and I do them every year. They are
7 electrofishing surveys that are conducted for Plant
8 Vogtle's radiological environmental monitoring
9 program. We sample upstream and downstream of the
10 intake structure.
11 And I've also sampled upstream for other
12 clients and other projects in the past, really over
13 the last 16 years. And I've been on the river a lot
14 and I can tell you from personal experience that when
15 one electrofishes down the river, many -- in fact most
16 of the fish we see are sunfish. They are terribly
17 abundant and that's really an understatement. For
18 example, in just a couple of hours of electrofishing
19 time, in the vicinity of Intakes 1 and 2, for these
20 monitoring surveys I mentioned, we can easily boat 40,
21 50 pounds of fish just with two hours of
22 electrofishing effort.
23 Fish are not uncommon in the area,
24 especially sunfish. So it's hard for me to put a
25 number on it but in the case of sunfish, if we impinge

1200 a year, I could say confidently, there are millions of sunfish in the Savannah River system in numbers that I can't estimate just around the middle Savannah associated with the area that Plant Vogtle lies in.

JUDGE BOLLWERK: Are there any fish that are too large or too small that this process won't work on?

MR. DODD: It can be -- it can be somewhat selective. Bottom fish, if they're beyond the range of the electrofisher, might be under-represented in electrofishing samples like catfish, for example. Larger fish, it's very effective on larger fish. Larger fish represent a larger body of electrical resistance, if you will, to electricity passing through the water and so they're slightly more vulnerable than even smaller fishes. But when we're electrofishing, in practice, I can tell you that catching an abundance, an absolute abundance of little and small sunfish particularly is a common place thing.

JUDGE BOLLWERK: Anything can you say about either of the two fish that we've been talking about essentially, the sturgeon or the red-horse in terms of how that would be effected by this? Would

1 they show up or not?

2 MR. DODD: They would show up. In -- as a
3 matter of course in other surveys in the past on other
4 river systems and I'd have to say in the lower
5 Savannah, we have encountered sturgeon as well as
6 robust redhorse, particularly in the Oconee River
7 system in Central Georgia. In fact, electrofishing is
8 the preferred method for collecting robust redhorse
9 where we have participated in -- and Georgia Power
10 does participate in robust redhorse recovery program
11 and we perform surveys on an annual basis in trying to
12 census robust redhorse populations with this gear
13 type.

14 JUDGE BOLLWERK: Dr. Coutant, anything you
15 want to say about this process in terms of what its
16 sort of overall value?

17 DR. COUTANT: Yes, yes, I would. Thank
18 you, your Honor.

19 JUDGE BOLLWERK: I should mention, Dr.
20 Young is going to have an opportunity to talk to us
21 about this, so your opportunity will definitely come.
22 Go ahead.

23 DR. COUTANT: Okay, I'd just like to pull
24 out an example from the FEIS referring to page 2-82,
25 referring to the species that really is most abundant

1 in the entrainment samples, and that's the American
2 shad. The FEIS notes that in sites of study in which
3 in 2001 they estimated 158,000 American shad migrated
4 up river to the spawning grounds. In 2002, it was
5 217,000, so doing a quick average, it comes out about
6 187, 190,000 fish, half of which we can assume would
7 be females. And each female shad produces on the
8 order of about 10,000 eggs. So if we do just a rough
9 calculation, and I hope I've got the number of zeros
10 added up right, we got around 9.3 million eggs that
11 would be produced in a year in the river that would be
12 potentially drifting past Vogtle.
13 Of course, all of them wouldn't be -- only
14 a small portion of those would be, but that gives you
15 a rough estimate that I think the FEIS authors were
16 intending to portray, that there are a lot of American
17 shad eggs out there of which a very small percentage
18 were entrained into the study that was done by
19 Southern in 2008. So I think that gives some
20 perspective.
21 I also would note that in power plants
22 that I've dealt with recently, personally sampled
23 impingement, we were dealing with numbers that on one
24 three-hour sampling would amount to more shad than was
25 collected in or is estimated from the sampling at

1 Vogtle. These are -- some of these plants that are on
2 the record have historically impinged so many fish
3 that they've collapsed the screens literally and
4 you're hauling off fish by the tens of thousands in a
5 lot of impingement instances. So I think if you look
6 at the broad picture of what has happened in some
7 power plants elsewhere, some in my own experience,
8 direct experience, the impingement rates are far
9 higher than what was sampled in this past year and was
10 estimated by the FEIS for the Vogtle site.
11 JUDGE BOLLWERK: Could you give us an
12 example of the plants you're talking about in terms of
13 the ones you mentioned that had large impingements?
14 DR. COUTANT: The ones that I was sampling
15 a year ago this past winter was the Cumberland Steam
16 Plant on the Tennessee River. It's a TVA plant. And
17 we did a year-long study of impingement there,
18 actually as part of a study to assess the impact or
19 the benefit of using strobe lights to literally scare
20 the fish away from the intake. In the course of that
21 study, we were sampling in three-hour increments
22 through the 24-hour period and counting and sizing and
23 all of the fish that we collected. And we did this
24 and quite often the numbers were, you know, in the
25 thousands of fish per collection.

1 And another example is on the Great Lakes.
2 It's very different from the Savannah River but the
3 Great Lakes have had a problem with impingement of the
4 alewife, which is a type of shad species, again,
5 which has been impinged, you know, in numbers that
6 have been physically detrimental to the plant. I say
7 this not to criticize the other plants, because
8 they've been dealing with this problem, too, but just
9 as an example to show you that on the basis of someone
10 who's been doing impingement surveys himself and has
11 looked at the impingement problems at other plants and
12 been involved with 316B issues nationally that the
13 impingement rates that we see here estimated from the
14 southern study that we've just been hearing about are
15 trivial. They're very tiny and certainly, personally
16 ones that I would not really worry about.
17 They're worth disclosing and having the
18 data for, but they're certainly not worth worrying
19 about in terms of the fish populations.
20 JUDGE BOLLWERK: What about electrofishing
21 as a way to count fish populations?
22 DR. COUTANT: It's an excellent technique.
23 I've used it myself and it's become one of the -- as
24 we've mentioned, it's one of the standard techniques
25 for fish censuses nationally.

1 JUDGE BOLLWERK: All right, let me see if
2 any of the other Board members have a question? Judge
3 Jackson?
4 JUDGE JACKSON: No.
5 JUDGE BOLLWERK: All right. We should
6 then take a break to see if we have any other
7 questions for this panel as well as look over the
8 questions we've been given. Does this generate any
9 additional questions you want us to look at? All
10 right. Okay. It is now about quarter to 3:00. Why
11 don't we take a break until 3:00 o'clock, and we'll
12 come back then and decide if there's any additional
13 questions we need to ask and the next subject of those
14 questions, the next step would obviously, be to move
15 toward the staff witnesses. All right, thank you.
16 (Whereupon, a short recess was taken.)
17 JUDGE BOLLWERK: Please, we're going to go
18 back on the record. All right, let's go back on the
19 record. We have a couple of questions. Judge
20 Jackson, Judge Trikouros?
21 JUDGE JACKSON: Sure. Mr. Moorer, the
22 first question is for you. Does the current discharge
23 permit for Units 1 and 2 contain a mixing zone or have
24 consideration of a mixing zone in it?
25 MR. MOORER: Your Honor, yes, it does.

1 consider a mixing zone.

2 JUDGE JACKSON: Are there dimensions

3 specified for this zone and --

4 MR. MOORER: The dimensions are quantified

5 in the model and they are extremely small, as you

6 might imagine from seeing the 3 and 4 data. It's --

7 the way the process works, or at least in this case it

8 worked is the model was reviewed by Georgia EPD and

9 they accepted those results, issued the permit as

10 talked before. The permit has a boilerplate

11 requirement that invokes the Georgia water quality

12 standard as a requirement of the permit. So the 90-

13 degree Fahrenheit, 5 degree Delta T° requirement is

14 part of the permit. It's a legal requirement of the

15 permit to comply with that -- the requirement, the

16 water quality standard and that's based on review of

17 the model input and the mixing zone that resulted from

18 the model.

19 JUDGE JACKSON: Okay, so the permit would

20 embody then, this analysis in order to have this

21 mixing zone of a certain size.

22 MR. MOORER: Yes, sir, I want to make it

23 clear that the permit -- we weren't directed to go do

24 a mixing zone study and turn it in. We had the mixing

25 zone information and submitted that as part of the

1 clear that the permit -- we weren't directed to go do
2 a mixing zone study and turn it in. We had the mixing
3 zone information and submitted that as part of the
4 permit application and the permit was issued with that
5 information as part of the record.
6 JUDGE JACKSON: Okay, thanks.
7 JUDGE BOLLWERK: All right, Dr. Coutant, a
8 couple questions. Relative to the mussel species of
9 the Savannah River, and host fish species which I take
10 it are the species that the mussels would use for
11 transportation from time to time, is that -- in terms
12 of -- I'm getting a little bit out of my area of
13 expertise here but maybe --
14 DR. COUTANT: That's close, actually.
15 JUDGE BOLLWERK: All right.
16 DR. COUTANT: The mussels reproduce in a
17 way that has an intermediate requirements for the
18 mussel larva to actually attach to a species of fish
19 and they're very species specific and it's the fish
20 that does the moving around. In a sense, it's like
21 the cocklebur plant that has to attach to somebody
22 walking by in order to spread its seeds. The mussel
23 that's stuck on the bottom somewhere uses the larva
24 that attach to the fish to distribute itself and then
25 it gets to the point where the larva matures, drops

1 off the fish and then colonizes an area.

2 JUDGE BOLLWERK: Are there host fish

3 species that are in decline in the Savannah River?

4 DR. COUTANT: Some of the host species for

5 certain mussel species haven't been determined and one

6 of the suggestions that has been made for some of the

7 mussel species being in decline not only in the

8 Savannah but elsewhere is the change -- perhaps change

9 in fish populations that provide the host. In some

10 cases, it's a dam that prevents the movement of the

11 fish and therefore, the mussel can't move either but

12 yes, the -- the hypothesis, at least, that some of the

13 mussel declines have been due to changes in fish

14 populations is certainly out there and acceptable in

15 some cases and uncertain in others.

16 JUDGE BOLLWERK: Do you know if any of the

17 mussel host species, the fish species, were found

18 during the impingement or entrainment study that were

19 done in 2008?

20 DR. COUTANT: I'm not sure that they were

21 actually. I haven't tried to correlate the mussel

22 with the host and the species that were entrained or

23 impinged.

24 JUDGE BOLLWERK: All right, Judge

25 Trikouros?

1 JUDGE TRIKOUROS: Yeah, if we -- if we
2 move into a period of many years of drought, at least
3 as bad as what's been experienced or worse, would you
4 think that there might be an impact on the species and
5 diversity of fish in the river?
6 DR. COUTANT: I guess it would depend on
7 how severe the drought would be. At the level of
8 drought flows that we're seeing now, I don't think the
9 drought would have that much of an impact on the fish
10 populations. There's still a lot of flow in the river
11 even though it's lower than historical.
12 To go back to the example I was using
13 earlier of the American shad, the shad population
14 which is an oceanic species, really, that comes up
15 river to spawn, probably wouldn't be effected that
16 much by the amount of flow in the Savannah unless it
17 got a whole lot lower than it is now and incidentally,
18 I should probably modify my testimony before the
19 break. I was chided by some of my biologists friends
20 for saying that shad produce 10,000 eggs. Actually,
21 it's more like 100 to 200,000 eggs per female. So I
22 was off by a few decimal points there but my point
23 remains the same.
24 But to get back to your question, I think
25 that certainly many of the species aren't going to be

1 affected to a great deal by the difference between
2 what we have seen this year and the more normal flows.
3 If it got below that, it might -- they might show
4 some effect.
5 JUDGE TRIKOUROS: So if you were to
6 conduct this study that was done in 2008 after a
7 number of years of drought, might that result in a
8 conclusion that would be different, for example,
9 rather than a very small impact, might it go to a
10 moderate impact?
11 DR. COUTANT: I suspect it would be
12 different but I would be surprised if it went from
13 small to moderate. Certainly, not large.
14 JUDGE TRIKOUROS: All right, thank you.
15 JUDGE BOLLWERK: All right, a question,
16 actually a couple of questions for Mr. Montz and Mr.
17 Dodd. Let me follow up with my discussion with Dr.
18 Coutant and ask you, did SNC identify any mussel
19 species during the 2008 impingement entrainment
20 studies in terms of host species for mussels that
21 you're aware of?
22 MR. DODD: This is Tony Dodd. No, sir,
23 not that I'm aware of. Undoubtedly, generally what is
24 known about mussels and their host fishes, some of the
25 fishes that we collect are likely to be host for

1 certain species, but we didn't make any correlation to
2 that effect for this study purpose.
3 JUDGE BOLLWERK: All right. A different
4 question although again, about the entrainment study,
5 you indicated there were significant numbers of
6 unidentified sucker larva entrained. In terms of the
7 -- what methods do you use to try to, the best you can
8 obviously, determine when you have a massive fish
9 entrainment, what fish is what, which fish is which?
10 What methods do you use? Visual? Do you do any
11 testing? How does that work?
12 MR. DODD: As far as entrainment goes?
13 JUDGE BOLLWERK: Yes.
14 MR. DODD: Well, in this case, the
15 samples, rather than processing them ourselves, we
16 sent them to a taxonomic laboratory that specializes
17 in fish taxonomy and early life history taxonomy. And
18 they use a system of keys or dichotomous keys or
19 guides in looking at certain meristic or morphological
20 characteristics of eggs and larva in determining
21 which species or family of those should be classified
22 into.
23 JUDGE BOLLWERK: And do they ever use
24 genetic testing of any kind?
25 MR. DODD: No, sir.

1 JUDGE BOLLWERK: Why not?

2 MR. DODD: Well, that would be just beyond
3 the scope of an ID and enumeration survey which is
4 what this amounts to.

5 JUDGE BOLLWERK: All right. Any other
6 questions from members of the Board at this point?
7 All right. Then gentlemen, I thank you for your
8 testimony. You are subject to being recalled and if
9 you were recalled you would still be under oath, but
10 at this point, we thank you for your testimony. We
11 appreciate your taking the opportunity to talk with
12 us. Thank you very much.

13 MR. DODD: Thank you.

14 JUDGE BOLLWERK: All right, I think the
15 next order of business would be to have the staff
16 panel come up so we can put their testimony into the
17 record as well as the exhibits that accompany them.
18 And while they're coming up, let me ask another
19 scheduling question of the Joint Interveners. In
20 terms of the witnesses you have for 1.3, are there any
21 scheduling problems with those in terms of going into
22 Wednesday?

23 MR. SANDERS: Going into Wednesday? Hold
24 on one second.

25 JUDGE BOLLWERK: Surely. I'm sorry, I've

1 got the wrong -- well, Tuesday, perhaps into
2 Wednesday, I guess is my -- we will definitely start
3 tomorrow. Any problems going into Wednesday is the
4 question.
5 JUDGE TRIKOUROS: Wednesday is all right,
6 though.
7 MR. SANDERS: Mr. Powers, our expert is
8 going to be here this afternoon and will be here all
9 day tomorrow and I just don't recall what his schedule
10 is for Wednesday.
11 JUDGE BOLLWERK: Okay.
12 MR. SANDERS: I'm just not sure if he's
13 going to be here.
14 JUDGE BOLLWERK: Okay, when he arrives
15 maybe you could ask him that question and just let us
16 know, we'd appreciate it.
17 MR. SANDERS: Sure.
18 JUDGE BOLLWERK: Thank you. All right,
19 before we start, I think we have -- we've identified
20 someone with a potential health problem; is that true?
21 No?
22 MR. VAIL: I don't think it's -- it's not
23 life-threatening. I just have a cold.
24 JUDGE BOLLWERK: Well, all I want to say
25 is, if you're having a problem and you need to just

1 signal me and we'll take a brief break. I don't want
2 anybody, you know, collapsing on the table. This is
3 not necessarily a marathon. So but just let me know,
4 all right.
5 All right, let's go ahead and if you would
6 each raise your -- let's see, I guess we'll have each
7 of the witnesses identified first, briefly.
8 MR. MOULDING: Yes, thank you, Judge
9 Bollwerk. For Contention 1.2, the Staff is calling
10 Dr. Michael Masnik, Ms. Anne R. Kuntzleman, Rebekah
11 Krieg, Dr. Christopher Cook, Mr. Lance W. Vail. And
12 they're seated in order.
13 JUDGE BOLLWERK: Mr. Reporter, I'm just
14 checking, did you get who those are or do we need to -
15 - do you know who's who?
16 MR. MOULDING: I'll walk through that
17 right now if you don't mind. Sitting on the far right
18 is Dr. Christopher Cook. To his left is Mr. Lance
19 Vail. To his left is Dr. Michael Masnik. To Dr.
20 Masnik's left is Ms. Rebekah Krieg and to her left is
21 Ms. Anne Nancy Kuntzleman.
22 JUDGE BOLLWERK: All right, then if you
23 would each raise your right hands, please. And again,
24 you need to give an affirmative answer orally to the
25 question and maybe we'll just go right down the line

1 starting on this end over here. I want to say it's my
2 left, your right, I think.
3 (Panel sworn.)
4 JUDGE BOLLWERK: All right, thank you very
5 much. All right, then if we want to go ahead and work
6 with their testimony then.
7 MR. MOULDING: Sure, at this time the
8 Staff requests that if you can bring up on the screen
9 both the direct and the rebuttal testimony for the NRC
10 staff for Contention 1.2. And perhaps in the interest
11 of saving time I'll read the question that will apply
12 to each of the witnesses and then each of them can
13 indicate --
14 JUDGE BOLLWERK: All right.
15 MR. MOULDING: -- indicate their
16 affirmation of their testimony.
17 JUDGE BOLLWERK: Okay.
18 MR. MOULDING: Witnesses, are you familiar
19 with the testimony entitled NRC Staff Testimony of Dr.
20 Michael T. Masnik, Anne R. Kuntzleman, Rebekah H.
21 Krieg, Dr. Christopher B. Cook and Lance W. Vail
22 concerning Environmental Contention 1.2 and the
23 testimony entitled NRC Staff Rebuttal Testimony of Dr.
24 Michael T. Masnik, Anne R. Kuntzleman, Rebekah H.
25 Krieg, Dr. Christopher B. Cook and Lance W. Vail

1 concerning Environmental Contention EC 1.2 which are
2 both dated February 26th, 2009 and which have been
3 provided to the Court Reporter in electronic format
4 under file name Vogtle ESP NRC Staff EC 1.2 Direct
5 Testimony and Vogtle ESP NRC Staff EC 1.2 Rebuttal
6 Testimony respectively.
7 DR. COOK: Yes.
8 MR. VAIL: I am.
9 DR. MASNIK: I am.
10 MS. KRIEG: I am.
11 MS. KUNTZLEMAN: I am.
12 MR. MOULDING: Do you affirm that the
13 portions of this direct and rebuttal testimony bearing
14 your initials as well as your attached statement of
15 professional qualification were prepared by you and
16 that together they are true and correct to the best of
17 your knowledge and belief?
18 DR. COOK: Yes.
19 MR. VAIL: Yes.
20 DR. MASNIK: Yes.
21 MS. KRIEG: Yes.
22 MS. KUNTZLEMAN: Yes.
23 MR. MOULDING: At this time, the staff
24 moves that the direct and rebuttal testimony be
25 entered into the record as if read.

1 JUDGE BOLLWERK: Are there any objections
2 to either the direct or the rebuttal testimony?
3 Hearing none, then the direct testimony of Dr. Cook,
4 Ms. Krieg, Ms. Kuntzleman, Dr. Masnik and Mr. Notich
5 and Mr. Vail, the direct testimony is entered into the
6 record as if read as DDMS Item ID 59320.
7 (Masnik, et al, Direct Testimony (DDMS-
8 59320) to be inserted at this point.)
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Corrected on: February 26, 2009
Corrected on: February 2, 2009
Originally Filed on: January 9, 2009

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, ANNE R. KUNTZLEMAN, REBEKAH H. KRIEG, DR. CHRISTOPHER B. COOK, AND LANCE W. VAIL CONCERNING ENVIRONMENTAL CONTENTION EC 1.2

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

A1(a). (MTM) My name is Dr. 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). (ARK) My name is Anne "Nancy" R. Kuntzleman (ARK). I am employed as an Aquatic Biologist in the Division of Site and Environmental Reviews, Office of New Reactors, NRC. I am a technical reviewer for the NRC on aquatic and terrestrial resources 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(c). (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, GA. A statement of my professional qualifications is attached hereto.

A1(d). (CBC) My name is Dr. Christopher B. Cook (CBC). I am employed as a Senior Hydrologist in the Division of Site and Environmental Reviews, Office of New Reactors (NRO), NRC. I was employed as a Senior Research Engineer at PNNL and was assigned as the lead technical reviewer on hydrology issues for PNNL's contract with the NRC when the application was submitted on August 14, 2006, by Southern for an ESP for a site within the existing VEGP site near Waynesboro, GA. While at PNNL, I assisted with the development of portions of NUREG-1872, "Draft Environmental Impact Statement for an Early Site Permit (ESP) at the Vogtle Electric Generating Plant Site," September 2007 ("DEIS"), relating to hydrological alterations, water use, and water quality issues. As part of my current employment, I was a technical reviewer for the NRC on hydrological alterations, water use, and water quality issues associated with the Vogtle ESP. A statement of my professional qualifications is attached hereto.

A1(e). (LWV) My name is Lance W. 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.

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 the evaluation of impacts to aquatic organisms due to interactions with the proposed station intake and discharge structures. My assessment of impacts 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"). I also had technical input to the descriptive information contained in Section 2.7.2 of the FEIS.

A2(b). (ARK) In my capacity as the aquatic biologist assigned to the VEGP ESP review I provided technical oversight to the PNNL reviewers during the preparation of Sections 2.7.2 (Aquatic Ecology), 4.4 (Ecological Impacts from Construction), 5.4 (Ecological Impacts from Operation), and 7.5 (Cumulative Impacts - Aquatic Ecosystem) of the FEIS.

A2(c). (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 4.4.2, 5.4, and 7.5 of the FEIS. I worked under the technical oversight of Dr. Michael T. Masnik and Ms. Nancy Kuntzleman of the NRC.

A2(d). (CBC) As part of my official responsibilities at PNNL as a hydrology technical reviewer to the VEGP ESP review, I evaluated the surface water hydrology and plant water systems documented in Chapters 2, 3, 4, 5, 7 and 9 of the DEIS. As part of my official responsibilities at the NRC as the hydrology technical reviewer assigned to the VEGP ESP review, I was responsible for reviewing the analysis prepared by Mr. Vail (LWV) related to surface water hydrology and plant systems until March 2008. Although I was not a technical reviewer on the application during completion of the FEIS, I am familiar with the Staff's analysis

and conclusions documented in Chapters 2, 3, 4, 5, 7, and 9 of the FEIS concerning surface water hydrology and plant water systems.

A2(e). (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 the FEIS. I assumed responsibility as the PNNL hydrology technical reviewer following publication of the NRC Staff's Draft Environmental Impact Statement ("DEIS").

Q3. What is the purpose of this testimony?

A3(a). (ALL) The purpose of this testimony is to present the NRC Staff's views with respect to Contention EC 1.2 , which challenges the adequacy of the analysis in the FEIS of cooling system-related impacts on aquatic resources.

Q4. Are you familiar with Contention 1.2?

A4. (ALL) Yes. Contention EC 1.2 submitted in this proceeding by the Center for a Sustainable Coast, Savannah Riverkeeper, Southern Alliance for Clean Energy, Atlanta Woman'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 January 15, 2008, ruling on the Applicant's Motion for Summary Disposition, alleges that:

> The [Environmental Report (ER)] fails to identify and adequately consider direct, indirect, and cumulative impingement/entrainment and thermal effluent discharge impacts of the proposed cooling system intake and discharge structures on aquatic resources.

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, and the declaration of Barry W. Sulkin, dated November 9, 2007. It is our understanding that the contention concerns the potential operational and cumulative impacts of the proposed new

Vogtle reactors on the aquatic biota in the Savannah River. Specifically, it concerns impacts from impingement and entrainment due to operation of the new units' intake structure, as well as thermal impacts due to the operation of a new discharge structure.

The new intake and discharge structures are necessary for the operation of two additional units at the VEGP site. The Staff's assessment of the impacts to aquatic biota in the Savannah River due to impingement and entrainment and thermal effects from the operation of two additional units at the VEGP site is presented in the FEIS. Our testimony therefore focuses on the Staff analysis documented in the FEIS. However, in preparing this testimony we have also considered and referenced the following specific documents (with NRC Exhibit numbers noted) in the responses for which we are individually responsible, as indicated by our initials:

- NUREG-1872, Final Environmental Impact Statement for an early Site Permit (ESP) at the Vogtle Electric Generating Plant Site, Volumes 1 & 2 (August, 2008) combined with corrected Appendix F and the September 3, 2008 Errata. Volume 1; Volume 2; Appendix F; Errata (NRC000001).

- Academy of Natural Sciences of Philadelphia (ANSP). 2001. 2000 Savannah River Biological Surveys for Westinghouse Savannah River Company. Report No. 01-16F. Patrick Center for Environmental Research, Philadelphia, Pennsylvania. (NRC000002).

- Academy of Natural Sciences of Philadelphia (ANSP). 2003. 2001 Savannah River Biological Surveys for Westinghouse Savannah River Company. Report No. 03-08F, Patrick Center for Environmental Research, Philadelphia, Pennsylvania. (NRC000003).

- Academy of Natural Sciences of Philadelphia (ANSP). 2005. 2003 Savannah River Biological Surveys for Westinghouse Savannah River Company. Report No. F04-06, Patrick Center for Environmental Research, Philadelphia, Pennsylvania. (NRC000004).

- The Catena Group. 2007. Freshwater Mussel Surveys, The Savannah River from Augusta to Savannah: South Carolina & Georgia. The Catena Group, Hillsborough, North Carolina. (NRC000005).

- Excerpts from: Marcy Jr. B.C., D.E. Fletcher, F.D. Martin, M. Paller, and M.J.M. Reichert. 2005. Fishes of the Middle Savannah River Basin. The University of Georgia Press, Athens, Georgia. (NRC000006).

- Excerpts from: Regulatory Guide 4.2 Rev. 2, Preparation of Environmental Reports for Nuclear Power Stations (1976). (NRC000007).

- Regulatory Guide 4.7, Rev. 2, General Site Suitability Criteria for Nuclear Power Stations (1998). (NRC000008).

- NUREG-1555 Standard Review Plans for Environmental Reviews for Nuclear Power Plants ("ESRP") (2000) Sections: 2.3.1, 2.4.1; 2.4.2; 5.3.1.2; 5.3.2.2; 9.4.1 (NRC000009).

- NUREG-1555 Standard Review Plans for Environmental Reviews for Nuclear Power Plants ("ESRP") Draft Rev. 1 (2007) Sections: 4.7; 5.3.1.2; 9.4.1 (NRC000010).

- Excerpts from: Specht 1987, Comprehensive Cooling Water Study, Final Report, Volume V, Aquatic Ecology, Savannah River Plant, DP-1739-5. (NRC000011).

- Paller M.H., B.M. Saul, and D.V. Osteen. 1986. Distribution and Abundance of Ichthyoplankton in the Mid-Reaches of the Savannah River and Selected Tributaries. Primary Report No. DPST-86-798, Environmental and Chemical Sciences, Inc., Aiken, South Carolina. (NRC000012).

- Excerpts from: Bennett D.H. and R.W. McFarlane. 1983. The Fishes of the Savannah River Plant: National Environmental Research Park. SRO-NERP-12. Savannah River Ecology Laboratory, U.S. Department of Energy, Washington, D.C. (NRC000013).

- NUREG -1087 Final Environmental Statement Related to the Operation of Vogtle Electric Generating Plant, Units I and 2. Docket Nos. 50-424 and 50-425 (1985). (NRC000014).

- Hendricks A.S. 2002. The Conservation and Restoration of the Robust Redhorse, Moxostoma robustum. Vol. 3. Georgia Power Company Environmental Laboratory, Smyrna, Georgia. (NRC000015)

- Nichols M. 2003. Conservation Strategy for Robust Redhorse (Moxostoma robustum) Environmental Laboratory Georgia Power Company for Robust Redhorse Conservation Committee, Atlanta, Georgia. (NRC000016).

- 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. (NRC000017).

- Letter from United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service from Walt Wilson, Fisheries Biologist, Protected Resources Division to NRC Staff, October 24, 2006, "Endangered and Threatened Species and Critical Habitats under the Jurisdiction of the NOAA Fisheries Service." (NRC000018).

- Georgia Department of Natural Resources (GDNR). 2008. Locations of Special Concern Animals, Plants and Natural Communities in Burke County, Georgia. (NRC000019).

- E-Mail from Jennifer Price, South Carolina Department of Natural Resources, to Rebekah Krieg, Pacific Northwest National Laboratories, July 26, 2007, "Federal Threatened and Endangered Species in the Vicinity of Vogtle Electric Generating Plant." (NRC000020).

- South Carolina, Rare, Threatened ,and Endangered Species Inventory; Species Found in Barnwell County. (NRC000021).

- 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. (NRC000022).

- Halverson et al. 1997, Savannah River Site Ecology Environmental Information Document. WSRC-TR-97-0223, Westinghouse Savannah River Company, Washington, D.C. (NRC000023).

- Collins M.R. and T.I.J. Smith. 1993. "Characteristics of the Adult Segment of the Savannah River Population of Shortnose Sturgeon." Proceedings of the Annual Conference of Southeastern Association of Fish and Wildlife Agencies 47:485-491. (NRC000024).

- Status Review of Atlantic Sturgeon (Acipenser oxyrinchus): Prepared by the Atlantic Sturgeon Status Review Team for the National Marine Fisheries Service National Oceanic and Atmospheric Administration February 23, 2007. Updated with corrections on July 27, 2007. (NRC000025).

- Graph Showing Waynesboro-Thurmond Discharge, Date (1.22.05 - 10.27.08). (NRC000026).

- Freeman, M.C. and P. Marcinek, 2006. "Fish Assemblage Responses to Water Withdrawals and Water Supply Reservoirs in Piedmont Streams" Envi. Management vol. 38, no. 3 pp. 435-450. (NRC000027).

- Historic Savannah Streamflow Graph from USGS gage # 02197000 at Augusta, GA (~1904-2007). (NRC000028).

- 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." (SNC000022).

- Southern Nuclear Operating Company, Draft Interim Report of Fish Impingement and Entrainment Assessment at the Plant Vogtle Electric Generating Plant, September 2008. (NRC000030).

- Letter from J. A. "Buzz" Miller, Senior Vice President, Nuclear Development, Southern Nuclear Operating Company, Inc. to NRC Staff dated May 27, 2008 with attached Impingement and Entrainment Monitoring Update at Plant Vogtle. (NRC000031).

- Note-to-File: Trip report of March 7-9, 2007, tour of VEGP Units 1 and 2. (NRC000032).

- Note-to-file: Trip report of October 14, 2008. (NRC000033).

- Paller M.H. 1992. The Influence of Savannah River Discharge and Changing Savannah River Site (SRS) Cooling Water Requirements on the Potential Entrainment of Ichthyoplankton at the SRS Savannah River Intakes. WSRC-RP-92-1001, Westinghouse Savannah River Co., Aiken, South Carolina. (NRC000034).

- U.S. Environmental Protection Agency "National Pollutant Discharge Elimination System: Regulations Addressing Cooling Water Intake Structures for New Facilities," 66 Fed. Reg. 65,256. (December 18, 2001). (NRCR00035).

- McFarlane R.W., R.F. Frietsche and R.D. Miracle. 1978. Impingement and Entrainment of Fishes at the Savannah River Plant. An NPDES 316b Demonstration. DP-1494, E.I. Du Pont DE Nemours and Company, Savannah River Laboratory, Aiken, South Carolina. (NRC000036).

- NUREG-1437 Vol. 1 & 2 Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Main Report, Final Report. (1996). (NRC000037).

- U.S. Army Corps of Engineers (USACE). 2006. Drought Contingency Plan Update: Savannah River Basin. Draft Environmental Assessment and Finding of No Significant Impact. Mobile/Savannah Planning Center, Savannah District, U.S. Army Corps of Engineers. (NRC000038).

- US Army Corps of Engineers, Savannah District, Draft Environmental Assessment and Finding of No Significant Impact, Temporary Deviation Drought Contingency Plan, Savannah River Basin, October 2008. (NRC000039).

- Aucott, W.R., S.R.S. Meadows, and G.G. Patterson. 1987. Regional Ground-Water Discharge to Large Streams in the Upper Coastal Plain of South Carolina and Parts of North Carolina and Georgia. Water-Resources Investigations Report 86-4332, U.S. Geological Survey, Columbia, South Carolina. (NRC000040).

- Flow Data from Thurmond Dam Discharge and USGS Gauge #021973269 Near Waynesboro, GA. (NRC000041).

- Excerpt from: Clarke, J.S. and C.T. West, USGS, Ground-Water Levels, Predevelopment Ground-Water Flow, And Stream-Aquifer Relations In The Vicinity Of The Savannah River Site, Georgia And South Carolina. 1997. (NRC000042).

- Excerpt from: US Global Change Research Program: The Potential Consequences of Climate Variability and Change (2000). (NRC000043).

- Excerpt from: Intergovernmental Panel on Climate Change: Climate Change 2007, Synthesis Report. (NRC000044).

- NUREG 1437, Supplement 34-General Environmental Impact Statement for Licenses Renewal of Nuclear Plants, Supplement 34, Regarding Vogtle Electric Generating Plant, Units I and 2. Draft Report for Comment. (NRC000045).

- AP1000 DCD Revisions 15 and 16 Values: Summary of Cooling System Flow Rate Changes. (NRC000050).

## I. Description of Aquatic Species and Habitat in FEIS

Q5. Does the U.S. NRC Staff ("Staff") discuss in the FEIS the aquatic species composition and habitat in the Savannah River?

A5. (RHK) Section 2.7.2.1 of the FEIS discusses the aquatic communities on and near the VEGP site. The discussion includes the species composition of molluscs and fish in the Savannah River. It also includes a short description of the habitat types in the middle reach of the Savannah River (defined as occurring from the Fall Line at RM 220 downstream to the mouth of Brier Creek (RM 97)). The FEIS discusses the results of studies related to diatoms, aquatic insects, molluscs and fish.

The discussion of attached algae, aquatic macrophytes, diatoms and aquatic insect composition from Section 2.7.2.1 of the FEIS is based on information provided in a series of reports written by the Academy of Natural Sciences, Philadelphia ("ANSP"), which contained the results of biological and water quality studies that the ANSP conducted in the Savannah River in the vicinity of the Savannah River Site (SRS). Exhibit NRC000001 at 2-75. In particular, "2000 Savannah River Biological Surveys for Westinghouse Savannah River Company", addresses attached diatoms, algae, aquatic macrophytes, and aquatic insects. Exhibit NRC000002 at v to vii, 17 to 73, and 122 to 206. "2001 Savannah River Biological Surveys for Westinghouse Savannah River Company", addresses diatoms, attached algae, aquatic macrophytes and aquatic insects. Exhibit NRC000003 at v to x, 19 to 99, and 153 to 198. In addition, "2003 Savannah River Biological Surveys for Westinghouse Savannah River Company", addresses diatoms and aquatic insects on pages 6-12. Exhibit NRC000004 at 6 to 12. The SRS is a U.S. Department of Energy ("DOE") site located across the Savannah River from the VEGP site.

A discussion of molluscs identified in the vicinity of the VEGP site is included in Section 2.7.2.1 of the FEIS. Exhibit NRC000001 at 2-76. The ANSP studies were used as a basis for describing the changes in the mussel fauna since studies began in 1951. Exhibit NRC000002

at vi, vii, and 74 to 79, 90 to 107 and 112 to 121; Exhibit NRC000003 at vii, viii, and 99 to 104, 117 to 137 and 141 to 152. The ANSP studies were also used to identify the continued presence of state protected species in the Savannah River. Exhibit NRC000001 at 2-87 and 2-88; Exhibit NRC000002 at 94; Exhibit NRC000003 at 121. After the draft was published, the Staff became aware of a more recent survey of freshwater mussels occurring in the middle and lower Savannah River in late 2006 for the U.S. Fish and Wildlife Service ("USFWS") (The Catena Group, 2007, "Freshwater Mussel Surveys: The Savannah River from Augusta to Savannah: South Carolina and Georgia"). Exhibit NRC000005. The Staff included information from the mussel survey in the FEIS, including the number of important species identified during the survey and their locations. Exhibit NRC000001 at 2-76, 2-87 and 2-88.

The list of native, diadromous, marine and upland fish species in the Middle Savannah River, in Table 2-7 of Section 2.7.2.1 of the FEIS is based on Marcy, et al. (2005), "Fishes of the Middle Savannah River Basin." Exhibit NRC000001 at 2-77 to 2-79; Exhibit NRC000006 at 9 to 11. A list of introduced fish species was provided in Table 2.8 of Section 2.7.2.1 of the FEIS. Exhibit NRC000001 at 2-80. FEIS Section 2.7.2.1 also provides information on the latest fish surveys that were conducted on the Savannah River in the vicinity of the VEGP site by the ANSP. Exhibit NRC000001 at 2-80 and 2-81; Exhibit NRC000002 at viii to ix and 207 to 251; Exhibit NRC000003 at ix and 199 to 238. These surveys occurred between RM 122 and 161. Exhibit NRC000002 at 9 to 14; Exhibit NRC000003 at 11 to 16. For reference, the VEGP Units 3 and 4 intake site is proposed to be located at approximately RM 151. Section 2.7.2.1 of the FEIS states the number of fish species and specimens that were identified in these samples, and specifies the five taxa that composed 74-75% of the sample. Exhibit NRC000002 at 221 to 223; Exhibit NRC000003 at 214 to 216. A brief description of the ichthyoplankton studies conducted at the Savannah River site in 1984 and 1985 is also presented in Section 2.7.2.1. Exhibit NRC000011 at V-241 to V-548; Exhibit NRC000012.

Q6. What is the applicable Staff guidance for preparing its description of aquatic species and habitat in the FEIS?

A6. (ARK) The Staff reviewed the environmental report (ER) prepared by the applicant in accordance with guidance provided in Regulatory Guide 4.2, Revision 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976). Regulatory Guide 4.2 identifies the information needed by the Staff in the preparation of its assessment of the potential environmental effects of the proposed nuclear facility. Regulatory Guide 4.2, Chapter 2.2, "Ecology," states that "the applicant should describe the flora and fauna in the vicinity of the site, their habitats, and their distribution. This initial inventory will reveal certain organisms which, because of their importance to the community, should be given special attention." Exhibit NRC000007 at 2-3.

The Staff also followed guidance set forth in NUREG-1555, *Environmental Standard Review Plan,* Section 2.4.2, and "Aquatic Ecology." This section "[d]irects the staff's description of the aquatic environment and biota at and in the vicinity of the site and other areas likely to be impacted by the construction, maintenance, or operation of the proposed project." Exhibit NRC000009 at 2.4.2-1. According to the ESRP, the scope of the Staff's review "[s]hould include the spatial and temporal distribution, abundance, and other structural and functional attributes of biotic assemblages on which the proposed action could have an impact. The review should also identify any "important" or irreplaceable aquatic natural resources and the location of sanctuaries and preserves that might be impacted by the proposed actions." Exhibit NRC000009 at 2.4.2-1. The ESRP explains that "[t]he depth and extent of the input to the EIS should be governed by the kinds of aquatic ecological resources that could be affected by plant construction or operation and by the nature and magnitude of the expected impacts to these resources." Exhibit NRC000009 at 2.4.2-6.

Furthermore, the ESRP states that:

> "The input should be brief and should contain the following information: 1) The principal aquatic ecological features of the site and vicinity...with emphasis on the communities of the ecosystem that will be potentially affected by project construction, operation, or maintenance. This information should be based on an analysis of at least one full year of data to reflect seasonal variations in aquatic populations. Thus, the extent of discussion of various biotic components should be in proportion to the estimated severity of impacts and should be adequate to support the assessment of ESRP Chapters 4.0 (Environmental Impacts of Construction) and 5.0 (Environmental Impacts of Station Operation). 2) Descriptions of environmental or man-induced stresses to aquatic biota at the existing site and vicinity. 3) A discussion of 'important' aquatic species that may be affected by plant or transmission corridor construction or operation. Estimates of their abundance should be provided where appropriate. Special habitat and forage needs should be emphasized, if the proposed project would potentially disrupt these. 4) A summary of consultations with appropriate Federal, State, regional, local and affected Native American tribal agencies, including the U.S. Fish and Wildlife Service (through the regional director), and the director of the State fish and wildlife agency."

Exhibit NRC000009 at 2.4.2-6 and 2.4.2-7. A description of how the Staff followed this guidance in its review of the Vogtle ESP application is described below in response to Question 7.

Q7. How did the Staff follow that guidance in its review of the Vogtle ESP application?

A7. (ARK) The Staff followed the guidance in Regulatory Guide 4.2 and in the ESRP in several ways. The Staff characterized the kinds of aquatic ecological resources in the vicinity of the VEGP site and other areas likely to be impacted by the construction, operation, or maintenance of the proposed VEGP Units 3 and 4. In doing so, the Staff emphasized the aquatic communities of the VEGP site (e.g., onsite ponds and streams as well as the reach of the Savannah River adjacent to the VEGP site) that will be potentially affected by project construction, operation and maintenance. Then, consistent with the definitions in the ESRP and Regulatory Guide 4.2, the Staff identified the "important" aquatic species, including Federally listed threatened, endangered, or candidate species; those aquatic species listed by the States of South Carolina or Georgia as threatened, endangered, or species of concern; and commercially and recreationally important fish species that may be affected by plant

construction or operation. The determination of these species for the review of the Vogtle ESP application is discussed in more detail in my colleague's response to Question 10, below. Also, the Staff consulted with the U.S. Fish and Wildlife Service, National Marine Fisheries Service, Georgia Department of Natural Resources ("GADNR"), and the South Carolina Department of Natural Resources ("SCDNR") and requested information on listed species, the presence of any critical habitat in the vicinity of the VEGP site, and any additional information considered to be appropriate under the provisions of the Fish and Wildlife Coordination Act.

Q8. During the Staff's preparation of the FEIS, was recent sampling or monitoring data obtained by the applicant available specifically for the existing Units 1 and 2?

A8. (RHK) No, the applicant did not provide recent sampling and monitoring data that it had conducted in support of the ESP application at the time the application was submitted. However, the applicant provided sampling and survey information from that stretch of the Savannah River from other sources in support of its application. Further, shortly before the publication of the FEIS, the applicant provided initial results of impingement monitoring.

Regulatory Guide 4.2, "Preparation of Environmental Reports for Nuclear Power Stations", Rev. 2 (1976), on page ix, specifies that an applicant "should present sufficient information in the environmental report that is submitted with the application to allow staff evaluation of the potential environmental impact of constructing and operating the proposed facility." Exhibit NRC000007 at ix. Further, the guidance states that "in all cases, the site-specific environmental data presented at the time of filing for a construction permit should (1) document the critical life stages and biologically significant activities (e.g., spawning, nesting, migration) that increase the vulnerability of the potentially affected biota at the proposed site and (2) characterize the seasonal variations of biota likely to be affected by the station." *Id.* In other words, the documentation and characterization of the potentially affected biota should be aimed at those activities and life-stages that make the biota vulnerable to the operations at the site and should span multiple periods in a year.

Further, Section 2.4.2 of the ESRP 2000 states that this information "should be based on an analysis of at least one full year of data to reflect seasonal variations in aquatic populations." Exhibit NRC000009 at 2.4.2-6. As discussed later in my testimony in response to Question 9, the applicant's ER did refer to studies that were systematic and spanned multiple years and multiple periods within years and that occurred in the vicinity of the site, even though these studies were not conducted by the applicant.

Moreover, as discussed in the FEIS, the applicant initiated impingement monitoring and entrainment monitoring in March 2008 to estimate species composition and density of ichthyoplankton entrained by the cooling water withdrawals and to qualitatively identify and enumerate fish impingement rates. Exhibit NRC000001 at 2-94; Exhibit NRC000031 at 1 and 2. The Staff discussed the initial results of the impingement monitoring in Section 5.4.2.2 of the FEIS. Exhibit NRC000001 at 5-32. Furthermore, since the time the FEIS was issued, the applicant has provided additional preliminary results of these site-specific studies for both entrainment and impingement, which are discussed later in this testimony.

The Staff considered the data that was presented in the application along with other data that was available to be adequate for the Staff's review and consistent with Staff guidance.

Q9. What sources or studies did the Staff rely on for preparing its description of aquatic species and habitat in the FEIS? How did the Staff determine which sources to include?

A9. (RHK) The Staff relied on a variety of sources of information to prepare the description of the aquatic species and habitats in the FEIS. There were five major sources or groupings of sources of information that were used, as well as specific reports that addressed individual species.

First, the Staff used Marcy et al. to provide a general description of the environment, and specifically to identify the fish species that are present in the stretch of the Savannah River adjacent to the site as given in Section 2.7.2.1 of the FEIS. Exhibit NRC000006; Exhibit NRC000001 at 2-74 and 2-77 to 2-80. In the Introduction to Marcy et al., the authors explicitly

state on page 1 that "Our book comprises habitat characterizations, family descriptions, species accounts, habitat and species photographs, and a taxonomic identification key." The data that are presented by Marcy et al. were obtained from an area from RMs 97 to 221. The VEGP site is located at RM 150 to 152, roughly the midpoint in this stretch of the river. Marcy et al. based their records of distribution in the Middle Savannah River Basin (MSRB) and species life history information on more than 120 years of data collection from the MSRB and 50 years for the Savannah River Site (SRS). Exhibit NRC000006 at 7. According to Marcy et al., the SRS, which is located directly on the other side of the Savannah River from the VEGP site, has contributed more than 500 publications to fish studies. Exhibit NRC000006 at 8. Marcy et al. also used other sources, including input from the South Carolina Department of Natural Resources. Over 33 pages of references are provided in Marcy et al., as literature sources that were cited in the development of this compendium. Exhibit NRC000006 at 419 to 452.

Marcy et al. was not developed to provide an impact assessment, although the chapter entitled "Savannah River and Swamps" and the subsection entitled "Human Influences on the Fish Fauna of the Savannah River and Associated Swamps" does describe the many sources of indirect influences on the local fish fauna including urbanization, fisheries, industrial activities, the Savannah River Site, flood/water control, channelization, sedimentation and pollution. Exhibit NRC000006 at 13 to 20 and 14 to 17. In the discussion of industrial activities, Marcy et al. indicates that historically the largest sources of entrainment in the MSRB have been the cooling water intakes for SRS and Plant Vogtle. Exhibit NRC000006 at 16. Marcy et al. does not specify water velocity across the intake screens. Marcy et al. also does not quantify or compare the magnitude of the entrainment impacts in relation to other industrial impacts or to other impact sources on this list.

Second, the Staff used a series of reports that were developed by the Academy of Natural Sciences in Philadelphia as a source of information for the FEIS to describe the aquatic species composition and habitat in the Savannah River. The three reports referred to in the

FEIS were published in 2001, 2003 and 2005 (ANSP 2001, ANSP 2003, ANSP 2005). The ANSP conducted biological and water quality studies in the Savannah River between RM 122 and RM 160 starting in 1951 for the purpose of assessing potential effects of the SRS on the aquatic communities in the Savannah River. Components of the ANSPs study included basic water chemistry, diatoms, other attached algae, aquatic macrophytes (mosses and rooted aquatic plants), protozoa, aquatic insects, non-insect macroinvertebrates and fish. Sampling stations were added at RM 151.2 and 149.8 in 1985 to assess the potential impacts of the VEGP site. Exhibit NRC000003 at ii, 2, 3 and 15-16. The ANSP conducted two types of surveys – "comprehensive surveys" and "cursory surveys", defined as surveys including "a reduced set of components, typically attached algae, insects and fish, but [that] were conducted annually with four sampling periods per year. During years with comprehensive surveys, the comprehensive surveys substituted for two of the usual cursory sampling periods. Cursory surveys occurred at the Vogtle site until 1997. Exhibit NRC000003 at ii. Beginning with data from 1997 and continuing with data collected through 2000, aspects of the Plant Vogtle surveys were combined into a single, comprehensive study, which included fish species. The last sampling at Station 2B (one of the original Vogtle stations) was conducted in 2001, but the samples were archived and not analyzed. Exhibit NRC000003 at 199 and 200.

The Staff used the ANSP studies to provide an understanding of the river ecology and the current species of fish and molluscs present in the vicinity of the VEGP site. These studies demonstrate that the Savannah River has been studied extensively upstream and downstream of the VEGP site and at different seasons throughout the year. The Staff also used the studies to provide an indication of the impacts of the SRS facilities and the existing VEGP Units 1 and 2 on the health of the Savannah River. When all SRS facilities were in operation, they withdrew considerably greater amounts of cooling water than are anticipated to be withdrawn by VEGP Units 3 and 4. The VEGP Units 1 and 2 withdraw an amount comparable to that anticipated for VEGP Units 3 and 4. The ANSP studies were "designed to assess the potential effects of

Savannah River Site (SRS) contaminants and warm-water discharges on the general health of the river and its tributaries." Exhibit NRC000003 at i. Surveys above and below the Plant Vogtle intakes were initiated in 1985 "to assess potential impacts of Georgia Power and Light's Vogtle Nuclear Power Plant so that these could be separated from potential SRS impacts" (*id.* at ii). The Staff noted in FEIS Section 2.7.2.1 that the ANSP 2001 study data (ANSP 2003) indicated that species richness for fish was significantly higher at the sampling location farther downstream than at the sampling location upstream of the SRS, and, further, that neither species diversity, nor densities of common species of fish, differed significantly between stations. Exhibit NRC000001 at 2-81; Exhibit NRC000003 at x. Moreover, in a finding the Staff did not specifically cite in the FEIS, the ANSP went further and stated that "We conclude that...results of the 2001 Savannah River biomonitoring study do not provide compelling evidence of an SRS impact on biological communities in the river." Exhibit NRC000003 at xi. The ANSP also characterized its sampling program as being "one of the most comprehensive ecological datasets available for any of the world's rivers." Exhibit NRC000003 at v.

A third source of information was two overlapping reports describing the ichthyoplankton distribution, which was discussed in FEIS Section 2.7.2.1. Exhibit NRC000001 at 2-81. Both sources were studies conducted by the Savannah River Site and reported in Specht (1987) and Paller (1986). Specht (1987), "Comprehensive Cooling Water Study Final Report," is a comprehensive review of Paller (1986), "Distribution and Abundance of Ichthyoplankton in the Mid-Reaches of the Savannah River and Selected Tributaries" and several other reports. Exhibit NRC000011 at V-241 to V-335 and V-454 to V-536; Exhibit NRC000012 at xii to xvii and 3-1 to 5-9, respectively. These studies involved the stretch of the river along the southwestern edge of the SRS, which is directly across the river from the VEGP site. Although the studies were 20 or more years old, they were included in the FEIS because they occurred at the same location and showed similar species distributions.

A fourth source of information that the Staff used became available after the Staff's Draft Environmental Impact Statement ("DEIS") was published, when the Staff received notice from the USFWS that a study had been performed for that agency by The Catena Group. The report, "Freshwater Mussel Surveys, The Savannah River from Augusta to Savannah: South Carolina & Georgia," is based on data collected in a survey of freshwater mussels in the Savannah River between RM 22.8 and RM 203, performed in late 2006. Exhibit NRC000005 at 2. This is the most recent study of the freshwater mussels in the river that has been conducted. The Staff used this study to update information in Section 2.7.2.1 of the FEIS, including the number of important species identified during the survey and their locations. Exhibit NRC000001 at 2-76, 2-87, and 2-88.

A fifth set of information was used to provide general background or used in the development of descriptions of specific species and their life histories. These include the Final Environmental Statement ("FES") for Vogtle Units 1 and 2, and comprehensive studies such as Bennett and McFarlane, 1983, "The Fishes of the Savannah River Plant: National Environmental Research Park" (written to provide background information on the Savannah River). Exhibit NRC000013, Exhibit NRC000014. Specific studies were used for developing descriptions of aquatic species and their life history, such as Hendricks, 2002, "The Conservation and Restoration of the Robust Redhorse, *Moxostoma robustum*"; Nichols, 2003, "Conservation Strategy for Robust Redhorse (*Moxostoma robustum*); and Grabowski and Isely, 2006, "Seasonal and Diel Movements and Habitat Use of Robust Redhorses in the Lower Savannah River, Georgia, and South Carolina", which are cited in the FEIS to describe the spawning locations and larval behavior of the robust redhorse. Exhibit NRC000001 at 2-88 and 2-89; Exhibit NRC000015, NRC000016, NRC000017, respectively. These sources and studies were among the most recent, reliable and authoritative studies of which the Staff was aware.

Q10. How did the Staff determine which aquatic species were to be described in detail?

A10. (RHK) The Staff's criteria for selection of "important" species is given in ESRP Section 2.4.2, "Aquatic Ecology," (ESRP 2000) and in Regulatory Guide 4.2, "Preparation of Environmental Reports for Nuclear Power Stations". ESRP Section 2.4.2 instructs the reviewer to "identify the species and habitats that will be considered 'important' ecological resources of the site, vicinity...and offsite areas for evaluation of potential impacts on them, using Table 2.4.2-1 as a reference." Exhibit NRC000009 at 2.4.2-6. ESRP Table 2.4.2-1 is titled "Important Species and Habitats," and it provides the guidance for determining species that are "important" for the Staff's review. Exhibit NRC000009 at 2.4.2-7.

Regulatory Guide 4.2's guidance for applicants defines a species to be "important" "if a specific causal link can be identified between the nuclear power station and the species and if one or more of the following criteria applies: (a) the species is commercially or recreationally valuable, (b) the species is threatened or endangered, (c) the species affects the well-being of some important species within criteria (a) or (b), or (d) the species is critical to the structure and function of the ecological systems or is a biological indicator of radionuclides in the environment." Exhibit NRC000007 at 2-3. In most cases, for facilities with closed-cycle cooling, the causal link between the nuclear power plant operations and impacts on aquatic species is rather weak (as discussed later in this testimony in response to Questions 22 and 28).

The Staff determined "important" species for the VEGP ESP review by referring to the criteria in Table 2.4.2-1 (following the guidance in ESRP Section 5.3.1.2) and comparing that guidance (along with the guidance in Regulatory Guide 4.2, which is similar) to the list of species identified in the studies discussed in the response to Question 9. In addition, the Staff contacted the appropriate Federal and state agencies. These agencies included the Southeast Regional Office of the National Marine Fisheries Service, the Coastal Georgia Suboffice of the U.S. Fish and Wildlife Service, the Georgia Department of Natural Resources, and the South Carolina Department of Natural Resources.

In a letter dated October 24, 2006, the National Marine Fisheries Service provided a listing of Federally-protected species under the jurisdiction of NMFS for the state of Georgia (NMFS 2006). Exhibit NRC000018. Of these species (as discussed in Section 2.7.2.1 and 2.7.2.2 of the FEIS), the only Federally listed threatened or endangered aquatic species known to occur in the Savannah River in the vicinity of the VEGP site was the shortnose sturgeon (*Acipenser brevirostrum*). Exhibit NRC000001 at 2-86 and 2-89. The State of Georgia lists the shortnose sturgeon (*Acipenser brevirostrum*), robust redhorse (*Moxostoma robustum*), and the Atlantic pigtoe mussel (*Fusconaia masoni*) as State-endangered. Exhibit NRC000001 at 2-85 and 2-86. The Savannah Lilliput mussel (*Toxolasma pullus)* is considered threatened in South Carolina. This information was obtained from the South Carolina Department of Natural Resources website and confirmed verbally with State staff. Exhibit NRC000021; Exhibit NRC000020. Nine mussels that were South Carolina state species of concern were identified from the South Carolina Department of Natural Resources website and confirmed through discussions with South Carolina DNR staff. In addition, the Savannah darter (*Etheostoma fricksium*) is considered a species of concern for the State of Georgia; however, it does not have a legal protected status in the State. The Staff therefore did not consider it an "important species." Exhibit NRC000001 at 2-86.

In the FEIS discussion of threatened and endangered aquatic species known to occur in the vicinity of the Vogtle site, the Staff states that the Atlantic sturgeon (*Acipenser oxyrinchus*) is considered a species of concern by the National Marine Fisheries Service. 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 NRC000018. However, the Staff subsequently discovered that the Atlantic sturgeon's Federal listing status was changed from "Species of concern" to "candidate species" in the Federal Register (71 Fed. Reg. 61022, 61023) on October 17, 2006, and thus the Atlantic sturgeon should have been included as an "important species" in the FEIS

because "candidate species" are included in the definition of "important species" provided in ESRP Section 2.4.2. Exhibit NRC000009 at 2.4.2-6 and 2.4.2-7. Listing as a candidate species, according to NMFS, "does not confer any procedural or substantive protections of the [Endangered Species Act (ESA)] on the candidate species". 71 Fed. Reg. 61,022. However, the Staff does consider the distinction between Federal "species of concern" and "candidate species" in its environmental review guidance, including NUREG-1555, "Environmental Standard Review Plan" (2000) ("ESRP"). Exhibit NRC000009 at 2.4.2-6.

The Staff discussed commercially and recreationally important fish (referred to in ESRP 2.4.2-7 as "Commercially and recreationally valuable species") in the vicinity of VEGP on page 2-81 and 2-83 of the FEIS. *Id.* at 2.4.2-7. These fish were identified from general statements in Marcy et al., 2005 and Halverson et al., 1997, as part of descriptions of the commercial and recreational fisheries in the area. Exhibit NRC000006 at 15; Exhibit NRC000023 at 3-45 and 3-48. In addition, the Staff consulted the SCDNR and GADNR regulations posted on those agencies' websites for commercial and recreational fishing. The identified commercial fisheries included American shad (*Alosa sapidissima*), channel catfish (*Ictalurus punctatus*), white catfish (*Ameiurus catus*) and American eels (*Anguilla rostrata*). Recreationally important fish included striped bass (*Morone saxatilis*) and to a lesser degree, sunfish (*Lepomis* spp.) and crappie (*Pomoxis* spp).

Based on the guidance in the ESRP and the information from other agencies, the Staff determined that, with the exception of the Atlantic sturgeon, a newly identified candidate species, the Staff correctly identified the list of "important" aquatic species for its review of the application.

Q11. Why did the Staff only provide the detailed life history information for the "important species" in the FEIS?

A11. (RHK) Life history information was only provided for species that were considered "Important species" as specified by ESRP Section 2.4.2. Exhibit NRC000009.

ESRP Section 2.4.2 instructs the reviewer to provide "a discussion of 'important' aquatic species that may be affected" by plant construction or operation. *Id.* at 2.4.2-7. It states that "[s]pecial habitat and forage needs should be emphasized, if the proposed project would potentially disrupt these." *Id.* The ESRP also states that the "extent of discussion of various biotic components should be in proportion to the estimated severity of impacts and should be adequate to support the assessment of ESRP Chapters 4.0 and 5.0 [for construction and operation impacts, respectively]." *Id.* at 2.4.2-6.

Guidance for applicants is also provided in Regulatory Guide 4.2. Regulatory Guide 4.2, "Preparation of Environmental Reports for Nuclear Power Stations," states that "[s]pecial attention should be given to the relative importance of the station area to the total regional area of the living resources (potential or exploited)." Exhibit NRC000007 at 2-4. Regulatory Guide 4.7, "General Site Suitability Criteria for Nuclear Power Stations," contains guidance concerning the ecological systems and biota at potential sites and states that their environs should be sufficiently well-known to allow reasonably certain predictions that there would be no unacceptable or unnecessary deleterious impacts on populations of important species. Exhibit NRC000008 at "B. Discussion." Under Regulatory Guide 4.2, as previously discussed in my testimony in response to Question 10, a species is "important" if a specific causal link can be identified between the nuclear power station and the species and if "one or more" specified criteria applies.

Consistent with the guidance in the ESRP and Regulatory Guide 4.2, the Staff included life histories of the robust redhorse, shortnose sturgeon, American shad, American eel, and striped bass in the FEIS. Exhibit NRC000009; Exhibit NRC000007. Although the blueback herring, sunfish, crappie, and catfish were identified as recreational or commercially important fish, they were not discussed in greater detail because they either were identified as being a significantly smaller fishery and thus less valuable (catfish; blueback herring) or they were not identified as being one of the favorite recreational species in the area (crappie and sunfish).

The instructions of Regulatory Guide 4.7 and Regulatory Guide 4.2 refer to a detrimental effect and a causal link. Exhibit NRC000008; Exhibit NRC000007 at 2-3. For closed-cycle cooling systems, like that proposed for VEGP Units 3 and 4, there is no detrimental effect on species (as discussed later in this testimony in response to Questions 22 and 28); accordingly, the Staff presented detailed life history data only for "important" species.

Q12. How did the Staff decide what life history information to include for those "important species"?

A12. (RHK) According to the guidance in ESRP Section 2.4.2, the Staff should provide "the temporal and spatial (including depth) distribution and abundance of important aquatic species, especially in the discharge area and receiving water body." Exhibit NRC000009 at 2.4.2-3. Relatedly, "[s]uch critical life-support requirements as spawning areas, nursery grounds, food habits, feeding areas, wintering areas, and migration routes" are included "to the extent that power plant construction or operation is expected to affect these parameters." *Id.* The depth and extent of life history information provided in the EIS for a given species should relate directly to the nature and magnitude of the impact to that species that would result from the construction and operation of the facility. *Id.* at 2.4.2-6.

In cases where a fish species is considered to be recreationally or commercially important, but where the fishery is not significant and unique to the vicinity of the plant, and where the plant is expected to have very little impact on the species, the life history is usually not discussed in the FEIS or is only discussed briefly. For example, members of the family Ictaluridae (freshwater bullheads, catfishes and madtoms) are located near the site and have been identified as species that are commercially fished; however, the fishery is not a major one, it is not unique to this portion of the Savannah River drainage, the fish species is not managed by state or Federal agencies, and the fish is known to be found commonly along the eastern coastal states or major parts of the United States.

ESRP Section 2.4.2 specifies that the "input should be brief" for life histories. *Id.* at 2.4.2-6. The data needed to assess the impact to important aquatic species is dependent on the type and potential for impact. While there may be much data available on the life history of a particular species, much of it may not be relevant to the Staff's analysis. For example, the Staff's life history description for the sturgeon and robust redhorse contains the species' spawning locations, and the characteristics of larvae, because this provides information relative to the impact of the proposed units on these fish. However, the Staff mentioned the spawning area for the American eel only in passing since it is in the Sargasso Sea, well out of range of any impact from the VEGP site.

Q13. You stated that the Atlantic sturgeon's Federal listing status was changed from "species of concern" to "candidate species" during the Staff's review and thus should have been discussed in the FEIS as an "important species." Accordingly, please explain how the Staff would have described the life history for the Atlantic sturgeon in the FEIS.

A13. (RHK) The Staff identified the Atlantic sturgeon, *Acipenser oxyrinchus*, in FEIS Table 2-7 as being present in the Middle Savannah River Basin based on information from Marcy et al., 2005. Exhibit NRC000001 at 2-79; Exhibit NRC000006 at 10. The Staff also discussed the species in the FEIS, in relation to a previous fishery closure for harvest of Atlantic sturgeon, and with respect to its status (as understood by the Staff at that time) as a "species of concern" and its similarity to the shortnose sturgeon (Collins and Smith 1997). Exhibit NRC000001 at 2-81 and 2-89; Exhibit NRC000022. Additional information that the Staff would have included with respect to the Atlantic sturgeon's life history includes the following:

> The Atlantic sturgeon is a member of the Family Acipenseridae, a long-lived group of ancient anadromous and freshwater fishes. The Atlantic sturgeon was listed in the Federal Register on October 17, 2006 (71 FR 61,022, 61,023) as a "candidate" species. Listing as a "candidate" species does not confer any procedural or substantive protections of the Endangered Species Act (ESA) on the "candidate" species (71 FR

61,022). Thus, the Atlantic sturgeon's changed status implicates no additional statutory requirement under the ESA. However, pursuant to its guidance, the Staff does include candidate species as "important species" in its environmental reviews.

Historically, the Atlantic sturgeon was present in 38 rivers in the United States, from St. Croix Maine to the Saint Johns River in Florida. Thirty-five of the rivers were confirmed to have a historical spawning population. Currently, Atlantic sturgeon is present in 35 rivers and spawning occurs in at least 20 of them (including the Savannah River). Exhibit NRC000025 at 6.

Although the Atlantic sturgeon life history has been intensely studied since the 1970s, there are still important aspects that are unknown. Generally the Atlantic sturgeon is anadromous and spends the majority of its life in marine waters, but reproduces in a freshwater habitat. Like the shortnose sturgeon, spawning adults generally migrate upriver in the spring (February to March) in southern rivers. Atlantic sturgeon spawning is believed to occur in flowing water between the salt wedge and the fall line of large rivers. Atlantic sturgeon eggs are highly adhesive and are deposited on the bottom substrate, usually on hard surfaces. Hatching occurs in approximately 94-140 hours after egg deposition at temperatures of 20 and 18 degrees C, respectively. Larvae tend to stay near the bottom. After 8-12 days, when the yolk-sac larval stage is complete, the larvae move downstream to rearing grounds over a 6-12 day period. During the first half of their migration, movement is limited to night, and in the day they use the bottom (for example a gravel matrix) as refugia. During the last half of the migration stage, when the larvae are more fully developed, the migration occurs both day and night. Juvenile sturgeon eventually arrive in estuarine waters, where they remain for months or years. *Id.* at 3 and 4.

Further, as explained later in response to Questions 24 and 33, the Staff would have come to a conclusion, which would be similar to that for the shortnose sturgeon, that the Atlantic sturgeon would not be adversely affected by the proposed VEGP units.

Q14. How does the Staff's description of aquatic species in the FEIS account for flow-habitat relationships and the potential impacts of the project on habitat availability?

A14. (MTM) As the flow in a river is reduced, it follows that the habitat available for aquatic biota is also diminished. In a river, the relationship between flow and the habitat available to a species, depending on the species' habitat requirements, is most often not a linear relationship. Depending on the bathymetry of the river, a small change in flow could, for example, significantly reduce the amount of shallow water overbank habitat necessary for some species. However, for a deep river channel with steep banks, even experiencing a significant change in river flow could have little effect on the amount of habitat available.

The Staff examined the relationship between river flow rate and habitat availability in the Savannah River. Low river flow conditions, coupled with the consumptive loss of water from the river due to the operation of VEGP Units 3 and 4, may result in a reduction of habitat for aquatic biota, thereby affecting local or regional fish populations. However, this situation is unlikely at the VEGP site. As stated in the FEIS, at the maximum withdrawal rate of 129 cfs, the resulting decrease in river stage as a result of operating the proposed VEGP Units 3 and 4 would be approximately 2 inches at Drought Level 3 conditions (3800 cfs) and approximately 1 inch under average-daily discharge river flow (8830 cfs). Exhibit NRC000001 at 5-8. Average river depth in the vicinity of the discharge structure is slightly more than 8 feet. *Id.* at 5-17. Such reductions in river stage would not result in any measurable impact to populations of aquatic biota inhabiting the river in the vicinity of the station.

Moreover, daily fluctuations in river flow due to upstream activities have a much greater effect on river stage than would the consumptive use of water due to Units 3 and 4 operations. Although the Staff did not discuss the relative size of these fluctuations in the FEIS, such daily

fluctuations, based on flow records from the USGS gauge on the Savannah River at Waynesboro, Georgia (Waynesboro gauge) for the period January 2005 through October 2008, would have exceeded the normal consumption rate of 62 cfs for the two proposed VEGP Units 83 percent of the time. Exhibit NRC000041. Changes in flow rate of the Savannah River occur frequently, and organisms inhabiting the river currently tolerate this variation and will continue to do so whether or not the VEGP Units 3 and 4 become operational.

A recent study by Freeman and Marcinek (2006) evaluated the effects to aquatic biota from altering stream flows through water withdrawals and the use of instream reservoirs. Exhibit NRC000027. Impacts related to changes in aquatic habitat due to altered flow regimes were investigated. *Id.* at 436. Some 27 sites on six river systems, including the Savannah River system, were studied. One of the parameters Freeman and Marcinek evaluated and determined did influence the presence of fluvial fish species was a parameter they termed the withdrawal index (WI). *Id.* at 436 to 439. The WI was computed by dividing the withdrawal rate of water from the water body by the calculated 7Q10 of the watercourse. For example, in the case of VEGP Units 3 and 4, the proposed consumptive water withdrawal for the two units is 62 cfs and the calculated 7Q10 for the Savannah River in the vicinity of the VEGP site is 3828 cfs; accordingly, the computed WI for VEGP Units 3 and 4 would be 0.016. Exhibit NRC000001 at 5-9 and 2-20.

Freeman and Marcinek (2006) concluded that "...streams in the lower Piedmont [Physiographic Province] may begin to experience species losses if permitted withdrawals exceeds about 0.5 to one 7Q10-equivalent of water." Exhibit NRC000027 at 447. The lower range of the WI value of 0.5 for Freeman and Marcinek's action level is over 30 times greater than the computed WI value for the VEGP Units 3 and 4 using the combined water consumption value for both units.

Although the Staff did not discuss this study in the FEIS, I believe that the results of this study provide additional support to the Staff's conclusion that the consumptive loss of water due

to operation of two additional units, even at persistent low flow conditions, will not result in habitat changes that cause a detectable alteration of the Savannah River fishery by shifting species composition from species that require flowing water for at least part of their life-cycle (fluvial specialists) to species that are able to maintain populations in both lotic and lentic environments (habitat generalists).

Additionally, as the Staff stated in FEIS, aquatic organisms inhabiting rivers and streams flowing into the Atlantic are preadapted to tolerate large variations in water flow. Exhibit NRC000001 at E-75. Periodic droughts have historically occurred in the rivers of the southeastern United States. *Id.* Prior to the construction of the upstream impoundments on the Savannah River, flows in the Savannah River periodically dropped to as low as 1000 to 1500 cfs. Exhibit NRC000028. Despite these periodic very-low flows, aquatic organisms have persisted in the Savannah River. Since the construction of Thurmond Reservoir, completed in the mid-1950s, flows have been regulated and these exceedingly low historic flows have not re-occurred. Finally, I am unaware of any species having been extirpated from the middle Savannah River for any reason, including very-low river flows, since scientific collecting in the river began.

In the FEIS, the Staff considered the flow-habitat relationship and its potential to affect the availability of suitable habitat, specifically the potential impact to aquatic organisms due to the reduction in flow resulting from the consumptive use of the river water. The Staff determined that the reduction in river stage would be minor and there would be no detectable impact on populations. For the reasons just discussed, this conclusion is supported by the persistence of species in the Savannah River despite historic low water events and the large daily variations in Savannah River water flow that already occur without adverse impact to fish populations.

Q15. What is the Staff's basis for determining that its description in the FEIS of relevant aquatic resources is adequate in the absence of additional monitoring in the vicinity of Plant Vogtle?

A15. (RHK) The Staff determined that its description of the aquatic resources in the Savannah River in the vicinity of the VEGP site contained in Section 2.4.2 of the FEIS is adequate and systematic for three reasons: 1) it provides a sufficient description of the aquatic resources in the vicinity of the VEGP site based on data obtained in the vicinity of the VEGP site by entities other than the applicant; (2) the Staff complied with the relevant guidance in ESRP Section 2.4.2; and (3) the comments received on the draft EIS from state and Federal agencies were used to update the description of the aquatic resources in the FEIS. Exhibit NRC000009 at Section 2.4.2.

The Staff's description of aquatic resources in the vicinity of the VEGP site is sufficient for assessing impacts, even in the absence of site-specific data provided by the applicant, because the Staff relied on sources of data, some of which were recent, some of which provided data that spanned multiple periods within years, and all of which were focused on the middle stretch of the Savannah River or on the sections of the river adjacent to the VEGP site. These sources included the FEIS for operation of Units 1 and 2, Marcy et al., 2005, the SRS studies (including Paller et al. 1986 and Specht 1987), the recent survey of freshwater mussels for the USFWS (The Catena Group, 2007), and the most recent ANSP studies (ANSP 2001, ANSP 2003, ANSP 2005). Exhibit NRC000014; Exhibit NRC000006; Exhibit NRC000012; Exhibit NRC000011; Exhibit NRC000005; Exhibit NRC000002, Exhibit NRC000003; Exhibit NRC000004, respectively. The Staff primarily used Marcy et al., 2005 to develop the list of species that appears in FEIS Table 2-7. Exhibit NRC000005; Exhibit NRC000001 at 77 to 79. The Staff compared this list with the species that were identified in the SRS studies and in the ANSP studies to confirm that the Staff's list was complete. The information in Marcy et al. 2005 spanned more than 120 years of scientific data collection. Exhibit NRC000005. The SRS data

were from focused studies on the stretch of river near the VEGP site and spanned multiple periods of time during a given year. Exhibit NRC000011; Exhibit NRC000012. As discussed in more detail in response to Question 22, the SRS studies evaluated impacts from intake structures with a much larger withdrawal rate and through-screen velocity than those anticipated for VEGP Units 3 and 4.

The Staff used the ANSP studies for characterization of the environment and the relative health of the stretch of the river adjacent to the SRS, a stretch which is also adjacent to the VEGP site. Because the ANSP data were recent, the Staff used it to capture the description of the status of the relative abundance of fish from the Savannah River, as well as to characterize the environment related to diatoms, aquatic insects and molluscs.

Because neither Marcy et al. nor the ANSP study directly addressed the concentrations of fish larvae and eggs in the Savannah River, the Staff relied on the studies performed by the SRS in the mid-1980s. Exhibit NRC000011; Exhibit NRC000012. Although this data is over 20 years old, the Staff determined that, based on the similarity in the descriptions of the environment and in the distribution and abundance of fish reported in the SRS studies as compared to the ANSP studies and the Marcy et al. compendium, the SRS studies on ichthyoplankton were appropriate sources for the FEIS analysis. *Id.*

The Staff complied with the relevant guidance in ESRP Section 2.4.2 by identifying the species and habitats that would be considered "important"; consulting with local offices of appropriate Federal (including the USFWS) and National Marine Fisheries Service (NMFS)) and State agencies to verify the possible occurrence of such species; identifying the threatened or endangered species that, based on known distributions, could be represented within these areas; and listing the commercially and recreationally valuable species in consultation with State or local agencies or organizations. Exhibit NRC000009 at Section 2.4.2.

Further, the Staff provided brief input that contained the information requested by ESRP 2.4.2, including principal ecological features of the site and an emphasis on the communities

that could potentially be affected by project construction, operation or maintenance. Exhibit NRC000009 at 2.4.2-6 to 2.4.2-8. This input included descriptions of studies that provided data that spanned multiple time periods in a given year to reflect seasonal variations in aquatic populations (the ANSP comprehensive studies and the SRS ichthyoplankton studies). The FEIS also included descriptions of environmental and man-induced stresses, and a description of important aquatic species that could be affected by construction or operation.

Following publication of the DEIS, the Staff received comments from other Federal agencies that supplemented the analysis made by the Staff. This information was incorporated into the FEIS. For example, the USFWS provided a copy of a report on mussels in the Savannah River, of which the Staff had not previously been aware. Exhibit NRC000005. The information in this report was provided in the FEIS to supplement the description of the Savannah River mussel population that had been presented in the DEIS. This information did not change the Staff's conclusion with respect to impacts on aquatic resources.

As mentioned previously, the Staff also consulted with other Federal agencies such as the USFWS and the NMFS. However, the response resulting from the Staff's consultation with the NMFS regarding the shortnose sturgeon was not included in the FEIS because it was received after publication of the FEIS. The response from NMFS to the biological assessment on the shortnose sturgeon that was provided by the NRC is given as an attachment to this testimony. Exhibit SNC000022 at 4. As explained later in this testimony, the response from NMFS supports the Staff's conclusion with respect to impacts on aquatic resources.

In sum, the Staff determined that the data available was adequate to characterize the environment in the vicinity of the VEGP site and to allow the identification of important species. Moreover, subsequent to the publication of the FEIS the applicant provided additional data related to the impingement and entrainment sampling program for VEGP Units 1 and 2, and these data support the Staff's conclusion on the distribution and abundance of species in the

river. Exhibit NRC000030. These data are discussed further in the Staff's responses to Questions 22, 25, 30 and 34, below.

## II. Impacts to Aquatic Resources from Impingement and Entrainment

### A. Background

Q16. What does the Staff mean when it discusses impacts from "impingement" and "entrainment"?

A16. (MTM) Operation of nuclear power stations requires the withdrawal of large amounts of water, almost always from surface waterbodies, to dispose of waste heat. Water is circulated through various station components and heat exchangers. Debris and large aquatic organisms need to be removed from the water before it enters critical station components. Removal of material in the water column is typically accomplished by rotating traveling screens. The typical intake screen mesh size is 3/8 inch. Any debris and aquatic organisms that are larger than about 3/8 inch in any dimension can end up "impinged" on the intake screens. Impingement takes place when organisms are trapped against intake screens by the force of the water passing through the cooling water intake structure. The most common organisms impinged are fish, macroinvertebrates, shellfish, and aquatic macrophytes. Impinged organisms can be injured or killed due to mechanical forces, asphyxiate due to the inability to properly move their gills, or be preyed upon by larger organisms. Impingement losses are dependent on a number of factors, including the type of cooling system, whether once-through or closed-cycle; the station location; the source waterbody type; the intake structure's through-screen velocity; characteristics of the species being impinged; the condition of the organism at the time of impingement; and the amount of debris in the water column. Certain species of fish can, after impingement, be returned by a fish return system to the source waterbody and experience little or no long term effects. Others experience a high level of mortality after transiting the fish return system.

The action of withdrawing organisms small enough to pass through the intake screens along with the cooling water into the plant is termed "entrainment." Organisms that typically become entrained are relatively small benthic, planktonic, and nektonic organisms, including the early life stages of fish and shellfish. Once entrained into the station, these organisms are subjected to mechanical, thermal, hydrostatic, and sheer stresses, as well as chemical toxemia induced by a variety of chemicals introduced into the cooling system. As with impingement, entrainment losses are dependent on a number of factors as well, such as type of cooling system, whether once-through or closed-cycle; the station location; intake design; the source waterbody type; the presence and density of ichthyoplankton; the motility of the entrainable organisms; and other characteristics of the species being impinged. Due to the recirculation nature of the cooling systems proposed for new facilities, the mortality sustained by entrained organisms is generally accepted to be 100 percent. Exhibit NRC000010 at 5.3.1.2-8.

Q17. What is the difference between closed-cycle and once-through cooling? Why is the distinction significant with respect to the water withdrawal rate at the Vogtle site?

A17. (MTM) A closed-cycle cooling system is designed to transfer most of the waste heat from the reactor to the atmosphere by evaporation. Water is routed to the station to support contact and/or non-contact cooling uses and then cycled to a cooling canal, lake, pond, or tower to allow waste heat to be dissipated to the atmosphere mostly through the process of evaporation. The water is then returned to the station for reuse. A portion of the water flow is discharged from the system (blowdown) to maintain water quality, and water is added (makeup) from the water source to replace water lost due to drift, evaporation, blowdown and any other losses from the system. The cooling system proposed for VEGP Units 3 and 4 is a closed-cycle cooling system. Exhibit NRC000001 at 3-5.

(LWV, CBC) In contrast, a once-through cooling water system utilizes a cooling strategy not proposed for VEGP Units 3 and 4. A once-through system relies on the withdrawal of water from a waterbody, using it at the facility to support contact and/or non-contact cooling uses, and

then discharging the heated water to a waterbody without recirculation. Hypothetically, if two units similar to those planned for VEGP Units 3 and 4 were designed to utilize once-through cooling, approximately 1.5 $E^{10}$ BTUs of heat would be transferred to the cooling water. Almost all of that heat would ultimately be transferred to the receiving waters. With a source waterbody inlet temperature of 80 degrees Fahrenheit, the two hypothetical once-through cooling system units would require approximately 5844 cfs of cooling water to maintain a discharge temperature of 91.5 degrees Fahrenheit. The hypothetical two unit plant would discharge the 5844 cfs of heated water into the receiving waters downstream of the intake structure.

(LWV, CBC) The applicant's proposed closed-cycle cooling system, employing cooling towers for both units, would result in approximately 4.26 $E^8$ BTU/hr of heat discharged to the receiving waterbody through a normal discharge flow of 21 cfs (9608 gpm as given in the FEIS) and the makeup flow to the cooling system of approximately 83 cfs. Exhibit NRC000001 at 3-9. Employing a closed-cycle cooling system for the two new units at the VEGP site results in only about 3 percent of the waste heat discharged to the receiving waters and 1.4 percent of the water withdrawal from the source waterbody when compared to the same station design utilizing once-through cooling system.

(MTM) For reasons described further in the FEIS and in the remainder of my testimony, these significant reductions in cooling water withdrawals and thermal discharges compared to a once-through cooling system, would result in no detectable impact to populations of aquatic organisms inhabiting the Savannah River due to impingement or entrainment or thermal discharges at the river stages evaluated by the Staff.

Q18. Did the Staff evaluate in the FEIS the impacts to aquatic resources in terms of impingement and entrainment from proposed Units 3 and 4 operations?

A18. (MTM) Yes. In Section 5.4.2.2 of the FEIS, the Staff evaluated the impacts to aquatic resources from impingement and entrainment from the proposed Units 3 and 4 operations. Exhibit NRC000001 at 5-29 to 5-33. As described in the testimony below, the Staff

determined that impingement caused by operation of the proposed VEGP Units 3 and 4 would have no detectable impact on fish populations inhabiting the Savannah River.

**B. Impingement**

Q19. What conclusion did the Staff reach as to impacts on fish populations in the Savannah River due to impingement losses due to the operation of VEGP Units 3 and 4?

A19. (MTM) The Staff concluded in Section 5.4.2.9 of the FEIS that impacts due to impingement on the intake screens to fish and shellfish populations in the vicinity of the site would be minor. Exhibit NRC000001 at 5-38. The Staff based that conclusion on a) the planned low through-screen intake velocity of less than 0.5 feet per second at the minimum river water level of 78 feet, b) the applicant's use of closed-cycle cooling, which reduced river water withdrawal substantially, c) a calculated intake canal flow velocity towards the intake screens of about 0.1 feet per second, d) an evaluation of life history, distribution, and abundance data of aquatic species, including "important species" inhabiting the middle Savannah River, e) the past absence of significant impingement episodes at the existing intake of Units 1 and 2 and information collected during NRC site visits, and f) the results of the SRS impingement study.

Q20. What is the Staff's guidance for reaching a determination of impacts from impingement?

A20. (MTM) The Staff's analysis and assessment of potential plant intake system impacts, including impingement, on aquatic organisms is directed by guidance found in NUREG–1555, the NRC's Environmental Standard Review Plan (ESRP). Exhibit NRC000009; Exhibit NRC000010. ESRP Section 5.3.1.2, Aquatic Ecosystems, states that the scope of the review should include an analysis of the effects of impingement in sufficient detail to allow the reviewer to predict potential impacts on "important species" and to evaluate the potential significance of such impacts. Exhibit NRC000010 at 5.3.1.2-1.

The reviewer is to determine the susceptibility of "important species" to impingement. This determination involves the evaluation both of station-related factors that influence

impingement loss rates as well as of life history data that influence the susceptibility to impingement for the various species present. The reviewer is to determine, based on the cooling system (closed-cycle or once-through), intake design and the life history data, if the effects of impingement on "important species" would be destabilizing or noticeably alter population levels. *Id.* at 5.3.1.2-7. The ESRP directs that the reviewer also draw on the experience of comparable, currently operating power stations to assist in the prediction of impact. *Id.* The ESRP further states that "in the most practical terms, the reviewer's final evaluation is determined through professional judgment based on the pertinent data and analysis." *Id.* If the reviewer determines that the effects of impingement would not be detectable or noticeably alter population levels, then the reviewer is to state that conclusion and the review is completed.

Q21. How did the Staff use the guidance identified in Answer 20 above to determine the impacts presented in the Vogtle FEIS?

A21. (MTM) The Staff became familiar with the proposed station design, including such aspects as the type of cooling system employed, the location and the dimensions of the intake structure and intake channel, the proposed vertical traveling screen system, and pertinent operating parameters such as flow rates and flow velocities. The Staff then reviewed the list of "important species" identified in Section 2.7.2 of the FEIS. Exhibit NRC000001 at 2-72 to 2-95. Additionally, the Staff reviewed the list of species of fish known to occur in the middle Savannah River to see if any species were unusually susceptible to impingement. The Staff also considered life history data for each important species. I conducted two site visits (identified in my response to Question 22) during which I examined the debris in the screen wash basket. Exhibit NRC000032; Exhibit NRC000033. I also considered the results of impingement sampling at the nearby Savannah River Site (Exhibit NRC000011 at V-305 to V-317) and I relied on my own personal experience related to impingement losses at closed-cycle nuclear power generating facilities located on 7 other run of the river sites in addition to the VEGP site

[Callaway, Grand Gulf, Hatch, Columbia, River Bend, Limerick, and Three Mile Island Unit 1]. I also considered, for both the existing VEGP Units 1 and 2 and the proposed Units 3 and 4, the physical characteristics and location of the intake, including such factors as the low through-screen velocities, the low approach velocities in the intake canal, and the use of a closed-cycle cooling system. I concluded that impingement losses from the intake structure for VEGP Units 3 and 4 would be similar to those of the intake structure for VEGP Units 1 and 2. Based on the above, I assessed that the effects of impingement from the operation of VEGP Units 3 and 4 on the populations of each of the important species would be minor, undetectable and SMALL.

Q22. On what data did the Staff base its conclusions with respect to impingement?

A22. (MTM) At the time of preparation of the FEIS, no record of a systematic impingement sampling study at the VEGP site was available to the Staff to consider when developing its conclusions of potential impact. Therefore, in reaching my conclusions, I relied on the station design information, the use of a closed-cycle cooling system for the planned Units 3 and 4, intake-related flow rates, and life history data for "important species." I also relied on my professional experience from conducting initial licensing reviews, other early site permit reviews, license renewal reviews, and endangered species assessments of other closed-cycle and once-through power stations located throughout the U.S. on other various watercourses.

Additionally, prior to publication of the FEIS, I was able to obtain qualitative information during two VEGP site visits in March of 2007 and March 2008. Exhibit NRC000032. Based on interviews with Units 1 and 2 screen wash operators, and a detailed examination of the cumulative screen wash debris that represented a composite sample spanning several weeks to several months, I was convinced that impingement events involving large numbers of fish had not occurred at the VEGP Units 1 and 2 intake during this time period.

My knowledge of swim speed data for species that inhabit the Savannah River that would be susceptible to impingement and the preliminary results of Southern's impingement monitoring study for Units 1 and 2 provide additional support for the conclusions in the FEIS

with respect to impingement mortality rates. Adult fishes inhabiting the Savannah River in good condition are capable of avoiding the 0.5 ft/sec through-screen intake flow velocity limit planned for VEGP Units 3 and 4. In May 2008, Southern informed the Staff that, in early March 2008, it had started a quantitative, biweekly, 24-hour impingement sampling program sampling debris and fish and shellfish collected on the screens of Units 1 and 2. Exhibit NRC000031; Exhibit NRC000001 at 5-32. I had the opportunity to examine the proposed study plan and sampling gear during a site visit on March 18, 2008. On August 13, 2008, just prior to issuance of the FEIS, I witnessed the results of one of these impingement sampling events and observed that a total of 3 fish from 3 taxa were collected from the Units 1 and 2 screen wash discharge over a twenty-four hour period. Exhibit NRC000033.

The data collected during this sampling event are summarized in a September 2008 report from Southern received by the Staff on the 7th of October 2008 containing the preliminary results of the first 6 months of impingement sampling. Exhibit NRC000030. According to the report, a total of 65 organisms from 18 taxa were collected during the six month period. Sixteen species of fish and two species of crustaceans have been reported. Although this report presents only 6 months of data and the study is planned for one year, in my opinion the preliminary results confirm the Staff's assessment provided in the FEIS. Extrapolation of these biweekly losses from operation of VEGP Units 1 and 2 to daily losses for the entire 6 month period from March to September 2008 would result in losses that would not detectably alter population levels in the Savannah River. Due to the similarity in intake design between the intakes for VEGP Units 1 and 2 and the planned Units 3 and 4, the Staff concludes that the impingement losses at the planned VEGP Units 3 and 4 will be similar to those observed at the Units 1 and 2 intake structure and also result in a SMALL impact.

In the FEIS, the Staff considered the US EPA requirements implementing section 316(b) of the Federal Water Pollution Control Act, 33 USC 1251, et seq., that were contained in the December 18, 2001 rulemaking (66 Fed. Reg. 65,256). Exhibit NRC000001 at 5-30 and 5-31;

Exhibit NRCR00035. The final rule establishes national technology-based performance requirements applicable to the location, design, construction, and capacity of cooling water intake structures at new steam electric generating facilities. The EPA established national intake capacity and velocity requirements as well as location- and capacity-based requirements to reduce intake flows below certain proportions of a variety of waterbody types – called proportional-flow requirements. Implementation of these national standards for new facilities is expected to help preserve aquatic organisms and the ecosystems they inhabit. This would be accomplished by significantly decreasing the expected mortality and/or morbidity from entrainment into cooling water systems or impingement against screens or other devices at the entrance of cooling water intake structures. New facilities with a design intake flow equal to or greater than 10 million gallons per day must meet the following requirements: 1) cooling water intake flow must be at a level commensurate with that achievable with a closed-cycle, recirculating cooling system, 2) through-screen water intake velocities must be less than or equal to 0.5 ft/sec, 3) for fresh water rivers or streams, intake flow must be less than or equal to 5 percent of the annual mean flow, and 4) additional design and construction technologies must be selected if certain other conditions exist. Exhibit NRCR00035 at 65,259 to 65,260. The EPA requirements apply to the proposed VEGP Units 3 and 4, which have a normal water withdrawal rate of 84 cfs, which is approximately 54 million gallons per day. Exhibit NRC000001 at 5-6.

Based on a review of VEGP Units 3 and 4 and the associated intake structure, I believe that the facility will meet the EPA capacity and intake velocity requirements as well as the location- and capacity- based requirements to reduce intake flows below the 5 percent standard required by 40 CFR 125.84(b)(3)(i). Exhibit NRCR00035 at 65,256 and 65,340. A key parameter affecting impingement losses is the through-screen intake velocities. The design through-screen velocity for VEGP Units 3 and 4 is less than 0.5 feet/sec. The EPA determined that the 0.5 ft/sec. requirement is scientifically based, and is protective of aquatic resources, with a reasonable margin of safety. *Id.* at 65,256 and 65,303. The design, location, and

proposed operation of the intake structures for the proposed new Vogtle units is consistent with EPA's technology-based performance standards and as such support the conclusion that impingement-related effects on aquatic biota will be SMALL.

The results of an impingement study conducted at the nearby Savannah River Site support the Staff's conclusion that impingement losses due to the operation of VEGP Units 3 and 4 will be minor. Exhibit NRC000001 at 7-22. The Comprehensive Cooling Water Study for the Savannah River Site reported the results of an impingement sampling study conducted between 1983 and 1985. Exhibit NRC000011 at V-305 to V-317. Daily impingement samples were collected at three separate intakes located on the Savannah River upstream of the VEGP site. *Id.* at V-305. Sampling was conducted on random days for a total of 204 samples over the sampling period. *Id.* at V-305 and V-311. Specht (1987) reported that the number of fish impinged daily ranged from 0 to 190 over the first year of sampling with an average of 18 fish per day. *Id.* The first year of the sampling program reported a total of 1,938 fish from 50 taxa. *Id.* at V-305. The majority of fish impinged on the screens were Centrarchids, the bass and sunfish family (46.4 percent). *Id.* The most numerous species was the threadfin shad (*Dorosoma petenense*) comprising 12.2 percent of the total number of fish taken. *Id.* at V-305. During the second year of sampling, the number of fish impinged ranged from 0 to 99 per day with a total of 745 fish for the year from 33 taxa. *Id.* at V-311. The majority of fish collected were Clupeids, the shad and herring family (53.7 percent). *Id.* Again the most abundant species collected was threadfin shad. *Id.* During the time of the impingement study, the amount of water withdrawn from the Savannah River required for full power operation of either the K or L reactor was greater than three times the anticipated rate for the combined VEGP Units 3 and 4. Exhibit NRC000034 at 5. Additionally, the velocity in front of the intake screens at the Savannah River Site intake structures was calculated to be about 2.5 times greater than that anticipated for VEGP Units 3 and 4. Exhibit NRC000036 at 28. The low impingement rates reported from the Savannah River Site, despite higher withdrawal rates and through-screen

velocities than those planned for VEGP Units 3 and 4, support the conclusion that impingement rates at the new intake will not result in a detectable impact to the Savannah River fishery.

Finally, while it is not specifically referenced in the ESRP guidance, I considered the NRC's generic environmental review developed in connection with the license renewal of existing operating facilities to be pertinent to the Staff's evaluation of the Vogtle ESP application. Specifically, it provides guidance related to impacts from the type of cooling design planned for VEGP Units 3 and 4. In NUREG-1437, Generic Environmental Impact Statement for License Renewal of Nuclear Plants (May 1996) ("GEIS"), the Staff evaluated generically the potential for impingement-related impacts to fish and shellfish populations at nuclear power facilities using wet-tower closed-cycle cooling. Exhibit NRC000037. Of the 104 operating nuclear power stations in the U.S., 38 units at 27 separate sites utilize closed-cycle cooling. After examining data from a variety of closed-cycle cooling stations on different types of waterbodies, reviewing literature and operation monitoring reports, consultations with utilities and regulatory agencies, and comments on the draft GEIS NUREG-1437, the Staff concluded in the final GEIS for License Renewal that the potential effect of impingement has been insignificant and not been shown to cause reductions in the aquatic populations near any existing operating nuclear power plant with closed-cycle cooling. Exhibit NRC000037 at 33 and 34. This generic conclusion has been successfully applied to the license renewal reviews of 11 closed-cycle units located on a variety of waterbodies in the US. Although it does not constitute review guidance for the evaluation of new facilities, I believe the results of this generic study are consistent with the Staff's analysis at the VEGP site and with the U.S. EPA's conclusions related to the impact of closed-cycle cooling on aquatic organisms.

Q23. Do the data used by the Staff account for variations in impingement rates that might occur in species composition at different times of the year, or for those species' vulnerability at different life stages?

A23. (MTM) Impingement rates at water intakes vary on a seasonal basis. In my experience, high impingement losses are typically confined to one or two species during certain times of the year at stations that use once-through and not closed-cycle cooling. Typically, however, large numbers of impinged fish are, with the occasional exception of some species of Clupeids (shad and herrings), unusual at riverine intakes. Riverine fishes are preadapted to tolerate and even thrive in an environment of wide variations in water velocities. Seasonal variation of impingement mortality in riverine environments such as that of the Savannah River at the VEGP site is generally less than in lakes, reservoirs, and estuary environments primarily because of the lack of large schooling populations of fish.

However, certain Clupeid species (such as threadfin shad (*Dorosoma petenense*) and the Alewife (*Alosa pseudoharengus*)) have unusual physiological characteristics that make them periodically susceptible to impingement. Additionally, Clupeids are a schooling fish and fragile, which increases their likelihood to experience impingement mortality and morbidity. Nevertheless, while some seasonal variation in impingement rates would be expected at the VEGP Unit 3 and 4 intake, the monthly variation would not be large because few fish are expected to be taken.

While preparing the FEIS I was aware of the results of impingement studies conducted over a two-year period at the Savannah River Site in the early 1980s. As reported in the Comprehensive Cooling Water Study Final Report for the Savannah River Site, Specht, (1987) found variation in impingement rates in both years of sampling, with peaks in November through December and April through May of 1983-84 and January through February and in July in 1984-85. Exhibit NRC000011 at V-308 and V-314. Specht believed that, at least in the 1983-84 sampling period, the variation may have been partially related to river flow. *Id.* at V-305. In any case, the daily variation in fish impingement for the 24-hour sampling program was not great, ranging from zero to 190 fish in a 24-hour period. *Id.* Considering the large withdrawal rates due to two unit operation at SRS operation (837cfs) (Paller 1992) and the intake velocities at the

SRS intake structures (about 1.25 ft/sec) (McFarlane et al. 1978) compared to the normal and maximum withdrawal rates for VEGP Units 3 and 4 of 83 and 129 cfs, respectively, and a through-screen intake velocity of less than 0.5 ft/sec, impingement rates at VEGP Units 3 and 4 should be exceedingly low, and the resulting impact minor, as the Staff concluded in the FEIS. Exhibit NRC000034 at 5; Exhibit NRC000036 at 28; Exhibit NRC000001 at 5-33. Preliminary impingement data collected since March 2008 from Units 1 and 2 support this conclusion due to the low number of organisms impinged. Exhibit NRC000030. The Staff expects that annual variation in impingement rates and species composition would occur at the VEGP Units 3 and 4 intake. After completion of the full year of impingement sampling at the VEGP Units 1 and 2 intake structure, Southern and the Staff will have a better understanding of annual variation in impingement losses. However, for the reasons just stated, the Staff does not expect that variation to be significant and expects that the impingement rate for all species would be small.

There would also be variation in susceptibility to impingement of different life stages for certain species. Juvenile fish, as well as post-larval fish, large enough to prevent entrainment, are more susceptible to impingement than sub-adults or adults. Preliminary impingement data from Units 1 and 2 support this conclusion), as Southern concluded that except for the gizzard shad, *Dorosoma cepedianum*, black crappie, *Pomoxis nigromaculatus*, and taillight shiner, *Notropis maculatus*, (each represented by a single specimen), primarily young of the year and juveniles were impinged at VEGP Units 1 and 2. *Id.*

Therefore, the Staff concludes that there will be daily and seasonal variation in impingement losses and that different life stages of organisms will experience varying susceptibility to being impinged. Nevertheless, for the reasons stated above, such losses will not result in detectable changes in the Savannah River fishery.

Q24. What is the basis for the Staff's conclusion that "important species" will be able to evade impingement? And how does the Staff use this information in evaluating the impingement impacts?

A24. (MTM) The Staff considered the intake design and location, the anticipated volume of water to be withdrawn from the river by the closed-cycle cooling system, the very low anticipated approach velocities (about 0.1 ft/sec) in the proposed intake canal, a designed through-screen intake velocity of less than 0.5 ft/sec, and pertinent life history data. Exhibit NRC000001 at 5-30 and 5-31. Adults of any of the "important species" that inhabit the Savannah River in the vicinity of VEGP Units 3 and 4 that are in good condition have a burst swim speed in excess of 0.5 ft/sec and should be able to avoid impingement. In my opinion, impingement losses will primarily be confined to small fish that inadvertently get too close to the surface of the screens or become entangled in floating debris, disoriented and then pinned to the screens, and fish in poor condition or already moribund. Larger fish in good condition such as the juvenile, sub-adult or adult robust redhorse (*Moxostoma robustum*) and shortnose sturgeon (*Acipenser brevirostrum*) would only be susceptible to impingement if moribund or already expired. Relatedly, although it was not specifically discussed in the FEIS, the Staff concludes that it is highly unlikely that a juvenile or adult Atlantic sturgeon (*A. oxyrinchus*) in good condition would end up impinged on the intake screens of VEGP Units 3 and 4. The Staff is unaware of any documented case of Atlantic sturgeon in good condition being impinged at any nuclear power station, including once-through stations, along the Atlantic coast.

Based on these factors, the Staff concluded that impingement of important species at a rate that might affect Savannah River populations is highly unlikely. This prediction is supported by the results of the impingement studies conducted at the SRS in the early 1980s, swim speed data for "important species" inhabiting the Savannah River, the preliminary results of the VEGP Units 1 and 2 impingement sampling study, information on the design, location and planned operation of the station intake, and the anecdotal information I collected at the intake structure during my visits to the site. Although some individuals of each species determined to be important may be impinged and experience mortality, the overall effect on the Savannah River fish populations would be undetectable.

Q25. Is impingement associated with the proposed new Vogtle units a threat to fish populations in the Savannah River?

A25. (MTM) Impingement at the proposed VEGP units 3 and 4 is not a threat to fish populations in the Savannah River. Impingement would result in some loss of individuals from the population. Individuals in poor condition would be more susceptible to impingement. These individuals are of less value to sustaining the river fishery. Although the details were not discussed in the FEIS, Specht 1987 found that impingement losses at the SRS over a two year sampling period during 1983 to 1985 ranged from zero to 190 fish/day with a mean of 18 fish per day the first year of study and 7.7 fish per day the second year. Exhibit NRC000011 at V-305 and V-311. As stated in response to Question 22, during the time of the impingement study, the amount of water withdrawn from the Savannah River required for full power operation of either the K or L reactor (Paller, 1992) was greater than three times the anticipated rate for the combined VEGP Units 3 and 4. Exhibit NRC000034 at 5. Additionally, the velocity in front of the intake screens at the SRS intake structures (McFarlane et al. 1978) was calculated to be about 2.5 times greater than that anticipated for VEGP Units 3 and 4. Furthermore, preliminary results of Southern's impingement study of VEGP Units 1 and 2 are consistent with the data collected by Specht (1987), indicating very low impingement rates in 2008. Exhibit NRC000036 at 28; Exhibit NRC000030; Exhibit NRC000011. Accordingly, the Staff does not expect that the very low impingement rates as a result of Units 3 and 4 operations would have a detectable or destabilizing effect on those same aquatic populations. As discussed in more detail in section F of this testimony, the Staff also evaluated the potential cumulative impact of impingement from VEGP Units 1 through 4 and determined that the losses are unlikely to adversely affect Savannah River fish populations. Exhibit NRC000001 at 7-22.

### C. <u>Entrainment</u>

Q26. What conclusion did the Staff reach in the FEIS as to the impacts of entrainment from operations of the proposed Units 3 and 4?

A26. (RHK) The Staff concluded in Section 5.4.2.2 of the FEIS that the impacts to the fish populations of the Savannah River from entrainment due to the operation of the proposed VEGP Units 3 and 4 would be minor. Exhibit NRC000001 at 5-32. The analysis in the FEIS was based on several factors, including the small percentage of total river flow that would be withdrawn by the closed-cycle cooling system employed by the new units as well as the design and location of the cooling intake canal and structure, including the use of a weir wall at the mouth of the intake. That design is shown in Figures 3-4 and 3-5 of the FEIS. *Id.* at 3-10 and 3-11. These factors are associated with the applicant's use of a closed-cycle cooling system (FEIS pages 5-30 and 5-31). Other factors include the lower larval densities in the run-of-the-river sampling performed by Specht 1987, when compared to the oxbows; the typically high fecundity of most species inhabiting rivers, the high natural mortality rates of eggs and larvae, and the results of sampling related to SRS operations. Exhibit NRC000011 at V-478.

Following the publication of the FEIS, the Staff's conclusion has been further supported by the preliminary results of Southern's entrainment sampling program near the Units 1 and 2 intake, as I explain below. Exhibit NRC000030 at 1-16, 18-25, 27-35 and Appendix D.

Q27. What is the Staff's guidance for reaching a determination of impacts from entrainment?

A27. (RHK) The Staff's analysis and assessment of potential plant intake system impacts, including entrainment, on aquatic organisms is directed by guidance in NUREG-1555, the U.S. Nuclear Regulatory Commission's Environmental Standard Review Plan (ESRP) (Rev. 1, July 2007), Section 5.3.1.2, "Aquatic Ecosystems." Exhibit NRC000010 at Section 5.3.1.2.

The ESRP states that the scope of the review "should include an analysis of the effects of... entrainment in sufficient detail to allow the reviewer to predict potential impacts on "important" species and their habitats and to evaluate the potential significance of such impacts" (ESRP 2007 at 5.3.1.2-1). *Id.* at 5.3.1.2-1. The ESRP 2007 states that

> "However, compliance with environmental quality standards and requirements of the Clean Water Act is not a substitute for and does not negate the requirement for NRC to weigh the environmental impacts of the proposed action...If an environmental assessment of aquatic impacts is available from the permitting authority, the NRC will consider the assessment in its determination of the magnitude of the environmental impacts in striking an overall benefit-cost balance. When no such assessment of aquatic impacts is available from the permitting authority the NRC...will conduct its own assessment."

*Id.* at 5.3.1.2-6.. Further, the ESRP states that "in the most practical terms, the reviewer's final evaluation is determined through professional judgment based on the pertinent data and analyses. The reviewer may refer to earlier NRC environmental reviews in which evaluation of intake system operational impacts has been important." *Id.*

The ESRP states that the reviewer is to first determine if the facility "is being located at a site close to an existing nuclear facility." *Id.* If it is, then the ESRP specifies that the reviewer should "determine whether the applicant has a current National Pollutant Discharge Elimination System (NPDES) permit with a Clean Water Act Section 316(b) determination, if appropriate, or equivalent State permits and supporting documentation." *Id.* If no 316(b) determination is available, the ESRP instructs the reviewer to "identify the "important" aquatic organisms and their life stages susceptible to...entrainment" by coordinating with the reviewer of ESRP 2.4.2. *Id.* at 5.3.1.2-7. Following the determination that "important" aquatic species are present and susceptible to entrainment, the reviewer is instructed to "estimate the levels of susceptibility in either qualitative or quantitative terms, or both." *Id.* It also instructs the reviewer to "estimate survival rates for those species entrapped, impinged or entrained by relying on experience at other stations." *Id.* It further instructs the reviewer to "assume 100% mortality for all entrained biota." *Id.* at 5.3.1.2-8.

The "potential for altered hydrodynamic characteristics" and the "potential for recirculation of heated effluent from the plant discharge system" are also to be considered. *Id.* Finally, the Staff is directed to "estimate the magnitude of the potential...entrainment impacts on the species population and aquatic ecosystem." This is accomplished by using the estimate provided above and considering cropping rates (loss of individuals due to entrainment in relation to the population) in relation to natural mortality rates, reproductive rates and standing stock estimates and by considering other existing stresses to fragile species (such as nearby electrical generating stations). *Id.* at 5.3.1.2-7 and 5.3.1.2-8.

Q28. How did the Staff follow this guidance in determining the impacts of entrainment for the Vogtle FEIS?

A28. (ARK,RHK) The proposed Vogtle Units 3 and 4 are adjacent to the existing Units 1 and 2. Exhibit NRC000001 at 2-1. The VEGP Units 1 and 2 are closed-cycle cooling systems and have an NPDES permit. However, they do not have a Clean Water Act Section 316(b) determination. Because there was no specific entrainment data available from the adjacent VEGP Units 1 and 2 at the time of preparation of the FEIS and because those Units did not have a 316(b) determination, the ESRP directs the Staff to estimate the levels of susceptibility to entrainment. Exhibit NRC000010 at 5.3.1.2-7. In doing so, first, the Staff identified that there were "important" species present that would be susceptible to entrainment. As a result, the Staff continued to follow ESRP Section 5.3.1.2 by considering in the FEIS the intake design, including the percentage of water from the river that would be withdrawn and the orientation of the design relative to the habitat ("intake canal would be built so that the river flow is almost perpendicular to the intake canal flow," with a weir wall that would extend upward approximately 1 ft from the bottom of the intake canal near its entrance), as well as the flow velocity along the intake canal (at the minimum river operating level of 78 ft above mean sea level, the flow velocity along the intake canal would be about 0.1 fps, based on the site maximum make-up water demand of 129 cfs). *Id.*; Exhibit NRC000001 at 5-30 and 5-31.

The Staff also considered how the amount of water withdrawn from the source waterbody greatly influences the degree to which entrainment affects the aquatic biota. The U.S. Environmental Protection Agency ("EPA"), in its Phase I final regulations for new facilities that withdraw water from waterbodies for cooling purposes, established proportional flow requirements for new facility cooling water intake structures (see response above to Question 22). Exhibit NRCR00035 at 65,256. EPA based these requirements on a similar assumption – that a facility withdrawing 5 percent of the water from a freshwater river or stream would thereby entrain approximately 5 percent of the river or stream's entrainable organisms. *Id.* at 65,256 and 65,277. EPA stated that "[e]ntrainment impacts of cooling water intake structures are closely linked to the amount of water passing through the intake structure, because the eggs and larvae of some aquatic species are free-floating and may be drawn with the flow of cooling water into an intake structure." *Id.*

Since a closed-cycle wet cooling tower system would be used for VEGP Units 3 and 4, at a normal withdrawal rate of 83 cfs, the two new VEGP units would withdraw between 0.9 and 2.2 percent of the total flow of the Savannah River depending on the river stage (average-daily discharge and Drought Level 3, respectively) in the Savannah River. Exhibit NRC000001 at 5-8 and 5-30. And as discussed in the response to Question 43, the normal withdrawal rate of 83 cfs represents 1.2 percent of the annual mean flow of 6991 cfs from the Waynesboro gauge. The percentage of river flow withdrawn through the intake structure provides an estimate of the impact of the entrainment from the river because, all other factors being equal, the higher the withdrawal rate, the greater the impact of entrainment.

Consistent with ESRP guidance at 5.3.1.2-8, the Staff assumed 100% mortality of the entrained biota. Exhibit NRC000001 at 5-32. The ESRP indicates that the Staff should evaluate the "potential for altered hydrodynamic characteristics" and the "potential for recirculation of heated effluent from the plant discharge system." Exhibit NRC000010 at 5.3.1.2-8. However, these factors were not directly discussed in the FEIS, because the design of the

intake canal, the location of the discharge and the velocity of the water in the Savannah River was such that the potential for altered hydrodynamic characteristics and recirculation of heated effluent were not realistic considerations. The potential for recirculation and altered hydrodynamic characteristics is important to consider in reservoirs and ponds, rather than in free-flowing rivers such as the segment of the Savannah River that flows past the VEGP site.

Additionally, in order to estimate the magnitude of the potential entrainment impacts, as specified in the ESRP, the Staff looked at the losses from entrainment of species based on the amount of water entrained by the facility. As described in the ESRP, "the reviewer may refer to earlier environmental reviews in which evaluation of intake system operational impacts has been important." *Id.* at 5.3.1.2-6. As discussed previously, the Staff, in the FEIS, did refer to the analysis in the 1985 FES for Units 1 and 2, which "assumed a uniform distribution of drift organisms". Exhibit NRC000001 at 5-31; Exhibit NRC000014 at 5-17. The Staff discusses this assumption later in this testimony. The Staff made a similar estimate of losses from entrainment by Vogtle Units 3 and 4 based on 0.9 and 2.2 percent removal depending on the flow conditions and assuming a normal withdrawal rate.

The Staff also looked at historic entrainment rates for reactor facilities at the Savannah River Site. Exhibit NRC000001 at 5-32. This consideration of the SRS rates was performed as a bounding comparison, since, as discussed in the FEIS, the volume of water withdrawn into each of the K-reactor or L-reactor intakes at full power is about 3 times the maximum withdrawal rate of the VEGP Units 3 and 4 (129 cfs) or a little more than four times the normal withdrawal rate of 83 cfs. Exhibit NRC000034 at 5. The intake velocity was about 2.5 times as great as that for the proposed VEGP Units 3 and 4. Exhibit NRC000036 at 28.

Finally, the Staff, using the professional judgment as specified by the ESRP, also considered the guidance in NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants" (GEIS). Exhibit NRC000010 at 5.3.1.2-6; Exhibit NRC000037. The GEIS states that "[s]tudies of intake and discharge effects of closed-cycle

cooling systems have generally judged the impacts to be insignificant (NUREG/0720; NUREG/CR-2337). None of the resource agencies consulted for this GEIS (Appendix F) [in Volume 2] expressed concerns about the impacts of closed-cycle cooling towers on aquatic resources." Exhibit NRC000037 at 4-33. Appendix F, page F-3 of the GEIS states that the Staff contacted resource agencies "with responsibility either for regulating the construction and operation of [sic] protection and maintenance of aquatic resources in the vicinity of the power plants." Responses were received from 17 Federal agency regions and 55 state agencies. *Id.* at F-5.

However, the GEIS also states that "even low rates of entrainment and impingement at a closed-cycle cooling system can be a concern when an unusually important resource is affected. Such aquatic resources would include threatened or endangered species or anadromous fish that are undergoing restoration." *Id.* at 4-33. For that reason, the Staff focused its attention strongly on the "important species." Therefore, consistent with ESRP guidance, the Staff specifically discussed the potential entrainment of important species, including the robust redhorse and the shortnose sturgeon, based on the life history data the Staff had obtained for these species as well as on the design of the Vogtle Units 3 and 4 intake structure. Exhibit NRC000010 at 5.3.1.2-7 and 5.3.1.2-8; Exhibit NRC000001 at 5-36, 5-37, 5-41 and 5-42. As explained further in response to Question 33, the Staff found that for all important species the potential for entrainment was minor.

Q29. On what data did the Staff base its conclusions with respect to entrainment?

A29. (RHK) As the ESRP states, because the existing VEGP units do not have a 316(b) determination, the Staff needed to estimate the magnitude of the potential entrainment impacts by examining the intake design and the life history data to determine if the impacts to "important species" would be detectable or noticeable. The Staff considered two sources of data: first, the information that was presented in the ER related to the design and placement of the intake structure and canal, and second, life history of "important" species. In addition, the

Staff compared the analysis of these data to the entrainment studies performed at the SRS between 1982 and 1985. Exhibit NRC000011 at V-1 to V15 and V-321 to V548.

The data from the ER included information related to the design and placement of the intake structure and canal. That information is presented in Section 3.2.2.2 of the FEIS. Exhibit NRC000001 at 3-8 to 3-14. The cooling system proposed for Units 3 and 4 is a closed-cycle system with a through-screen velocity of less than 0.5 ft/second and a normal withdrawal rate of 83 cfs. A surface skimmer wall would be present to keep floating debris from entering the intake canal. The weir wall, extending upward approximately 1 ft from the bottom of the intake canal near the entrance of the canal would, along with the skimmer wall, serve to reduce entrainment mortality, especially of eggs, which as discussed in the FEIS and shown by the SRS data tend to have higher densities near the bottom of the river. Exhibit NRC000001 at 2-81; Exhibit NRC000012 at xv and 3-36 to 3-39.

As explained in response to Question 28, because entrainment data was not available from the existing VEGP units, the Staff considered and compared the available site-specific entrainment data from the SRS. The SRS studies conducted in the vicinity of the VEGP site conducted between 1982 and 1985 measured entrainment rates of once-through cooling system intakes, which had four times the anticipated water withdrawal rate of the proposed VEGP Units 3 and 4 (at normal consumption) and an intake velocity of about 2.5 times as great as for the proposed VEGP Units 3 and 4. Exhibit NRC000001 at 5-32. The operation of the intakes at the SRS involved withdrawals much greater than those anticipated from VEGP Units 3 and 4. According to Specht 1987, "[w]hile a substantial fraction of the Savannah River ichthyoplankton are entrained at the SRP cooling water intake structures, there appears to be no effect on the fishery of the river." Exhibit NRC000011 at V-13.

Furthermore, preliminary data collected by Southern (2008) during entrainment studies at Units 1 and 2 support the Staff's conclusions in the FEIS by showing lower larval densities in the intake canal as compared to the densities in the river. Exhibit NRC000030 at 30.

Q30. You stated that in assessing entrainment, the Staff assumed uniform distribution of drift organisms in the water column. What do you mean by "uniform distribution," and why is it an appropriate assumption for this analysis?

A30. (RHK) Uniform distribution is a conceptual term meaning that the organisms would be distributed uniformly or evenly throughout the water column. Thus, there would be equal spacing between all organisms, and the same number of organisms would be selected in any given volume of water regardless of where within the particular waterbody that volume of water was obtained. This is an artificial construct because in reality organisms do not distribute uniformly. However, the Staff considered the uniform distribution of drift to be an appropriate assumption for two reasons. First, the ESRP suggests that the Staff should rely on earlier environmental reviews when assessing environmental impacts associated with intake structures and the assumption of uniform distribution was made in the original FES (NRC 1985) for Units 1 and 2. Exhibit NRC000010 at 5.3.1.2-6; Exhibit NRC000014 at 5-17. And second, it is a conservative estimate of the ichthyoplankton that will be entrained.

Some aquatic species (including fish and molluscs) release their eggs into the water column, where the eggs hatch into larvae. Others deposit their eggs on, or near, the bottom and are considered demersal spawners. The robust redhorse is one example. The robust redhorses lay their eggs in gravel bars, where the eggs hatch into larvae. Exhibit NRC000001 at 2-88; 17 at 1152. The shortnose sturgeon and the Atlantic sturgeon, as two more examples of demersal spawners, also have eggs that sink quickly and adhere to sticks, stones, gravel and rubble shortly after fertilization. Exhibit NRC000001 at 2-90; Exhibit NRC000046 at 172. The assumption of uniform distribution for species such as the shortnose sturgeon and the robust redhorse is not realistic, since their eggs and larvae are found primarily in and on the substrate at the bottom of the river; thus, assuming a uniform distribution for entrainment of these species will greatly bias the entrainment losses higher than what would occur in actuality.

Other species of fish spawn their eggs in the water column, where the larvae are hatched. The eggs and larvae that are suspended in the water column are termed "ichthyoplankton drift." The distribution of eggs and larvae in the drift will vary depending on the density of the eggs and the ability of the larvae to swim and the water currents. American shad and striped bass are two of the "important" species for which the eggs and larvae tend to be carried in the water column, and would be considered to be part of the ichthyoplankton drift. As a result, the assumption of uniform distribution is somewhat more realistic for the striped bass and the American shad, which have eggs that are pelagic or semipelagic. Exhibit NRC000006 at 292, 294 and 104. These species have a relatively high fecundity rate relative to demersal spawners; nevertheless, the distribution is not really uniform, with clouds of eggs and larvae moving through the river as a result of spawning patterns and river flow. However, as explained below, the Staff believes that the uniform distribution assumption is an appropriate method for determining environmental impacts.

Overall, the actual volume of water being moved into the intake will result in lower numbers of fish eggs and larvae entrained than would be anticipated based on the uniform distribution assumption for the following reasons. First, as described in the FEIS, data from the SRS studies shows that egg densities exhibit significant differences between the top and bottom of the river column at over half of the transects in the sampling sites examined. Exhibit NRC000001 at 2-81; Exhibit NRC000012 at 3-37 and 3-39. In all of these cases, the densities were higher near the bottom than near the surface. *Id.*

Second, as discussed in the FEIS, the proposed VEGP Units 3 and 4 will not draw water directly from the bottom of the water column, due to the presence of a weir wall projecting up from the river bottom at the entrance of the intake canal. Exhibit NRC000001 at 5-31. Additionally, the applicant plans to install a surface skimming wall primarily to restrict floating debris from entering the canal. This surface curtain skimmer, along with the bottom weir wall, would result in water from the middle of the river water column preferentially entering the canal.

For these reasons, the assumption made in the FES for Units 1 and 2 of a uniform distribution of eggs and larvae results in an overestimation of the entrainment losses of eggs and larvae entrained, which is why the Staff considered it to be a conservative approach for its analysis of Units 3 and 4. Exhibit NRC000014 at 5-17.

Furthermore, the preliminary results of Southern's entrainment sampling program for Units 1 and 2 support the Staff's position that the uniform distribution assumption represents a conservative estimate because these results show that the concentration of eggs and larvae in the water column in the intake canal are significantly lower than the concentration reported from the river. Exhibit NRC000030 at 30.

Q31. How does the Staff's FEIS analysis account for the mobility of the eggs and larvae of aquatic species?

A31. (RHK) The Staff did not assume mobility of eggs or larvae in the water column. The Staff assumed that, from the standpoint of avoidance of entrainment, once an egg or larvae is in the hydraulic zone of influence it will be entrained. The Staff did not assume that eggs or larvae will preferentially move towards or away from the hydraulic zone of influence or seek out the middle of the water column. Instead, the Staff made the assumption that entrainment impacts are closely linked to the amount of water passing through the intake. Thus, if 0.9% of the river is withdrawn by the intake structure under normal withdrawal and average flow conditions, then 0.9% of the eggs and larvae in the river are assumed to be entrained. Inherent in this is the further assumption that the eggs and larvae are incapable of avoiding entrainment if they are in the zone of hydraulic influence of the intake structure.

This assumption of uniform distribution of eggs and larvae in the water column is also an assumption that is made by the EPA in its Phase I Final regulations for new facilities that withdraw water for cooling purposes (also see my colleague's response above to Question 22). Exhibit NRCR00035 at 65,256, 65,277 and 65,340. The EPA states in those regulations that "Entrainment impacts of cooling water intake structures are closely linked to the amount of water

passing through the intake structure, because the eggs and larvae of some aquatic species are free floating and may be drawn with the flow of cooling water into an intake structure." *Id.* For these reasons, the Staff considered this assumption of entrainment being generally proportional to water withdrawal to be appropriate in the FEIS analysis.

Q32. Do the data used by the Staff in its entrainment analysis account for variations that might occur in species composition at different times of the year (or for those species' vulnerabilities at different life stages)?

A32. (RHK) The Staff's analyses did not directly take into account the variations that might occur at different times of the year, or those species' vulnerability at different life stages. Instead, as discussed in the previous response, the Staff assumed that the entrainment impacts are closely linked to the amount of water being withdrawn by the intake. However, the Staff recognizes that there are differences in river flows during the year and likewise there are differences in ichthyoplankton densities throughout the year, with the higher densities corresponding to periods of higher flow in the March to June time frame. Exhibit NRC000011 at V-454 and V-456 to V-461. These differences would result in a lower percentage of the ichthyoplankton being entrained (since the plant is pulling in a smaller percentage of the water flowing down the river) than was assumed by the Staff. Accordingly, this too results in a conservative estimate.

Q33. What is the basis for the Staff's conclusion that populations of important aquatic species will not be adversely affected by entrainment?

A33. (RHK) The Staff reached the conclusion in the FEIS that populations of important species will not be adversely affected by entrainment from proposed Units 3 and 4. Exhibit NRC000001 at 5-32. For fish that spawn pelagically, such as the striped bass or American shad, this conclusion is based on the anticipated small percentage of water the new units would withdraw and the resulting small percentage of ichthyoplankton lost using the conservative assumption that the amount of water pulled through the intake is closely linked to

the amount of ichthyoplankton entrained. This assumption is even more conservative when one takes into account the design of cooling intake canal and structure, which selects water from the middle of the water column and reduces the overall percentage of ichthyoplankton entrained from the water column. *Id.* at 5-31 to 5-32. This reasoning is supported by the finding from the SRS studies that egg densities are higher at the bottom of the water column than at the top, which would further reduce the significance of the entrainment-related losses. Exhibit NRC000012 at 3-37 and 3-39.

The Staff's conclusion that there will be a lack of impact to fish such as striped bass or American shad is also supported by the typically high fecundity of these species that spawn pelagically in rivers such as the Savannah River, where there is a high natural mortality rate for eggs and larvae of these important species. The timing of the spawning of these species relates to seasonal periods of naturally higher river flow, when the fraction of the water removed by the proposed units (and the subsequent fraction of eggs and larvae entrained) is smaller. Exhibit NRC000006 at 104, 292, and 294.

With respect to the robust redhorse, the Staff's conclusion was supported by the life history of the fish including the placement and development of robust redhorse eggs in gravel. Exhibit NRC000001 at 2-88, 2-89 and 5-36. In addition, the location of the nearest known spawning area is 25 river miles upstream of the VEGP site, further reducing the likelihood of entrainment of redhorse eggs or larvae at VEGP. Exhibit NRC000017 at 1152 and 1148.

The Staff's conclusion in the FEIS, that the shortnose sturgeon will not be adversely affected by entrainment from Units 3 and 4 is also based on the shortnose sturgeon's life history data, which shows that the sturgeon 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 NRC000001 at 2-89 to 2-93, 5-41 and 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 NRC000046 at 172, 179 and 180. In addition,

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 to 118 and upstream at RM 171-172. Exhibit NRC000047 at 695. Collins and Smith (1993) reported a probable spawning site between RM 111 and 142. Exhibit NRC000024 at 485. In comparison, the VEGP units 3 and 4 intake structure is approximately at RM 151.

Because Atlantic sturgeon eggs are also highly adhesive and deposited on the bottom substrate and larvae tend to stay near the bottom (see response to Question 13) the Staff also concludes that the eggs and larvae of the Atlantic sturgeon would not be adversely affected by entrainment.

The Atlantic pigtoe mussel, another species identified in the FEIS as an "important species," has only been tentatively identified in the Savannah River, and only at a considerable distance from the VEGP site (52 river miles upstream) and thus the Staff concluded, in the FEIS, that it would not be adversely affected by entrainment. Exhibit NRC000005 at 4, 5, 6 and 18; Exhibit NRC000001 at 5-37.

The nine South Carolina mussel species identified in the FEIS could be entrained, however, the glochidia (larval stage) of most freshwater mussels are obligate parasites of fish and once they attach to the gills or fins of a fish they are less susceptible to the impacts of entrainment. Exhibit NRC000001 at 5-37.

As a result, after examining the specific life-history characteristics of each of the important species, the Staff concluded that the impact to the important species in the Savannah River from the proposed new Units 3 and 4 would be minor or SMALL. *Id.* at 5-37 and 5-42.

In addition, as I explain in more detail below, the Staff's conclusion with respect to the impact of entrainment of important species is supported by the preliminary results of Southern's entrainment monitoring program for VEGP Units 1 and 2. Exhibit NRC000030.

Q34. Is the Staff aware of additional information pertinent to the Staff's conclusions in the FEIS that projected impacts from entrainment will be minor?

A34. (RHK) Yes. Since the issuance of the FEIS, the Staff has become aware of two sources of new information relevant to the Staff's conclusions with respect to entrainment. The Staff has also revisited some information previously supplied by the applicant that was not cited in the FEIS. The Staff has determined that these three sources of information support the Staff's conclusions in the FEIS.

First, by letter dated August 11, 2008, the U.S. National Marine Fisheries Service (NMFS) responded to the Staff's January 2008 Biological Assessment. Exhibit SNC000022. The NMFS concurred with the Staff's conclusions and concluded that "this proposed action is not likely to adversely affect shortnose sturgeon[.]" *Id.* at 4.

Second, as discussed in FEIS Section 5.4.2.2, entrainment monitoring was initiated by Southern in March 2008 at the VEGP Units 1 and 2 intake structure to estimate the species composition and density of ichthyoplankton in the Savannah River and entrained in the cooling water withdrawals. An interim report provided by Southern dated September 2008 states that fish eggs and larvae in samples taken from the Savannah River were approximately 36.4 times more numerous than in samples taken in the intake canal collected at approximately the same period of time. Exhibit NRC000030 at 30. The majority (52%) of entrainment sample organisms were collected during March through July. Although eggs were the most abundant life stage collected in the Savannah River (accounting for 61.8 percent of the total sample), no eggs were encountered in entrainment samples, possibly indicating they may have settled out of the water column at the entrance to the canal where the water velocities are the lowest. Annualized extrapolation of sample data by the applicant resulted in an entrainment rate of 1302 organisms (eggs and larvae) per day. *Id.* This rate of 1302 organisms per day is minor when compared to the estimates by Specht of 23.4 million eggs and larvae entrained/year (64,000 per day) in 1984 and 25.9 million entrained per year (71,000 per day) in 1985. Exhibit NRC000011 at V-13.

The entrainment from the VEGP Units 1 and 2 (and by extension from Units 3 and 4) would be a small percentage (less than 1%) of the entrainment experienced in 1984 and 1985 at the SRS, when three nuclear reactors (K, L, and P) and a coal-fired power plant were operating. The Staff believes these data support its conclusions in the FEIS that the impacts of entrainment would be minor, as discussed in the response to Question 29. The impacts of entrainment at the SRS did not appear to have an effect on the fishery of the river, even though they were much higher entrainment rates than would occur at VEGP.

The Staff is also aware of a May 7, 2008, study by Southern to conduct a hydraulic zone of influence survey at the VEGP Units 1 and 2 intake structure. Exhibit NRC000031 at 2, 4. While this study was not discussed in the FEIS, the Staff has determined that it provides additional insight into the assessment of impacts that the VEGP Units 3 and 4 will potentially have on the aquatic biota in the vicinity of the site. The purpose of this study was to determine what fraction of the Savannah River that flows past the VEGP site is drawn into the Unit 1 and 2 intake canal by the operation of the pumps. The Savannah River flow at the time of the survey was 4,482 cfs. The water withdrawal rate was 110 cfs, compared to a normal withdrawal rate for VEGP Units 1 and 2 of 90 cfs. Exhibit NRC000001 at 7-4.

The results of the hydraulic zone of influence determination showed that, under approximately the same low flow conditions but with slightly greater withdrawal rates, the Units 1 and 2 intake structure had an area of hydraulic influence of 0.14 acres and extended about 1/6$^{th}$ of the way across the river in the vicinity of the VEGP site. In the vicinity of the intake and discharge, under Drought Level 3 conditions, the river is over 300 feet wide. Therefore, the vast majority of ichthyoplankton drifting down the river would be unaffected by the water withdrawal of the intake structure for Units 3 and 4, since they are designed similar to Units 1 and 2. The Staff believes that this information provides additional support for its conclusions in the FEIS, because it demonstrates that only a fraction of the Savannah River is influenced by the kinds of water withdrawals associated with closed-cycle cooling system for Units 1 and 2. By extension,

the Staff believes influence on the river from the Units 3 and 4 intake structure would affect only a fraction of the river, comparable to that of Units 1 and 2; thus, most species that are moving up or down the river would not be adversely affected by the influence of the intake structures.

**D. General River Flow Considerations**

Q35. In evaluating impacts to aquatic resources, how did the Staff determine what river flow values to consider?

A35. (LWV, CBC) As discussed in the FEIS, the Staff considered a representative range of river flows, including seasonal variability, based on data from the USGS stream gauging network. Additionally, due to public concern with low-flow conditions resulting from the ongoing drought, the Staff augmented its analysis with consideration of some exceptionally low-flow conditions. This approach was consistent with guidance in the ESRP that directs the Staff to look at a range of flow conditions. Exhibit NRC000009 at 2.3.1-2.

As discussed in the FEIS, the U.S. Army Corps of Engineers ("Corps") released a draft Drought Contingency Plan in 2006. Exhibit NRC000038. The draft plan proposed release rates from upstream reservoirs under four drought levels. The draft Drought Contingency Plan, defines the drought levels by the elevations of the pool in the Thurmond and Hartwell storage reservoirs. Exhibit NRC000001 at 2-20. As the pools in the reservoirs drop, the drought levels increase from 1 to 4. As the drought level increases, the maximum release from Thurmond reservoir is decreased in an attempt to preserve the conservation pools in the reservoirs thus reducing the streamflow downstream. These reductions in releases are balanced against the need to maintain instream flow for aquatic habitat downstream from the Thurmond Dam.

The Drought Contingency Plan was not finalized at the time the FEIS was written. Exhibit NRC000001 at 2-20. However, in the FEIS, the Staff presented the reservoir release policies described in the draft Drought Contingency Plan, because it represented the most current understanding of future operations and releases by the Corps. The Staff used these published proposed minimum releases at Thurmond reservoir to represent streamflows

downstream at the VEGP site during drought periods when the Drought Contingency Plan would be in effect. We discuss this methodology and its relevance for the Staff's impact analysis later in this testimony.

As stated in the FEIS, the Savannah River Basin is currently in a severe and multiple-year drought. As a result, the Corps is presently operating in a manner similar to the draft Drought Contingency Plan, except that the Thurmond Dam discharge has been at 3600 cfs and not the 3800 cfs minimum currently prescribed in the draft plan. Exhibit NRC000038 at 1. Based on the draft plan, at the time that the FEIS was prepared, the Savannah River Basin was at Drought Level 2 and had never reached Drought Level 3 or 4. Exhibit NRC000001 at 5-7. However, the Corps had stated that without a reprieve in the drought, Drought Level 3 would be likely during the summer of 2008. *Id.* at 5-8. This did occur and, as of the date of this testimony, the Savannah River hydrosystem is in Drought Level 3 for the first time. This development is discussed in a Draft Environmental Assessment and Finding of No Significant Impact published by the Corps in October 2008 concerning a "Temporary Deviation Drought Contingency Plan" for the Savannah River Basin. Exhibit NRC000039 at 1. At the time the FEIS was written, the Staff was additionally advised that the Corps was considering revising the minimum releases in the December to April period downward to 3100 cfs. Exhibit NRC000001 at E-44. This change has also now been proposed in the Corps' Temporary Deviation Drought Contingency Plan. Exhibit NRC000039 at 1.

The Staff explained in the FEIS that the implementation of Drought Level 4 in the draft Drought Contingency Plan did not provide the explicit flows that would be needed for an impact analysis. Exhibit NRC000001 at E-44. The Corps, the State of Georgia and the State of South Carolina are presently clarifying the operational implementation of Drought Level 4. Without explicit flow levels (and given the likelihood that any such flow levels would likely change based on the ongoing development of the Draft Drought Contingency Plan) and because a Drought Level 4 would be an extremely rare event, the Staff determined that it was still conservative to

base its low-flow analysis in the FEIS on Drought Level 3 flows (3800 cfs). Exhibit NRC000001 at E-44.

However, in part because of the ongoing drought conditions and the reservoir-release changes contemplated by the Corps, the Staff did include calculated values in the FEIS in order to disclose potential fractional withdrawals and consumptive water use at flow rates of 3000 and 2000 cfs, in addition to the 3800 cfs minimum for Drought Level 1, 2, and 3 from the current draft Drought Contingency Plan. Exhibit NRC000001 at 5-9 to 5-10. While, as we have just mentioned, the Corps is proposing a further seasonal drop in releases from Thurman reservoir down to 3100 cfs, this value is still bounded by the 3000 cfs the Staff already considered in the FEIS. The 3000 and 2000 cfs values are not specifically Drought Level 4 flow rates but instead were the Staff's attempt to provide additional conservative context for its analysis. The Staff expects that the occurrence of these flows would be extremely rare and of only temporary duration.

Q36. In light of these recent developments concerning both the declared Drought Level and the Corps' proposed temporary deviation plan, do you believe the Staff's analysis in the FEIS of Drought Level 3 flows of 3800 cfs and of very-low flows of 3000 cfs and 2000 cfs remains appropriate?

A36. (LWV, CBC) Yes. Particularly when considering factors such as river flow, it is important in a NEPA review of a plant with a 40 plus year operating life not to bias the description of a site and the associated assessment of environmental impacts based on the limited context of current conditions. The current drought has provided a new drought of record. This occurrence increases the overall probability of a future occurrence of a similar event. However, this does not mean that the current state of flows in the river has become the new norm. As stated in the FEIS in response to comments on the DEIS, and as we will discuss later in our testimony, we do not believe that the current drought conditions represent a new baseline condition for the Savannah River Basin. Furthermore, as the Staff stated in the FEIS in

response to public comments on the DEIS, if flows decline to a level that the consumptive use of water by the plant's cooling system or the discharge of blowdown to the Savannah River represent a significant impact, the plant may be required by appropriate State water permitting authorities (e.g., GADNR) to derate or stop operation. Exhibit NRC000001 at E-44.

Q37. Why is it appropriate to use Thurmond Dam releases as the basis for the Staff's analysis of impacts at the site, given the withdrawals and releases upstream between Thurmond Dam and the Vogtle site? Why did the Staff not use flows from any USGS gauge closer to the site?

A37. (LWV, CBC) In the FEIS, in response to public comments on the DEIS, the Staff explained that between the Thurmond Dam and the VEGP site, discharges to the river and withdrawals from the river will change the flows reaching the VEGP site. Exhibit NRC000001 at E-45. The two largest water withdrawals upstream of the VEGP site are Urquhart Station at RM 195, which withdraws 3.61 $m^3/s$ (127.5 cfs) and the D-Area Powerhouse, which withdraws 1.94 $m^3/s$ (68.4 cfs). Both facilities are operated by South Carolina Electric and Gas. Upstream of the VEGP site, primary discharges of groundwater and surface water (including from Butler Creek, Spirit Creek, Hollow Creek, McBean Creek, Upper Three Runs Creek, Four Mile Branch, and Pen Branch) into the river increase the streamflow. Exhibit NRC000001 at E-45. A map showing these tributaries is attached as Exhibit NRC000042 at 8. The U.S. Geological Survey (USGS) estimated groundwater discharge over the reach of the river from just below Thurmond Dam to just above the VEGP site to be approximately 223 cfs during low flow conditions (i.e., river flow of 3800 cfs). Exhibit NRC000001 at 2-35; Exhibit NRC000040. Furthermore, the Staff stated in the FEIS that groundwater discharges to the river would likely increase at extremely low stream flows, while the withdrawals would not. Exhibit NRC000001 at E-45.

For these reasons, the Staff considers it likely that the groundwater discharges to the river are approximately equivalent to the consumptive loss from the upstream users (even under lower flow conditions). In any event, whatever the potential difference between the upstream

withdrawals and discharges, that difference would be very small compared to the total river flow. The Staff also found that the Jackson gauge, which is closer to the VEGP site than Thurmond Dam, was taken out of service in 2002 and is not available to measure streamflow near the VEGP site. Exhibit NRC000001 at 2-32. Moreover, the Staff notes that the accuracy of the Savannah River stream gauges ranges from 5 to 10 percent of true. *Id.* Accordingly, given the likelihood that upstream withdrawals from and discharges to the Savannah River are approximately equivalent, and considering the reliability of the flow estimates at the Thurmond Dam release point, the Staff considered it appropriate to base its FEIS analysis of the flow past the VEGP site on the Thurmond Dam estimated releases.

Since the issuance of the FEIS, the Staff also has considered additional recent data from the Waynesboro gauge. Exhibit NRC000041. The USGS operation and maintenance of this real-time stream gauge is funded in cooperation with Southern Nuclear under FERC licensing regulations. While the gauge is located near the VEGP site, it has only been in operation since January 2005 and, therefore, the Staff considered it to be of too limited a period of record to be the basis of the Staff's assessment in the FEIS.

However, the record of data from this new gauge does show flows in excess of the releases from Thurmond Dam and shows some periods of flow significantly above the Thurmond Dam releases, consistent with the unregulated surface water flow that, as we have just discussed, would enter the Savannah River from tributaries (Exhibit NRC000042) below Thurmond Dam. Therefore, this supports the Staff's view that the flow at the VEGP site will exceed the release at Thurmond reservoir, as long as the inflow from tributaries and groundwater exceed the consumptive water losses by users between Thurmond reservoir and the VEGP site (an assumption the support for which we have already explained). In general, the limited data shows greater flows at the Waynesboro gauge than at Thurmond reservoir. Therefore, in our opinion, this data from the Waynesboro gauge provides further support for the Staff's determination that the use of the Thurmond Dam flow releases represents a reasonable

and conservative assumption for evaluating river flows at the ESP site. Exhibit NRC000041. (The Waynesboro gauge data is available at http://waterdata.usgs.gov/nwis/uv?021973269.)

Q38. How does the Staff's analysis of impacts to aquatic resources account for monthly or annual ranges and averages of Savannah River flows?

A38. (MTM) The Staff based its analysis of operational impacts in FEIS Chapter 5 on the maximum withdrawal rate for the proposed VEGP Units 3 and 4. The Staff considers use of this rate to be a conservative assumption since the withdrawals at this maximum rate would occur infrequently and only for short periods of time. For river flows, the Staff used the average-daily river discharge of 8830 cfs and the Drought Level 3 river discharge rate of 3800 cfs. Exhibit NRC000001 at 5-29. Because the releases at Thurmond Dam are controlled, particularly at low flow levels, the Staff considers the use of these values to be reasonable. During low flow conditions, variation in releases at Thurmond Dam is minimal; nevertheless, the range in flows at the VEGP site, even on a daily basis, is often greater than the normal and maximum withdrawal rates for the planned VEGP Units 3 and 4. Such daily fluctuations, based on the flow records from the Waynesboro gauge for the period January 2005 through October 2008 would have exceeded the normal planned water withdrawal rate for Units 3 and 4 of 83 cfs 79 percent of the time. Exhibit NRC000041.

Withdrawals from the Savannah River by VEGP Units 3 and 4 will be relatively constant. Superimposed on this constant withdrawal rate will be the daily fluctuations in river flow. As stated above, river flows fluctuate at the site despite the fairly constant releases from Thurmond Dam. Variation in river flow rates is considered normal and beneficial to riverine systems. Often resource agencies insist on more normative flows downstream of impoundments by requiring variations in flow, both seasonally and in some cases more frequently, to maintain a balanced indigenous system.

Hypothetically, at very low river flows (less than 2000 cfs) that persist over a long period of time, the VEGP water withdrawals could have an adverse impact on the Savannah River

fishery with respect to impingement and entrainment losses. However, these very low-flows are not expected, and if they did occur they are unlikely to persist over a long period of time. Should very-low flows occur the Staff believes that the impacts related to operation of two additional units at the VEGP site on the fishery at these very low flow levels would be temporary, reversible, and confined to a stretch of river that is not biologically unique. Historically, even since the construction of the upstream impoundments, higher river flows occur in the spring and early summer, which is typically when most fish spawning occurs. Exhibit NRC000001 at 2-19. However, while the Staff recognized that this was the case, as an additional conservatism the Staff did not factor these historically higher flows into its FEIS assessment. Instead, the Staff relied on the average-daily discharge flow and the Drought Level 3 flows in performing its assessment. The Staff used these two flow values and the assumption of maximum withdrawal rate for the two units to conservatively assess the impact related to the water withdrawals.

### E. Flow Considerations for Impingement and Entrainment

Q39. Did the Staff consider how the proposed cooling system for Units 3 and 4 would alter the flow in the Savannah River?

A39. (LWV, CBC) In the FEIS, the Staff acknowledges that operation of the proposed VEGP Units 3 and 4 will result in a small reduction in the amount of water downstream of the VEGP site. Exhibit NRC000001 at 5-7 to 5-10. This reduction in downstream flow is primarily the result of the evaporation of water to transfer reject heat from the plant into the atmosphere. At the daily-average river discharge flow of 8830 cfs, the normal consumptive use of water by VEGP Units 3 and 4 would be about 0.7 percent. The reduction in downstream flow will be proportionately greater during periods of drought, such as the one the Savannah River Basin is currently experiencing.

The flow in the Savannah River at the VEGP site is highly regulated by a series of dams upstream of the VEGP site. However, the Corps manages the reservoirs in an attempt to

balance multiple objectives of the Savannah River, including flood control, municipal needs, industrial needs, recreation, navigation, and the aquatic ecosystem. Due to the small amount of water consumed by VEGP Units 3 and 4, the Staff does not believe that any significant alteration in the Corps' reservoir management policies would be made in response to operation of the additional units.

Q40. In your opinion, does the current regional drought and the lower flows in the Savannah River associated with it suggest a need to reconsider long-term "normal" flows in analyzing impacts at the ESP site, or is this an extremely rare event?

A40. (LWV, CBC) Since early in 2006, the Savannah River Basin has been experiencing a drought. The drought has persisted to the time that this testimony is being prepared and currently represents the drought of record for the Savannah River Basin. Exhibit NRC000039 at 3. The U.S. Army Corps of Engineers operates three large multipurpose reservoirs that regulate the flow of water in the Savannah River at the VEGP site. In normal years, even with this large capacity to regulate flows, the flow in the Savannah River varies considerably both annually and seasonally. This flow variability is a result of the limited ability of the Corps reservoirs to reshape the flows entering and leaving the reservoir system in normal flow years. In low flow years, while the releases from Thurmond Dam remain rather constant, the unregulated inflows from tributaries to the Savannah River downstream of Thurmond Dam and above the VEGP site also contribute to the annual and seasonal variability.

However, the recent drought has forced the Corps to release a nearly steady minimum low flow from these reservoirs in order to maintain instream flows while still protecting the conservation pools of the reservoirs. While these low flows have persisted since 2006, that persistence does not suggest that these low flows represent a trend that will continue indefinitely. While the occurrence of drought periods such as the recent drought will increase the presumed probability of a subsequent drought, this does not mean that using the current historical record as the basis for this environmental impact assessment is inappropriate.

Another possible cause of a severe and systematic change in streamflows that might bring into question the validity of using the current historical record as a basis for this assessment is climate change. In preparing the FEIS, the Staff did consider the potential impact of climate change on streamflows. As described in response to public comments (Exhibit NRC000001 at App. E), the Staff considered both the United States Global Climate Change Research Program National Assessment and the Intergovernmental Panel on Climate Change AR4 Synthesis Report. Exhibit NRC000043; Exhibit NRC000044. Both studies agree on predicted increases in temperature. However, precipitation estimates in the climate models suggest either a regional increase in precipitation or precipitation remaining about the same as present. While there is general agreement in the scientific community that some change in climate is occurring, considerable uncertainty remains with respect to the magnitude and direction of some of the changes. Therefore the staff considers the historical record to be the most appropriate basis for analysis available at this time.

Another possible reason for a severe and systematic change in streamflows that might bring into question the validity of using the current historical streamflow record as a basis for this analysis would be a bias in the current record associated with a persistent climate pattern such as El Niño or La Niña. However, while there is some evidence to suggest a weak correlation between La Niña conditions and winter droughts in the Southeast, given the long duration of the flow record and the relatively short persistence of a La Niña event, the Staff believes it is unlikely that the historical streamflow recorded in the VEGP site vicinity and used in the FEIS analysis is significantly biased. While the 20th century has been a relatively moist period in the Southeast compared to earlier centuries, the 20$^{th}$ century is the longest period with relatively reliable streamflow records. The Staff identified no other patterns of climate variability to suggest that the historical streamflow record was an unsuitable basis for this NEPA assessment.

Moreover, with respect to recent flow rates, the Waynesboro gauge shows that despite the lingering drought, the streamflow past the VEGP site has only been recorded below 3800 cfs on two days in the period of 3.75 years from January 22, 2005 through October 27, 2008. Exhibit NRC000041. These data also indicate that the river flow past the site has only been recorded below 4000 cfs on 49 days during this same period. *Id.* In addition, the day-to-day fluctuation in the streamflow in the Savannah River has been greater than 173 cfs (equivalent to the normal withdrawal of all four units) two-thirds of the time. *Id.* Thus, these data confirm the Staff's determination in the FEIS that a flowrate of 2000 cfs would be an infrequent occurrence.

Q41. Earlier in your testimony, you discussed the Staff's evaluation of impacts to aquatic resources from impingement and entrainment. What river flow conditions did the Staff assume as part of that evaluation?

A41. (RHK) The Staff evaluated the impacts to aquatic resources in Chapter 5 of the FEIS under average daily flow conditions (8830 cfs) and Drought Level 3 conditions (3800 cfs). Exhibit NRC000001 at 5-30. Later in the FEIS, the Staff also considered the impacts to aquatic biota at river flow rates of 3000 cfs and 2000 cfs. Exhibit NRC000001 at 5-38.

Q42. Did the Staff determine in the FEIS what percentage of the river flow would be withdrawn (or consumptively used) by the proposed new units?

A42. (LWV, CBC) The Staff determined that, at normal withdrawal and average daily river flow conditions, 0.9 percent of the water in the river would be withdrawn for Units 3 and 4. Exhibit NRC000001 at 5-8, Table 5-1. At maximum withdrawal rates and Drought Level 3 flow conditions, this percentage increases to 3.4 % of the Savannah River flow. The percentage of water withdrawn at the maximum withdrawal rate from the Savannah River due to operation of VEGP units 3 and 4 assuming river flows of 3000 cfs is 4.3%. Assuming river flows of 2000 cfs this rises to 6.5%. Exhibit NRC000001 at 7-6.

Only a fraction of the water withdrawn by the proposed intake at the VEGP site would be subsequently returned to the river. The difference between the water withdrawn from the river

and the water returned to the river is called the consumptive use. Most of this water is discharged into the environment as water vapor from the cooling towers. The consumptive use values are shown in Table 5-2 of the FEIS. Exhibit NRC000001 at 5-9. For normal consumptive use and average river flow conditions, the percentage of the river water consumed by Units 3 and 4 is 0.7%. For maximum consumptive use and Drought Level 3 conditions the percentage of the river water consumed by the VEGP Units 3 and 4 is 1.7%. The Staff also analyzed the consumptive use under river flows of 3000 cfs and 2000 cfs. Exhibit NRC000001 at 5-10. Maximum surface water consumptive use would increase from 2.1% to 2.3% and from 3.2% to 3.4% respectively. This would constitute a 0.2 percent increase in the percent of consumptive water use.

Q43. Is the percentage of water withdrawn (or consumptively used) relevant to the Staff's impact conclusions for impingement and entrainment? If so, why?

A43. (RHK) Yes, the Staff based its analysis of impingement and entrainment impacts, in part, on the percentage of water withdrawn from the Savannah River, although the percentage of water withdrawn from the river is of greater significance for the assessment of impact from entrainment than it is for the assessment of impact from impingement. However, as we explained earlier in our testimony, the Staff's conclusions in the FEIS also considered other factors --the life history data of important aquatic species (see testimony at Question 28, above) and most importantly, the smaller amounts of water that are withdrawn by a closed-cycle cooling system (see testimony at Question 17, above).

Within the range of river flows anticipated at the VEGP site, the Staff does not anticipate variations in impingement losses directly related to river stage that could result in impacts to fish populations inhabiting the Savannah River. However, at very low flows, some increase in impingement may occur (see response to Question 45, below). The type of cooling system, the intake design and location, species composition, type of watercourse, and life history data all

have a greater potential for affecting impingement rates than do the kinds of flow variation expected in the Savannah River at the VEGP site.

The Staff is aware of the U.S. EPA's "Phase I Final regulations for new facilities that withdraw water from waterbodies for cooling purposes," and that it established proportional flow requirements for new facility cooling water intake structures requiring that the total design intake flow from all cooling water intake structures at a facility withdrawing from a freshwater river or stream be no greater than 5 percent of the source water body annual mean flow (also see my colleague's response to Question 22, above). Exhibit NRC000001 at 5-30. According to the U.S. EPA, "[t]he 5 percent value for rivers and streams reflects an estimate that this would entrain approximately 5 percent of the river or stream's entrainable organisms." Exhibit NRCR00035 at 65277, 65340. The EPA stated that "[p]roportional flow limitations are one way to provide protection for aquatic life and enhancement of commercial and recreational uses of source waters. Larger proportionate withdrawals of water may result in commensurately greater levels of entrainment. Entrainment impacts of cooling water intake structures are closely linked to the amount of water passing through the intake structure, because the eggs and larvae of some aquatic species are free floating and may be drawn with the flow of cooling water into an intake structure." *Id.*

The FEIS considered the percentage of water withdrawn during normal operations for the proposed VEGP Units 3 and 4 from the Savannah River at the average daily discharge and Drought Level 3 river flow levels. At normal withdrawal rates the proposed VEGP Units 3 and 4 would withdraw between 0.9 and 2.2 percent, respectively, of the river flow at these flow rates. Exhibit NRC000001 at 5-30. The staff has also subsequently considered the withdrawal rate at the annual mean flow for the Savannah River. The annual mean flow value for the Savannah River was determined for both the USGS Augusta and Waynesboro gauges. The staff conservatively used the calculated annual mean flow value for the Waynesboro gauge which was determined to be 6991 cfs. Because of the much shorter period of record and the influence

of the recent drought, on the average the Waynesboro flow rate value is significantly less than the annual mean flow value for the Augusta gauge. The combined normal withdrawal rate of 83 cfs for both VEGP Units 3 and 4 represents 1.2 percent of the Waynesboro annual mean flow value. This is significantly less than the USEPA national performance requirement of 5 percent for a cooling water intake structure located in a freshwater river or stream.

Q44. How did those calculated percentages affect the Staff's conclusions in the FEIS with regard to impingement and entrainment?

A44. (MTM, RHK) Although the Staff relied on the fact that only a small percentage of water is projected to be withdrawn from the river by the closed-cycle cooling system in its assessment of impacts related to impingement and entrainment on the aquatic organisms in the Savannah River, other factors and data were considered in the evaluation as well. The Staff discussed these factors earlier in this testimony. Based on the use of closed-cycle cooling, the design, location and planned operation of the intake structure, the life history data for species inhabiting the Savannah River, the results of studies conducted at the nearby Savannah River Site, the preliminary results of systematic sampling in the vicinity of the VEGP Units 1 and 2 intake, several site visits, as well as river stage and withdrawal rates, it is the Staff's professional judgment that the impacts of impingement and entrainment on aquatic resources would be minor.

Q45. What did the Staff conclude with regard to impingement and entrainment impacts to aquatic resources from Units 3 and 4 normal and maximum withdrawals under very-low-flow conditions? What was the basis for that conclusion?

A45. (MTM/RHK) The Staff determined that the impact of two additional units at the VEGP site to fish populations and particularly to the "important species" in the Savannah River due to impingement and entrainment at very-low flows would result in entrainment of a greater proportion of the ichthyoplankton in the Savannah River water column, and possibly a slight increase in impingement mortality rates. However, the Staff determined that any losses from

entrainment and impingement are unlikely to have any persistent long term impacts on populations of aquatic organisms in the river. Exhibit NRC000001 at 5-38.

It is postulated that at the very-low flows of 3000 and 2000 cfs, aquatic biota in the river would be concentrated and the through-screen velocities at the intake would increase slightly. These effects would potentially increase the rate of impingement, particularly of small and juvenile fish and fish in poor condition. However, it would likely result in only a minimal increase in impingement rates, if the rates were to increase at all. As explained earlier in this testimony, factors other than river flow (such as station water withdrawal rate, species present, and intake location) play a more significant role than low flows in influencing the magnitude of impingement losses.

The Staff determined in the FEIS that the impact of two additional units at the VEGP site due to entrainment at very-low flows would result in a proportionate increase in entrainment. The Staff evaluated the impacts to aquatic biota from entrainment at river flows of 3000 cfs and 2000 cfs in Section 5.4.2.9 of the FEIS. Exhibit NRC000001 at 5-38. The Staff concluded that at river flows of 3000 and 2000 cfs, the river stage and available habitat for aquatic organisms would be reduced, resulting in an increased fraction of water flowing past the site being drawn into the cooling system. Accordingly, entrainment would increase proportionately for both the 3000 and 2000 cfs river flow cases. However, the Staff concluded that both the increased percentage of organisms entrained and the possible increase in impingement mortality are unlikely to have any persistent long term impacts on populations in the river. The Staff reached that conclusion because the low flow conditions would likely be temporary (as discussed above in response to Question 35) and the characteristics of the Savannah River in the vicinity of the VEGP site are not biologically unique; in other words, the analysis in the FEIS does not demonstrate that there are features in the vicinity of the site that are not present in other parts of the river.

## F. Cumulative Impingement and Entrainment Impacts

Q46. Did the Staff determine in the FEIS what percentage of the river flow would be cumulatively withdrawn and consumptively used by Units 1, 2, 3, and 4 at various flow levels?

A46. (LWV, CBC) Yes, the Staff's analysis in Section 7.3 determined the percentage of the river flow that would be cumulatively withdrawn by all four units. At the four flow rates considered (8830 cfs, 3800 cfs, 3000 cfs, and 2000 cfs), the fractional withdrawal of the Savannah River for normal withdrawals are 2.0 percent, 4.6 percent, 5.9 percent, and 8.8 percent, respectively. Exhibit NRC000001 at 7-4, 7-6. For maximum withdrawals at those flow rates, the fractional withdrawal would be 2.5 percent, 5.8 percent, 7.3 percent, and 11.0 percent, respectively.

The Staff's analysis also determined the cumulative consumptive use percentages for all four units. The fractional consumptive use of the Savannah River at the four flow rates mentioned above for normal consumption rates would be 1.5 percent, 3.4 percent, 4.3 percent, and 6.5 percent, respectively. Exhibit NRC000001 at 7-5, 7-6. For maximum consumption rates by all four units, the consumptive use percentages would be 1.5 percent, 3.4 percent, 4.4 percent, and 6.6 percent, respectively.

Prior to publishing the FEIS, Southern informed the Staff that a revision to the proposed plant design would increase the cumulative needs by 3 cfs. The Staff evaluated the effect of this change and determined that it would result in an increase in the normal water consumptive use to approximately 3.5 percent (an increase of only 0.1 percent) of the Drought Level 3 river flow (3800 cfs). Even with the 3 cfs cumulative increase identified by Southern, the Staff determined that the consumptive use rate for very-low river flows of 3000 cfs and 2000 cfs would be 4.4 percent and 6.6 percent, respectively. *Id.* at 7-6.

Q47. Did the Staff evaluate in the FEIS the cumulative impacts to aquatic resources from impingement and entrainment from existing Units 1 and 2 in combination with Units 3 and 4?

A47. (MTM,RHK) Yes. The Staff's review is in Section 7.5.2 of the FEIS. *Id.* at 7-21.

Q48. For flows down to Drought Level 3, what was the Staff's conclusion with respect to cumulative impingement and entrainment impacts, and how did the calculated water withdrawal percentages affect the Staff's conclusions in the FEIS regarding those impacts?

A48. (MTM,RHK) The Staff assessed cumulative impacts to fish and shellfish due to impingement and entrainment losses at VEGP Units 3 and 4 at average-daily and Drought Level 3 flows of 8830 and 3800 cfs, respectively. The Staff did not rely solely on the percent water withdrawal values to assess the cumulative impacts associated with impingement and entrainment. As explained earlier in our testimony concerning impingement, the Staff's evaluation of the location, design, and planned operation of the intake and cooling system, the life history characteristics of the "important" species, conformance with U.S. EPA national requirements (see response to Question 22, above) for intake design, and the characteristics of the watercourse in the immediate vicinity of the intake location led to the Staff's conclusion that the resulting impact to Savannah River aquatic populations would be SMALL.

Based on the Staff's analysis, there is no indication that the Savannah River fishery would be destabilized as a result of the additional small and undetectable impact related to impingement losses from proposed VEGP Units 3 and 4 at river flow levels down to Drought Level 3.

The Staff's assessment of losses due to entrainment, however, relied more heavily on the percent water withdrawal values to assess the cumulative impacts. The Staff determined in the FEIS that the impact of two additional units at the VEGP site due to entrainment at low flows would result in a proportionate increase in entrainment. Exhibit NRC000001 at 7-22. The anticipated total entrainment percentage would be as much as 4.6 percent under combined withdrawals by Units 1 through 4 at Drought Level 3 (3800 cfs) flows. *Id.* at Table 7-1, page 7-4.

The Staff concluded that the impacts of entrainment would be minor even from the cumulative withdrawals for all four units. As stated in Chapters 2 and 5 of the FEIS and further

explained earlier in our testimony, this conclusion is based on a number of factors. These factors include the use of closed-cycle cooling; the design, location and planned operation of the proposed intake, including conformance with US EPA National standards for intake design (see response to Question 16 above); the characteristics of the watercourse in the immediate vicinity of the intake location; the distribution, abundance, and life history data of species inhabiting the Savannah River near VEGP; the results of the SRS studies of impingement and entrainment completed in the 1980s; and the preliminary results of the impingement and entrainment sampling program for VEGP Units 1 and 2. Also, the percentage withdrawal of the flow for all four units combined would be under the EPA's 5% threshold for riverine system withdrawals (40 CFR 125.84(b)(3)(i)) at the annual mean flow rate of the Savannah River, 6991 cfs (see response to Question 43) .

These are all additional reasons why the Staff believes that the impact to fish and shellfish populations in the Savannah River due to impingement and entrainment losses as a result of the operation of two additional units at the VEGP site would not be detectable or noticeably alter or destabilize the population.

Q49. Did the Staff also evaluate cumulative impacts from impingement and entrainment under very-low-flow conditions?

A49. (MTM, RHK) Yes. The analysis is presented on FEIS page 7-24.

Q50. What did the Staff conclude, and what was the basis for that conclusion?

A50. (MTM, RHK) In FEIS Section 7.5.2, the Staff assessed cumulative impacts to fish and shellfish due to impingement and entrainment losses at VEGP Units 3 and 4 at very-low flows down to 3000 and 2000 cfs. Exhibit NRC000001 at 7-23, 7-24. At the normal withdrawal rates for all four 4 VEGP Units, the percentage of water withdrawn from the river would be 5.8 percent at 3000 cfs and 8.7 percent at 2000 cfs. *Id.*

However, the Staff did not rely solely on the percent water withdrawal values to assess the cumulative impacts associated with impingement and entrainment at these very-low flows.

For impingement, the Staff's evaluation considered the use of closed-cycle cooling, the location, design, and planned operation of the intake structure, the life history characteristics of the "important" species, conformance with US EPA national performance requirements for intake structures (see response to Question 22 above), and the characteristics of the watercourse in the immediate vicinity of the intake location. These factors led to the Staff's conclusion that the resulting impact to Savannah River populations would be small even though a small increase in impingement mortality might occur as a result of the very-low flow conditions. This conclusion factored in the likelihood that the low flow conditions would be temporary and that the characteristics of the river in the vicinity of the site are not biologically unique.

At very-low flows of 3000 and 2000 cfs, the river stage and available habitat for aquatic organisms would be reduced, which would concentrate aquatic biota populations, and through-screen velocities at the intake would likely increase slightly. These effects could result in a slight increase in impingement. However, in the FEIS the Staff emphasized that the additional reduction in river flows would be temporary and that the Staff considered it likely that, within the range of very-low flows considered, there would be no detrimental effect on the Savannah River fishery. Exhibit NRC000001 at 7-24. The Staff reached this conclusion because many of the factors controlling impingement losses, such as behavior or physiology, are relatively unaffected by the very-low flows considered. Furthermore, healthy, adult fish inhabiting the Savannah River are capable of swim speeds in excess of any likely increase in through-screen velocities and should be able to escape impingement. Moreover, should very-low flow conditions occur and impingement rates increase, Southern could be directed by the State resource agencies to reduce power or cease power operations, which would reduce water withdrawals significantly and thereby mitigate or eliminate the increased impingement.

Similarly, entrainment would increase according to the percentage of water that would be withdrawn under the very-low river flow cases. The water withdrawal percentages are 5.8% for 3000 cfs and 8.7% for 2000 cfs. However, as discussed above and as stated in the FEIS,

such very-low flows are expected to be temporary, on the order of days or weeks, rather than months. *Id.* at 7-24. Accordingly the staff did not consider it appropriate to heavily weight these percentage withdrawals under very low flow conditions in its analysis. Also in comparison to the water withdrawal rates, the entrainment losses of ichthyoplankton from the SRS site occurred under withdrawals estimated at 8.3 and 12.3 percent of the Savannah River flow, which is a greater percentage than that evaluated by the Staff for all 4 VEGP units under those very-low flow conditions. Exhibit NRC000001 at 7-24; Exhibit NRC000012 at 3-143. Specht 1987 states that "[w]hile a substantial fraction of the Savannah River ichthyoplankton are entrained at the SRP cooling water intake structures there appears to be no effect on the fishery of the river". Exhibit NRC000011 at V-13.

Again, at very-low flow conditions Southern could be directed by the State resource agencies to reduce power or cease power operations (actions which would reduce water withdrawals significantly) for several reasons. These reasons might include if it proved necessary to protect aquatic biota during, for example, a critical spawning period for an important species when fish eggs and larvae would be present.

Q51. Why did Staff use normal rather than maximum withdrawal rates in evaluating cumulative impacts (both generally and with regard to impingement and entrainment)?

A51. (LWV, CBC) Normal withdrawals are most representative of the combined flows of all four units operating. Because maximum withdrawal are rare, it is unlikely that maximum withdrawal rates would occur for more than one unit at any time. Maximum withdrawals (and maximum blowdowns) are primarily associated with activities to control the water chemistry in the cooling tower and are not associated with changes in consumptive water use. Furthermore, such periods are partially offset by periods when one of the units is experiencing an outage.

In addition, all four Vogtle units would be using closed-cycle cooling. As opposed to once-through systems, which regularly vary flows to maintain discharge temperatures below some temperature limit, closed–cycle wet cooling towers rely nearly exclusively on the latent

heat of vaporization of water. Therefore, closed-cycle wet cooling towers like those at Vogtle are able to operate at very stable flow rates. Accordingly normal withdrawal rates are the most appropriate for evaluating cumulative impacts for all four units.

## III. Thermal Impacts

Q52. Did the Staff evaluate in the FEIS the thermal impacts to aquatic resources from operation of proposed Units 3 and 4?

A52. (ARK) Yes. The Staff's analysis is provided in Sections 5.4.2.3 (Aquatic Thermal Impacts) and 5.4.2.9 (Summary of Aquatic Impacts) of the FEIS. Exhibit NRC000001.

Q53. Please summarize the Staff's conclusion relative to the impact of thermal discharges on aquatic organisms.

A53. (ARK) As stated in the FEIS, the Staff has determined, based on the results of the CORMIX assessment (discussed in more detail in the response to Questions 55 through 57), that the size of the thermal plume from the proposed effluent discharge would be small in comparison to the width of the Savannah River at the VEGP site. Exhibit NRC000001 at 5-33. The Staff also determined that the location and design of the discharge structure would not impede fish passage up and down the river. *Id.* at 5-33. Furthermore, the Staff found that fish and other organisms in the river would likely avoid the elevated temperatures within the plume. *Id.* Likewise, the fish and other organisms could move through this part of the river unencumbered by any structures or physical features that would retain them in the plume. *Id.*

In the FEIS, the Staff also analyzed potential impacts from cold shock, another factor related to thermal discharges that may affect aquatic biota. Cold shock occurs when aquatic organisms that have been acclimated to warm water are exposed to a sudden temperature decrease. Typically this is a potential problem at stations that employ once-through cooling systems and that discharge to a confined body of water, such as a small lake or reservoir. Cold shock sometimes occurs when single-unit power plants shut down suddenly in winter; however, since the VEGP site will consist of multiple units, the temperature decrease from shutting down

one unit would be moderated by the heated discharge from the units that continue to operate. Moreover, cold shock is less of a factor when the discharge is to a river where the volume of the discharge in comparison to the flow of the river is very small, as is the case at the VEGP site. Therefore, the Staff determined that cold shock would not be a concern.

Heat shock occurs when fish are confined to an area in which the temperature of the water rises quickly. The rapid rise in temperature causes the fish to become disoriented and eventually succumb. As with cold shock, this is typically a potential problem at stations that employ once through cooling that discharge into a confined body of water, such as a small lake or reservoir. These conditions do not exist at the Vogtle site; therefore, the Staff determined that heat shock is not a concern.

The Staff also considered the potential impacts from the thermal plume with respect to invasive or nuisance organisms. Neither Asiatic clams (*Corbicula fluminea*), nor any other invasive species has been observed to have increased in numbers in the vicinity of the thermal plume operated by VEGP Units 1 and 2. Therefore, no large growths of invasive or nuisance organisms are anticipated from the thermal plume for the proposed units.

Based on its analysis of these factors, the Staff concluded in the FEIS that the impacts to aquatic organisms from thermal discharges from the proposed VEGP Units 3 and 4 would be minor.

Q54. What is the Staff guidance for reaching a determination of impacts on thermal discharges? How did the Staff follow that guidance?

A54. (ARK) The Staff followed guidance set forth in ESRP Section 5.3.2.2 "Aquatic Ecosystems" (2000). Exhibit NRC000009. This ESRP includes guidance that directs "the Staff's description, quantification, and assessment of potential thermal...stresses to aquatic organisms that may occur as a result of plant cooling system discharges to receiving water bodies." *Id.* at 5.3.2.2-1.

The ESRP instructs that the Staff's review "should include the analysis of alterations to the receiving water body resulting from plant thermal...discharges in sufficient detail to predict and determine the nature and extent of potential impacts on aquatic ecosystems." *Id.* at 5.3.2.2-1.

Furthermore, the ESRP states that "[t]he Staff's analysis may be provided by referencing the aquatic biota descriptions of ESRP 2.4.2 and describing in brief detail the effects on biota that are 'important' and susceptible to thermal...impact." *Id.* at 5.3.2.2-10. In FEIS Section 2.7.2, the Staff described the aquatic environment and biota, including the types, life stages, and relative abundance of important biota in the vicinity of the VEGP site and described thermal effects on important aquatic biota. Exhibit NRC000001 at 5-36, 5-37, 5-41. In addition, a Biological Assessment describing the Staff's findings was prepared and sent to the National Oceanic and Atmospheric Administration under Section 7 of the Endangered Species Act. *Id.* at 5-41.

Following the ESRP, the Staff "considered species in the vicinity of the station" (VEGP site) "and their susceptibility to thermal effects." Exhibit NRC000009 at 5.3.2.2-7. As part of the evaluation process, the Staff considered several factors. First, the Staff considered the physical and thermal characteristics of the plume in relation to the receiving water body. At the location of the discharge outfall, at a Drought Level 3 flow rate, the Savannah River is approximately 312 feet wide, and, assuming conservative river conditions (e.g., minimum river temperatures, maximum discharge temperatures), the maximum width of the $5^0$F thermal plume would be 15 feet while the length would be would be 97 feet downstream of the outfall pipe. Exhibit NRC000001 at 5-33. Based on these calculations, the Staff determined that the size of the thermal plume would be small in comparison to the width of the Savannah River at the VEGP site and therefore would not impede fish passage up and down the river. In addition, the Staff concluded that fish and other organisms would likely avoid the elevated temperatures and would

be able to move through this part of the river unencumbered by any structures or physical features that would retain them in the plume. *Id.*

Second, the Staff also considered the potential for cold shock. Cold shock occurs when aquatic organisms that have been acclimated to warm water, such as fish in a power plant's discharge canal, are exposed to a sudden temperature decrease. The Staff concluded that cold shock would be less likely to occur at the VEGP site since the VEGP site would consist of multiple units, which would not be likely to all shut down simultaneously, and the plume discharge volume would be very small in comparison with the river flow. *Id.*

Third, the Staff analyzed the interaction between the plume and the habitat and life history of important species. As stated above, the size of the thermal plume is small in comparison to the width of the Savannah River at the VEGP site; therefore, the Staff concluded that impacts to the South Carolina mussel species of concern would be minor. *Id.* at 5-37. In addition, the Staff determined that the thermal plume would not create a barrier to the up- or down-stream migration of the important fish species of concern known to occur in the vicinity of the VEGP site, including the robust redhorse and the shortnose sturgeon. *Id.* at 5-36, 5-42. Although not discussed in the FEIS, the Staff has concluded that the thermal plume likewise would not create a barrier to the up- or downstream migration of the Atlantic sturgeon, as described in my colleague's testimony in response to Question 59.

Fourth, the Staff evaluated the potential for any adverse impacts. The Staff concluded that impacts to aquatic organisms from thermal discharges would be minor. *Id.* at 5-34.

Finally, the Staff also considered the direct and indirect effects of the plume on nuisance, invasive, and introduced species. The Staff anticipates no large growths of invasive or nuisance organisms from the thermal plume for the proposed units. *Id.*

Q55. On what information did the Staff base its conclusion with respect to thermal impacts?

A55. (RHK) The Staff based its conclusions related to thermal impacts on the discharge temperature, the plume size as estimated by using the CORMIX code, the design and the location of the discharge structure, and the width of the river at the location of the VEGP site, as based on the bathymetry of the river. *Id.* at 5-33. The plume size was compared to the width of the river to provide an estimate of how much of the river was actually involved in the 5 degree Fahrenheit plume.

Q56. Why was data on thermal tolerance and species' varying tolerances by life stage not included in the analysis of the impact to aquatic species from the thermal plume?

A56. (RHK) ESRP 5.3.2.2 states that the reviewer should consider the effects of the thermal plume on biota that are important and susceptible to thermal impact, as well as the areal extent of the plume from the point of discharge and the percent of unaffected area (in other words the percentage of the river that is not affected by the thermal plume). Exhibit NRC000009 at 5.3.2.2-7, 5.3.2.2-8. The results of the CORMIX assessment presented in Section 5.3.3.1 of the FEIS described the areal extent of the heat plume from the point of discharge, and the anticipated temperature of the plume as it extends downstream. Exhibit NRC000001 at 5-18, 5-19. Because the discharge is located in a river, and the plume was so small compared to the width of the river at the VEGP site, even under Drought Level 3 conditions it was apparent that there was no thermal blockage to movement of aquatic biota and that adult fish could easily avoid the plume. *Id.* at 5-33. The Staff acknowledges that there may be some mortality of eggs and larvae as they pass through the plume; however, this would be a very small fraction of the eggs and larvae in the river. Based on the short duration of plume transit, and the small area that it encompasses, the Staff concludes that the impact to the aquatic biota of the river would be minimal.

Based on the above reasons and the ESRP guidance, the Staff determined that thermal tolerance data on varying species and life stages was not necessary to predict impacts.

Q57. How did the Staff determine the extent of the thermal plume? Does the analysis account for the cumulative effects of all four units?

A57. (LWV, CBC) The Staff's assessment of the cumulative water temperature impacts considered discharges of heated water from all four units. The analyses considered the combined impacts by assigning the total effluent discharge for all four units to a single outfall pipe. Staff considered this scenario to produce the maximum single thermal plume. The CORMIX code was used to compute the extent of the thermal plume. CORMIX is a U. S. EPA-supported mixing zone decision support system for environmental impact assessment of regulatory mixing zones resulting from continuous point source discharges. The CORMIX methodology contains representations of single-port, multiport diffuser discharges and surface discharge sources. It considers the hydrodynamics of the system to be one dimensional and at steady state. CORMIX is an industry standard for such assessments and is commonly employed by the U.S. EPA.

Effluent from the proposed new facility will be discharged directly into the Savannah River through a new discharge structure. The new discharge structure will be 2,500 feet downstream of the intake. It will discharge the cooling water through a single port two feet in diameter. The port will be located 3 ft above the river bottom.

For a bounding analysis with the largest mixing zone, the Staff employed conservative inputs for the key parameters for the CORMIX assessment. The Staff considered the lowest ambient stream temperature (5 °C) because it provides the largest difference between the temperature of the water coming out the discharge pipe and the water flowing down the river. The Staff also considered the highest combined (Units 1, 2, 3, and 4) discharge (90.5 cfs) because it provides the largest volume of heated water being released to the river at a single discharge point. Finally, the Staff considered the Drought Level 3 flows of 3800 cfs As stated in the FEIS, the resulting plume length and width were 97 ft and 15 ft, respectively. *Id.* at 5-18.

Q58. Does the Staff's analysis of the thermal plume account for varying river flow conditions?

A58. (LWV, CBC) Yes. In addition to the flow rates discussed above, the Staff also considered the impacts to water quality in the Savannah River at river flow rates below Drought Level 3. For additional conservatism, the Staff considered thermal impacts under flows of 3000 and 2000 cfs and analyzed how the thermal plume and associated impacts would change under such very-low flows. Exhibit NRC000001 at Errata 7. Low flow conditions result in the greatest plume size and greatest impact. As stated in the FEIS, the plume at 2000 cfs would be approximately twice the areal extent of the plume at 3800 cfs. *Id.* However, as discussed previously, the 3000 and 2000 cfs values were the Staff's attempt to provide additional conservative context for its analysis. The Staff expects that the occurrence of these flows would be extremely rare and of only temporary duration.

Q59. What was the basis for the Staff's determination that Units 3 and 4 operations at river flow levels down to 3800 cfs would result in only SMALL thermal impacts to aquatic resources?

A59. (LWV) In Section 5.4.2.3 of the FEIS, the Staff referred to the Staff's thermal plume analysis, which determined the size of the plume under maximum two-unit blowdown rate, Drought Level 3 river flows, and the conservative approach of combining the discharge from both VEGP Units 1 and 2 with Units 3 and 4. Exhibit NRC000001 at 5-19. Even under these conditions, the Staff determined in the FEIS that the maximum width of the plume, as defined by the 5 degree Fahrenheit isotherm, is about 15 feet wide and less than 100 feet in length. At the point of discharge, the river is approximately 312 feet wide. Therefore, the 5 degree Fahrenheit isotherm would occupy about 5 % of the river cross section.

(MTM) The Staff determined in the FEIS that this plume would not result in a thermal blockage and would not impede upstream or downstream movement of fish. Fish actively avoid areas of unhealthy water temperatures, provided there is an escape route. The remainder of

the cross section of the river would provide such an alternative escape route for fish. No important species of Unionid mussel are known from the river in the vicinity of the VEGP site and immediately downstream of the planned discharge structure. Therefore, it is unlikely that the thermal discharge would affect any protected mussel species. There would likely be some bottom scouring in the vicinity of the discharge location. However, the area affected would be confined to a small portion of river bottom. Typically the warm discharge water rapidly rises to the surface of the river. River turbulence would further mix and dissipate the heated water. Only a small area of river bottom would be exposed to elevated water temperatures.

(MTM) Due to the small area of the plume and the fact that a fish would have to actively swim to maintain its position in the plume, it is unlikely that a fish would become acclimated to the higher station discharge temperature. However, even assuming that fish did become acclimated to a higher water temperature than ambient, the chances of cold shock as a result of Units 3 and 4 simultaneously going offline quickly and resulting in a significant fish kill is exceedingly small because of the presence of VEGP Units 1 and 2 and the small size of the plume. There may be some loss of eggs and larvae as they pass through the plume; however, this would be only a small percentage of the total number of organisms passing the site, resulting in minor and undetectable impact to fish populations. Additionally, due to the short duration of plume transit, there would be some survival of the eggs and larvae that did experience elevated temperatures. This latent survival would further reduce any impact.

Q60. Did the Staff assess thermal impacts to aquatic resources from Units 3 and 4 operations under very-low-flow conditions? If so, what was the basis for that conclusion?

A60. (MTM) Yes, the Staff did assess the thermal impacts to aquatic resources from Unit 3 and 4 operations under very-low (less than 3800 cfs) river flows, namely down to 2000 cfs. The Staff determined that the velocity and depth of the river will decrease with lower flows and the fraction of the discharge of the blowdown to the streamflow will increase. The net impact will be a larger mixing zone defined by the five degree Fahrenheit isotherm.

At a very-low river flow of 2000 cfs, the mixing zone plume would approximately double in areal extent, as discussed in my colleague's response to Q58. Given the small size of the plume in the baseline assessment as discussed in my response to Question 59 above, the Staff determined that even a doubling in its area would not represent a significant impact to water quality in the river. Exhibit NRC000001 at Errata 7. Additionally, because the Staff believes that such very-low flow conditions would be rare and of only temporary duration, the Staff does not consider the impacts under these conditions to be significantly different from the impacts analyzed for flows down to Drought Level 3 levels.

Although the lower flows would reduce the river stage, the lateral extent of the plume relative to river width at these flow rates would still be small, and would not result in a river-wide thermal blockage since the size of the plume would be approximately double the size of the plume under Drought Level 3 conditions. Again, very-low flow conditions are expected to be temporary and, based on the historical record of flows since the construction of the upstream impoundments, would be more unlikely during the spring and early summer spawning period when most river-running species are moving up and down river. Exhibit NRC000001 at 2-19. Additionally, should the low river flow rates result in an unacceptable thermal impact or the applicant exceed its mixing zone requirements, Southern could be directed by the State resource agencies to reduce power or cease power operations. Such actions would reduce the size of the thermal plume and thus mitigate the associated thermal impacts to aquatic biota.

Q61. What is the basis for the Staff's conclusion that projected impacts will be minor if there has not been any monitoring of the current impacts of the existing units on thermal discharges in the vicinity of VEGP Site?

A61. (LWV, CBC) Section 5.3.3.1 of the FEIS describes the Staff's analysis of the size and location of the thermal plume. As explained in FEIS Section 5.3.3.1, for the VEGP ESP review, the Staff conservatively combined the discharge from both Units 1 and 2 with the discharge of Units 3 and 4 and performed the analysis for a variety of low river flows. Exhibit

NRC000001 at 5-18; Errata 7. The Staff also assumed maximum plant flows, maximum discharge temperatures, and minimum ambient river temperature to maximize the size of the plume. The conservative assumptions described earlier in this testimony predicted a small plume relative to the river width and with a downstream extent of less than 100 feet. Given the small size of the plume relative to the river, for such a conservative bounding assessment, the Staff determined that stream temperature measurements downstream of the plume were not required to make a reliable impact determination.

(MTM) All discharges of regulated non-radiological constituents, including thermal discharges, from VEGP Units 1 and 2 are addressed in NPDES permit GA0026786 issued by the State of Georgia Department of Natural Resources. Exhibit NRC000045 at 2-31. Except for occasional minor exceedances, or possible exceedances of permit standards (six since 2002, none resulting in impacts to the Savannah River or enforcement action) the existing Unit 1 and 2 discharge complies with Georgia State water-quality standards, and the Staff anticipates that Units 3 and 4 will also comply with State requirements.

(MTM) Based on the use of closed-cycle cooling for all four units and the fact that the thermal plume was calculated to be of small size even under a number of conservative assumptions such as low flows in the Savannah River and combining the discharge from all four units, the Staff did not believe additional empirical data was necessary to reach a conclusion on the potential for thermal impact to aquatic biota. Additionally, there have been no fish kills related to the thermal discharge reported from the site. Exhibit NRC000001 at 2-93.

Q62. Following publication of the draft EIS, Southern advised Staff that based on changes between Revision 15 and 16 of the AP1000 DCD, some of the cooling water demand values would change. Please describe the magnitude of these changes and how they would affect normal and cumulative impacts associated with impingement, entrainment, and thermal effects under average-daily, Drought Level 3 and very-low flow conditions.

A62. (LWV, MTM) Following publication of the draft EIS, Southern advised the Staff that flows related to cooling system operation would differ based on changes between Revision 15 and Revision 16 of the AP1000 DCD. The relevant flows consistent with DCD Revisions 15 and 16 are summarized in the attached table. Exhibit NRC000050.

The heat rejected per unit would increase by 8.0E+07 BTU/hr or 1.1 percent. The normal combined (Units 3 and 4) circulating water system makeup flow would increase by 3.57 cfs (1601 gpm) or 4.3 percent, whereas the maximum combined circulating water system makeup flow would increase by 7.49 cfs (3361 gpm) or 5.8 percent. The normal combined circulating water system consumptive use would increase by 2.68 cfs (1201 gpm) or 4.3 percent, whereas the maximum combined circulating water system consumptive use would increase by 3.75 cfs (1681 gpm) or 5.8 percent. The normal combined plant discharge would not change, whereas the maximum combined plant discharge would increase by 2.08 cfs (934 gpm) or 3.0 percent.

In order to determine how the impacts evaluated for Revision 15 would be affected, the Staff identified the increase in fractional withdrawal of the Savannah River associated with the change between Revision 15 and Revision 16 at the four flow rates considered – normal flows of 8830 cfs, Drought Level 3 flows of 3800 cfs, and also the very-low flows of 3000 cfs and 2000 cfs. For normal withdrawals by the proposed Units 3 and 4, the increase would be 0.04 percent, 0.1 percent, 0.1 percent, and 0.2 percent, respectively. For normal withdrawals by all four units, the increase would be 0.04 percent, 0.1 percent, 0.1 percent, and 0.2 percent, respectively.

For maximum withdrawals by the proposed Units 3 and 4, the increase associated with the change between Revision 15 and Revision 16 would be 0.1 percent, 0.2 percent, 0.2 percent, and 0.4 percent, respectively. For maximum withdrawals by all four units, the increase would be 0.1 percent, 0.2 percent, 0.2 percent, and 0.4 percent, respectively.

The Staff also identified the increase in fractional consumptive use of the Savannah River associated with the change between Revision 15 and Revision 16 at the four flow rates

considered (8830 cfs, 3800 cfs, 3000 cfs, and 2000 cfs). For normal consumptive rates by the proposed Units 3 and 4, the increase would be 0.03 percent, 0.1 percent, 0.1 percent, and 0.1 percent, respectively. For normal consumptive rates by all four units, the increase would be 0.03 percent, 0.1 percent, 0.1 percent, and 0.1 percent, respectively.

For maximum consumptive rates by the proposed Units 3 and 4, the increases associated with the change between Revision 15 and Revision 16 would be of 0.04 percent, 0.1 percent, 0.1 percent, and 0.2 percent, respectively. For maximum consumptive rates by all four units, the increases would be of 0.04 percent, 0.1 percent, 0.1 percent, and 0.2 percent, respectively.

As discussed above in response to Question 38, the range in flows at the VEGP site, even on a daily basis, is often greater than the normal and maximum withdrawal rates for the proposed VEGP Units 3 and 4. Accordingly, relative to the natural variability of the Savannah River, all of these percentage increases in water use associated with the change between Revision 15 and Revision 16 are exceedingly small. There was no change in the blowdown flow rate associated with the change between Revision 15 and Revision 16; therefore, there would be no change in the thermal plume analysis or its impact under all flow conditions considered. The effects on aquatic biota of the slight increase in normal and maximum withdrawal rates associated with Revision 16 would be undetectable and not result in a change in the impact level associated with impingement or entrainment. The Staff believes that would be the case under average-daily, Drought Level 3, or very-low flows when assessing both normal and cumulative impacts of operation of VEGP Units 3 and 4.

Q63. Does this conclude your testimony?

A63. (All) Yes.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

AFFIDAVIT OF ANNE R. KUNTZLEMAN CONCERNING
PREFILED TESTIMONY ON ENVIRONMENTAL CONTENTIONS 1.2 AND 6.0

I, Anne R. Kuntzleman, do declare under penalty of perjury that my statements in *NRC Staff Testimony of Dr. Michael T. Masnik, Anne R. Kuntzleman, Rebekah H. Krieg, Jill S. Caverly, and Lance W. Vail Concerning Environmental Contention EC 1.2*, and in *NRC Staff Testimony of Mark D. Notich, Anne R. Kuntzleman, Rebekah H. Krieg, Jill S. Caverly, and Lance W. Vail Concerning Environmental Contention EC 6.0,* as well as in my attached statement of professional qualifications are true and correct to the best of my knowledge, information, and belief.

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

_____
Anne R. Kuntzleman

Executed at Rockville, Maryland
This 9th day of January, 2009

Anne "Nancy" R. Kuntzleman
STATEMENT OF PROFESSIONAL QUALIFICATIONS
UNITED STATES NUCLEAR REGULATORY COMMISSION
Washington, D.C.

I am currently employed as an aquatic biologist in the Office of New Reactors, Division of Site and Environmental Reviews, Environmental Technical Support Branch, U.S. Nuclear Regulatory Commission. As an NRC staff member, I am responsible for conducting the aquatic and terrestrial technical reviews associated with the preparation of an environmental impact statement (EIS) for siting, construction, and operation new nuclear power plants.

I hold a Bachelor of Science in Biology from the Pennsylvania State University (1975), a Master of Science in Education from Temple University (1981), and a Master of Science in Biology from the University of Michigan (1982). I have also pursued graduate studies in biology at the University of Maryland (1980) and the University of Pennsylvania (1985).

From July 1975 through August 1986, I was an aquatic ecologist for two environmental consulting firms (Ichthyological Associates and Radiation Management Corporation, respectively) under contract to Philadelphia Electric Company. I assisted in all phases (field work, data processing, data analyses, report writing) of both aquatic and terrestrial preoperational studies at the Limerick Generating Station (LGS), Limerick Township, PA. My duties during this time included assisting in the age and growth survey of redbreast sunfish (*Lepomis auritus*), green sunfish (*Lepomis cyanellus*), and white sucker (*Catostomus commersonii*) from the East Branch Perkiomen Creek and the Schuylkill River in the vicinity of LGS by participating in field sampling with a small stream shocker and performing fish scale removal, pressing, and reading. I also participated in field work to conduct fish population estimates along the Schuylkill River via electrofishing, fish community characterizations via seine in the Perkiomen Creek, and angler surveys along the East Branch Perkiomen Creek and Schuylkill River in conjunction with the pre-operational monitoring program at LGS. Assisted in writing the procedures for collecting plant, mammal, sediment, and fish samples in conjunction with the Radiological Environmental Monitoring Program (REMP) at LGS and was responsible for coordinating the collection of the REMP sediment, vegetation, and fish samples.

In addition, from August 1975 through December 1976, I supervised two fishery biologists and two fishery technicians during the field work performed for two Clean Water Act (CWA) Section 316(a) thermal plume investigations on the Schuylkill River: Schuylkill Generating Station (SGS), Philadelphia, PA, and Cromby Generating Station (CGS), Phoenixville, PA, respectively. Field work included electrofishing, larval fish tows, Ponar grabs for benthic macroinvertebrates, plankton sampling, thermal plume mapping, and collection of physical chemistry data. I sorted, identified, measured, and processed both adult and larval fish collections. I assisted in report writing, data coding, and editing. I conducted a thorough non-parametric statistical analysis of both the catch per effort and larval fish data for SGS. Our electrofishing efforts at the base of Fairmount Dam in Philadelphia documented the presence of American shad (*Alosa sapidissima*). This finding assisted the Pennsylvania Fish Commission in justifying construction of the Fairmount Dam Fish ladder in 1979.

During the late 1970's I was also a field biologist for CWA Section 316(b) cooling water intake studies (impingement of fish and macroinvertebrates and entrainment of plankton, macroinvertebrates, and larval fish) at four freshwater and seven estuarine steam electric power stations on the Schuylkill and Delaware Rivers, respectively. I sorted, identified, measured, and processed the impingement and larval fish collections. I assisted in the preparation of the 316(b) evaluations for CGS and SGS located on the Schuylkill River and the Eddystone Generating Station and Edge Moor Power Station on the Delaware River.

Later as an environmental educator, I developed and presented aquatic ecology and fish identification in-service training programs for elementary and secondary schoolteachers within the Philadelphia Electric service area. I also presented lectures to community groups, environmental organizations, and students explaining the environmental preoperational studies and monitoring requirements for LGS.

From September 1986 until September 1987 I taught life science and physical science at Northeast Junior High School, Reading, PA.

From October 1987 until June 2006, I was a senior biologist with the Department of the Navy, Engineering Field Activity Northeast (EFANE), a component of the Naval Facilities Engineering Command, Atlantic Division. For almost 18 years, I served as the sole professional/technical authority for EFANE in the preparation and coordination of all Department of the Army permit applications, Coast Guard permits, state wetland permits, and water quality certificates for activities in waters of the United States (U.S.) and navigable waters of the U.S. within the regulatory authority of Sections 401 and 404 of the Clean Water Act (CWA), Sections 9 and 10 of the Rivers and Harbors Act of 1899, and Section 103 of the Marine Protection, Research, and Sanctuaries Act of 1972. In addition, I also prepared federal consistency determinations pursuant to Section 307 of the Coastal Zone Management Act and Volume 15 of the Code of Federal Regulations, Part 930, Federal Consistency.

During my tenure at EFANE, I had signatory authority for permit applications and attendant issues involving some of the Navy's most complex, controversial, and environmentally sensitive projects in the northeastern U.S.: dredging and dredged material disposal, waterfront construction, and new construction in or adjacent to wetlands.

Concomitant with regulatory requirements, I prepared or evaluated environmental documentation or analyses (prepared by Navy contractors) conducted under the National Environmental Policy Act (NEPA), Section 7 of the Endangered Species Act (ESA), the Magnuson-Stevens Fishery Conservation and Management Act (Essential Fish Habitat Assessment), Marine Mammal Protection Act, Fish and Wildlife Coordination Act, Executive Order 11988 (Floodplain Management), Executive Order 11990 (Protection of Wetlands), and Executive Order 13112 (Invasive Species).

As the Navy technical representative, I developed scopes of work, prepared independent cost estimates, analyzed contractor proposals, participated in negotiations, and developed contract execution schedules for Navy contractors. I provided technical oversight of contractor's work, monitored work in progress, and evaluated contractor's performance. I reviewed technical

submissions for accuracy and interpreted biological, chemical, and other environmental test results during contractor preparation of a variety of environmental documents including: NEPA environmental assessments and EISs, essential fish habitat assessments, coastal zone consistency determinations, 401 water quality certification applications, sediment sampling and testing plans for dredging projects, wetland delineations, wetland restoration plans, CERCLA remedial action plans, and integrated natural resources management plans.

In June 2006, I joined the Nuclear Regulatory Commission as an aquatic biologist. I serve as a technical specialist whose primary responsibility is that of independently assessing the environmental impacts of siting, construction, and operation of new nuclear power plants and related facilities on the aquatic environment. This involves reviewing and evaluating specific aspects of Environmental Reports submitted to the NRC by applicants and licensees and then assisting in the preparation an EIS. My duties also include updating the NRC environmental standard review plans for aquatic ecology contained in NUREG-1555, preparing biological assessments for Federal threatened and endangered species, and coordinating with federal and/or state agencies pursuant to NEPA, ESA, Sections 401 and 404 of the CWA, Section 10 of the Rivers and Harbors Act of 1899, Magnuson-Stevens Fishery Conservation and Management Act (Essential Fish Habitat Assessment), Marine Mammal Protection Act, and Fish and Wildlife Coordination Act.

Thus far I have participated in pre-application activities for the Bell Bend, North Anna, Shearon Harris, William States Lee, Vogtle, River Bend, South Texas Project, Comanche Peak, and Callaway combined license (COL) applications. I have conducted the aquatic and terrestrial acceptance reviews for the Shearon Harris, William States Lee, and Callaway COL applications. In addition, I have participated in site audits and alternative site visits for the Vogtle Early Site Permit (ESP) as well as the William States Lee and Shearon Harris COL applications. I have provided technical oversight for the aquatic and terrestrial sections of the Vogtle ESP draft and final EISs.

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) | ) | |

AFFIDAVIT OF LANCE W. VAIL CONCERNING
PREFILED TESTIMONY ON ENVIRONMENTAL CONTENTIONS 1.2, 1.3 AND 6.0

I, Lance W. Vail, do declare under penalty of perjury that my statements in *NRC Staff Testimony of Dr. Michael T. Masnik, Anne R. Kuntzleman, Rebekah H. Krieg, Jill S. Caverly, and Lance W. Vail Concerning Environmental Contention EC 1.2*, in *NRC Staff Testimony of Dr. Michael T. Masnik, Rebekah H. Krieg, Jill S. Caverly, and Lance W. Vail Concerning Environmental Contention EC 1.3*, and in *NRC Staff Testimony of Mark D. Notich, Anne R. Kuntzleman, Rebekah H. Krieg, Jill S. Caverly, and Lance W. Vail Concerning Environmental Contention EC 6.0,* as well as in my attached statement of professional qualifications are true and correct to the best of my knowledge, information, and belief.

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

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Lance W. Vail

Executed at Richland, Washington
This 9th day of January, 2009

# STATEMENT OF PROFESSIONAL QUALIFICATIONS OF LANCE W. VAIL

## CURRENT POSITION

Senior Research Engineer II
Environmental Technology Division
Battelle, Pacific Northwest Division
Pacific Northwest National Laboratory

Since joining Battelle in 1981, Mr. Vail has been involved in projects covering a diverse set of water related issues. His professional experience includes basic and applied research, and regulatory compliance assessments. His areas of expertise cover a broad spectrum of areas related to water resources.

## RESEARCH INTERESTS

Water resource management
Multiple objective tradeoff analysis in water resources
Uncertainty analysis in water resources
Advanced hydrologic process modeling
Impacts of climate on water resources
Neural networks, fuzzy logic, and genetic algorithms applied to water resource issues
Linking simulation models with optimization methods to water resource problems
Linkage of physical and biological models in fisheries management

## EDUCATION

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|---|---|---|
| B.S. | Humboldt State University, environmental resources engineering | 1979 |
| M.S. | Montana State University, civil engineering | 1982 |

## PROFESSIONAL AFFILIATIONS

American Geophysical Union
American Society of Civil Engineers
American Water Resources Association

## CURRENT PROJECTS

***Hydrologic Site Safety Reviews for Early Site Permits.*** Principal Investigator and Project Manager. Three applications for an Early Site Permit (ESP) have been submitted to the Nuclear Regulatory Commission. This project provides an independent assessment of hydrologic suitability of the proposed sites. Assessments include a broad range of considerations such as flooding, low water conditions, ice impacts, seiches, storm surge, and tsunamis.

***Water-related Environmental Reviews for Early Site Permits.*** Task Manager. Three applications for an Early Site Permit (ESP) have been submitted to the Nuclear Regulatory Commission. This task provides an independent assessment of the proposed sites' environmental suitability. Assessments include a broad range of considerations such as water-use conflicts and changes in water quality.

***Snohomish Basin Characterization.*** Technical Lead. Advanced distributed watershed models were applied to provide the Tulalip Tribes of Western Washington state a thorough understanding of the impacts of logging, development, and climate on the Snohomish River Basin.

***Acid Rain TMDL.*** Principal Investigator and Technical Project Manager. The objective of this work assignment for Region II of the U.S. Environmental Protection Agency is to develop a preliminary assessment approach for TMDLs

for pH impaired waters listed on the New York State Section 303(d) list. The intent is to enhance and further develop TMDL program capabilities by providing expertise in both acid deposition and TMDL development. The development of such an assessment approach requires that available models and data resources be reviewed. Systems engineering methods will be used in developing a conceptual model to ensure the relationships between models and data are fully understood. The assessment approach will be tested on one or more representative watersheds to be determined in close coordination with EPA, NYSDEC and Battelle. http://acidraintmdl.pnl.gov

## PAST PROJECTS

***Environmental Impact of License Renewal of Commercial Nuclear Power Plants.*** Contributor. Mr. Vail assesses the water use, water quality, and hydrologic impacts of license renewal for the Nuclear Regulatory Commission's NEPA process. He has performed this function for the following commercial nuclear plants: Calvert Cliffs, Oconee, Arkansas Nuclear One, Hatch, McGuire, Catawba, North Anna, Robinson, Ginna, and St. Lucie.

**Chehalis Basin Characterization.** Principal Investigator and Project Manager. Advanced numerical modeling and GIS methods were applied to assist the Corps of Engineers in characterizing the Chehalis Basin in Western Washington State. The Chehalis Basin is subject to frequent flooding. The native populations of anadramous fish have been stressed to adverse changes in habitat resulting from development and logging.

***Generic Environmental Impact Statement (GEIS) for Decommissioning Commercial Nuclear Power Plants.*** Contributor. Mr. Vail is providing expertise in the development of a GEIS for decommissioning of nuclear plants. He provides expertise on water use, water quality, and hydrologic impacts for the Nuclear Regulatory Commission.

***Impact of Climate on the Lower Yakima Basin.*** Principal Investigator and Project Manager. The objective of this three-year EPA STAR Grant Project was to develop and demonstrate an integrated assessment of the impact of climate variability and climate change on a diverse set of interests in the Lower Yakima Valley in Central Washington State. Interests considered include: surface and groundwater supply, surface and groundwater quality, air quality, public health, farm and regional economics, and fisheries. The project considered the effectiveness of changes in land management (crop selection) and water management (reservoir operation) in adapting to an uncertain future climate. A diverse set of models was linked with an optimization procedure to ensure that the tradeoffs between various resource management objectives are clearly articulated. http://projects.battelle.org/yakima/

***Use of NOAA's Seasonal Climate Forecast for Water Resource Management.*** Task Manager of Reservoir Optimization Task. The objective of this NOAA funded project was to show the potential value of improved climate forecasts in managing surface water reservoirs for multiple objectives. Using a pareto genetic algorithm, the reservoir operating rules were optimized to define the tradeoff curves for hydropower, flood control, and instream flow requirements in the Tennessee River basin. Changes in forecast reliability result in changes to these tradeoffs and thereby express the value of such improved forecasts.

***Accelerated Climate Prediction Initiative.*** Task Manager of Water Resources and Habitat Task. This project will provided a limited, systematic assessment of the potential effects of anthropogenic climate change over the next half-century on water resources in the western United States. This objective was accomplished by "downscaling" the results of the global-scale simulations described above to the spatial and temporal resolution needed to drive impact assessment models. Downscaling is particularly important for the West, where topography is a dominant climate driver. An important aspect of the hydrology of almost all western rivers is water management. Other than a few headwater streams, the hydrology of most rivers in the west is strongly affected by water use and artificial storage. Water management models were

used to study the effect of reservoir operations and understand the implications of climate variability and change on the water resources of the west. http://acpiwater.pnl.gov

***Linking Physical and Biological Models.*** Principal Investigator and Project Manager. The objective of this three-year Laboratory Directed Research and Development project is to develop and demonstrate an integrated natural resource analysis framework. This framework: dramatically improves the ability to integrate physical and biological models, thereby encouraging the utilization of advanced process models; allows utilization of large, sparse, and distributed data sets (including model output); communicates high-level tradeoffs and their respective uncertainties; and assesses, communicates, and minimizes scales issues. During the first year, the fundamental structural differences between such models was identified as a significant obstacle to successful linking of physical and biological models. The pervasive vagueness of rules and the multivaluedness associated with temporal/spatial upscaling suggested an approach using "fuzzy methods". The second year of this project utilized a variety of fuzzy methods including: fuzzy arithmetic, fuzzy logic, fuzzy clustering, and adaptive neural fuzzy inference systems (ANFIS). A series of rules and a database from the Multispecies Framework Process were employed to test the various fuzzy methods. These rules and data are used to define aquatic habitat diversity in the Pacific Northwest. A tool called FuzzyHab was developed to estimate habitat diversity from a set of categorical statements about the environment. Each of these categorical statements is vaguely defined. Estimates for each categorical statement are derived from physical process models.

***Integrated Natural Resource Data System.*** Contributor. This project is to demonstrate INRDS. INRDS is an advanced, web-based environmental information system that will promote public understanding of natural resource management issues and assist planners and decision makers in accessing the most relevant information and analytical tools and evaluating the tradeoffs of alternate actions. http://inrds.pnl.gov

***Early Warning of El Ni o Southern Oscillation (ENSO) Events for Regional Agriculture.*** Task Manager of Reservoir Optimization Task. This project is investigating the current predictability of interannual variability in climate conditions in the Pacific Northwest to determine whether and how early warning and seasonal climate forecasts by the Climate Prediction Center (CPC) of the National Oceanic and Atmospheric Administration (NOAA) forecasts can be used to reduce the vulnerability of irrigated agriculture to low water-availability conditions. The study is funded by a grant from the economics and Human Dimensions Program of the NOAA Office of Global Programs. The Economics and Human Dimensions program aims to improve our understanding of how social and economic systems are currently influenced by fluctuations in short-term climate (seasons to years), and how human behavior can be (or why it may not be) affected based on information about variability in the climate system. http://elrino-northwest.labworks.org

***Impact of Reservoir Operating Strategies on Resident Fish*** - Mr. Vail has employed several models to assess the impact on resident fish species of a variety of reservoir operating strategies. This study was undertaken as part of the Columbia Basin System Operation Review process. Mr. Vail helped define the values and value measures of the Resident Fish Work Group.

***Multiobjective Optimization*** - Mr. Vail is the project manager of an effort to assess the multiobjective optimization needs of Bonneville Power Administration. Objectives include: hydropower, resident fish, anadramous fish, irrigation, flood control, wildlife, and navigation. Mr. Vail is developing definitions of the canonical mathematical form of each of these objectives. The resulting multiobjective statement will be used to define the required optimization tools.

***Integrated Environmental Monitoring Initiative*** - Mr. Vail is a co-principal investigator for the Integrated Environmental Monitoring Initiative. The objective of this initiative is to develop and demonstrate a comprehensive interdisciplinary methodology targeted to improve the effectiveness of environmental monitoring and restoration activities. This objective required comprehensive integration of monitoring regimes, analytical practices, design methodologies, and compliance needs.

***Coupled Simulation/Optimization of Ground Water Remediation*** - Mr. Vail developed a computer code that coupled a ground water flow model with an optimization procedure. The code was able to provide estimates of the pumping/injection rates that would mitigate or remove a plume at minimal cost.

***Simulation of Watershed Hydrologic Responses to Alternative Climates*** - Mr. Vail is the principal investigator of a project studying the impacts of global climate change on the hydrologic response of a watershed. The results of hydrologic simulations using distributed snowmelt and soil moisture accounting algorithms were graphically compared via video displays of daily simulated snow water equivalent, soil moisture, and runoff for the American River, Washington, which drains 204 square kilometers of the east slopes of the Cascade Mountains, Washington. Snow water equivalents and snowmelt were simulated using a simplified distributed temperature-index model augmented with seasonally estimated net solar radiation. A classification scheme was used to partition the empirical cumulative probability distributions of precipitation (rain plus melt) and a topographic index over the basin into groups of near-equal membership. Topographically-based soil moisture capacities were assumed for each class and were estimated via automated calibration methods using historical data. The simulated soil moisture and snow water accumulations for each class were geographically mapped for visualization. Test of the effect of alternative, warmer climates on snow accumulation, the seasonal distribution of soil moisture, and runoff were conducted by adjusting historical (daily) temperature and precipitation and repeating the analysis.

***Pacific Northwest Climate Change Case Study - Water Resource Impacts*** - Mr. Vail is investigating the effects of global climate change on water resources of the Pacific Northwest. Spatially distributed snowmelt, soil moisture, and runoff models have been combined with a graphics visualization package to understand the changes in snowpack, soil moisture, and evapotranspiration over time. A weather classification scheme has been developed which estimates point precipitation as a function of large-scale atmospheric variables. This allows the synthesis of point precipitation given large-scale meteorological information as might be produced by GCM simulations. Orographic effects also have a significant role in defining climate at the watershed scale. Efforts are under way to develop a scientific basis to extend the sparse meteorological measurements basis to extend the sparse meteorological measurements available for any watershed to estimate the spatial distribution of precipitation, temperature, and wind speed within the watershed. A reservoir network model for the Columbia River Basin has been aggregated to fourteen nodes. This network model of the Columbia River Basin has been aggregated to fourteen nodes. This network model will be driven by a collection of index watersheds. A daily hydroclimatological data set has been developed to aid in the selection of index watersheds.

***Acid Rain Watershed Modeling Project*** - Mr. Vail directed the hydrologic part of a study to evaluate and apply several coupled hydrology/geochemical codes that were developed to model the impact of acid rain on surface water chemistry. The project involved extensive behavior and sensitivity analyses of three coupled geochemical/hydrological simulation codes.

***Incineration at Sea*** - The objective of this project was to assess the impact of incinerating toxic waste at sea on the aquatic environment. Mr. Vail developed a model on an IBM-PC to estimate the concentration of contaminant in the ocean.

***Aquifer Thermal Energy Storage*** - The objective of this project was to develop and apply computer codes that would simulate the trade-offs between different management policies of an Aquifer Thermal Energy Storage system. Mr. Vail independently developed, validated, and applied several computer codes for this purpose.

***Flow and Fractured Media*** - The objective of this study is to develop a state-of-the-art predictive capability for flow and transport in saturated fractured media. Mr. Vail was responsible for implementing, modifying, and testing a computer code that models steady flow in permeable media with discrete fractures. Mr. Vail has also developed a computer code that models steady flow through fractures in an impermeable rock mass. The fractures can either be specified or generated via Monte Carlo Methods. This code was applied in an investigation of the potential impact of a nuclear meltdown on groundwater.

***Modeling Flow With Certainty in Hydraulic Parameters*** - The objective of this study is to develop a methodology to analyze the uncertainty in predicting piezometric surfaces caused by uncertainty in groundwater flow parameters. Mr. Vail developed a computer code that couples perturbation and finite-element techniques to estimate the mean and variance of the piezometric surface.

***Stripa Mine Hydrogeologic Characterization*** - The objective of this study was to perform three-dimensional simulations with the CFEST code for ground water flow at the Stripa Mine in Sweden. Mr. Vail was the Battelle project manager of this effort.

**PUBLICATIONS**

Coleman A, LW Vail, and A Savery. 2005. "Landscape Classification for Assessment of Impacts of Landuse and Climate on Water Resources." Presented by Andre M Coleman (Invited Speaker) at 25th Annual Environmental Systems Research Institute International User Conference, San Diego, CA on July 25, 2005. PNWD-SA-7118.

Prasad R, LW Vail, CB Cook, and G Bagchi. 2005. "Establishment of Safety-Related Site Characteristics Based on Consideration of External Sources of Flooding at Nuclear Power Plant Sites in the United States of America." Presented by Rajiv Prasad (Invited Speaker) at IAEA-India External Flooding Hazards Workshop , Kalpakkan, Tamil Nadu on August 29, 2005. PNNL-SA-46005.

Scott MJ, LW Vail, CO Stockle, A Kemanian, KM Branch, R Prasad, MS Wigmosta, and JA Jaksch. 2005. "Benefits and Costs of Options to Mitigate the Uncertain Effects of Climate Change on Irrigated Agriculture in the Yakima Basin. What Matters? What Doesn't?" Presented by Michael J. Scott (Invited Speaker) at 39th Annual Pacific Northwest Regional Economic Conference, Bellingham, WA on May 20, 2005. PNWD-SA-6980.

Scott MJ, LW Vail, and R Prasad. 2005. "Managing Water for Irrigated Agriculture Under Extended Climate-Related Drought." Presented by Micahel J. Scott at American Water Resources Association 2005 Annual.

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Scott MJ, LW Vail, CO Stockle, and A Kemanian. 2005. "Impacts of Water Availability on Washington Agriculture in a Changing Climate." Presented by Michael J. Scott (Invited Speaker) at 2005 Fall Climate Change Conference, Seattle, WA on October 27, 2005. PNNL-SA-47128.

Meza EP, and LW Vail. 2005. Real-time Harvesting of Distributed Environmental Data for Improved Management of Complex Distributed Water and Power Management Systems . PNNL-15333, Pacific Northwest National Laboratory, Richland, WA.

Prasad R, LW Vail, CB Cook, and G Bagchi. 2005. "Establishment of Safety-Related Site Characteristics Based on Consideration of External Sources of Flooding at Nuclear Power Plant Sites in the United States of America". In Proceedings of International Workshop on External Flooding Hazards at Nuclear Power Plant Sites (tentative; title yet to be finalized by IAEA). PNNL-SA-46268, Pacific Northwest National Laboratory, Richland, WA.

Coleman A, LW Vail, and A Savery. 2005. "Landscape Classification for Assessment of Impacts of Landuse and Climate on Water Resources." PNWD-SA-7118, Battelle—Pacific Northwest Division, Richland, WA.

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Scott MJ, LW Vail, CO Stockle, and A Kemanian. 2005. "Climate Change and Adaptation in Irrigated Case Study of the Yakima River ." American Association for the Advancement of Science, Portland, OR.

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Burke JS, GR Danielson, DA Schulz, and LW Vail. 2002. "Parallel computing for automated model calibration." vol. XVIII, pp. 424-429. The 6th World Multiconference on Systemics, Cybernetics, and Informatics (SCI 2002), Orlando, FL.

Scott MJ, LW Vail, and A Kemanian. 2002. "Integrated Impact of Climate Warming on Yakima Valley Water Demand and Availability." PNWD-SA-5613, Battelle—Pacific Northwest Division, Richland, WA.

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

AFFIDAVIT OF MICHAEL T. MASNIK CONCERNING
PREFILED TESTIMONY ON ENVIRONMENTAL CONTENTIONS 1.2 AND 1.3

I, Michael T. Masnik, do declare under penalty of perjury that my statements in *NRC Staff Testimony of Dr. Michael T. Masnik, Anne R. Kuntzleman, Rebekah H. Krieg, Jill S. Caverly, and Lance W. Vail Concerning Environmental Contention EC 1.2*, and in *NRC Staff Testimony of Dr. Michael T. Masnik, Rebekah H. Krieg, Jill S. Caverly, and Lance W. Vail Concerning Environmental Contention EC 1.3*, as well as in my attached statement of professional qualifications are true and correct to the best of my knowledge, information, and belief.

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

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Michael T. Masnik

Executed at Rockville, Maryland
This 9th day of January, 2009

Michael T. Masnik
STATEMENT OF PROFESSIONAL QUALIFICATIONS
UNITED STATES NUCLEAR REGULATORY COMMISSION
Washington, D.C.

I am currently employed as a Senior Aquatic Ecologist in the Office of New Reactor Operations, U. S. Nuclear Regulatory Commission (NRC). As a senior member of the staff I am responsible for understanding and assessing the non-radiological impacts of nuclear power generation on a variety of aquatic environments.

I hold a Bachelor of Science in Conservation from Cornell University (1969), a Master of Science in Zoology from Virginia Polytechnic Institute and State University (1971), and a Doctor of Philosophy in Zoology also from Virginia Polytechnic Institute and State University (1975).

While at Virginia Polytechnic Institute and State University (VPI&SU), I undertook research in a variety of areas, specializing in zoogeography and distribution of freshwater fishes in large river systems. Other areas of research which resulted in published papers include thermal studies on fishes, recovery of damaged aquatic ecosystems, and development of sampling methodology for fish and macroinvertebrates. I have authored or co-authored some 16 publications on the above areas or research. My formal education has encompassed and emphasized studies in Zoology, Aquatic Ecology, Ichthyology, and Evolutionary Biology. Prior to joining the Federal government I participated as scientific staff for a Duke University Caribbean cruise conducting oceanographic investigations, and served as a consultant, through VPI&SU, for American Electric Power Company, Koppers Company, Inc., U.S. Army Corps of Engineers, and the Tennessee Valley Authority. I was also employed by Ichthyological Associates as a field biologist investigating the fisheries resources of the Delaware Bay as part of a baseline study for several new nuclear stations.

I joined the Atomic Energy Commission, the predecessor to the NRC, in 1974 as a Fisheries Biologist performing and overseeing NEPA reviews for nuclear power reactor license applications. My principal expertise was in evaluating the impacts of various cooling system designs and intake structures on fish and shellfish in source and receiving waterbodies. In the late 1970s and early 1980s I participated in the initial licensing reviews for more than 10 sites, three alternative site reviews and investigated numerous environmental events involving aquatic resources occurring at operating nuclear power stations. In 1976, as the NRC representative, I participated in the development of U.S. Environmental Protection Agency's draft Guidance for Evaluating the Adverse Impact of Cooling Water Intake Structures on the Aquatic Environment as well as the 316(a) Technical Guidance Manual and Guide for Thermal Effects Sections of Nuclear Facilities Environmental Impact Statements. I also provided expert testimony at a number of NRC administrative hearings on a variety of environmental topics including shipworms, alternative site reviews, impingement and entrainment, and shortnose sturgeon. I developed the NRC staff's practices related to Commission compliance to the Endangered Species Act.

In 1982 I became the Technical Assistant to the Director of the Three Mile Island (TMI-2) Program Office. For the next 13 years I provided technical oversight on all aspects of the TMI-2 cleanup. I made over 15 containment entries at TMI-2, conducted numerous inspections and surveys developed custom technical specifications for the damaged facility, and oversaw the preparation of three supplements to the programmatic environmental impact statement on the cleanup. I provided expert testimony at an administrative hearing on the impacts of disposal of

the TMI-2 accident generated water. From 1982 to 1995 I served as the Designated Federal Official (DFO) to the NRC sponsored TMI-2 Advisory Panel. During my tenure as the DFO the panel held over 65 public meetings in the Harrisburg, PA area. In 1993, as the TMI-2 cleanup effort neared its conclusion I assumed project management responsibilities for the decommissioning of the Trojan Nuclear Power Plant. Trojan was the first large PWR to permanently cease operation and immediately begin active decontamination and dismantlement.

In 1997 I became first Acting, then Section Chief, of the Decommissioning Section in the NRC's Office of Nuclear Reactor Regulation (NRR). I was responsible for the project management of 19 permanently shutdown reactors. I also oversaw the implementation of NRC's 1996 final rule on decommissioning and the development of the 2002 Generic Environmental Impact Statement on the decommissioning of nuclear power reactors. During my tenure as Section Chief I made numerous presentations on the subject before industry, trade, and professional society meetings. In 1997, along with two coworkers, I developed and taught a one week course on reactor decommissioning at the University of Kiev, Ukraine. During my assignment to the TMI-2 cleanup effort and then as Chief of the Decommissioning Section I continued to periodically assist the NRC in the specialized areas of aquatic impact assessment and compliance with the Endangered Species Act. In the early 1990s I assisted in the development of the Generic Environmental Impact Statement for License Renewal of Nuclear Plants, and the Final Environmental Impact Statement, Operating License Stage, for the Watts Bar Nuclear Station Unit 1.

In 2001, with the transfer of the responsibility for decommissioning within the NRC to the office of Nuclear Materials Safety and Safeguards I joined the license renewal effort in NRR, again as an expert in environmental impacts assessment. Since 2001 I has served as the license renewal environmental project manager for the St. Lucie, Browns Ferry, and the Oyster Creek nuclear stations, worked on numerous other license renewals as well as several early site permits serving as the Commission's expert in aquatic and terrestrial ecology, and water intake design. I also was responsible for or assisted in conducting formal and informal endangered species consultations for a number of nuclear power stations including Crystal River, Hatch, Saint Lucie, and Turkey Point. I provided oversight in the preparation of the aquatic and in some cases the hydrological sections of the supplemental environmental impact statements for license renewal for the following both closed-cycle and once through nuclear stations: Arkansas, Turkey Point, Saint Lucie, Fort Calhoun, North Anna, Surry, Catawba, Ginna, Summer, Cook, Quad Cities, Millstone, Vermont Yankee, Nine Mile Point, Monticello, FitzPatrick and Wolf Creek.

In early 2007 I transferred to the NRC's Office of New Reactors to devote myself full time to the environmental assessment of the construction and operation of new reactors, both at existing as well as Greenfield sites, on aquatic ecosystems. I am the NRC's principal contact for endangered species concerns with the National Marine Fisheries Service (NMFS) Southeast Regional Office (SERO). I assisted in the development of the Biological Assessment for the Vogtle Early Site Permit (ESP) application that was submitted to SERO for their review. I have also provided oversight to the aquatic ecology and hydrology sections for the preparation of the environmental impact statements for the North Anna, Clinton, and Grand Gulf ESP sites. I am currently providing technical oversights to the Grand Gulf, North Anna, Bellefonte, Vogtle, and Levy Combined License Applications as well as the Vogtle ESP. I am a member of the American Fisheries Society.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

AFFIDAVIT OF REBEKAH HARTY KRIEG CONCERNING
PREFILED TESTIMONY ON ENVIRONMENTAL CONTENTIONS 1.2, 1.3 AND 6.0

I, Rebekah Harty Krieg, do declare under penalty of perjury that my statements in *NRC Staff Testimony of Dr. Michael T. Masnik, Anne R. Kuntzleman, Rebekah H. Krieg, Jill S. Caverly, and Lance W. Vail Concerning Environmental Contention EC 1.2*, in *NRC Staff Testimony of Dr. Michael T. Masnik, Rebekah H. Krieg, Jill S. Caverly, and Lance W. Vail Concerning Environmental Contention EC 1.3*, and in *NRC Staff Testimony of Mark D. Notich, Anne R. Kuntzleman, Rebekah H. Krieg, Jill S. Caverly, and Lance W. Vail Concerning Environmental Contention EC 6.0,* as well as in my attached statement of professional qualifications are true and correct to the best of my knowledge, information, and belief.

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

_____
Rebekah Harty Krieg

Executed at Richland, Washington
This 9th day of January, 2009

# Resume

**Rebekah Harty Krieg**

Ecology Group
U.S. DOE's Pacific Northwest National Laboratory, operated by Battelle
P.O. Box 999 K6-85
Richland, WA. 99352
(509) 371-7155 (509) 371-7160 (fax)

**Education:**

M.S. in Fisheries and Oceanographic Sciences, University of Washington, 1983

B.S. in Biology , Washington State University, 1979.

**Experience:**

*Senior Research Scientist* (1979-2002 and 2005 – present) Battelle, Pacific Northwest National Laboratory, Richland, WA.

Technical Reviewer for the aquatic ecology sections of the Combined License (COL) application in support of the U.S. Nuclear Regulatory Commission's (NRC's) environmental evaluation of Tennessee Valley Authority's application for a COL for Bellefonte Units 3 and 4..

Technical Reviewer for the aquatic ecology sections of the Early Site Permit (ESP) application in support of the U.S. Nuclear Regulatory Commission's (NRC's) environmental evaluation of Southern Nuclear Corporation's application for an ESP for Vogtle Units 3 and 4.

Preapplication Team lead for COLs for Summer (SCEG), Bellefonte (TVA), Levy (Progress Energy), and Victoria (Exelon). Aquatic Ecology reviewer for Comanche Peak preapplication.

Technical contributor on project to assist the Army Corps of Engineers (Walla Walla District) develop configuration and operation plans for their hydroelectric projects to meet the requirements of the Biological Opinion on anadromous salmonid species listed under the Endangered Species Act.

Task leader for the Knowledge Management portion of the Infrastructure for New Reactor Environmental Reviews project. This project includes developing tools (GIS, comment databases, collaboration sites) for the Nuclear Regulatory Commission and their contractors to use during the environmental reviews that will occur when applications are received for new power reactor licenses.

Technical leader for NRC's review of license renewal applications. Managed interdisciplinary teams that provided technical support to the NRC on their review of the

environmental impacts related to the renewal of operating licenses for commercial nuclear power stations. Specifically Ms. Krieg managed the team that developed the Supplemental Environmental Impact Statement for the Oconee Nuclear Station and co-managed the teams for McGuire and Catawba.

Technical leader for development of an interdisciplinary team that provided assistance to the NRC on the development of a Supplemental Environmental Impact Statement for the Watts Bar Nuclear Plant.

Deputy Team lead for updating and revising the Environmental Standard Review Plan (ESRP), NUREG-1555.

Project Manager for assisting the NRC with development of a Generic Environmental Impact Statement (GEIS) to decommissioning of commercial nuclear power reactors. Includes the development of a revision to the Generic Environmental Impact Statement (GEIS) on Decommissioning that was originally published in 1988, development of Regulatory Guides and review plans related to the initial phases of the decommissioning process, technical review of the types of accidents that are of concern during the decommissioning process and the development of a handbook related to decommissioning for resident inspectors.

Project Manager to provide technical assistance to the NRC on the cleanup of Three Mile Island, Unit 2. Included occupational dose calculations, safety evaluations, development of supplements to a programmatic environmental impact statement, and measurement of fuel quantities remaining in the facility.

Provided technical support to the U.S. Department of Energy (DOE) in relation to the use of collective dose as a performance measurement, the development of guidance for fetal/reproductive health hazards from ionizing radiation and chemicals and extremity dosimetry.

**Publications:**

Krieg, RH, E.E. Hickey, J.R. Weber, and M.T. Masnik. 2004. *Nuclear Power Plants, Decommissioning of* contained in *Encyclopedia of Energy.* Cutler J. Cleveland, Editor-in-Chief. Volume 4. Elsevier Inc. Oxford, England.

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Harty, R., and G. A. Stoetzel. 1986. *Occupational Dose Estimates for a Monitored Retrievable Storage Facility.* PNL-5744, Pacific Northwest Laboratory, Richland, Washington.

Harty, R., W. D. Reece and J. A. MacLellen. 1986. *Extremity Dosimetry at U.S. Department of Energy Facilities.* PNL-5831, Pacific Northwest Laboratory, Richland, Washington.Reece, W. D., R. Harty, L. W. Brackenbush and P. L. Roberson. 1985. *Extremity Monitoring: Considerations for Use, Dosimeter Placement, and Evaluation.* NUREG/CR-4297, U.S. Nuclear Regulatory Commission, Washington, D.C.

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Parkhurst, M. A., D. E. Hadlock, R. Harty and J. L. Pappin. 1985. *Radiological Assessment of BWR Recirculatory Pipe Replacement.* NUREG/CR-4494, U.S. Nuclear Regulatory Commission, Washington, D.C.

Reece, W. D., R. T. Hadley, R. Harty, J. Glass, J. E. Tanner and L. F. Munson. 1984. *Personnel Exposure from Right Cylindrical Sources (PERCS).* NUREG/CR-3573, U.S. Nuclear Regulatory Commission, Washington, D.C.

Fisher, D. R., and R. Harty. 1982. "The Microdosimetry of Lymphocytes Irradiated by Alpha Particles." Int. J. Radiat. Biol. 41(3):315-324.

W. E. Kennedy, Jr., E. C. Watson, D. W. Murphy, B. J. Harrer, R. Harty and J. M. Aldrich. 1981. *A Review of Removable Surface Contamination on Radioactive Materials Transportation Containers.* NUREG-CR/1858, PNL-3666, Pacific Northwest Laboratory, Richland, Washington.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

AFFIDAVIT OF DR. CHRISTOPHER B. COOK CONCERNING
PREFILED TESTIMONY ON ENVIRONMENTAL CONTENTIONS 1.2, 1.3
AND 6.0 AND REBUTTAL TESTIMONY ON ENVIRONMENTAL CONTENTION 1.2

I, Dr. Christopher B. Cook, do declare under penalty of perjury that my statements in *NRC Staff Testimony of Dr. Michael T. Masnik, Anne R. Kuntzleman, Rebekah H. Krieg, Dr. Christopher B. Cook, and Lance W. Vail Concerning Environmental Contention EC 1.2 (as corrected and refiled on February 2, 2009 and February 26, 2009)*, in *NRC Staff Testimony of Dr. Michael T. Masnik, Rebekah H. Krieg, Dr. Christopher B. Cook, and Lance W. Vail Concerning Environmental Contention EC 1.3 (as corrected and refilled on February 2, 2009 and February 26, 2009)*, in *NRC Staff Testimony of Mark D. Notich, Anne R. Kuntzleman, Rebekah H. Krieg, Dr. Christopher B. Cook, and Lance W. Vail Concerning Environmental Contention EC 6.0 (as corrected and refilled on February 2, 2009 and February 26, 2009,* and in NRC Staff Rebuttal testimony of *Dr. Michael T. Masnik, Anne R. Kuntzleman, Rebekah H. Krieg, Dr. Christopher B. Cook, and Lance W. Vail Concerning Environmental Contention EC 1.2 (as corrected and refiled on February 26, 2009*) (including to the extent it modifies my testimony in the Staff's prefiled direct testimony on EC 1.2), as well as in my attached statement of professional qualifications are true and correct to the best of my knowledge, information, and belief.

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

Christopher B. Cook

Executed at Rockville, Maryland
This 26th day of February, 2009

**Christopher Bruce Cook**
STATEMENT OF PROFESSIONAL QUALIFICATIONS

## Current Position

Senior Hydrologist
Hydrologic Engineering Branch
Division of Site and Environmental Reviews
Office of New Reactors
U.S. Nuclear Regulatory Commission

## Education

Ph.D., Civil and Environmental Engineering, University of California at Davis, 2000
M.S., Civil and Environmental Engineering, University of California at Davis, 1993
B.S., Civil Engineering, Colorado State University, 1991

## Professional Experience

Dr. Cook joined the U.S. Nuclear Regulatory Commission in 2007. Prior to joining the NRC, he was employed as a Senior Research Engineer at the Pacific Northwest National Laboratory (PNNL) for over seven years. Dr. Cook's professional experience covers a diverse set of hydrology-related areas including basic and applied research and regulatory compliance assessments. Past research areas have focused on the use of multi-dimensional hydrodynamic and water-quality modeling of surface water systems, including simulation of complex density-driven flows in stratified environments, and field instrumentation relevant to environmental fluid mechanics.

NRC Experience

**Hydrologic Reviews for New Plant Applications**. Dr. Cook's duties include support of NRC reviews associated with early site permits and combined license applications. Dr. Cook is currently the lead hydrologist for the Bell Bend, Bellefonte, Grand Gulf, and North Anna combined license applications. Responsibilities associated with these reviews include preparation of hydrology-related sections of the Safety Evaluation Report (SER) and Environmental Impact Statement (EIS). Safety-related assessments include a broad range of surface water and groundwater site hazard assessments. Responsibilities on the EIS reviews include assessment of water-use and water-quality impacts to the environment from construction and operation of the proposed nuclear reactor, as well as evaluation of alternatives to the proposed action.

**IAEA Safety Standard Development**. Dr. Cook is currently assisting with the development of hydrology-related sections of the new International Atomic Energy Agency (IAEA) Safety Guide DS417, "Meteorological and Hydrological Hazards in Site Evaluation for Nuclear Installations." This new guide will both update and combine Safety Guide NS-G-3.5 "Flood Hazard for Nuclear Power Plants on Coastal and River Sites" and Safety Guide NS-G-3.4 "Meteorological Events in Site Evaluation for Nuclear Power Plants."

Private Sector Experience

**Hydrologic Site Safety Reviews for Early Site Permits**. PNNL Task Manager. Dr. Cook prepared surface water hydrology (Section 2.4) sections of the Safety Evaluation Reports (SERs) associated with the North Anna (NUREG-1835), Clinton (NUREG-1844), and Grand Gulf (NUREG-1840) early site permit applications. Assessments included a broad range of site hazards, including flooding from extreme storm events and cascade-failure of upstream dams.

**Hydrology-Related Environmental Reviews for Early Site Permits**. PNNL Task Manager. Dr. Cook provided assessments for the hydrology-related sections of the Environmental Impact Statements associated with the North Anna (NUREG-1811), Clinton (NUREG-1815), Grand Gulf (NUREG-1817), and Vogtle (NUREG-1872; draft) early site permit applications. Assessments include a broad range of water-use and water-quality impacts to the environment from both construction and operation of the proposed nuclear reactors.

**Field Assessment and Simulation of Temperature Fluctuations in the Lower Snake River.** PNNL Principal Investigator and Project Manager. Dr. Cook lead a multi-year project to monitor and model temperature fluctuations in the lower Snake River (contract totaling over $1 million per year). He applied three-dimensional numerical models to simulate transient density currents at the confluence of the Clearwater and Snake rivers, and a two-dimensional laterally-averaged model to simulate temperature variations throughout the 140 river mile reach downstream to the confluence of the Snake and Columbia rivers. *In situ* measurements in the confluence region focused on density gradients and their impacts on juvenile Chinook salmon migration, and included the use of a wide range of field instrumentation.

**Analysis and Simulation of 3-D Free-Surface Hydrodynamics near Hydroelectric Dams.** PNNL Principal Investigator and Project Manager. Dr. Cook participated in and managed several free-surface computational fluid dynamics (CFD) modeling projects to compute water velocities, turbulence intensities, and pressure variations (including hydraulic loads) to assist with designing various hydraulic structures at several hydroelectric dams. Typical examples are an analysis of the spillway and tailrace conditions at The Dalles Dam (Columbia River) and simulation of entrance conditions at the Bonneville Second Powerhouse Ice and Trash Sluiceway (Columbia River).

**Three-Dimensional Hydrodynamic and Water Quality Simulation of a Terminal Basin Lake.** UC Davis Post-Graduate Research Engineer. While at the University of California at Davis, Dr. Cook modified and applied the multi-dimensional finite element model RMA10 to the Salton Sea, California. To calibrate and verify the model, a team lead by Dr. Cook implemented a year-long field data monitoring program to obtain *in situ* water current (ADCP) and quality (e.g. temperature, salinity, pH, and dissolved oxygen) information. Applications of the computational model focused on management alternatives to restore the Salton Sea's degrading saline environment.

## Selected Publications and Technical Reports

Cook, C. B., M. C. Richmond, and J. A. Serkowski. (2007). "Observations of Velocity Conditions near a Hydroelectric Turbine Draft Tube Exit using ADCP Measurements." *Journal of Flow Measurement and Instrumentation*, 18(3):148-155.

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Cook, C. B., B. Dibrani, J. A. Serkowski, M. C. Richmond, P. S. Titzler, and G. W. Dennis. (2006). "Acoustic Doppler Current Profiler Measurements in the Tailrace at John Day Dam." *Pacific Northwest National Laboratory*, PNNL-15627, Richland, Washington, January.

Cook, C. B., B. Dibrani, M. C. Richmond, M. D. Bleich, S. P. Titzler, and T. Fu. (2006). "Hydraulic Characteristics of the Lower Snake River during Periods of Juvenile Fall Chinook Salmon Migration." *Pacific Northwest National Laboratory*, PNNL-15532, Richland, Washington, January.

Johnson, G. E., M. E. Hanks, F. Khan, C. B. Cook, J. Hedgepeth, R. P. Mueller, C. L. Rakowski, M. C. Richmond, S. L. Sargeant, J. A. Serkowski, and J. R. Skalski. (2005). "Hydroacoustic Evaluation of Juvenile Salmonid Passage at The Dalles Dam in 2004." *Pacific Northwest National Laboratory*, PNNL-15180, Richland, Washington.

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Cook, C. B., L. W. Vail, and D. L. Ward. (2005). "Report on the North Anna Early Site Permit Water Budget Model (LakeWBT) for Lake Anna." *Pacific Northwest National Laboratory*, PNNL-14944, Richland, Washington, January.

Cook, C. B. and M. C. Richmond. (2004). "Simulating the Flow Field Upstream of the Dworshak Dam Regulating Outlets." *Pacific Northwest National Laboratory*, PNNL-14591, Richland, Washington, March.

Cook, C. B. and M. C. Richmond. (2004). "Monitoring and Simulating 3-D Density Currents at the Confluence of the Snake and Clearwater Rivers", in *Critical Transitions in Water and Environmental Resources Management*, eds. G. Sehike, D. Hayes and D. Stevens, American Society of Civil Engineering Press, 2004.

Cook, C. B., C. L. Rakowski, M. C. Richmond, S. P. Titzler, A. M. Coleman, and M. D. Bleich. (2003). "Numerically Simulating the Hydrodynamic and Water Quality Environment for Migrating Salmon in the Lower Snake River." *Pacific Northwest National Laboratory*, PNNL-14297, Richland, Washington.

Cook, C. B., G. T. Orlob, and D. W. Huston. (2002). "Simulation of Wind-Driven Circulation in the Salton Sea: Implications for Indigenous Ecosystems." *Hydrobiologia*, 473: 59-75.

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Cook, C.B. (1993). "A One-Dimensional Model to Simulate Water Infiltration and Redistribution in Soils." M.S. thesis, Department of Civil and Environmental Engineering, University of California, Davis.

Abt, S. R., C. B. Cook, K. Staker, and D. Johns. (1991). "Small Parshall Flume Rating Corrections." *Journal of Hydraulic Engineering*, American Society of Civil Engineering, 118(5): 798-802.

## Selected Conference Proceedings

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Prasad, R., L. W. Vail, C. B. Cook, and G. Bagchi. (2005). "Establishment of Safety-Related Site Characteristics Based on Consideration of External Sources of Flooding at Nuclear Power Plant Sites in the United States of America." In *Proceedings of International Workshop on External Flooding Hazards at Nuclear Power Plant Sites*, Kalpakkam, India, August.

Cook, C. B., M. C. Richmond, J. A. Serkowski, and L. L. Ebner. (2002). "Free-Surface Computational Fluid Dynamics Modeling of a Spillway and Tailrace: Case Study of The Dalles Project." *Hydrovision 2002*, Portland, Oregon, July.

Cook, C. B., D. W. Huston, M. R. Jensen, G. T. Orlob, and S. G. Schladow. (1998). "Internal Dynamics of a Large Saline Lake: Field Investigation and Monitoring of the Salton Sea, California." *1998 Ocean Sciences Meeting*, AGU and ASLO, San Diego, February.

## Professional Affiliations

American Society of Civil Engineers
American Geophysical Union

1 JUDGE BOLLWERK: And then the rebuttal
2 testimony of this panel would be -- is there any
3 objections to the entry of that? Hearing none, then
4 the rebuttal testimony of the panel will be entered
5 into the record as if read as DDMS Item ID Number
6 59321.
7 (Masnik, et al, Rebuttal Testimony (DDMS-
8 59321 to be inserted at this point.)
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Corrected on: February 26, 2009
Originally Filed on: February 6, 2009

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 REBUTTAL TESTIMONY OF DR. MICHAEL T. MASNIK, ANNE R. KUNTZLEMAN, REBEKAH H. KRIEG, DR. CHRISTOPHER B. COOK, AND LANCE W. VAIL CONCERNING ENVIRONMENTAL CONTENTION EC 1.2

Q1. Please state your name.

A1(a). (MTM) My name is Dr. Michael T. Masnik (MTM).

A1(b). (ARK) My name is Anne "Nancy" R. Kuntzleman (ARK).

A1(c). (RHK) My name is Rebekah H. Krieg (RHK).

A1(d). (CBC) My name is Dr. Christopher B. Cook (CBC).

A1(e). (LWV) My name is Lance W. Vail (LWV).

Q2. Have you previously submitted testimony concerning Contention EC 1.2 in this proceeding?

A2. (All) Yes. My direct testimony is provided in "NRC Staff Testimony of Dr. Michael T. Masnik, Anne R. Kuntzleman, Rebekah H. Krieg, Dr. Christopher B. Cook, and Lance W. Vail Concerning Environmental Contention EC 1.2." (Jan. 9, 2009; as corrected and refiled February 2, 2009 and February 26, 2009) (hereinafter "Staff EC 1.2 Direct Testimony"). A statement of my professional qualifications was attached to that filing.

## I. General Questions

Q3. Are you familiar with the direct testimony submitted by the Joint Intervenors concerning EC 1.2, "Revised Pre-Filed Direct Testimony of Shawn P. Young in Support of EC 1.2" (Feb. 2, 2009) ("Young EC 1.2 Testimony") and "Revised Prefiled Direct Testimony of Barry W. Sulkin in Support of EC 1.2" (Feb. 2, 2009) ("Sulkin EC 1.2 Testimony")?

A3. (All) Yes.

Q4. Have any statements in the Joint Intervenors' testimony led you to believe that revisions to your direct testimony are necessary? If so, please explain.

A4. (LWV) Yes. In its ESP analysis, the Staff used a combined water withdrawal for Units 1 and 2 of 90 cubic feet per second (cfs). This value for the "normal" withdrawal of 90 cfs was based on the Applicant's Plant Parameters for VEGP Units 1 and 2 (Table 2.9-1 of Southern's Environmental Report (ER)). Exhibit SNC000001 at 2.9-2. Based on water balance considerations, the water withdrawal was assumed to be the sum of the Blowdown flow rate and the River water consumptive use listed in Table 2.9-1 of the ER. *Id.* Since the Staff interpreted this Table to reflect bounding conditions, the Staff believed that it would be conservative to use 90 cfs as both the average and the maximum withdrawal rate.

As noted by the Joint Intervenors, however, the Staff analysis in the Final Supplemental Environmental Impact Statement (FSEIS) for the renewal of the Units 1 and 2 licenses uses actual water use values at Units 1 and 2 in 2006, including values higher than 90 cfs. Sulkin EC 1.2 Testimony at A22. Subsequently, in identifying the reason for this discrepancy, the Staff has determined that in the license renewal analysis, the Staff instead based its estimate for normal withdrawals on withdrawal data reported by Southern to the State of Georgia pursuant to the Monthly Surface Water Withdrawal Report requirements of Permit No. 017-0191-05. Exhibit NRC000051; Exhibit JTI000022 at 4-13, 4-14. Based on the data record used in the FSEIS, the

reported withdrawal for Units 1 and 2 on the majority of days is 98 cfs, which the Staff believes represents the typical daily withdrawal rate of Units 1 and 2. Exhibit NRC000051. Occasionally, and typically only for a day at a time, the records show that the Units 1 and 2 withdrawal rates increase. *Id.* These increases occur to manage water quality or to adjust cooling basin storage. In the data that Southern reported to the State of Georgia Environmental Protection Division for the year of 2006, the maximum flow withdrawal for any specific day was reported as 136 cfs. *Id.* The maximum average flow for any calendar month during that period was approximately 104 cfs. *Id.*

The Staff acknowledges the inconsistency between the ESP FEIS and the license renewal FSEIS. Rather than the parameter value of 90 cfs, the maximum monthly average withdrawal value of 104 cfs derived from the data would be an appropriate, though still conservative, basis for evaluating cumulative impacts analysis with respect to the ESP application. Over the long term, considering outages, this monthly average number would be lower than 104 cfs; however, the Staff believes it is conservative to neglect these decreases in average withdrawal rate in determining cumulative impacts.

Therefore, based on the revised withdrawal rate of 104 cfs, the Staff has reconsidered the effect of the Unit 1 and 2 withdrawals on the water withdrawal percentages presented and considered in the FEIS. These values are presented in a table attached as Exhibit NRC000052.

As shown in that table, the Staff compared the effect of changing the water withdrawal rate from 90 cfs to 98 cfs (typical daily withdrawal) and to 104 cfs (maximum monthly average). Use of the 136 cfs value (the maximum daily withdrawal observed in the license renewal FSEIS data), however, is not an appropriate basis for a NEPA analysis, since such a withdrawal rate would occur only occasionally and would be for a short duration. *Id.* Nonetheless, to provide context for its determination that the significance of the revised withdrawal rates for Unit 1 and 2 is minor, the Staff computed the fractional withdrawal of the average daily discharge (8830 cfs)

in the Savannah River at the VEGP site that would occur under the highly unlikely conditions of Units 1 and 2 withdrawing at the 136 cfs rate and Units 3 and 4 withdrawing at the maximum rate of 129 cfs. Using these conditions would result in a combined withdrawal of 3.0 percent of the mean annual flow, compared to a combined withdrawal of 2.5 percent when instead using 90 cfs for Units 1 and 2. Even if the percentage of withdrawal is computed based on the more conservative mean annual flow from the short-term flow record at the Waynesboro, GA gauge (6691 cfs), for the case of Units 1 and 2 withdrawing at the 136 cfs rate and Units 3 and 4 withdrawing at the maximum rate of 129 cfs, the value would be 3.8 percent. The percentage withdrawn when using 104 cfs rather than 90 cfs for Units 1 and 2 is 2.6 percent of river flow, for a total difference of 0.1 percent, which is an insignificant change. A 0.1 percent difference is at least an order of magnitude less than any hydrological impact that could be detected. Therefore, as indicated in this table, the Staff determined that the revised withdrawal rates for Units 1 and 2 result in only a small change to the percentage of river flow cumulatively withdrawn by the two existing and two proposed Vogtle Units over the entire range of flows considered.

Given this reassessment of the appropriate Units 1 and 2 withdrawal rates to use for this NEPA analysis, the Staff also decided to confirm the consumptive water loss values previously assumed for Units 1 and 2. In the FEIS, the Staff assumed a consumptive water use rate of 67 cfs for Units 1 and 2. Exhibit NRC000001 at 7-5. The ESP application provides estimates for reject heat load of either Unit 3 or Unit 4 as 2212 MW and average combined consumptive loss as 62 cfs. The reject heat load was assumed to be the difference between the net thermal generation and the electrical generation. The recent power uprate license amendment for Units 1 and 2 indicates that these values are 3625 MWt and 1250 MWe respectively, for an estimated reject heat load of 2375 MW. Exhibit NRC000053 at Cover Page and p.26 of Safety Evaluation Report. Scaling of the evaporation rates for Units 1 and 2 based on the reject heat load of 2375

MW per unit, and assuming the same consumptive loss to reject heat load ratio as for Units 3 and 4, results in an estimate of combined consumptive use rate of 67 cfs for Units 1 and 2. Accordingly, the Staff believes that this confirms that the Staff's use of the 67 cfs consumptive use rate for Units 1 and 2 in its existing analysis remains reasonable.

Q5. Would the percentage changes due to the differences between Revision 15 and Revision 16 of the AP1000 DCD discussed in the Staff's direct testimony (Q62) be impacted by the Staff's revision of the water withdrawal rate for Units 1 and 2 to 104 cfs?

A5. (LWV) No. The percentage changes between Revision 15 and Revision 16 discussed in A62 of the Staff's direct testimony are determined by the presumed river flow and the withdrawals for Units 3 and 4, not the withdrawals by Units 1 and 2. Therefore, those percentage differences would not change as a result of any changes to the withdrawal rates used for Units 1 and 2. However, in Exhibit NRC000052 the Staff has provided the cumulative water withdrawal percentages associated with both Revision 15 and Revision 16.

Q6. Has the Staff considered the significance of the above responses for the Staff's analysis of impacts to aquatic biota? If so, please explain.

A6. (MTM, RHK) Yes. In light of the changes described above in water withdrawal rates for Units 1 and 2, the Staff has considered the significance of this change for the Staff's conclusions regarding cumulative impingement and entrainment impacts for all four units at the normal flow, the Drought Level 3 flows (3800 cfs) and extremely low-flows (3000 cfs and 2000 cfs).

Based on the Unit 1 and 2 maximum observed monthly average withdrawal rate of approximately 104 cfs, and normal withdrawal rates for Units 3 and 4 (83 cfs for AP1000 DCD Revision 15), the combined water withdrawals for Units 1 through 4 would be 2.1% of the average daily discharge flows (8830 cfs) of the Savannah River and 4.9% at Drought Level 3 (3800 cfs) flows, rather than 4.6% as stated in Staff EC 1.2 Direct Testimony at A48. With the

changes in withdrawal rates associated with AP1000 DCD Revision 16, the combined water withdrawals would increase by 0.1% for both the average daily discharge flows and the Drought Level 3 flows. Exhibit NRC000052.

The increase for the Drought Level 3 (3800 cfs) flows of 0.3% (0.4% when considering the DCD Revision 16 withdrawal for Units 3 and 4) would not change the Staff's conclusion in its direct testimony that the impacts of impingement and entrainment would be minor as a result of the cumulative withdrawals for all four units because these increases are small in comparison to the withdrawal rates that are being evaluated. Moreover, as stated in the Staff's EC 1.2 Direct Testimony at A48, the Staff did not rely solely on the percent water withdrawal values to assess the cumulative impacts associated with impingement and entrainment. The Staff's conclusions are based on a number of factors, including the use of closed-cycle cooling; the design, location and planned operation of the proposed intake including conformance with the US EPA National requirements for intake design; the characteristics of the watercourse in the immediate vicinity of the intake location; the river hydrology; the distribution, abundance, and life history data of species inhabiting the Savannah River near VEGP; the results of the SRS studies of impingement and entrainment completed in the 1980s; and the preliminary results of the impingement and entrainment sampling program for VEGP Units 1 and 2.

In the FEIS and as described in its direct testimony, the Staff also assessed the cumulative impacts from entrainment and impingement losses at all four VEGP units at very-low flow rates of 3000 and 2000 cfs. Staff EC 1.2 Direct Testimony at A50. As a result of the changes in the withdrawal rates for Units 1 and 2, the Staff has considered the significance of this change for the Staff's conclusions regarding the cumulative impingement and entrainment impacts for all four units assuming normal withdrawals for Units 3 and 4 using the DCD Revision 15 withdrawal rate (83 cfs) and the maximum observed monthly average withdrawal rate from Units 1 and 2 (104 cfs). Using these values would result in the withdrawal of 6.2% of the river

flow at 3000 cfs and 9.4% at 2000 cfs (rather than 5.8% and 8.7% as given in Staff EC 1.2 Direct Testimony at A50). Exhibit NRC000052. With the changes in withdrawal rates associated with DCD Revision 16, the combined water withdrawals increase to 6.4% of the river flow at 3000 cfs and 9.5% of the river flow at 2000 cfs. *Id.* These increases in the cumulative withdrawal rate for all four units of 0.4% (3000 cfs) and 0.7% (2000 cfs) for DCD Revision 15 - or 0.5% and 0.7% for DCD Revision 16 - do not change the Staff's conclusions in the FEIS and described in its direct testimony. That is because these increases are small in comparison to the withdrawal rates that are being evaluated. Moreover, as stated in the FEIS and in the direct testimony, such very-low flows are expected to be temporary, on the order of days or weeks, rather than months. Exhibit NRC000001 at 7-24; Staff EC 1.2 Direct Testimony at A50. In addition, the Staff did not rely solely on the percent water withdrawal values to assess the cumulative impacts associated with impingement and entrainment at these very-low flows. Other factors include the use of closed-cycle cooling, the location, design, and planned operation of the intake structure, and the life history characteristics of "important species".

In addition, under very-low flow conditions, Southern could be directed by the State resource agencies to reduce power or cease power operations (actions which would reduce water withdrawals significantly) for reasons including increased impingement rates, or to protect aquatic biota during a critical spawning period for an important species when fish eggs and larvae would be present. *Id.*

## II. Description of Aquatic Species and Habitat

Q7. Dr. Young asserts that "[t]he FEIS does not contain sufficient data to analyze the construction and operation impacts on fish species located in the Middle, Lower, and estuarine Savannah River." Young EC 1.2 Testimony at A12. Does the Staff agree with this assertion?

A7. (RHK) No. As discussed in its direct testimony, the Staff stated that it followed the guidance of the Environmental Standard Review Plan ("ESRP") Section 2.4.2 by providing a brief description of the aquatic ecological features of the site and vicinity that includes an "emphasis on the communities of the ecosystem that will be potentially affected by project construction, operation and maintenance." Staff EC 1.2 Direct Testimony at A6; Exhibit NRC000009 at 2.4.2-6, 2.4.2-7. This discussion of fish species and habitats within the Savannah River was included in Section 2.7.2.1 of the FEIS. Exhibit NRC000001 at 2-74, 2-76 to 2-86 and 2-88 to 2-93. In addition, following the guidance in ESRP 5.3.1.2, the Staff discussed the effects of plant operations, including entrainment, impingement, and discharge impacts in Sections 5.4.2.2 through 5.4.2.5 of the FEIS. Exhibit NRC000010 at 5.3.1.2-8, 5.3.1.2-9; Exhibit NRC000001 at 5-29 to 5-37. In its direct testimony, the Staff described the basis for its analysis and the sources of information used to support the FEIS analysis. Staff EC 1.2 Direct Testimony at A5, A9, A11, A19, A22, A29, A33 and A55. As further explained in the Staff's direct testimony, the Staff's data collection and analysis followed the appropriate ESRP guidelines for the description of aquatic resources and assessment of impacts due to entrainment, impingement, and thermal discharge. Staff EC 1.2 Direct Testimony at A6, A7, A20, A21, A27, A28, and A54. The Staff believes that because it followed the ESRP guidance regarding information needs, analysis, and the amount of information to be presented in the FEIS, the Staff ensured that it had presented adequate site-specific information in the FEIS and used the appropriate information in the analysis for determining the impacts to the aquatic biota of the Savannah River.

Q8. Dr. Young refers to six fish species that "are experiencing population decline and considered most imperiled and/or most important to Savannah River fisheries" and he asserts that "[i]n order to accurately evaluate the construction and operation impacts, the causes of the

population decline must be articulated." Young EC 1.2 Testimony at A12. Does the Staff agree with this assertion?

A8. (RHK) No. Dr. Young states that in order to accurately evaluate impacts, the causes of population decline to species (specifically the six species identified and described in the FEIS on pages 2-81 through 2-91) must be articulated. Young EC 1.2 Testimony at A12. However, the purpose of the FEIS is to present the Staff's analysis, "which considers and weighs the environmental impacts of the proposed action at the VEGP site, including the environmental impacts associated with construction and operation of reactors at the site...and the mitigation measures available for reducing or avoiding adverse environmental effects." Exhibit NRC000001 at 1-4. The impact from the operation of the facility is based on the potential for the facility to affect the species via means such as entrainment, impingement, and thermal discharges. Any potential impacts from the facility may exacerbate previous population declines depending on the magnitude of the impact. However, the potential impact of a facility using closed-cycle cooling on fish species does not generally depend on the cause or causes of the population declines of those species.

Nevertheless, in the interest of providing background information related to the species that inhabit the Savannah River in the vicinity of the VEGP site, the Staff does describe the reasons for population decline in several of the important fish species. For example, the FEIS states that data on the number of eels caught per unit of effort (in eastern rivers) indicate large localized declines in rivers across the Atlantic coast. *Id.* at 2-82. The FEIS describes several possible causes for the decline including overfishing, seaweed harvesting in the Sargasso Sea, loss of adult habitat in rivers and estuaries from dams, dredging and wetland destruction, and migration past dams and water intakes. *Id.* at 2-83. Further, the FEIS states that the population of striped bass drastically declined in the 1980's throughout the species' range on the Atlantic coast and refers to sources positing that the Savannah River harbor modifications resulted in

habitat alterations in the estuarine spawning grounds and contributed to the decline of the fishery in the Savannah River. *Id.* at 2-84. Additionally, the FEIS notes that population estimates indicate that the population of adult shortnose sturgeon is increasing but that juveniles are still rare, likely due to a recruitment bottleneck in the early life stages and in part because of water-quality degradation in the nursery habitat in the lower Savannah River. *Id.* at 2-91. Regarding the robust redhorse, the Staff has monitored the work of the Robust Redhorse Conservation Committee that was formed, in part, to investigate the species. Exhibit NRC000001 at 2-89; Exhibit NRC000015; Exhibit NRC000016.

Dr. Young's testimony mentions six fish species that are located in the Middle, Lower and estuarine Savannah River and that are mentioned on FEIS pages 2-81 through 2-91; he then states that "the FEIS lacks adequate discussion of the other fish species that may be at risk of population decline, as a result of construction and operation of Units 3 and 4." Young EC 1.2 Testimony at A12. However, Dr. Young does not name these "other fish species," nor does he describe what specific factors should be considered in the assessment of these "other fish species." As described in its direct testimony and in the FEIS, the Staff followed the guidance provided in the Environmental Standard Review Plan 2.4.2 to identify which species meet the definitions of "important," including those that are commercially important, recreationally valuable, rare (i.e. threatened or endangered), or important to the structure and function of the aquatic ecosystem; the Staff limited its detailed assessment to those species. Staff EC 1.2 Direct Testimony at A10; Exhibit NRC000001 at 2-81; Exhibit NRC000009 at 2.4.2-7.

Q9. Dr. Young argues that the surveys conducted by the Academy of Natural Sciences of Philadelphia ("ANSP") "are not an adequate indicator" of impacts on fish species and that the FEIS's reliance on the ANSP research does not provide sufficient data to substantiate conclusions regarding the impact of Units 3 and 4 on fish species. Young EC 1.2 Testimony at

A13. Do you agree with Dr. Young's characterization of how ANSP studies and data were used in the FEIS analysis?

A9. (RHK) No. As stated in the Staff's direct testimony at A9, the Staff used the ANSP studies to provide an understanding of the river ecology and the current species of fish and molluscs present in the vicinity of the VEGP site, as well as to demonstrate that the Savannah River has been studied extensively upstream and downstream of the VEGP site and at different seasons throughout the year. Staff EC 1.2 Direct Testimony at A9. The Staff also used the ANSP studies to provide an overall indication of the impacts of the SRS facilities and the existing VEGP Units 1 and 2 on the health of the Savannah River. *Id.* The ANSP studies were not the source of information for life history, migration timing or population numbers. The sources used for life history, migration timing and population numbers are clearly referenced in the appropriate sections of the FEIS. Exhibit NRC000001 at 2-81 to 2-93. For example, the Staff's description of the life history and spawning migration of the American Shad relies on background information from five different sources, none of which were the ANSP studies. *Id.* at 2-82

Dr. Young states that "several parts of the existing – albeit outdated – ANSP research, including ichthyoplankton surveys, were performed on a limited basis, only a few times per year, and during alternating years." Young EC 1.2 Testimony at A13. The Staff has reexamined the ANSP studies and notes that no data or results of ichthyoplankton studies are included in any of the three ANSP reports cited in the FEIS (ANSP 2001, ANSP 2003 or ANSP 2005). Exhibits NRC000002; NRC000003; NRC000004. Because the ANSP studies did not include ichthyoplankton survey data, the Staff in the FEIS relied on other studies to provide information on ichthyoplankton density and distribution. The Staff's direct testimony states that "[b]ecause neither Marcy et al. nor the ANSP study directly addressed the concentrations of fish larvae and

eggs in the Savannah River, the Staff relied on the studies performed by the SRS in the mid-1980s." Staff EC 1.2 Direct Testimony at A15.

As a result, Dr. Young's testimony inaccurately characterizes the contents of the ANSP studies and how the Staff considered those studies in the FEIS.

## III. Analysis of Impacts From Intake Structure

Q10. Dr. Young states that "[d]ata for early life history of fish that inhabit the Savannah River near Plant Vogtle, or pass by Plant Vogtle as part of the community drift, is of paramount importance when analyzing entrainment." Young EC 1.2 Testimony at A14. Does the Staff agree with this statement?

A10. (RHK) No. Such data are useful, but are not of "paramount" importance when analyzing entrainment. Dr. Young bases his claim on statements such as "[t]he early life stages of fish are the most susceptible to entrainment because they have limited capacity for avoidance." Young EC 1.2 Testimony at A14. However, as explained in direct testimony, the Staff assumed that fish eggs and larvae have no independent mobility, and that if they enter the hydraulic zone of influence they will be entrained and will suffer mortality. Staff EC 1.2 Direct Testimony at A31. The Staff's analysis, therefore, is conservative relative to Dr. Young's concern because it does not account for the ability of larvae to avoid entrainment. As described elsewhere in its direct testimony, the Staff did consider relevant life history information for important fish species, such as whether the species are pelagic or demersal spawners, the distribution of eggs and larvae within the water column, the concentration of ichthyoplankton in different within-river habitats, and the fecundity of the species. *Id.* at A12, A30, and A33. The Staff also determined the observed spawning areas for the "important species." *Id.* at A33. These factors are, in most cases, more important than the capacity for avoidance of entrainment in the overall assessment of entrainment impacts. Additionally, other factors such as the

location and design of the intake structure and the proportion of river flow entrained through the cooling system must also be considered. The supporting basis for the conclusions regarding entrainment impacts for each important species, including relevant life history factors, is described in the Staff's direct testimony. *Id.* at A33.

Q11. According to Dr. Young, "[t]he FEIS at page 5-30 states that 'species and life stages evaluated in various studies could endure a velocity of 1 ft/sec'." Young EC 1.2 Testimony at A15. Dr. Young then argues that "many of the endangered or important fish of the Savannah River cannot endure that water intake velocity." *Id.* Does the Staff agree that any of the "important" species identified in the FEIS cannot endure the water intake velocity anticipated at the proposed new units?

A11. (MTM) The FEIS on page 5-30 states that "EPA [not the NRC Staff] determined that species and life stages evaluated in various studies could endure a velocity of 1.0 ft/sec..." Exhibit NRC000001 at 5-30. In that context, the Staff was referring to an organism's ability or inability to avoid impingement. Nevertheless, the Staff recognizes that certain individual organisms, particularly the early life stages of many species, including the identified "important species," are incapable of overcoming an intake velocity of 1.0 ft/sec or even less. Those individual organisms that are entrained will likely transit the intake structure, enter the cooling water system, and experience 100 percent mortality. *Id.* at 5-30. Organisms affected could include the larval stages of both the robust redhorse and the shortnose sturgeon. However, other factors, such as the use of closed-cycle cooling, the design, location and operation of the intake structure, the location of the site on the Savannah River, and the river hydrology, as well as consideration of life history information (i.e., fecundity, spawning sites, spawning period), also affect the number of individuals lost due to entrainment. Exhibit NRC000001 at 5-30 to 5-32; Staff EC 1.2 Direct Testimony at Section II.C.

Therefore, the Staff agrees that at least some individual organisms, particularly those in early developmental stages (egg, larvae, and post-larvae, and in some cases juvenile fish), and including those from species identified as "important species," will not be able to overcome the through-screen intake velocity and will be entrained and lost from the fishery. However, the susceptibility of these early life stages for almost all species to entrainment due to the lack of or limited motility is fully consistent with the Staff's analysis in the FEIS. It is the consideration of the other abiotic and biotic factors identified above and the results of past field studies described in the FEIS that leads the Staff to conclude that the number of individuals lost will be sufficiently small that there will be no detectable changes in fish populations attributable to the operation of VEGP Units 3 and 4. Exhibit NRC000001 at 5-30 to 5-33; Staff EC 1.2 Direct Testimony at II.C. This conclusion is supported by the results of the Applicant's entrainment study conducted during 2008. Staff EC 1.2 Direct Testimony at A34.

Q12. Dr. Young argues that "[i]t is not reasonable to assume that the drift community near Plant Vogtle is uniformly distributed." Young EC 1.2 Testimony at A16. He subsequently argues that "[w]hen the drift community is not uniformly distributed, entrainment will not correspond directly with the percent of flow withdrawn." *Id.* at A17. Do you agree with these arguments?

A12. (MTM) The assumption of uniform distribution was made in the original FES for Units 1 and 2. Exhibit NRC000014 at 5-17. The Staff's use of a uniform distribution model is also consistent with ESRP guidance. Exhibit NRC000010 at 5.3.1.2-6. The Staff refers to the assumption of uniform distribution of drift organisms on pg 5-31 of the FEIS and states that it is a conservative assumption. Exhibit NRC000001 at 5-31. Dr. Young is critical of the Staff's assumption that entrainment is proportional to water withdrawals because of the use of the uniform distribution assumption. Young EC 1.2 Testimony at A17. Dr. Young cites the results of sampling by JTI000006 (Wiltz, 1983), JTI000007 (Nichols, 1983) and JTI000004 (Paller,

1995) to support the assumption that the drift community is non-uniformly distributed in the Savannah River. Young EC 1.2 Testimony at A16. The Staff does not dispute the results of these field studies; however, due to the temporal and spatial variation in densities and the generally higher concentrations of drift near the surface or the bottom of rivers, the Staff finds the use of a uniform-distribution model is conservative for the assessment of entrainment impact at this facility. The Staff believes this assumption is conservative with respect to impacts at the Vogtle site in particular primarily due to the design of the intake structure. The intake design includes a skimmer wall extending from the water surface downward and a weir wall extending upward from the river bottom. The effect of these two walls is to preferentially remove water from the middle of the water column where the density of drift organisms is generally lower than near the surface or bottom.

Thus for reasons already detailed in the Staff's direct testimony, the Staff considers the uniform distribution assumption to be appropriate and conservative, especially because it would likely result in an overestimation of organisms lost for most species. Staff EC 1.2 Direct Testimony at A28. Also, as described in the Staff's direct testimony, the preliminary results of Southern's entrainment study show that the densities of organisms in the intake canal are significantly lower than the densities in the Savannah River. Staff EC 1.2 Direct Testimony at A29; Exhibit NRC000030 at 20-25, 29-34.

The assumption that entrainment is proportional to the percent of river flow withdrawn is not only intuitive but is also consistent with EPA analysis as presented in its Phase I regulations for cooling water intake structures. In the statement of considerations for the final rulemaking (and specifically in section V. Basis for the Final Regulation), EPA states that "...entrainment impacts of cooling water intake structures are closely linked to the amount of water passing through the intake structure." Exhibit NRCR00035 at 65,277. As described above in response to Question 9, and previously in the Staff's direct testimony, although the Staff's consideration of

water withdrawals assumes proportional entrainment, the percentage withdrawn was not the only relevant consideration in reaching impact conclusions. Staff EC 1.2 Direct Testimony at A43, A44. The Staff also considered biotic and abiotic factors, as well as past and recent field studies in the Savannah River, to arrive at its assessment of impact.

Q13. According to Dr. Young, "[t]he FEIS fails to provide any baseline data regarding species composition, abundance, and distribution to support its conclusions." Young EC 1.2 Testimony at A18. Young further argues that the FEIS "fails to take into account Paller's 1995 study of the horizontal distribution of American shad eggs in the drift near Plant Vogtle." *Id.* Do you agree with this characterization of the FEIS analysis? And would the results of the analysis have been different if the Paller 1995 study had been taken into account?

A13. (RHK) No, the Staff does not agree with the statement that "the FEIS fails to provide any baseline data regarding species composition, abundance, and distribution to support its conclusions." This information is provided in the FEIS at 2-76 to 2-86 and 2-88 to 2-93. Exhibit NRC000001. Information specific to the American shad populations is provided specifically at page 2-82. *Id.*

In regard to the results of the Paller 1995 study, this study provides an analysis of drifting American shad eggs at two transects located in the Savannah River at approximately rkm 250. Exhibit JTI000004 at 3. The study area for Paller (1995) was located approximately 6 kilometers upstream of the proposed VEGP intake structure (approximately rkm 244).

While the data in Paller (1995) is appropriate for illustrating generally that the assumption of "uniform distribution" is not realistic (as explained in Staff EC 1.2 Direct Testimony at A30), it is not an appropriate set of data to extrapolate specifically to ichthyoplankton entrainment at the location of the proposed VEGP site because of its distance from the proposed VEGP site, and the differences in habitat and current at the two locations. The Staff agrees that for facilities that are using once-through cooling, where "[w]ithdrawal rates

formerly reached as high as approximately 18% of the total river flow during the spring spawning months, primarily to satisfy the need for nuclear reactor cooling water," the assessment of entrainment impact at different locations can be a useful tool for determining the placement of intake structures. Exhibit JTI000004 at 3. This is because the removal of up to 18% of the ichthyoplankton from a river such as the Savannah River would be a much greater impact than was evaluated by the Staff for the closed-cycle cooling system of the proposed VEGP Units 3 and 4. The smaller water withdrawal rates of a closed-cycle cooling system such as the proposed VEGP Units 3 and 4, in a river the size of the Savannah River, result in a smaller impact to the aquatic biota. Thus, given these factors and available information (including Southern's interim report on its entrainment monitoring program for VEGP Units 1 and 2), data from further site-specific assessments are not necessary to obtain an impact determination of SMALL. Staff EC 1.2 Direct Testimony at A33 and A34; Exhibit NRC000030.

Q14. According to Dr. Young, "...on page 2-82 of the FEIS, the Staff illogically relies on oxbow population data, which is not relevant to its analysis of the mainstream ichthyoplankton community." Young EC 1.2 Testimony at A18. Do you agree with this characterization of the FEIS analysis?

A14. (RHK) No. The FEIS includes a statement that "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." Exhibit NRC000001 at 2-82; Exhibit NRC000011 at V-478. The Staff is not relying on oxbow data for assessment of impacts to American shad, but instead is simply stating that the data indicate that American shad are more prevalent in the main river than in oxbows. Earlier in the FEIS, it was pointed out that Specht (1987) found higher larval densities in the oxbows than in the main river, but the

oxbow communities were dominated by gizzard shad and threadfin shad, while the main river was dominated by American shad." Exhibit NRC000001 at 2-81; Exhibit NRC000011 at V-472.

In evaluating the placement and location of the cooling water intake structure ("CWIS") in the river, the Staff reiterated the finding by Specht (1987) that larvae densities in the oxbows suggest that they may be important spawning areas. Exhibit NRC000001 at 5-31. Specht (1987) stated that "although approximately half of all the larvae collected in the 1985 study were collected in the oxbows, only 15% of the samples were collected there, which suggests that oxbows may be important spawning areas." Exhibit NRC000011 at V-478. The Staff is thus acknowledging that the location of the CWIS is in an area of the water body away from areas of high productivity to minimize impingement and entrainment. However, the Staff does not use this observation as a determining factor for the impact of the proposed VEGP units on the environment; rather, the Staff viewed the location of the CWIS as one factor that was considered in the analysis of entrainment, along with the small percentage of water withdrawn from the river, the design of the cooling intake canal and structure, the typically high fecundity of most species inhabiting rivers, and the high natural mortality rates of eggs and larvae. Exhibit NRC000001 at 5-32.

Q15. Dr. Young asserts that ichthyoplankton-net collection is the "most effective method to determine current ichthyoplankton species composition, distribution, and vulnerability to entrainment in the vicinity of the VEGP site[.]" Young EC 1.2 Testimony at A19. Are such studies necessary for adequate analysis of environmental impacts in the FEIS?

A15. (MTM) No, such studies are not always necessary for an adequate analysis of environmental impacts. The Staff agrees with Dr. Young that under most situations, the use of ichthyoplankton nets is an effective method of collecting the early life stages of most fish species. Southern's interim report on its impingement and entrainment assessment describes the sampling technique used to collect ichthyoplankton samples from the Savannah River and

the VEGP Units 1 and 2 intake canal. Exhibit NRC000030 at 13-15. The Applicant employed an ichthyoplankton net in the Savannah River and an entrainment pump system in the intake canal.

An understanding of the facility operation, the site and its waterbodies, and the biota inhabiting those waterbodies is necessary to determine the need for and design of an ichthyoplankton monitoring program. Assessing the level of impact to a fishery due to entrainment first requires an understanding of the operation of the cooling water system. For example, the EPA in its final rulemaking regarding cooling water intake structures makes the argument that the scientific literature and the EPA record "contains ample evidence to support the proposition that reducing flow and capacity reduces impingement and entrainment." Exhibit NRCR00035 at 65,300. Intuitively, removing several gallons of water from a river will not affect the fishery. However, removing 50 percent of the flow of a river and causing the complete mortality of the entrained organisms certainly could have an adverse effect. So one of the first questions to ask in assessing the potential for impact is what percentage of the river flow is being removed by the facility. If it is a very small percentage of the river flow, if the facility is not located in a biologically unique area, and if there is no direct interaction with important species, sampling to assess entrainment losses may not be required. However, while not required for all impact analyses, the Staff recognizes that it is always preferable to have recent collections from the water source to supplement and, if appropriate, confirm the assessment.

VEGP Units 3 and 4 will withdraw only a few percent of the flow of the Savannah River, the units will utilize closed-cycle cooling, and the intake will likely comply with EPA requirements. The site is not located in a biologically unique stretch of the river. Past sampling of all life stages of fishes had been conducted in the Middle Savannah River and already available information provides a reasonable understanding of the indigenous biota. Life history data does not reveal a close association between the operation of the new units and "important

species." Accordingly, additional site-specific sampling was not necessary to enable the Staff to determine impacts. Nevertheless, subsequent to the Staff's analysis of impact due to entrainment, the Applicant did conduct an ichthyoplankton sampling program, employing the sampling gear identified by Dr. Young as being appropriate. Exhibit NRC000030 at 20-25. The results of the sampling program were consistent with the Staff's conclusions about impacts.

Q16. Dr. Young criticizes the Hydraulic Zone of Influence study conducted by the Applicant, stating that "[t]he Hydraulic Zone Influence [sic] study lacks sufficient data and analysis because the study was conducted while operation [of Units 1 and 2] was only at 56% capacity during a limited range of flows." Young EC 1.2 Testimony at A23. Is this an appropriate characterization of the study?

A16. (MTM) Although the Staff did not rely on the Applicant's hydraulic zone of influence study for its conclusions in the FEIS, the Staff did include a discussion of the study in its testimony and explained why the study provides additional support for the Staff's conclusions on the impact to fish populations from entrainment. Staff EC 1.2 Direct Testimony at A34. Dr. Young, in his testimony, states that the "study lacks sufficient data and analysis because the study was conducted while operation was only at 56% capacity during a limited range of flows." Young EC 1.2 Testimony at A23. Dr. Young goes on to state that "the modeling should also include the impact at full capacity under different flows." *Id.* The purpose of the Applicant's study was to define the hydraulically affected zone from which planktonic organisms and organisms with limited motility would be subject to entrainment. The Staff acknowledges that changing the pumping rate and the river flow rates would affect the hydraulic zone of influence in the Savannah River. For the following reasons, however, the study does provide useful information on the potential for entrainment of organisms in the Savannah River drifting by the site, and this information supports the Staff's assessment of impact for the proposed VEGP Units 3 and 4.

As noted recently in the Final Supplemental EIS (FSEIS) for the application for the renewal of the licenses for Units 1 and 2, the maximum observed average monthly withdrawal rate in 2006 was 104 cfs. Exhibit JTI000022 at 4-13. Also as described above in response to Question 4, the typical daily withdrawal rate for VEGP Units 1 and 2 is 98 cfs. Exhibit NRC000051. The hydraulic zone of influence study conducted on May 7, 2008, reported an intake withdrawal rate of 110 cfs. Exhibit NRC000031 at 2. This is a conservative number relative to both the maximum observed average monthly withdrawal rate in 2006 (104 cfs) and the typical daily withdrawal rate (98 cfs) as explained above in A4. Although the Applicant reported that the intake flow on the day of the measurements was 56 percent of intake "capacity" (three of the four intake pumps operating), this fact is consistent with the normal operation of the intake structure and does not detract from the applicability of the study. The intake full pump design capacity is 196 cfs, double the typical daily withdrawal rate of 98 cfs. Exhibit NRC000031 at 2; Exhibit NRC000051. However, intakes are designed with considerable excess capacity to allow for maintenance and replacement of pumps and other equipment while the plant is in operation and the intake is withdrawing water. Because of the likely infrequency and temporary nature of withdrawals at the maximum pumping rate, it is the normal withdrawal rate that is important in assessing the hydraulic zone of influence. The Applicant's study was conducted on a day when the withdrawal rate was significantly larger than the typical daily withdrawal rate or even the maximum observed average monthly withdrawal rate for 2006, so the conditions under which the study was conducted were conservative. Accordingly, conducting the study at a time when withdrawals were even higher would not result in a more reasonable and realistic assessment of impact.

At the time of the study, the flow on the Savannah River was reported at 4,482 cfs. Historically, lower flows have been reported and may occur in the future. Lower flows would result in lower river stage and presumably an increase in the hydraulic zone of influence. In the

Applicant's study, the area of hydraulic influence at a withdrawal rate of 110 cfs and a river flow of 4,482 cfs was determined to be 0.14 acres in the Savannah River and extended about one-sixth of the way across the river in the vicinity of the VEGP site. Exhibit NRC000031 at 2. In the FEIS, the Staff assessed impacts at the average-daily streamflow of 8830 cfs, and also down to the Drought Level 3 flow of 3800 cfs and the very-low flow levels of 3000 and 2000 cfs. For practical reasons, the Applicant was unable to measure the hydraulic zone of influence under all of the river flow conditions evaluated in the FEIS (average-daily, Drought Level 3 and very-low flows). It is the Staff's opinion that, although lower flows would result in an increase in the hydraulic zone of influence, the increase would not extend all the way across the river, and also would be less likely to occur in the spring and early summer during the spawning season when flows in the river have been historically higher. Therefore, as stated in the Staff's direct testimony, this information provides additional support for the Staff's conclusions in the FEIS, because it demonstrates that only a fraction of the Savannah River is influenced by the kinds of water withdrawals associated with the closed-cycle cooling system for Units 1 and 2. Staff EC 1.2 Direct Testimony at A34.

Q17. Dr. Young states that "[t]he FEIS lacks sufficient data and analysis to support its conclusion that the fish and shellfish located in the vicinity of the VEGP site are adapted to survival in varying flow regimes and velocities[.]" Young EC 1.2 Testimony at A20. Is additional explanation or analysis necessary in the FEIS to support the view that fish are able to tolerate variations in flow that might be created by the operation of two additional units at the VEGP site?

A17. (MTM) The Staff stated in the FEIS that "aquatic organisms inhabiting rivers and streams flowing into the Atlantic are preadapted to tolerate large variations in water flow. Periodic droughts have historically occurred in rivers in the southeastern United States, and species occurring in the river, although periodically stressed, persist." Exhibit NRC000001 at

E-75. The Staff again addressed this issue in its testimony, where the Staff stated that fish found in southeastern rivers that drain to the Atlantic are preadapted to tolerate large variations in flow. Staff EC1.2 Direct Testimony at A14, A23. In support of this assertion, one only has to look at the historic 1930 high flow of the Savannah River at Augusta estimated at 350,000 cfs and compare that to the historic low river flows of 1500 to 1000 cfs. Exhibit NRC000041. That represents a 233- to 350-fold variation in flow, and yet the fish have persisted in the river. The Staff, as stated in its direct testimony, is unaware of any species having been extirpated from the middle Savannah River for any reason, including very-low river flows, since scientific collecting in the river began. Staff EC1.2 Direct Testimony at A14.

Dr. Young states that while fish and shellfish can adapt to natural variability, "human-induced variability produces different results." Young EC 1.2 Testimony at A20. I reviewed Young's Exhibits 16 through 19 and found that none of the papers cited addresses impacts related to impingement, entrainment or thermal effects due to water withdrawals or discharges. Three of the studies (JTI000016, JTI000018 and JTI000019) focus on large scale modification of the aquatic environment such as impoundments, while the fourth study (JTI000017) develops a hypothetical extinction rate for aquatic species. That paper (JTI000017) relates the loss of aquatic species to habitat deterioration in general.

The Staff interprets Dr. Young's EC 1.2 Testimony at A20 as implying that organisms can adapt to the natural variation in water flow in a river but that somehow man-induced variability produces different results, presumably ones detrimental to populations of fish and shellfish. However, none of the references cited in Dr. Young's testimony discusses the distinction between the effects of human-induced variation versus natural variation on aquatic organisms. *Id.* at A20.

The Staff recognizes that impoundments can profoundly change the flow regime of a river, which can in turn affect species distribution and abundance. Flow variation in rivers and

streams draining the Atlantic coast is considered necessary and important to maintain a healthy riverine fishery. Fisheries management professionals have advocated the return to more normative flows in the free flowing sections of impounded rivers. The release of water during fish spawning periods has been a widely used technique that has had some success in managing fish populations. In fact, resource agencies have instituted periodic planned releases to benefit downstream biota in a number of river basins. There is no indication that fish or shellfish are able to discern the difference in the source of these flow pulses – whether man-made or naturally occurring. The desire to restore more normative flows in the Savannah River has resulted in the USACE initiating a program to periodically release high-flow pulses on the order of 15,900 cfs to 30,000 cfs to the Savannah River. Exhibit NRC000054 at 13. It is believed that such high-flow pulses benefit fish spawning, inundate low-lying floodplain areas that can be utilized by aquatic species, and flush oxbow lakes. *Id.*

Similarly, the Staff's direct testimony presented the results of a study that concluded that very large reductions in flows, far in excess of those expected from consumption of water due to the additional VEGP units, need to occur on a river the size of the Savannah before fish populations are extirpated or even adversely affected. Staff EC 1.2 Direct Testimony at A14; Exhibit NRC000027. Additionally, the Staff's direct testimony demonstrated that the day-to-day variation of river flow of the Savannah River in the vicinity of the site is often greater than the proposed Units 3 and 4 water consumption rate. Staff EC 1.2 Direct Testimony at A14; Exhibit NRC000041. Any variation in river flow attributable to the future operation of VEGP Units 3 and 4 would be minor compared to upstream releases from Thurmond Dam along with natural variation in river flow between the dam and the VEGP site.

The Staff reaffirms its conclusion that the small contribution in flow reduction due to the consumption of water (62 cfs) by operation of two additional units will have no detectable effect on the Savannah River fishery. Exhibit NRC000001 at 7-5. Furthermore, the fact that flow

variations in excess of several hundredfold have occurred in the past in the Savannah River, and fish species persist in the river, supports the premise that fish are preadapted to tolerate wide variations in river flow. For the reasons discussed above and in my direct testimony, I do not believe that additional data or analysis in the FEIS is necessary to support the conclusion that the fish are able to tolerate variations in flow resulting from the operation of two additional units at the VEGP site.

## IV. Flow Considerations and Water Withdrawals

Q18. Dr. Young states that the "FEIS fails to consider a sufficient range of flows" and considers only flows of 8830 cfs, 4200 cfs, 4000 cfs, and 3800 cfs. Young EC 1.2 Testimony at A24. Is that correct?

A18. (MTM, LWV) The Staff disputes Dr. Young's assertion that the range of flows considered in the FEIS was insufficient. The range of flows considered in the draft EIS (8830 cfs to 3800 cfs) was indeed appropriate for a NEPA analysis because it reflected reasonably anticipated flow conditions, even during drought conditions. However, the Staff decided, based on comments to the DEIS associated with the ongoing drought, to include two lower flows (3000 cfs and 2000 cfs) in the final EIS to provide additional conservative context. Exhibit NRC000001 at 5-9. Thus, contrary to Dr. Young's claim, the Staff considered a sufficient range of flows in the FEIS, including flows lower than 3800 cfs. For example, the Staff evaluated impingement and entrainment losses at the Savannah River under average-daily and Drought Level 3 flow conditions (*Id.* at 5-30 and 5-31) and at very-low flows of 3000 cfs and 2000 cfs. *Id.* at 5-38 and 7-24 and 7-25. The Staff's direct testimony described how the Staff evaluated impacts to aquatic biota at a variety of streamflows including the average-daily discharge (8830 cfs), Drought Level 3 (3800 cfs), 3000 cfs and 2000 cfs. Staff EC 1.2 Direct Testimony at A38, A41, A45, A48, A50, A59, and A60.

Q19. Dr. Young asserts that "the level is below Drought Level 3, the lowest level considered" and that "the area is experiencing extreme drought conditions not contemplated by the FEIS." Young EC 1.2 Testimony at A24. Is that correct?

A19. (LWV) No. The Savannah River Basin has drifted between Drought Level 2 and Drought Level 3 for the past few months. The Savannah River Basin has never reached Drought Level 4. The Staff determined that it was appropriate to base its NEPA analysis of impacts of operation under low flow conditions on Drought Level 3, which has never been exceeded. In any event, as explained above in response to Question 18, the flows under the current drought conditions are still bounded by the flows of 3000 cfs and 2000 cfs analyzed in the FEIS.

Q20. Mr. Sulkin also asserts that "actual Savannah River discharge has consistently been below 3,800 cfs since November 2007, and was recently reduced to 3,100 cfs." Sulkin EC 1.2 Testimony at A14. In Exhibit JTI000021, he also lists "3100 cfs" as "Current Flow." Do you know what Mr. Sulkin means by "actual Savannah River discharge"?

A20. (LWV) Mr. Sulkin appears to be referring to flows at Thurmond Dam. However, as the Staff explains in its direct testimony, while the Staff used Thurmond Dam releases in the FEIS as a method of estimating flows at the site, tributaries and groundwater do contribute to the Savannah River between Thurmond Dam and VEGP site. Staff EC 1.2 Direct Testimony at A37. The Staff's direct testimony presented recent flow data from the gauge at Waynesboro, GA that indicated flows past the site were consistently higher than the releases at the Dam. Exhibit NRC000041. The relationship between the Waynesboro gauge flows and the Thurmond Dam releases is also illustrated in the graph presented as Exhibit NRC000026. Therefore, the Staff believes its analysis in the FEIS using a streamflow of 3800 cfs for low flow conditions is appropriate and thereby provides conservative estimates of what fractional withdrawals and consumptive use of the Savannah River flows will be at the VEGP site. In any event, as

explained previously, the flows under the current drought conditions would be bounded by the flows of 3000 cfs and 2000 cfs analyzed in the FEIS.

Q21. Dr. Young also states that the "FEIS fails to consider a sufficient range of flows in its analysis of water intake percentages and their affect [sic] on entrainment and impingement[.]" Young EC 1.2 Testimony at A21. Dr. Young asserts that the FEIS "lacks sufficient analysis of entrainment and impingement during low flows, even though low flows are reasonably likely to occur" and that the FEIS "should, at the very least, include analysis of flows ranging from normal to Drought Level 4." *Id.* Did the Staff analysis of impingement and entrainment include consideration of flows lower than 3800 cfs, and does the Staff disagree that the analysis should include Drought Level 4 flows?

A21. (MTM) Yes. As explained in A18 above, the Staff considered a range of flows in its assessment of impacts due to impingement and entrainment. The Staff evaluated impingement and entrainment losses at the Savannah River under average and Drought Level 3 flow conditions (Exhibit NRC000001 at 5-30, 5-31) and at very-low flows of 2000 cfs and 3000 cfs. *Id.* at 5-38, 7-24 and 7-25. The Staff's direct testimony described how the Staff evaluated impacts to aquatic biota at a variety of river flows, including the average-daily discharge flow (8830 cfs), Drought Level 3 (3800 cfs), and very-low flows of 3000 cfs and 2000 cfs. Staff EC 1.2 Direct Testimony at A38, A41, A45, A48, A50, A59, and A60. The Staff also described how it evaluated the changes in flows related to the cooling system operation associated with changes between Revision 15 and Revision 16 of the AP1000 DCD. *Id.* at A62.

With respect to evaluating impacts to aquatic biota at Drought Level 4, the Staff determined that without explicit flow levels (and given the likelihood that any such flow levels would likely change based on the ongoing development of the Draft Drought Contingency Plan) and because Drought Level 4 would be an extremely rare event, it was still conservative to base its low-flow analysis in the FEIS on Drought Level 3 flows (3800 cfs). Exhibit NRC000001 at

E-44; Staff EC 1.2 Direct Testimony at A38. Therefore, the Staff did not assess the impact to aquatic biota at Drought Level 4.

Q22. In his testimony, Mr. Sulkin calculates "withdrawal and consumption use rates" using a range of flows including 957 cfs, which he defines as "Drought Level 4, the hypothetical unimpaired minimum flow if there were no dams or reservoirs[.]" Sulkin EC 1.2 Testimony at A15. He mentions that this value was reported in NUREG-1437, Supplement 34, in connection with the renewal of the Vogtle Units 1 and 2 licenses. *Id.* at A16. Would it be reasonable to analyze a "hypothetical minimum" 957 cfs flow rate as part of the Staff's analysis in the FEIS?

A22. (LWV, CBC) No. The 957 cfs flow value mentioned in the license renewal FSEIS was described as "the hypothetical minimum flow during the most extreme drought[.]" Exhibit JTI000022 at 4-13. Such extreme conditions are considered as part of the safety analysis for the site, but not as a representative scenario for an environmental analysis. (Low river water is not a safety consideration for the proposed ESP units because the AP1000 design relies on a passive cooling design.) Safety analyses rely on extremely conservative bases, rather than on representative conditions. Such extreme design bases for safety reviews are not appropriate for a NEPA review.

Q23. Mr. Sulkin states that 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." Sulkin EC 1.2 Testimony at A25. Did the FEIS identify flow percentages for the relevant range of uses (e.g., the likely water withdrawals of the four Vogtle Units) and flows?

A23. (LWV) The FEIS did calculate flow percentages consistently for the range of conditions that the Staff considered to be representative of likely flow conditions and likely operating conditions. The Staff does not believe that 2,000 cfs is a representative flow condition. The Staff included some lower flows (3000 cfs and 2000 cfs) in the FEIS in response

to comments to the DEIS associated with the drought. However, particularly in light of the data confirming that there is generally net inflow between the Thurmond Dam and the VEGP site, the Staff believes that 3800 cfs is representative of low flow conditions in the Savannah River at the VEGP site. *See* Exhibit NRC000041; Staff EC 1.2 Direct Testimony at A35 to A37. As mentioned in A22, the 957 cfs flow value that Mr. Sulkin listed in JTI000021 is entirely inappropriate for a NEPA analysis, as it represents a worst-case scenario. Mr. Sulkin also refers to 3100 cfs as the current flow in JTI000021. As the Staff explained above in A20, Mr. Sulkin appears to be referring to the current release from Thurmond Dam; while the Staff has used this methodology, the flows currently being measured at the VEGP site indicate that use of the Dam flows is a conservative approach. Finally, with respect to the operating conditions that are appropriate to consider in assessing the cumulative withdrawals for all four Vogtle Units, as described in A4, the Staff has revised its estimates of the Unit 1 and 2 contribution to cumulative withdrawals based on the Joint Intervenors' testimony. However, in doing so the Staff explained why it is still not appropriate to assume maximum withdrawals by all four units as a basis for determining cumulative impacts.

Q24. Mr. Sulkin also argues that the Staff consideration of withdrawal percentages "does not capture the time dimension – the frequency of extremely low flows and their duration." Sulkin EC 1.2 Testimony at A25. Is it necessary for the FEIS to specify the likely frequency and duration of extremely low flows?

A24. (LWV) No. The Staff determined the impacts under steady low flow conditions (3800 cfs) to be SMALL. As the Staff mentions in its direct testimony, the streamflow values used in the FEIS assumed releases at Thurmond Dam, but flows are likely to be higher at the VEGP site as a result of runoff between Thurmond Dam and the VEGP site and, therefore, withdrawals from the proposed Vogtle units would result in even smaller impacts than those analyzed for 3800 cfs. Staff EC 1.2 Direct Testimony at A37. Furthermore, in response to

comments on the DEIS associated with the ongoing drought, the Staff provided additional conservative context by considering flows of 3000 and 2000 cfs. While droughts may exist over extended periods of time, the Staff still does not believe that flows of 3000 cfs and 2000 cfs are representative of anticipated drought conditions, whereas 3800 cfs is a better representation of such conditions. The Staff thus did not consider it necessary to elaborate on the expected frequency of flow departures from this conservative condition. However, in the unlikely event that 3000 cfs or 2000 cfs flows were to ever occur at the VEGP site, the Staff believes that such flows would be of short duration.

Q25. Mr. Sulkin describes water withdrawals using primarily Revision 16 to the AP1000 Design Control Document (DCD). Sulkin EC 1.2 Testimony at A17 to A20; Exhibit JTI000021. In the FEIS, did the Staff describe changes in water use percentages associated with the differences between Revision 15 and Revision 16?

A25. (LWV) Yes. The Staff discussed the differences between Revision 15 and Revision 16 of the DCD in the FEIS. Exhibit NRC000001 at 5-10, 7-6, 7-7, 7-10, 7-12 and 7 Errata. The Staff also presents values for the differences between Revision 15 and Revision 16 based on the revised water withdrawal estimates for Units 1 and 2 described in A4 of this testimony. Similarly, as Mr. Sulkin points out in his testimony regarding his independent assessment, there is little difference in withdrawal percentages associated with the differences between Revision 15 and Revision 16 of the AP1000 DCD. Sulkin EC 1.2 Testimony at A19.

Q26. Mr. Sulkin asserts that "[t]here is no scientific or regulatory basis for setting the threshold of significance for withdrawals at 5% of the total flow." Sulkin EC 1.2 Testimony at A11. Did the Staff set or rely on a 5% "threshold of significance" for water withdrawals in reaching its conclusions with respect to entrainment in the FEIS?

A26. (MTM) The Staff did not use the phrase "threshold of significance" in its analysis in either the DEIS or the FEIS. The phrase appears in the FEIS in a comment by the Georgia

Water Coalition on the DEIS. Exhibit NRC000001 at E-33. The Staff does not believe that there is a threshold of significance with respect to impact to the fishery related to water withdrawals in excess of the five percent limit required by 40 CFR § 125.84(b)(3)(i). The Staff did consider the proportional flow requirements of the EPA's Phase I regulations. Exhibit NRC000001 at 5-30; Staff EC 1.2 Direct Testimony at A28. In the Staff's direct testimony, the Staff specifically stated that "the Staff considered the US EPA requirements implementing section 316(b) of the Federal Water Pollution Control Act...," which include the five percent annual mean flow withdrawal requirement for intake structures located in freshwater rivers and streams. Staff EC 1.2 Direct Testimony at A14. The Staff's conclusion regarding the level of impact related to entrainment losses is based on an evaluation of several factors, including the design, location, and planned operation of the intake structure; the site location and the uniqueness of the habitat in the vicinity of the site; the site hydrology; the applicable life history data for "important species"; and nearby past and recent field studies. Staff EC 1.2 Direct Testimony at A28; Exhibit NRC000001 at 5-30 to 5-33. The Staff's conclusions are not based solely on whether or not the intake would in fact meet the EPA requirements. *See* Exhibit NRC000001 at 5-30 to 5-33. In the FEIS, the Staff was merely pointing out that EPA had established these requirements and that the intake structure for the new Vogtle units will likely be consistent with the requirements. Exhibit NRC000001 at 5-30; Staff EC 1.2 Direct Testimony at A28. Presumably, the EPA regulations are protective of the aquatic environment.

Although the Staff did not rely on the EPA requirement to arrive at the level of significance for entrainment impacts at Vogtle, some background on how the EPA arrived at the five percent value is helpful. In the EPA's description of the basis for the requirement that a facility located on a freshwater stream or river withdraw no more than five percent of the annual mean flow, EPA makes the argument that the scientific literature and its rulemaking record "contain[s] ample evidence to support the proposition that reducing flow and capacity reduces

impingement and entrainment." Exhibit NRCR00035 at 65,300. EPA further states that "[t]he 5 percent value mean annual flow [sic] reflects an estimate that this would entrain approximately 5 percent of the river or stream's organisms and a policy judgment that such a degree of entrainment reflects an inappropriately located facility." Exhibit NRCR00035 at 65,301. The proposed rule for new facilities published in the Federal Register on August 10, 2000, provides additional insight into why the EPA chose five percent of the annual mean flow as the limit for withdrawals from rivers and streams. 65 Fed. Reg. 49,060 (Exhibit NRC000055). In the supplemental information to the proposed Phase I rule, EPA states that

> The five percent requirement would establish a maximum level for entrainment effects that, in all areas within 50 meters of the littoral zone, would be further reduced by additional requirements (such as requirements to reduce cooling water withdrawals, and additional design and construction technologies to further reduce impingement and entrainment). EPA estimates that the combination of these requirements (and the design intake velocity limitation for reducing impingement in almost all waterbody types) should result in protection of greater than 99 percent of the aquatic community from impingement and entrainment.

Exhibit NRC000055 at 49,085. EPA states that the combination of requirements "provide[s] the minimum level of protection for designated uses that reflect the goals in section 101(a) of the CWA, i.e. 'protection and propagation of fish and shellfish and wildlife and recreation in and on the water.'" *Id.* The Staff believes that EPA in its rulemaking was not establishing a uniform threshold at which the significance level of impacts changes from SMALL to MODERATE or LARGE, but rather was defining the combination of requirements, including limiting the withdrawal rate from rivers and streams, that will provide adequate protection to aquatic biota inhabiting the waterbody.

In any event, as stated above, the Staff did not rely on the 5 percent requirement to conclude that the impact of entrainment on the Savannah River fishery would be SMALL. The Staff's analysis is presented in section 5.4.2.2 of the FEIS and section II.C of the Staff's direct testimony. Exhibit NRC000001 at 5-30 to 5-33; Staff EC 1.2 Direct Testimony. The Staff's

testimony stated that the normal water withdrawal of the two proposed units would be approximately 1.2 percent of the annual mean flow, which was conservatively derived from the Waynesboro, GA gauge using a limited record during an extended drought. Staff EC1.2 Direct Testimony at A43. Therefore, assuming entrainment losses are proportional to withdrawal rate (see A12 above) and that the five percent value established by EPA in concert with other requirements would result in protection of greater than 99 percent of the aquatic community, then a withdrawal rate of 1.2 percent, approximately a four-fold decrease in EPA's proportional flow withdrawal requirement, would result in even less entrainment mortality. This conclusion is consistent with the Staff's testimony and the FEIS.

Q27. Mr. Sulkin states that the "FEIS obscures the fact that several scenarios result in withdrawals that exceed the 5% threshold of significance." Sulkin EC 1.2 Testimony at A11. He also asserts that the presentation of the Staff's calculations in the FEIS is problematic. *Id.* at A14. Did the FEIS identify circumstances under which withdrawals would exceed 5% of the river flow? Please explain the Staff's approach, including how it presented the flows and associated withdrawals in the FEIS.

A27. (LWV) The Staff intentionally limited the values listed in the tables of the FEIS to the range of flows (mean annual flow of 8830 cfs to Drought Level 3 of 3800 cfs) that Staff considered representative of likely conditions consistent with the objectives of NEPA analysis. Exhibit NRC000001 at 5-9. Based on comments to the DEIS, the Staff added additional text to describe impacts at lower flows, flows that the Staff nevertheless considers unrepresentative of future flow conditions. The Staff did not include the values in the FEIS tables (3000 cfs and 2000 cfs) because the Staff believes they are not representative of likely conditions. The Staff did not obscure this information but instead provided additional context for the reader beyond what the Staff believes is necessary under NEPA. The Staff explicitly acknowledges that withdrawal percentages in excess of 5% can occur at low flows and high withdrawals. However,

as discussed further in A26 above, the Staff does not make its impact determination based solely on the 5% criteria and the Staff believes these conditions are overly conservative for highlighting in a NEPA analysis.

Q28. Mr. Sulkin states that the "5% threshold is not compelled by any statute or regulation." Sulkin EC 1.2 Testimony at A12. Is this assertion consistent with the Staff's understanding of the 5 percent withdrawal requirement as set forth in 40 CFR 125.84? In light of Mr. Sulkin's assertions, please explain under what conditions the 5 percent withdrawal requirement applies and whether the FEIS properly considered it.

A28. (MTM) The Staff believes that the 5 percent withdrawal requirement is compelled by EPA regulations at 40 CFR § 125.84(b)(3)(i). As stated in the Staff's direct testimony, the EPA established national technology-based performance requirements in its December 18, 2001 rulemaking. Exhibit NRCR00035 at 65,256; Staff EC 1.2 Direct Testimony at A22. EPA's regulations at 40 CFR 125.84(b)(3)(i) state "[f]or cooling water intake structures located in a freshwater river or stream, the total design intake flow must be no greater than five (5) percent of the source water annual mean flow;...". The 5 percent withdrawal requirement applies to owners or operators of a new facility that have withdrawals of equal to or greater than 10 million gallons per day ("MGD"). As stated in Staff testimony, the proposed VEGP Units 3 and 4 would withdraw approximately 54 MGD. Staff EC 1.2 Direct Testimony at A22.

In response A26 above, the Staff stated that it based its conclusion regarding the level of impact related to entrainment losses on an assessment of impact, not on whether or not the design, location and proposed operation of the intake met the EPA requirements. *See also* Exhibit NRC000001 at 5-30 to 5-33. The Staff in the FEIS and its testimony merely was pointing out that the intake structure for the new Vogtle units will likely be consistent with the EPA regulations and that the EPA regulations were presumably protective of the aquatic environment. *Id.*; Staff EC 1.2 Direct Testimony at A22.

Q29. Mr. Sulkin states that with respect to the 5 percent proportional withdrawal requirement, the Staff failed to assess the condition in which 1) all four reactors are operating in their maximum capacity mode and 2) one or more of the reactors is operating in the maximum water withdrawal mode while the remainder are in normal mode. Sulkin EC 1.2 Testimony at A21. Does the Staff agree that the scenarios raised by Mr. Sulkin must be considered in the Staff's environmental analysis?

A29. (MTM) In its direct testimony, the Staff stated that "[n]ormal withdrawals are most representative of the combined flows of all four units operating. Because maximum withdrawal[s] are rare, it is unlikely that maximum withdrawal rates would occur at more than one unit at any time. Maximum withdrawals (and maximum blowdowns) are primarily associated with activities to control the water chemistry in the cooling tower and are not associated with changes in consumptive water use. Furthermore, such periods are partially offset by periods when one of the units is experiencing an outage." Staff EC 1.2 Direct Testimony at A51. Therefore, the Staff concluded that it was unreasonable to assess cumulative impact to aquatic biota under the conditions of all four VEGP units operating simultaneously at their maximum withdrawal rates.

The Staff acknowledges that there could be periods in which one or more units are withdrawing at or near their maximum rates. However, as described in response to Question 4 above, such conditions would be infrequent and of short duration. As explained further in A4, the Staff has reconsidered the withdrawal rates for Units 1 and 2 for its cumulative impacts analysis and determined that using higher withdrawal rates for Units 1 and 2 (104 cfs) in its assessment of cumulative impact would be more appropriate. Nevertheless, the Staff evaluated that change in the Units 1 and 2 withdrawal value and, because it resulted in only a small change in the total percentage of water withdrawn, concluded that the change was not

significant for its impact conclusions. The Staff also noted that withdrawals would still meet the EPA 5% withdrawal requirement (see A4 above), even assuming higher withdrawals from the two existing (136 cfs) and two proposed (129 cfs) Units and assuming a conservative annual mean flow (6691 cfs). Furthermore, as explained in response to Question 6 above, the station water withdrawal rate from the river is only one of several factors taken into consideration by the staff in assessing impact. The Staff concludes that the impact due to entrainment on the Savannah River fishery, even with infrequent and temporary use of maximum pumping rates by the Vogtle units, would have no detectable effect on fish populations inhabiting the river.

Q30. Mr. Sulkin asserts that "short term maximum withdrawal conditions can result in significant cumulative impacts on water resources and aquatic species." Sulkin EC 1.2 Testimony at A21. Is the Staff aware of the basis for this statement?

A30. (MTM) The Sulkin testimony offers no explanation of the assertion that short term maximum withdrawal conditions can result in significant cumulative impacts on water resources and aquatic effects. The Staff acknowledges that increasing the withdrawal rate for one or more units could result in some increased mortality to aquatic organisms but, as explained in the response to Q29 above, such maximum withdrawals would be infrequent and would be of short duration. Therefore, the Staff believes that such transients would have no lasting effect on aquatic populations inhabiting the Savannah River.

## V. Thermal Impacts

Q31. Dr. Young states that reduced river flow "places more of the drift community at danger of thermal impacts due to river channel confinement" and that low flow reduces "the ability for the heat to be dissipated across time and space." Young EC 1.2 Testimony at A26. Does the Staff's analysis in the FEIS account for these considerations?

A31. (ARK) Yes. The Staff's direct testimony and Section 5.4.1.4 of the FEIS discuss the relationship between river flow and habitat availability in the Savannah River. Staff EC 1.2 Direct Testimony at A14; Exhibit NRC000001 at 5-25, 5-26. The Staff considered the flow-habitat relationship and its potential to affect the availability of suitable habitat, specifically the potential impact to aquatic organisms due to the reduction in flow resulting from the consumptive use of the river water. The Staff determined the reduction in river stage would be negligible, even at river flow rates of 3000 cfs and 2000 cfs, and any impacts to downstream shoreline habitat would result principally from the extremely low river flows, not the consumptive use. Exhibit NRC000001 at 5-25, 5-26.

A59 and A60 of the Staff's direct testimony discuss thermal impacts to aquatic resources from VEGP Units 3 and 4 operations under Drought Level 3 (3800 cfs) and very-low (less than 3800 cfs) river flows, respectively. Staff EC 1.2 Direct Testimony at A59, A60. The Staff concluded that due to the small plume size and resultant short duration of plume transit, only a small percentage of fish eggs and larvae would be lost, resulting in minor and undetectable impact to fish populations. *Id.* At a very-low river flow of 2000 cfs, the mixing zone plume would approximately double in areal extent; however, the lateral extent of plume relative to river width at these flow rates would still be small. *Id.* at A58. The Staff determined that even a doubling in its area would not represent a significant impact to water quality in the river. Exhibit NRC000001 at Errata 7. The Staff believes the very-low flow conditions would be rare and of only temporary duration, and unlikely to occur during the spring and early summer spawning period. In the FEIS the Staff reviewed the potential for thermal impacts to the aquatic environment in the vicinity of the VEGP site and concluded that impacts to aquatic organisms from thermal discharges from the proposed VEGP Units 3 and 4 would be minor. *Id.* at 5-34.

Q32. Dr. Young states that "[t]he FEIS fails to consider *all possible* river conditions and rather, focuses on *conservative* river conditions. The FEIS lacks analysis under elevated

temperatures." Young EC 1.2 Testimony at A27 (emphasis added). Is it necessary to consider "all possible" river conditions when evaluating thermal stress at the VEGP site?

A32. (ARK, LWV) No, it is not necessary to consider "all possible" river conditions when evaluating thermal stress at the VEGP site, particularly when the Staff's initial analysis, developed with conservative inputs, resulted in a thermal plume with a very small areal extent. The Staff examined an appropriate range of variable effluent and river discharge conditions considering the VEGP location (deep river channel with steep banks). For a bounding analysis with the largest plume (5°F above ambient isotherm), the Staff employed conservative inputs for key parameters for the CORMIX assessment considering a Drought Level 3 flow of 3800 cfs. This analysis is explained in Staff EC 1.2 Direct Testimony at A57; the resulting plume length and width were 97 ft and 15 ft, respectively. Exhibit NRC000001 at 5-18. Note that the largest plume, assuming fixed river and effluent discharge rates, occurs when the temperature difference is the greatest between the ambient river and the discharging effluent. Therefore, the maximum temperature difference occurs when the ambient river temperature is at a minimum (e.g. mid-winter). *Id.* Thus, as the ambient river temperature increases, the plume size decreases.

For additional conservatism, the Staff considered thermal impacts under flows of 3000 and 2000 cfs and analyzed how the thermal plume and associated impacts would change under such very-low flows. Staff EC 1.2 Direct Testimony at A58; Exhibit NRC000001 at Errata 7. As stated in the FEIS, the plume at 2000 cfs would be approximately twice the areal extent of the plume at 3800 cfs. Exhibit NRC000001 at Errata 7.

In its direct testimony, the Staff describes how it followed guidance in ESRP Section 5.3.2.2 directing its description, quantification, and assessment of potential thermal stresses to aquatic organisms (A54), what information it used to make its conclusions regarding thermal impacts (A55), and why it was not necessary to include thermal tolerance data on various

species and their life stages to predict thermal impacts (A56). Staff EC 1.2 Direct Testimony at A54, A55, and A56.

The Staff's direct testimony details how the Staff evaluated thermal impacts to aquatic biota at Drought Level 3 (3800 cfs) (A59) and at very-low river flows, namely down to 2000 cfs (A60). Staff EC 1.2 Direct Testimony at A59, A60. The FEIS concluded that impacts to the aquatic ecosystem from the thermal discharge from the proposed VEGP Units 3 and 4 are likely to be minor based upon the size of the thermal plume relative to the size of the Savannah River at the Drought Level 3 flow of 3800 cfs. Exhibit NRC000001 at 5-38. The Staff also concluded that given the small size of the plume at Drought Level 3, even doubling the area under the very-low flow conditions would not represent a significant impact to water quality in the river. Staff EC 1.2 Direct Testimony at A60; Exhibit NRC000001 at Errata 7. The FEIS stated that "the effects on aquatic biota in the river from the thermal ... discharges from VEGP Units 3 and 4 at the 3000 and 2000 cfs river flow rates, even at maximum withdrawal rates, would not result in impacts to aquatic biota that are significantly different from those analyzed for VEGP operation at Drought Level 3." Exhibit NRC000001 at 5-39.

Because the conservative and cumulative conditions evaluated by the Staff resulted in such a small plume, it was not necessary to look at a wider range of conditions in order to be able to make a reasonable determination of thermal impacts. The Staff's conclusion that impacts to the aquatic ecosystem from the thermal discharge would be minor is also confirmed by the National Marine Fisheries Service's (NMFS) response to the Staff's January 2008 Biological Assessment, which was received after publication of the FEIS. Exhibit SNC000022. The NMFS stated that "[t]he potential effect from thermal discharge will be insignificant[.]" *Id.* at 4.

Q33. Dr. Young states that "[t]he FEIS does not provide sufficient data and analysis of thermal stress and mortality for the fish species located in the Middle, Lower, and estuarine

Savannah River." Young EC 1.2 Testimony at A27. Dr. Young also states that "[h]igh water temperature kills the early life history stages of several highly-valued fish found near VEGP, and most likely also causes mortality in many less-studied and less-desired Savannah River fish species"; he presents examples of several fish species that he says "suffer mortality" at particular temperatures, and he describes effects of water temperature changes on early stages of striped bass. *Id.* Does the Staff agree with this assessment, and does the Staff analysis in the FEIS account for the studies cited with respect to mortality of individual species?

A33. (ARK) The Staff does not agree with Dr. Young's assessment. The Staff followed the guidance provided in ESRP Section 5.3.2.2, "Aquatic Ecosystems" (2000) (Exhibit NRC000009) and considered the areal extent of the thermal plume, the effects of the thermal plume on "important" aquatic biota, as well as the current National Pollutant Discharge Elimination System (NPDES) permit for the VEGP Units 1 and 2. The Staff determined that thermal tolerance data on various species and their life stages was not necessary to predict impacts for the following reasons.

First, as described in my direct testimony and in the FEIS, the Staff considered the physical and thermal characteristics of the plume in relation to the receiving water body. Staff EC 1.2 Direct Testimony at A54. At the location of the discharge outfall, at a Drought Level 3 flow rate (3800 cfs), the Savannah River is approximately 312 feet wide, with an average depth of 8.2 feet, and a cross-sectional average velocity of 1.50 ft/s. The local water depth near the outfall, which is located near the deepest point in the cross section, is 10.0 feet. Exhibit NRC000001 at 5-17. Assuming conservative river conditions (e.g., minimum river temperatures, maximum discharge temperatures), the maximum width of the 5°F isotherm would be 15 feet while the length would be 97 feet downstream of the outfall pipe. *Id.* at 5-33. Based on these calculations, the Staff determined that the size of the thermal plume would be small (about 5% of the river cross section) in comparison to the width of the Savannah River at

the VEGP site. The Staff also considered thermal impacts at a very-low flow (2000 cfs). *Id.* at Errata 7. Under this scenario, which would be an extremely rare event, the mixing zone plume would approximately double in areal extent and would not represent a significant impact to water quality in the river. *Id.* As described in the Staff's direct testimony, such very-low flow conditions are expected to be temporary and, based on the historical record of flows since the construction of the upstream impoundments, would be more unlikely during the spring and early summer spawning period when most river-running species are moving up and down river. Staff EC 1.2 Direct Testimony at A60. Additionally, that testimony explains that should low flow rates result in an unacceptable thermal impact or should the Applicant exceed its mixing zone requirements, Southern could be directed by the State resource agencies to reduce power or cease power operations. *Id.*

Next, the Staff, in following the guidance of ESRP 5.3.2.2, considered "[i]f 'important' aquatic species are present and are susceptible to heat shock resulting from plant-cooling-system discharges to the receiving water bodies such that the effects will be detectable or may destabilize or noticeably alter population levels[.]" Exhibit NRC000009 at 5.3.2.2-6. The Staff concluded that given the small size of the plume relative to the river, the thermal plume would not create a barrier to the up- or down-stream migration of important fish species, including the robust redhorse and the shortnose sturgeon. Exhibit NRC000001 at 5-36, 5-42. And, as my colleague Dr. Masnik stated in the Staff's direct testimony, "[f]ish actively avoid areas of unhealthy water temperatures, provided there is an escape route." Staff EC 1.2 Direct Testimony at A59. The Staff acknowledges in that testimony that there may be some mortality of eggs and larvae as they pass through the plume; however, this would be only a small percentage of the total number of organisms passing the site, resulting in minor and undetectable impact to fish populations. *Id.* at A56, A59. In addition, due to the short transit

time within the plume due to the small area it encompasses, there would be some survival of eggs and larvae, thereby reducing the thermal impact to fish populations. *Id.* at A59.

The Staff concluded that since the areal extent of the thermal plume would be so small and the transit time through the plume would be so short, fish populations would remain stable even if some eggs and larvae would be affected by the thermal plume. *Id.* at A56. The Staff determined that cooling-system discharge impacts on aquatic biota from the proposed VEGP Units 3 and 4 would be minor. Exhibit NRC000001 at 5-34. Therefore, in accordance with the ESRP guidance and based upon the Staff's analysis of cooling-system discharge impacts, the Staff determined that a review of additional thermal tolerance and mortality data for various fish species and their life stages in the Middle, Lower, and estuarine Savannah River was not necessary to predict thermal impacts. Staff EC 1.2 Direct Testimony at A56.

Finally, as my colleague Dr. Masnik explained in the Staff's direct testimony, VEGP Units 1 and 2 are in compliance with the current NPDES permit (GA0026786) issued by the State of Georgia, and the Staff anticipates that Units 3 and 4 would also comply with State requirements. *Id.* at A61. Additionally, the FEIS states there have been no fish kills related to the thermal discharge reported from the site. Exhibit NRC000001 at 2-93, 5-33.

For these reasons, the Staff's analysis in the FEIS already appropriately accounts for the temperature effects on individual species.

Q34. Dr. Young asserts that the FEIS does not provide a comprehensive analysis of potential thermal impacts on vulnerable life history stages of fish species. Young EC 1.2 Testimony at A28. He argues that "[f]ish thermal tolerance and mobility changes across life history stages," that "[e]ggs have no mobility and reduced thermal tolerance during embryonic development," and that the FEIS does not present "data detailing spatial distribution of ichthyoplankton drift in the vicinity of the thermal plume[.]" *Id.* Does the Staff's analysis account for these concerns?

A34. (ARK) Yes, the Staff's analysis does account for the potential impacts to the vulnerable life history stages of fish species. As my colleague Ms. Krieg explained in the Staff's direct testimony, the Staff evaluated the discharge temperature, plume size as estimated by CORMIX code, design and location of discharge structure, and the width and bathymetry of the river at the discharge site. Staff EC 1.2 Direct Testimony at A55. The Staff also considered river velocity. Exhibit NRC000001 at 5-17. Following the guidance at ESRP 5.3.2.2 (Exhibit NRC000009 at 5.3.2.2-7, 5.3.2.2-8), the Staff considered the small areal extent of the thermal plume relative to the cross section of the Savannah River and the relatively short transit time of eggs and larvae within the plume. Staff EC 1.2 Direct Testimony at A56, A59. Due to these considerations, a comprehensive analysis of ichthyoplankton drift in the vicinity of the thermal plume is not warranted.

Q35. Does this conclude your testimony?

A35. (ALL) Yes.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

AFFIDAVIT OF MICHAEL T. MASNIK CONCERNING
PREFILED REBUTTAL TESTIMONY ON ENVIRONMENTAL CONTENTION 1.2

I, Michael T. Masnik, do declare under penalty of perjury that my statements in *NRC Staff Rebuttal Testimony of Dr. Michael T. Masnik, Anne R. Kuntzleman, Rebekah H. Krieg, Jill S. Caverly, and Lance W. Vail Concerning Environmental Contention EC 1.2*, are true and correct to the best of my knowledge, information, and belief.

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

_____
Michael T. Masnik

Executed at Rockville, Maryland
This 6th day of February, 2009

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

AFFIDAVIT OF ANNE R. KUNTZLEMAN CONCERNING PREFILED
REBUTTAL TESTIMONY ON ENVIRONMENTAL CONTENTIONS 1.2 AND 6.0

I, Anne R. Kuntzleman, do declare under penalty of perjury that my statements in *NRC Staff Rebuttal Testimony of Dr. Michael T. Masnik, Anne R. Kuntzleman, Rebekah H. Krieg, Jill S. Caverly, and Lance W. Vail Concerning Environmental Contention EC 1.2*, and in *NRC Staff Rebuttal Testimony of Anne R. Kuntzleman Concerning Environmental Contention EC 6.0,* are true and correct to the best of my knowledge, information, and belief.

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

_____
Anne R. Kuntzleman

Executed at Rockville, Maryland
This 6th day of February, 2009

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

AFFIDAVIT OF REBEKAH HARTY KRIEG CONCERNING
PREFILED REBUTTAL TESTIMONY ON ENVIRONMENTAL CONTENTION 1.2.

I, Rebekah Harty Krieg, do declare under penalty of perjury that my statements in *NRC Staff Rebuttal Testimony of Dr. Michael T. Masnik, Anne R. Kuntzleman, Rebekah H. Krieg, Jill S. Caverly, and Lance W. Vail Concerning Environmental Contention EC 1.2*, are true and correct to the best of my knowledge, information, and belief.

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

_____
Rebekah Harty Krieg

Executed at Richland, Washington
This 6th day of February, 2009

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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| | ) | |
| SOUTHERN NUCLEAR OPERATING CO. | ) | Docket No. 52-011-ESP |
| | ) | |
| (Early Site Permit for Vogtle ESP Site) | ) | |

AFFIDAVIT OF LANCE W. VAIL CONCERNING PREFILED
REBUTTAL TESTIMONY ON ENVIRONMENTAL CONTENTIONS 1.2 AND 1.3

I, Lance W. Vail, do declare under penalty of perjury that my statements in *NRC Staff Rebuttal Testimony of Dr. Michael T. Masnik, Anne R. Kuntzleman, Rebekah H. Krieg, Jill S. Caverly, and Lance W. Vail Concerning Environmental Contention EC 1.2*, and in *NRC Staff Rebuttal Testimony of Lance W. Vail Concerning Environmental Contention EC 1.3*, are true and correct to the best of my knowledge, information, and belief.

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

_____
Lance W. Vail

Executed at Richland, Washington
This 6th day of February, 2009

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) | ) | |

AFFIDAVIT OF DR. CHRISTOPHER B. COOK CONCERNING
PREFILED TESTIMONY ON ENVIRONMENTAL CONTENTIONS 1.2, 1.3
AND 6.0 AND REBUTTAL TESTIMONY ON ENVIRONMENTAL CONTENTION 1.2

I, Dr. Christopher B. Cook, do declare under penalty of perjury that my statements in *NRC Staff Testimony of Dr. Michael T. Masnik, Anne R. Kuntzleman, Rebekah H. Krieg, Dr. Christopher B. Cook, and Lance W. Vail Concerning Environmental Contention EC 1.2 (as corrected and refiled on February 2, 2009 and February 26, 2009)*, in *NRC Staff Testimony of Dr. Michael T. Masnik, Rebekah H. Krieg, Dr. Christopher B. Cook, and Lance W. Vail Concerning Environmental Contention EC 1.3 (as corrected and refilled on February 2, 2009 and February 26, 2009)*, in *NRC Staff Testimony of Mark D. Notich, Anne R. Kuntzleman, Rebekah H. Krieg, Dr. Christopher B. Cook, and Lance W. Vail Concerning Environmental Contention EC 6.0 (as corrected and refilled on February 2, 2009 and February 26, 2009,* and in NRC Staff Rebuttal testimony of *Dr. Michael T. Masnik, Anne R. Kuntzleman, Rebekah H. Krieg, Dr. Christopher B. Cook, and Lance W. Vail Concerning Environmental Contention EC 1.2 (as corrected and refiled on February 26, 2009*) (including to the extent it modifies my testimony in the Staff's prefiled direct testimony on EC 1.2), as well as in my attached statement of professional qualifications are true and correct to the best of my knowledge, information, and belief.

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

Christopher B. Cook

Executed at Rockville, Maryland
This 26th day of February, 2009

1 JUDGE BOLLWERK: And then I think we have
2 a series of exhibits. My suggestion would be let's
3 not go ahead and -- I take it that is the rebuttal
4 testimony. They saw both the direct and the rebuttal,
5 right?
6 MR. MOULDING: Yes, your Honor, I believe
7 so.
8 JUDGE BOLLWERK: We have a series of
9 exhibits and why don't you go ahead and just -- rather
10 than having the problem we had before, why don't you
11 go ahead and just identify them for the record, each
12 one individually, and we'll identify each one and then
13 we'll go ahead and admit them?
14 MR. MOULDING: Your Honor, would you like
15 me to do them just in numerical order or by witness?
16 JUDGE BOLLWERK: No go ahead and do them
17 in numerical order. I think that makes the most sense
18 at this point.
19 MR. MOULDING: Okay, Exhibit NRC000002.
20 Would you like each one to be brought up on the
21 screen?
22 JUDGE BOLLWERK: No, we'll just go ahead
23 and move through them.
24 MR. MOULDING: Okay, which is entitled
25 Academy of Natural -- which is from the Academy of

1 Natural Science in Philadelphia entitled "2000
2 Savannah River Biological Survey for Westinghouse
3 Savannah River Company, That's NRC000002.
4 (The document referred to was
5 marked as NRC Exhibit Number
6 NRC000002 for identification.)
7 JUDGE BOLLWERK: All right, then, NRC
8 Exhibit 000002 is identified for the record.
9 MR. MOULDING: NRC Exhibit NRC000003 which
10 is entitled 2001 Savannah River Biological Survey for
11 Westinghouse Savannah River Company also from the
12 Academy of Natural Sciences of Philadelphia.
13 (The document referred to was
14 marked as NRC Exhibit Number
15 NRC000003 for identification.)
16 JUDGE BOLLWERK: All right, Exhibit Number
17 NRC000003 is identified for the record.
18 MR. MOULDING: Exhibit NRC000004 also from
19 the Academy of Natural Sciences of Philadelphia
20 entitled 2003 Savannah River Biological Surveys for
21 Westinghouse Savannah River Company.
22 (The document referred to was
23 marked as NRC Exhibit Number
24 NRC000004 for identification.)
25 JUDGE BOLLWERK: All right, Exhibit Number

1 000004 has been identified for the record.

2 MR. MOULDING: Exhibit NRC000005 entitled

3 Fresh Water Mussels Surveys, the Savannah River from

4 Augusta to Savannah, South Carolina and Georgia, by

5 the Catena Group.

6 (The document referred to was

7 marked as NRC Exhibit Number

8 NRC000005 for identification.)

9 JUDGE BOLLWERK: All right, the record

10 should reflect that NRC Exhibit 000005 has been

11 identified for the record.

12 MR. MOULDING: Exhibit NRC000006 which is

13 excerpts from Fishes of the Middle Savannah River

14 Basin by Marcy, et al.

15 (The document referred to was

16 marked as NRC Exhibit Number

17 NRC000006 for identification.)

18 JUDGE BOLLWERK: All right, the record

19 should reflect that NRC Exhibit 000006 has been

20 identified.

21 MR. MOULDING: Exhibit NRC000007 which is

22 excerpts from Regulatory Guide 4.2, Revision 2,

23 entitled "Preparation of Environmental Reports for

24 Nuclear Power Stations".

25 (The document referred to was

1 marked as NRC Exhibit Number
2 NRC000007 for identification.)
3 JUDGE BOLLWERK: The record should reflect
4 that NRC000007 has been identified for the record.
5 MR. MOULDING: Exhibit NRC000008 which is
6 entitled Regulatory Guide 4.7, Revision 2, General
7 Site Suitability Criteria for Nuclear Power Stations.
8 (The document referred to was
9 marked as NRC Exhibit Number
10 NRC000008 for identification.)
11 JUDGE BOLLWERK: Let the record reflect
12 NRC Exhibit 000008 has been identified.
13 MR. MOULDING: Exhibit NRC000009 NUREG
14 1555, Standard Review Plans for Environmental Reviews
15 for Nuclear Power Plants from the year 2000.
16 (The document referred to was
17 marked as NRC Exhibit Number
18 NRC000009 for identification.)
19 JUDGE BOLLWERK: Let the record reflect
20 Exhibit NRC -- there's an R in there, isn't there,
21 NRCR00009?
22 MR. MOULDING: It has been revised but I'm
23 not sure if that is reflected on the exhibit. It was
24 resubmitted.
25 JUDGE BOLLWERK: Okay, that's the number

1 we have, so we'll identify NRC Exhibit NRCR00009 for
2 the record.
3 MR. MOULDING: And I should indicate that
4 these are selected sections of the Environmental
5 Standard Review Plan, not the document in its
6 entirety.
7 JUDGE BOLLWERK: All right.
8 MR. MOULDING: Exhibit NRC000010 NUREG
9 1555, Standard Review Plans for Environmental Reviews
10 for Nuclear Power Plants draft Revision 1, published
11 in 2007 again, selected sections of that document.
12 (The document referred to was
13 marked as NRC Exhibit Number
14 NRC000010 for identification.)
15 JUDGE BOLLWERK: All right, let the record
16 reflect that NRC Exhibit 000010 has been identified
17 for the record.
18 MR. MOULDING: Exhibit NRC000011 excerpts
19 from Specht 1987 Comprehensive Cooling Water Study
20 Final Report, Volume 5, Aquatic Ecology.
21 (The document referred to was
22 marked as NRC Exhibit Number
23 NRC000011 for identification.)
24 JUDGE BOLLWERK: All right, the record
25 should reflect that Exhibit NRC000011 has been

1 identified for the record.

2 MR. MOULDING: Exhibit NRC000012 entitled

3 Distribution and Abundance of ichthyoplankton in the

4 Mid-Reaches of the Savannah River and selected

5 tributaries by Paller, et al., 1986.

6 (The document referred to was

7 marked as NRC Exhibit Number

8 NRC000012 for identification.)

9 JUDGE BOLLWERK: Let the record reflect

10 that NRC Exhibit 000012 has been identified for the

11 record.

12 MR. MOULDING: Exhibit NRC000013 excerpts

13 from Bennett and McFarlane, 1983, The Fishes of the

14 Savannah River Plant, National Environmental Research

15 Park.

16 (The document referred to was

17 marked as NRC Exhibit Number

18 NRC000013 for identification.)

19 JUDGE BOLLWERK: All right, let the record

20 reflect that NRC Exhibit NRC000013 has been identified

21 for the record.

22 MR. MOULDING: Exhibit NRC000014 excerpts

23 from NUREG 1087 Final Environmental Statement related

24 to the operation of Vogtle Electric Generating Plant,

25 Units 1 and 2. These are excerpts from that document.

1 (The document referred to was
2 marked as NRC Exhibit Number
3 NRC000014 for identification.)
4 JUDGE BOLLWERK: Let the record reflect
5 that NRC Exhibit 000014 has been identified for the
6 record.
7 MR. MOULDING: Exhibit NRC000015 entitled
8 The Conservation and Restoration of the Robust
9 RedHorse (moxostoma robustum), Volume 3, by Hendricks,
10 2002.
11 (The document referred to was
12 marked as NRC Exhibit Number
13 NRC000015 for identification.)
14 JUDGE BOLLWERK: The record should reflect
15 that NRC000015 has been identified for the record.
16 MR. MOULDING: Exhibit NRC000016 entitled
17 Conservation Strategy for Robust Redhorse (moxostoma
18 robustum) Environmental Laboratory, Georgia Power
19 Company for Robust Redhorse Conservation Committee
20 published by Nichols, 2003.
21 (The document referred to was
22 marked as NRC Exhibit Number
23 NRC000016 for identification.)
24 JUDGE BOLLWERK: Let the record reflect
25 that NRC Exhibit 000016 as identified by counsel has

1 been identified for the record.

2 MR. MOULDING: Exhibit NRC000017 excerpts

3 from Grabowski and Isely entitled "Seasonal and Diel

4 Movements in Habitat Use of Robust Redhorses in the

5 Lower Savannah River, Georgia and South Carolina".

6 (The document referred to was

7 marked as NRC Exhibit Number

8 NRC000017 for identification.)

9 JUDGE BOLLWERK: Let the record reflect

10 that NRC Exhibit 000017 has been identified.

11 MR. MOULDING: Exhibit NRC000018 a letter

12 from the United States Department of Commerce,

13 National Oceanographic and Atmospheric Administration,

14 National Marine Fisheries Service from Walt Wilson,

15 Fisheries Biologist, Protected Resources Division, to

16 NRC Staff dated October 24th, 2006.

17 (The document referred to was

18 marked as NRC Exhibit Number

19 NRC000018 for identification.)

20 JUDGE BOLLWERK: And the record should

21 reflect that Exhibit NRC000018 has been identified for

22 the record.

23 MR. MOULDING: I note that Exhibit NRC-

24 000019 is omitted.

25 JUDGE BOLLWERK: All right.

1 MR. MOULDING: The next exhibit is
2 NRC000020 entitled "E-mail from Jennifer Price, South
3 Carolina Department of National Resources to Rebekah
4 Krieg, Pacific Northwest National Laboratories, dated
5 July 26th, 2007.
6 (The document referred to was
7 marked as NRC Exhibit Number
8 NRC000020 for identification.)
9 JUDGE BOLLWERK: NRC Exhibit NRC000020 is
10 identified for the record.
11 MR. MOULDING: Exhibit NRC000021 entitled
12 South Carolina Rare, Threatened and Endangered Species
13 Inventory; Species found in Barnwell County.
14 (The document referred to was
15 marked as NRC Exhibit Number
16 NRC000021 for identification.)
17 JUDGE BOLLWERK: Let the record reflect
18 NRC Exhibit 000021 has been identified.
19 MR. MOULDING: Exhibit NRC000022 excerpts
20 from Collins & Smith 1997 titled "Distributions of
21 Shortnose and Atlantic Sturgeon in South Carolina.
22 (The document referred to was
23 marked as NRC Exhibit Number
24 NRC000022 for identification.)
25 JUDGE BOLLWERK: Let the record reflect

1 that NRC Exhibit 000022 has been identified.

2 MR. MOULDING: Exhibit NRC000023 excerpts

3 from Halverson, et al, 1997 titled "Savannah River

4 Site Ecology Environmental Information Document".

5 (The document referred to was

6 marked as NRC Exhibit Number

7 NRC000023 for identification.)

8 JUDGE BOLLWERK: NRC Exhibit 000023 has

9 been identified.

10 MR. MOULDING: Exhibit NRC000024 Collins &

11 Smith, 1993, entitled "Characteristics of the Adult

12 Segment of the Savannah River Population of Shortnose

13 Sturgeon".

14 (The document referred to was

15 marked as NRC Exhibit Number

16 NRC000024 for identification.)

17 JUDGE BOLLWERK: The record should reflect

18 that NRC Exhibit 000024 has been identified.

19 MR. MOULDING: Exhibit NRC000025 entitled

20 "Status Review of Atlantic Sturgeon, Acipenser

21 oxyrhincus," prepared by the Atlantic Sturgeon Status

22 Review Team for the National Marine Fisheries Service,

23 National Oceanic and Atmospheric Administration.

24 (The document referred to was

25 marked as NRC Exhibit Number

1 NRC000025 for identification.)

2 JUDGE BOLLWERK: The record should reflect

3 that Exhibit NRC000025 has been identified.

4 MR. MOULDING: Exhibit NRC000026 entitled

5 graph showing Waynesboro, Thurmond Discharge dated

6 January 22nd, -- January 22nd, 2005 through October

7 27th, 2008.

8 (The document referred to was

9 marked as NRC Exhibit Number

10 NRC000026 for identification.)

11 JUDGE BOLLWERK: NRC Exhibit 000026 has

12 been identified for the record.

13 MR. MOULDING: Exhibit NRC000027 excerpts

14 from the Freeman and Marcinek, 2006, entitled, "Fish

15 Assemblage Responses to Water Withdrawals and Water

16 Supply Reservoirs in Piedmont Streams".

17 (The document referred to was

18 marked as NRC Exhibit Number

19 NRC000027 for identification.)

20 JUDGE BOLLWERK: The record should

21 identify -- reflect, rather, that NRC Exhibit 000027

22 has been identified.

23 MR. MOULDING: Exhibit NRC000028 entitled

24 "Historic Savannah Stream Flow Graph USGS Gauge Number

25 02197000 at Augusta, Georgia from approximately 1904

1 through 2007."

2 (The document referred to was

3 marked as NRC Exhibit Number

4 NRC000028 for identification.)

5 JUDGE BOLLWERK: The record should reflect

6 that Exhibit NRC000028 has been identified.

7 MR. MOULDING: I note that what had been

8 Exhibit NRC-000029 is an exhibit submitted by the

9 Applicant and the Staff will refer -- to which the

10 staff will refer.

11 The next Exhibit is NRC000030 entitled

12 "Southern Nuclear Operating Company, Draft Interim

13 Report of Fish Impingement and Entrainment Assessment

14 at the Plant Vogtle Electric Generating Plant" dated

15 September 2008.

16 (The document referred to was

17 marked as NRC Exhibit Number

18 NRC000030 for identification.)

19 JUDGE BOLLWERK: The record should reflect

20 that Exhibit NRC000030 has been identified.

21 MR. MOULDING: Exhibit NRC000031 entitled

22 Letter from J.A. "Buzz" Miller, Senior Vice President,

23 Nuclear Development, Southern Nuclear Operating

24 Company, Incorporated, to NRC staff dated May 27th,

25 2008 with attached impingement and entrainment

1 monitoring update at plant Vogtle.

2 (The document referred to was

3 marked as NRC Exhibit Number

4 NRC000031 for identification.)

5 JUDGE BOLLWERK: The record should reflect

6 that Exhibit NRC000031 has been identified.

7 MR. MOULDING: Exhibit NRC000032 entitled

8 "Note to File Trip Report of March 7th through 9th,

9 2007, Tour of VEGP Units 1 and 2".

10 (The document referred to was

11 marked as NRC Exhibit Number

12 NRC000032 for identification.)

13 JUDGE BOLLWERK: And the record should

14 reflect that NRC Exhibit 000032 has been identified.

15 MR. MOULDING: Exhibit NRC000033 entitled,

16 "Note to File, Trip Report of October 14th, 2008.

17 (The document referred to was

18 marked as NRC Exhibit Number

19 NRC000033 for identification.)

20 JUDGE BOLLWERK: NRC Exhibit 000033 has

21 been identified for the record.

22 MR. MOULDING: Exhibit NRC000034 entitled

23 Paller 1992, The Influence of Savannah River

24 Discharge and Changing Savannah River Site Cooling

25 Water Requirements on the Potential Entrainment of

1 Ichthyoplankton at the SRS Savannah River Intakes".
2 (The document referred to was
3 marked as NRC Exhibit Number
4 NRC000034 for identification.)
5 JUDGE BOLLWERK: The record should reflect
6 that NRC Exhibit 000034 has been identified.
7 MR. MOULDING: Exhibit NRCR00035 titled
8 "Excerpts from US Environmental Protection Agency
9 Rulemaking National Pollutant Discharge Elimination
10 System Regulations Addressing Cooling Water Intake
11 Structures for New Facilities", dated December 18th,
12 2001.
13 (The document referred to was
14 marked as NRC Exhibit Number
15 NRCR00035 for identification.)
16 JUDGE BOLLWERK: The record should reflect
17 the identification of NRC Exhibit R00035.
18 MR. MOULDING: Exhibit NRC000036 McFarlane
19 et al, 1978 entitled, "Impingement and Entrainment of
20 Fishes at the Savannah River Plant. An NPDES 316B
21 Demonstration.
22 (The document referred to was
23 marked as NRC Exhibit Number
24 NRC000036 for identification.)
25 JUDGE BOLLWERK: The record should reflect

1 that NRC Exhibit 000036 has been identified.

2 MR. MOULDING: Exhibit NRC000037 entitled

3 "Excerpts from NUREG-1437 Volume 1 and 2, Generic

4 Environmental Impact Statement for License Renewal of

5 Nuclear Plants Main Report, Final Report dated 1996.

6 (The document referred to was

7 marked as NRC Exhibit Number

8 NRC000037 for identification.)

9 JUDGE BOLLWERK: The record should reflect

10 that NRC Exhibit 000037 has been identified.

11 MR. MOULDING: Exhibit NRC000038 and it's

12 entitled, "Drought Contingency Plan Update Savannah

13 River Basin Draft Environmental Assessment and Finding

14 of No Significant Impact. It's a document from the US

15 Army Corps of Engineers dated 2006.

16 (The document referred to was

17 marked as NRC Exhibit Number

18 NRC000038 for identification.)

19 JUDGE BOLLWERK: The record should reflect

20 that NRC Exhibit 000038 has been identified.

21 MR. MOULDING: Exhibit NRC000039 entitled

22 "Draft Environmental Assessment and Finding of No

23 Significant Impact, Temporary Deviation, Drought

24 Contingency Plan, Savannah River Basin, again a US

25 Army Corps of Engineers Document dated October 2008.

1 (The document referred to was
2 marked as NRC Exhibit Number
3 NRC000039 for identification.)
4 JUDGE BOLLWERK: The record should reflect
5 the identification of NRC Exhibit 000039.
6 MR. MOULDING: Exhibit NRC000040 Aucott --
7 entitled Aucott et al, 1987, Regional Groundwater
8 Discharge to Large Streams in the Upper Coastal Plain
9 of South Carolina and parts of North Carolina and
10 Georgia. Water Resources Investigation Report 86-4332.
11 (The document referred to was
12 marked as NRC Exhibit Number
13 NRC000040 for identification.)
14 JUDGE BOLLWERK: The record should reflect
15 that NRC Exhibit 000040 has been identified.
16 MR. MOULDING: Exhibit NRC000041 entitled,
17 "Flow Data from Thurmond Dam Discharge and USGS Gauge
18 Number 021973269 near Waynesboro, Georgia.
19 (The document referred to was
20 marked as NRC Exhibit Number
21 NRC000041 for identification.)
22 JUDGE BOLLWERK: The record should reflect
23 that Exhibit NRC000041 has been identified.
24 MR. MOULDING: Exhibit NRC000042 an
25 excerpt from Clarke and West entitled "Groundwater

1 Levels Pre-development Groundwater Flow and Stream
2 Aquifer Relations in the Vicinity of the Savannah
3 River Site Georgia and South Carolina.
4 (The document referred to was
5 marked as NRC Exhibit Number
6 NRC000042 for identification.)
7 JUDGE BOLLWERK: Exhibit NRC000042 has
8 been identified for the record.
9 MR. MOULDING: Exhibit NRC000043 entitled
10 excerpt from US Global Change Research Program
11 Potential Consequences of Climate Variability and
12 Change dated 2000.
13 (The document referred to was
14 marked as NRC Exhibit Number
15 NRC000043 for identification.)
16 JUDGE BOLLWERK: The record should reflect
17 the identification of NRC Exhibit 000043.
18 MR. MOULDING: Exhibit NRC000044 entitled
19 excerpt from Intergovernmental Panel on Climate
20 Change, Climate Change 2007 Synthesis Report.
21 (The document referred to was
22 marked as NRC Exhibit Number
23 NRC000044 for identification.)
24 JUDGE BOLLWERK: The record should reflect
25 the identification of Exhibit NRC000044.

1 MR. MOULDING: Exhibit NRC000045 entitled
2 excerpts from NUREG 1437 Supplement 34, entitled
3 General Environmental Impact Statement for License
4 Renewal of Nuclear Plants Supplement 34 regarding
5 Vogtle Electric Generating Plant, Units 1 and 2 Draft
6 Report for Comment.
7 (The document referred to was
8 marked as NRC Exhibit Number
9 NRC000045 for identification.)
10 JUDGE BOLLWERK: The record should reflect
11 the identification of Exhibit NRC000045.
12 MR. MOULDING: Exhibit NRC-000046 entitled
13 excerpts from -- sorry, the next exhibit that relates
14 to Contention 1.2 is, in fact, Exhibit NRC000050.
15 JUDGE BOLLWERK: Right.
16 MR. MOULDING: Entitled AP1000, DCD
17 Revisions 15 and 16 Values, Summary of Cooling System
18 Flow Rate Changes.
19 (The document referred to was
20 marked as NRC Exhibit Number
21 NRC000050 for identification.)
22 JUDGE BOLLWERK: The record should reflect
23 the identification of NRC000050.
24 MR. MOULDING: Exhibit NRC000051 entitled
25 Compilation of Monthly Surface Water Withdrawal

1 Reports for 2006 from Vogtle Units 1 and 2,
2 transmitted to the Georgia Environmental Protection
3 Division.
4 (The document referred to was
5 marked as NRC Exhibit Number
6 NRC000051 for identification.)
7 JUDGE BOLLWERK: The record should reflect
8 the identification of Exhibit NRC000051.
9 MR. MOULDING: Exhibit NRC000052 entitled
10 "Table Showing the Cumulative Water Withdrawals of all
11 Four Vogtle Units as a Percentage of Savannah River
12 Flow'.
13 (The document referred to was
14 marked as NRC Exhibit Number
15 NRC000052 for identification.)
16 JUDGE BOLLWERK: The record should reflect
17 the identification of Exhibit NRC000052.
18 MR. MOULDING: Exhibit NRC000053 entitled
19 excerpts from Amendment Number 149, to Facility
20 Operating License NPF-68 and Amendment Number 129 to
21 Facility Operating License NPF-81 for the Vogtle
22 Electric Generating Plant Units 1 and 2 and the
23 associated safety evaluation report dated February
24 27th, 2008.
25 (The document referred to was

1 marked as NRC Exhibit Number
2 NRC000053 for identification.)
3 JUDGE BOLLWERK: The record should reflect
4 the identification of Exhibit NRC000053.
5 MR. MOULDING: Exhibit NRC000054 entitled
6 excerpts from Richter & Thomas, 2007 Restoring
7 Environmental Flows by Modifying Dam Operations.
8 (The document referred to was
9 marked as NRC Exhibit Number
10 NRC000054 for identification.)
11 JUDGE BOLLWERK: Exhibit (sic) should
12 reflect the identification of NRC000054 and we're in
13 the home stretch now.
14 MR. MOULDING: And I'm glad to hear it.
15 Exhibit NRC000055 entitled excerpts from US
16 Environmental Protection Agency Rulemaking -- Proposed
17 Rule National Pollutant Discharge Elimination System
18 Regulations Addressing Cooling Water Intake Structures
19 for New Facilities dated August 10th, 2000.
20 (The document referred to was
21 marked as NRC Exhibit Number
22 NRC000055 for identification.)
23 JUDGE BOLLWERK: The record should reflect
24 the identification of Exhibit NRC000055. And now,
25 sir, if you'd like to move them into evidence.

1 MR. MOULDING: The staff moves that these
2 exhibits be admitted into evidence.
3 JUDGE BOLLWERK: Any objections? Hearing
4 none, then NRC Exhibits 000002, 3, 4, 5, 6, 7, 8,
5 NRCR00009, NRC000010, 11, 12, 13, 14, 15, 16, 17, 18,
6 20, 21, 22, 23, 24, 25, 26, 27, 28, 30, 31, 32, 33,
7 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44 -- let's
8 back up a second here, yes, 44, 45, 48, 49 -- I'm
9 sorry, go back a second, 45, correct the record, 49,
10 50, I'm sorry, correct the record one more time, 45,
11 50, 51, 52, 53, 54, and 55 are admitted into evidence.
12 (The documents referred to
13 having been previously marked
14 as
15 NRC Exhibit Numbers
16 NRC000002 3, 4, 5, 6, 7, 8,
17 NRCR00009, NRC000010, 11, 12,
18 13, 14, 15, 16, 17, 18, 20, 21,
19 22, 23, 24, 25, 26, 27, 28, 30,
20 31, 32, 33, 34, 35, 36, 37, 38,
21 39, 40, 41, 42, 43, 44 , 45,
22 50,
23 51, 52, 53, 54, and 55 for
24 identification were received in
25 evidence.)

1 JUDGE BOLLWERK: So, not 46, not 47, not
2 48 and not 49 at this point. Let me just check and
3 make sure. All right, there was only one revised
4 exhibit, right?
5 MR. MOULDING: That would be NRCR00035.
6 JUDGE BOLLWERK: All right, let's correct
7 the record one -- NRC-0000 -- one more time, NRCR00035
8 is admitted into evidence not NRC000035. There's no -
9 - that one was revised. All right, anything else from
10 the staff in terms of the admission of exhibits?
11 (The document referred to
12 having
13 been previously marked as NRC
14 Exhibit Number R00035 for
15 identification was received in
16 evidence.)
17 MR. MOULDING: Not at this time, your
18 Honor.
19 JUDGE BOLLWERK: All right, and I think
20 that's all the exhibits that you really -- well, you
21 have a few more for 1.6 and 6.0 but that's the bulk of
22 what you have, right?
23 MR. MOULDING: Yes, sir.
24 JUDGE BOLLWERK: All right, at this point,
25 then, the panel is available for questions by the

1 Board. And I believe Judge Jackson may have a few.

2 JUDGE JACKSON: Okay, thank you.

3 JUDGE BOLLWERK: Appreciate everyone's

4 patience.

5 JUDGE JACKSON: I'd like to begin by

6 looking at the direct testimony submitted by the Staff

7 and the first question relates to Question and Answer

8 12 in that testimony on page 22. The question that

9 the staff was addressing said, "How did the staff

10 decide what life history information to include for

11 those important species"? And the answer looks like

12 it was attributed to Ms. Krieg; is that right?

13 MS. KRIEG: That's correct.

14 JUDGE JACKSON: "According to the

15 guidance, in the ESRP Section 2.4.2, the Staff should

16 provide the temporal and spacial, including depth,

17 distribution and abundance of important aquatic

18 species especially in the discharge area and receiving

19 water body." So my question is, if you could give us

20 some examples of how the FEIS provides the spacial and

21 temporal distributions that are mentioned there.

22 MS. KRIEG: Okay, I'll give you an example

23 from the short-nose sturgeon. We talk about where the

24 sturgeon is located during the year that the juveniles

25 stay down near that estuary and the adults come up for

1 their spawning migrations. And we've identified
2 through the literature three spawning areas and in the
3 FEIS we disclosed which river miles those were.
4 There's two of them above the Vogtle site, one of them
5 above the Vogtle site and two of them below the site,
6 downstream.
7 And we talk about the orientation of the
8 eggs in the water, that they're demersal and they're
9 adhesive so that they sink to the bottom and they
10 attach to cobbles or other structures in the bottom,
11 the hard bottom of the river and we also talked about
12 how the larva are -- when they're hatched out, they
13 tend to stay near the bottom, you know, in the first
14 few days and then after awhile, they start to swim up.
15 So we were -- that's spacial there and also temporal
16 because we also discussed times of year that the
17 sturgeon would spawn, which is in the early part of
18 the spawning season, in that February to March time
19 frame for the short-nose sturgeon.
20 JUDGE JACKSON: Okay, how do you decide
21 how much spacial and temporal information is adequate?
22 MS. KRIEG: Well, we use the ESRPs.
23 That's our guidance for how to write the EIS's and the
24 ESRPs are very specific that the extent of the input
25 into the EIS should be governed by the depth of the

1 ecological resources and their impact from the
2 facility that we're studying. So although we do a lot
3 of research and look at a lot of information, we don't
4 overburden the reader with that information in the
5 EIS. We try to keep it limited to those aspects of
6 the -- for instance in this case, the fish's life
7 history that are pertinent to our decisions.
8 JUDGE JACKSON: Okay, thank you. Next
9 question refers to Question and Answer 38 which I
10 believe is on page 65 of the pre-filed testimony. The
11 question was, "How does the staff analysis of impacts
12 to aquatic resources account for monthly or annual
13 ranges in averages of Savannah River flows," another
14 flow question. It looks like, Dr. Masnik, this is one
15 that you answered and it said, "The Staff based its
16 analysis of operating impacts in the FEIS Chapter 5 on
17 the maximum withdrawal rate for the proposed VEGP
18 Units 3 and 4. The Staff considers use of this rate
19 to be conservative, a conservative assumption since
20 the withdrawals at the maximum rate would occur
21 infrequently and only for short periods of time."
22 I wanted to ask if you could clarify what
23 infrequently means.
24 DR. MASNIK: Well, infrequently means that
25 the withdrawals from the plant vary over time based on

1 the plant's power level and whether or not the plant
2 is in a refueling outage or such. Generally, nuclear
3 plants are run at 100 percent power that they're kept
4 up operating continuously as much as possible. So the
5 variation on flow would be relatively infrequent.
6 JUDGE JACKSON: Could you characterize
7 that a little more? Would that be twice a year? Is
8 that infrequent?
9 DR. MASNIK: Well, if you look at -- in
10 this case, with the two units, the two new units, you
11 know, assuming that they're operating at 100 percent
12 power, they would go down for outages on a basis of
13 maybe 18 to 24 months. So those would be, you know,
14 fairly infrequent drops in power.
15 JUDGE JACKSON: Okay, I guess in the same
16 vein, let us know what your view is on how long are
17 short periods of time.
18 DR. MASNIK: Short periods of time, again,
19 if we're using the example of the refueling outages on
20 the matter, on the -- between 20 and 30 days
21 generally.
22 JUDGE JACKSON: Okay, lastly, I'd like to
23 hear your comment on why it's reasonable to use 3800
24 CFS as the low flow for the river, given the recent
25 drought situation.

1 DR. MASNIK: That's the value that the
2 plant or that the river has been at for quite some
3 time. And it's the one that's controlled -- we've
4 used a lot of different flow rates in this document
5 and 3800 is the controlling flow at the Thurmond Dam,
6 that typically is -- that has actually been the case
7 over the last year, year and a half. So that's why we
8 assume that 3800 CFS is the typical low flow
9 condition.
10 And to my knowledge, I think Lance, you
11 can correct me, we have not gone below -- we have gone
12 below 3800 but not 3800 at the site.
13 MR. VAIL: Yeah, just to clarify, if I can
14 take a second and sort of clarify, when you're talking
15 about, there's two time scales we talk about, the
16 withdrawals being infrequent and one case you can look
17 at is the sort of water management where you might
18 actually be cycling the pumps a little bit more for
19 either topping off the pond under the cooling tower or
20 managing water quality in the tower. Those things,
21 you know, if you look at the records for Units 1 and
22 2, which would have a reasonably similar behavior,
23 you'd see those higher flows occurring for maybe, you
24 know, three days out of a month, non-consecutively
25 would often be a sort of common situation.

1 So you sort of have these -- you have
2 these two types of variability that we're talking
3 about, so -- and I think typically when you'd see
4 those higher than normal withdrawal rates occurring
5 from the river, I don't think I ever saw anything that
6 persisted for longer than a week, and presumably, that
7 was probably to deal with some water quality issues in
8 the tower. So there's that part of the variability.
9 As far as the 3800 CFS number goes, you
10 know, we've looked at that and, you know, we've
11 discussed that in our testimony about using the 3800
12 number and basically, I think we, you know, only found
13 two days over the entire record where it ever came
14 below that at the Waynesboro gauge and that's over a
15 period of drought.
16 And the Corps is operating the reservoir
17 system basically to do everything they can do to
18 basically avoid reaching drought level 4. And we've
19 had a very long persistent drought here. We've
20 touched on drought Level 3, you know, for relatively
21 short periods of time but we've never had any
22 persistence found in drought Level 3, so we still
23 don't believe that considering flows below 3800 are
24 reasonable, particularly in a NEPA analysis. If I was
25 doing a safety analysis, we'd certainly be looking at

1 more say radically conservative flow scenarios, but
2 you know, droughts happen and you know, we have --
3 this one is -- we're having this hearing in the midst
4 of a drought.
5 It wouldn't be appropriate in a NEPA
6 analysis, it is supposed to take a longer term
7 integrated view to bias our whole assessment on the
8 fact that we're currently within a drought. So we
9 think it's important to keep that mind and we think
10 that 3800 being that it's never -- you know, that we
11 don't see flows below that, except for very short --
12 you know, for a day or so, I think two days in the
13 record and stuff, that we would actually ever drop
14 below 3800. The 3800 represents a very good
15 conservative number.
16 JUDGE JACKSON: Well, as was discussed
17 earlier in some of our other questions, it can get
18 confusing between the use of the release from the
19 Thurmond Dam versus the Waynesboro Gauge as an
20 indicator of what's actually flowing by the site and I
21 think I understand your answer.
22 MR. VAIL: I mean, would you like me to
23 elaborate on that?
24 JUDGE JACKSON: We heard about that this
25 morning and I guess what you're saying is, even though

1 the release at Thurmond Dam had been lower than 3800
2 for some time, the flow at the site maintained above
3 3800 except, as you mentioned, with the exception of
4 two days.
5 MR. VAIL: We have a considerable distance
6 between Thurmond and this location, so we accrue flow
7 and pick up water as we move downstream both from
8 surface water discharges and groundwater discharges to
9 the river. So even when they drop their numbers,
10 their releases down to 3100, we were still exceeding
11 3800 at the site. So the reason for using Thurmond
12 was we had this very limited record basically, a very
13 short period of record at the Waynesboro Gauge.
14 Ideally, if we'd had, you know, a long extended
15 record, that's what we would have relied on but we had
16 a very short period of record during the drought. So
17 it didn't really represent a good basis to do this on.
18 And also Thurmond is the control of the
19 system, and so it's important to get that
20 consideration in.
21 JUDGE JACKSON: Okay, thank you. Let's go
22 on to the next question I'd like to ask. This relates
23 to the answer to 15. Let me see if I have this
24 marked, so I -- on page 28 of your testimony, the
25 question in 15 is, "What is the Staff's basis for

1 determining that its description in the FEIS of
2 relevant aquatic resources is adequate in the absence
3 of additional monitoring in the vicinity of Plant
4 Vogtle?" And go down to the end of that first
5 paragraph, you talk about that you had comments that
6 were received on the draft EIS from state and federal
7 agencies and that these were used to update the
8 description of the aquatic resources and so that's
9 basically what I wanted to ask you about.
10 How did you use their comments? What were
11 the comments, the very interesting comments that had
12 an impact and how did you use them?
13 MS. KRIEG: Well, the two comments that
14 were the most important to us that had the most impact
15 were the ones -- the e-mail from Jennifer Price from
16 South Carolina DNR, Department of Natural Resources
17 and I'd had -- she'd made some comments and then there
18 were comments that were also submitted from the draft
19 from South Carolina and talked about some additional
20 species of mollusks that were sensitive, species of
21 concern for the State of South Carolina and they had
22 knowledge of these -- of these species being present
23 in the river.
24 And the second one was the study by the
25 Catena Group that was done for the Fish and Wildlife

1 Service that we had -- we had previously talked to
2 representatives from the Fish and Wildlife Service and
3 had not been -- had not received any information on
4 this study. And then after we published the draft
5 EIS, their comment letters came back and said, "Yes,
6 there was this study and they would like us to look at
7 it," and so we did and we included that information in
8 the final EIS.
9 JUDGE JACKSON: So those would be the main
10 concerns that you --
11 MS. KRIEG: Right, those were the two main
12 ones, right.
13 JUDGE JACKSON: Okay, there were no other
14 major comments or concerns from other agencies?
15 MS. KRIEG: No, there were not.
16 JUDGE JACKSON: Okay, thank you. Okay,
17 I'd like to look next at the answer to Question 33
18 which is, I believe, on page 52 if my notes are
19 correct. I'll just check. Okay, the answer to
20 Question 33, you testified that "The nearest Robust
21 Redhorse spawning area is about 25 miles up stream"
22 and we talked -- we had this question this morning and
23 we got SNC's view on it, but I would like to ask it
24 again. So you testified that the robust redhorse
25 spawning area is about 25 miles upstream from the site

1 and you testified that because this site is 25 miles
2 away the likelihood of redhorse larvae entrainment is
3 kind of reduced.
4 So I guess here are the questions. Do
5 robust redhorse eggs and larvae generally remain in
6 place or do they move downstream? I guess that's a
7 good place to start and I'd be interested in your
8 take on it.
9 MS. KRIEG: Well, the eggs are deposited
10 in a gravel bar. That's where they spawn and the eggs
11 remain there until the larva are hatched. And the
12 larva spend some time and the larva spends some time
13 in that vicinity, but then they could potentially move
14 downstream. I did not see information in the
15 literature that said whether they actually did move
16 downstream or whether they would stay in the vicinity.
17 So I made the assumption that they would likely move
18 downstream.
19 JUDGE JACKSON: Yeah, that's really what I
20 wanted to ask you about, the basis for -- you're 25
21 miles away and I realize that's a great distance. I
22 just wondered did you have information that would give
23 you any indication as to how far they might travel or
24 if that was just your gut feel or what?
25 MS. KRIEG: I did not have any information

1 on how far they would travel, so --

2 DR. MASNIK: The early life history of

3 this species is not well-known. Because it is so

4 rare, they have cultured the species in laboratories

5 but they really don't know the behavior of the post-

6 larval forms.

7 JUDGE JACKSON: Okay. All right, I think

8 that's mainly what I was looking for. The next

9 question, this question relates to Answer 35 which I

10 believe is on page 62 of the testimony. Let's see if

11 I've got that right. Yes, the Question 35 was, "In

12 evaluating impacts to aquatic resources, how did the

13 Staff determine what river flow values to consider?"

14 And again, we've hit this flow issue several times but

15 if you go down in your testimony you talk about the

16 2000 and 3000 CFS values, that's on page 62, down near

17 the end of the second major paragraph on page 62. Are

18 you with me? It says, "The 3,000 and 2,000 CFS values

19 are not specifically drought level four flow rates,

20 but instead were the staff's attempt to provide

21 additional conservative context for its analysis."

22 And it goes on to say, "The Staff expects

23 that the occurrence of these flows would be extremely

24 rare and of only temporary duration". So my question

25 is, if you could give me some insight of what you mean

1 by extremely rare and while you're thinking about
2 that, temporary duration.
3 MR. VAIL: Well, I think the -- as I
4 stated, there's reason using the historic record when
5 the Corps has gone back using its drought continency
6 plan. It basically used its historical inflow record
7 to estimate what operating policies that they would
8 need to use to avoid ever reaching drought level four.
9 So basically based on the Corps' analysis, when I
10 think the drought level four -- is likely to occur.
11 That's not to say that, you know, droughts
12 can persist and droughts can go on for a long period
13 of time. However, even if you look at what happened
14 with drought Level 3 recently, it just basically, you
15 know, touches over the line at Drought Level 3, move
16 back into Drought Level 2 and now it's quite a ways
17 back into Drought Level 2.
18 So, you know, the Corps is doing
19 everything they can do to basically avoid encountering
20 Drought Level 4. And so we don't think that it's
21 likely that that's going to occur and you know, over
22 the life of the plant, it would be easy to come up
23 with a scenario where that would not occur over the
24 period of the life of the plant. But, again, you
25 know, it' still --

1 JUDGE JACKSON: You're just saying in your
2 view it's extremely improbable that that would happen.
3 MR. VAIL: Right.
4 JUDGE JACKSON: You wouldn't expect it to
5 happen in the next 50 years or something like that.
6 MR. VAIL: I wouldn't expect it to reach
7 drought Level 4 in the next 50 years.
8 JUDGE JACKSON: Okay, and temporary
9 duration, I guess it's a similar evaluation on that,
10 that if it ever did, you're saying the conditions
11 would be very extreme, way beyond what's been
12 experienced?
13 MR. VAIL: Right
14 JUDGE JACKSON: Is that your testimony?
15 MR. VAIL: Yeah, and, you know, some of
16 those periods could occur again, if we're looking at
17 the Vogtle site itself, which is downstream from the
18 Thurmond Dam, you're going to picking up some of
19 additional flow. So there are going to be lots of
20 periods where you're going to be recovering flow even
21 if you were -- had lower releases because of that
22 additional flow that you accumulate downstream. But
23 the drought would be hitting those areas, too, so you
24 know, you would see some loss in the flow, but it's a
25 matter of judgment about -- and again, in a

1 distinction between a safety analysis, clearly we
2 wouldn't use this criteria in the safety analysis. In
3 a NEPA analysis, however, you know, we do feel that
4 using this value to represent low flow conditions
5 which are the conditions that we're seeing you know,
6 basically haven't gotten below in the drought of
7 record, which is what we're in right now.
8 JUDGE JACKSON: Are there modeling tools
9 that people use to predict drought levels? Does the
10 Corps use modeling tools?
11 MR. VAIL: Well, they use models. The
12 catch in the modeling, the whole thing that drives the
13 hydrologic cycle is the climate, and you know, climate
14 predictive tools. The Corps looks at, you know,
15 relatively extended forecasts and those are still just
16 the, you know, matters of weeks in terms of a
17 predictive reliability.
18 So, you know, they do look at those
19 assessments and they basically use that in trying to
20 define their operation. But I don't think anyone at
21 this point in time can basically give a reliable
22 estimate about how much longer this drought is going
23 to persist or whether this drought is going to have
24 reversed by the time, you know, we leave here in two
25 weeks.

1 JUDGE JACKSON: Okay, so to your
2 knowledge, the Corps isn't trying to do the long-term
3 modeling or probabilistic analysis of what the odds
4 are and --
5 MR. VAIL: Not for long-term. What they
6 use is they basically use the historic inflow and then
7 they basically apply some sort of conservative factors
8 so they can basically do an assessment where they'll
9 say, "We'll take the -- operate the -- you know, this
10 is what would happen to the system if we had the
11 unregulated inflows coming into the system at 50
12 percent their average value. This is what we would
13 see in terms of those projections.
14 JUDGE JACKSON: Okay.
15 MR. VAIL: But, you know, that's using
16 what we call just you know, climatological hydrology
17 just like looking at the long-term climate and
18 basically saying that, you know, next month is going
19 to look something like all the months --
20 JUDGE JACKSON: Okay, it's more of the
21 near-term operational --
22 MR. VAIL: There's a near-term operational
23 that will use NOAA forecasting.
24 JUDGE JACKSON: Okay, the next part of the
25 testimony I'd like to ask you about is Answer 51 which

1 I believe is on page 79, that's right. Okay, Question
2 51, "Why did Staff use normal rather than maximum
3 withdrawal rates in evaluating cumulative impacts both
4 generally and with regard to impingement and
5 entrainment". And the answer, "Normal withdrawals are
6 most representative to combine flows of all four units
7 operating because maximum withdrawal -- maximum
8 withdrawals are rare. It is unlikely that maximum
9 withdrawal rates would occur for more than one unit at
10 a time.
11 I guess if I'd just ask you to expand on
12 the basis for your assumption that it's unlikely that
13 the maximum withdrawals would occur more than one unit
14 at a time. I know that you hit upon that and that it
15 was answered. I'd just like you to expand on that a
16 little if you could.
17 MR. VAIL: Well, I mean, there's two
18 reasons we expect there to be those changes in flows.
19 One is sort of filling the cooling tower basin pool if
20 it's dropped, they may cycle the pumps on for a period
21 of time, for a short period, and the other is if they
22 have some you know, water quality issue within the
23 cooling tower that they're trying to manage by you
24 know, blowing down some extra water potentially to
25 help control an issue. There's no reason, really, to

1 assume that those would all occur at the same time
2 over all four plants, and particularly in a cumulative
3 analysis, you know, we're looking at a longer term,
4 more integrated assessment in a cumulative analysis
5 than we normally would in a Chapter 4 or 5 analysis on
6 the specific units.
7 So I wouldn't think it was appropriate to
8 put everything in their maximum configuration at one
9 point in time.
10 JUDGE JACKSON: Okay. I just wondered,
11 have you ever looked at some intermediate situations
12 like a scenario where three units were operating
13 normally and one was operating at max withdrawal and
14 the --
15 MR. VAIL: Well, you know, I suspect at
16 some point we sort of looked at, you know, all the
17 sort of possible -- and I mean, it's pretty simple
18 algebra here and stuff we're talking about.
19 JUDGE JACKSON: That's right.
20 MR. VAIL: So it really wasn't -- you
21 know, in the case of the cumulative, what we were
22 trying to do is get something that we thought was you
23 know, representative and not overly conservative,
24 overly conservative in terms of NEPA analysis.
25 JUDGE JACKSON: I guess another question

1 then is, when you're looking at the cumulative impact
2 analysis, why didn't you use the actual withdrawal
3 rates from Units 1 and 2? I understand that in the
4 record that the actual withdrawal rates at 1 and 2 are
5 frequently higher than the normal withdrawal rate, at
6 least by the staff. Is that -- first of all, let me
7 ask you if that's correct?
8 MR. VAIL: Yeah, there's a normal
9 withdrawal rate basically, is what you'd expect you
10 might see you know, three days out of a month or you
11 know, 29 days out of a month and then a few other
12 days, like I say, where you might be filling basins or
13 doing some water quality control where you'd cycle the
14 pumps up for a period of time. Those would be very
15 short duration.
16 JUDGE JACKSON: So again, you're saying
17 that -- your position is it's the normal rate that is
18 most appropriate for this kind of an analysis and
19 because you -- well, you say the others are
20 infrequent.
21 MR. VAIL: Well, we did, you know, modify
22 the testimony where we actually did include the
23 cumulative values where it wasn't -- you know, this is
24 a case where you have the normal's happening, you
25 know, basically constantly except for a few times

1 where you go higher, so your average is actually going
2 to go up slightly. I mean, your normal isn't your
3 average. What I'm talking about with normal is what,
4 you know, on most days, you're going to be operating
5 with a certain difference between, a sort of, you
6 know, median and a mean.
7 The mean will be slightly higher in this
8 case because you would have these days with slightly
9 higher flows. And so we did correct that and used
10 numbers that we actually had from the -- received from
11 the water withdrawal information that the applicant
12 had submitted to the state and then we based our
13 assessment on the highest monthly average value to
14 represent our case in that revised table that was
15 submitted in the testimony.
16 JUDGE JACKSON: Yeah, thank you. I was
17 going to ask you about that revision but I did see it
18 and thanks for commenting on it. As far as the direct
19 testimony, those are my main specific questions. I
20 might ask one or two overriding questions but we could
21 look at the rebuttal testimony first. Anyone -- Judge
22 Trikouros, do you want to add anything on the -- okay,
23 let's take just a quick look then and shift gears and
24 look at your rebuttal testimony for a moment.
25 I'd like to take a look at Answer 28 in

1 your rebuttal testimony. I believe it's on page 34.
2 Yes. All right, Question 28, Mr. Sulkin states, "That
3 the five percent threshold is not compelled by any
4 statute or regulation", and so on. Go down to your
5 answer; "The staff believes that the five percent
6 withdrawal requirement is compelled", and you go on to
7 talk about that. I guess my question is, I'd like you
8 to clarify the role, if any, using this five percent
9 withdrawal threshold as a measure of the impact level
10 according to the three impact levels that NRC uses, is
11 there any -- I think the question was, and the concern
12 was, boy, you're using this five percent and if you
13 exceed it, suddenly you're out of the small. If
14 you're below there, you're in small impact. So I just
15 would like you to clarify how the five percent rule of
16 thumb is used and what its relationship to your
17 assigning the impact level is.
18 DR. MASNIK: The staff, in its assessment
19 of impact, considered a variety of abiotic and biotic
20 factors. We didn't just stick with one particular
21 issue in a go/no-go kind of mode. Things that we
22 looked at was the type of cooling system, the design
23 and location of the intake structure, the actual
24 through screen velocities. Things like that life
25 history of the species that potentially could be

1 impacted by this. All of these factors were
2 considered. Additionally, as we explained in our
3 direct testimony, I believe in response to Answer 14
4 or Question 14.
5 We looked at some supporting evidence or
6 supporting information that seemed to indicate that
7 perhaps, this type of design on this type of river
8 would result in limited impact and one of the things
9 that we brought out in our explanation was the Phase 1
10 regulations that EPA had placed into rulemaking. And
11 these Phase 1 regulations limit capacity and flow --
12 provide capacity and flow limits on facilities and EPA
13 felt that if a utility complied with those capacity
14 and flow restrictions, that the resulting facility
15 would have limited or at least an acceptable level of
16 impact on the environment.
17 One of these restrictions was the five
18 percent flow restriction for streams and rivers. And
19 it's five percent of the annual mean flow. Somehow in
20 response to comments, this became a threshold and the
21 five percent then became -- somehow was applied to a
22 variety of different flow rates in the river, but from
23 the standpoint of perspective of the staff, we felt
24 that this was supportive of our position but not
25 necessarily a key part of our decision to -- in the

1 assessment of impact.

2 JUDGE JACKSON: Okay. There's not a one-
3 to-one correlation between it being small and being
4 under five percent.

5 DR. MASNIK: Now, clearly EPA did not
6 state that in the rulemaking. There was no -- there
7 was no assessment of impact related to that
8 requirement.

9 JUDGE JACKSON: Okay, all right, thank
10 you. Okay. Mr. Vail, I think in your answer 4 of the
11 pre-file rebuttal testimony you state, "The maximum
12 monthly average withdrawal value of 104 CFS would be
13 appropriate although still conservative basis for
14 evaluating the cumulative impacts analysis with
15 respect to ESP application.

16 You state in Answer 4 the use of the 136
17 CFS value, however, is not an appropriate basis for a
18 NEPA analysis, since such a withdrawal rate would
19 occur only occasionally, It would be for a short
20 duration. Is there a specific section of NEPA that
21 supports this conclusion or sets these guidelines out?

22 MR. VAIL: I'm not a NEPA expert, so I'm
23 more following the ESRP guidance which basically
24 suggests a cumulative, you're looking at more a long-
25 term larger time scale impact.

1 JUDGE JACKSON: Okay, so you say that the
2 standard review plan is explicit in its guidance.
3 MR. VAIL: In the cumulative impacts you
4 know, I'd have to go back and review the Standard
5 review plan to see if I could find the explicit but we
6 have been working with that guidance and how we do the
7 cumulative impacts that those are not supposed to be
8 as worst case bias as you would in units alone.
9 JUDGE JACKSON: Okay. Well, we heard
10 earlier in testimony that -- and things that I read
11 that NEPA doesn't call for a worst case situation or
12 analysis. It does require agencies to address
13 reasonably foreseeable impacts. Does that sound
14 right?
15 MR. VAIL: Certainly the reasonable
16 foreseeable is the term that we use.
17 JUDGE JACKSON: Okay, and so that plays
18 into if the plant withdrew 136 CFS, then that would
19 certainly be reasonably foreseeable.
20 MR. VAIL: That's true but we're also not
21 looking at it at one point in time to base that
22 assessment on. So to base it exclusively on what
23 would happen on -- you know, over a short period of
24 time, you know, we did take the highest monthly
25 average over an entire year and thought that was

1 appropriately conservative for a cumulative analysis.

2 JUDGE JACKSON: Okay, this approach is

3 consistent practice in preparing the FEIS then for

4 nuclear power plants, this is the guidance that you'd

5 seen followed.

6 MR. VAIL: Yes, and all EIS's, you know,

7 both within NRC and others that I've been involved in,

8 the cumulative analysis is supposed to you know,

9 communicate and you know, sort of a reasonable

10 understanding of what those impacts are going to be

11 over the long term with a more integrated view to the

12 system. So we wouldn't be putting everything in a

13 worst case configuration.

14 JUDGE JACKSON: Okay.

15 MR. VAIL: The cumulative analysis, that

16 can be particularly biasing because you have so many -

17 - you know, if you had four factors and you fill all

18 four factors in a cumulative analysis, the -- I mean,

19 in the most conservative mode, that would just, you

20 know propagate the sort of extreme nature and wouldn't

21 necessarily well-represent the impacts.

22 JUDGE JACKSON: Okay. This might not be a

23 bad time to ask maybe a cross-cutting question and one

24 that I want to ask each panel and that again, is the

25 level of detail and I'd like to ask, is the level of

1 detail that you find consistent with the guidance and
2 consistent with what you -- we would find if we looked
3 at many other FEIS's? In other words, is the level of
4 detail what it should be and again, how do you decide?
5 And I'm interested in each panel's take on that
6 because it is an issue. How far do you have to go in
7 including more -- we talked about spacial effects,
8 temporal effects, non-uniformities in drift
9 population.
10 I mean, are the basic assumptions and the
11 approach used consistent with guidance and general
12 practice? That's my question.
13 DR. MASNIK: I think we can say that that
14 is the case. If we look at Environmental Impact
15 Statements that the Agency has produced over the last
16 10 years they vary considerably and they vary to some
17 extent and I'm speaking from my field which is the
18 aquatic ecology, based on the potential for impact. I
19 can give you several examples. For example, the
20 relicensing of the Millstone Plant, there was great
21 concern expressed by state, local agencies and members
22 of the public over impacts associated with operation
23 of the facility on winter flounder.
24 The staff did an extensive review of
25 winter flounder. We looked at both standard field

1 studies and genetic studies that were done in the
2 region. Just recently we published a license renewal
3 supplement for Indian Point, the Indian Point Station.
4 Indian Point has been studied close to 35 years worth
5 of data on its impact on fishes of the Hudson River.
6 The Commission has put together quite an elaborate
7 impact statement that considers a whole host of
8 species.
9 So we try to tailor the impact assessment
10 to the potential impact. In this case, we have found
11 that -- and I've worked on quite a few Environmental
12 Impact Statements related to fresh water systems. We
13 typically, do not find impacts to species inhabiting
14 rivers in which power plants are located on rivers.
15 And as a result we did not expect to see much of an
16 impact of the existing two facilities nor two
17 additional facilities on the aquatic ecology at this
18 location.
19 We did do a thorough review and our
20 expectations were borne out based on our analysis of
21 the data, that, in fact, we do not believe that two
22 additional units at this site would result in
23 unacceptable impacts to the aquatic environment. And
24 I think that the level of detail that we provided in
25 this assessment is acceptable and appropriate for the

1 potential for impact.

2 JUDGE JACKSON: Thank you. That was

3 helpful.

4 JUDGE BOLLWERK: Can I ask a question?

5 JUDGE JACKSON: Yes.

6 JUDGE BOLLWERK: I'm a little concerned.

7 I seem to hear something that's almost like a self-

8 fulfilling prophecy, that you go out and you think

9 it's going to be low and you look around and nothing

10 says yes, it says something else, so it becomes low.

11 I mean, how do you pick up trends? If something is

12 going on and all you're looking at is old literature,

13 how are you ever going to know that there's something

14 else developing?

15 DR. MASNIK: I guess the answer to that is

16 it's probably a personal bias because I've been doing

17 this for quite a few years and what I find is that

18 depending on the source water body, we have different

19 potential levels of impact and typically we do not see

20 and when we did the generic Environmental Impact

21 Statement for license renewal, we looked at just about

22 every operating nuclear power plant in the country and

23 we looked at impacts associated with impingement and

24 entrainment. And what we found is, in riverine

25 systems with closed-cycle cooling it's -- we did not

1 discover any plant resulting in any adverse impact to
2 the aquatic environment that resulted in changes in
3 population levels.
4 So we believe that this is probably not
5 the type of situation that would result in
6 unacceptable impacts. Nevertheless, I think the staff
7 did a complete review and essentially turned over all
8 the stones and to see if there's any data that would -
9 - that was contrary to our -- to this hypothesis.
10 JUDGE TRIKOUROS: I think Dr. Masnik that
11 this is a somewhat unusual location because it --
12 because of the presence of Savannah River Site and
13 also this drought situation which it doesn't seem to
14 be getting a lot better and quite possibly could get a
15 lot worse. So I don't know if there's anything like
16 that in any of the other hundred plants but I view
17 this as rather a unique site from that perspective at
18 least.
19 MS. KRIEG: I'd like to add something
20 because I don't have nearly the years of experience
21 that Dr. Masnik does and I went into this a lot more
22 skeptical although I was aware of the information in
23 the generic Environmental Impact Statement about the
24 low impact from closed-cycle cooling systems on
25 rivers, but we did do a very thorough analysis and we

1 looked at the parts of the aquatic environment that we
2 thought could be impacted or that we were quite
3 worried about, for instance, the short-nose sturgeon
4 and the robust redhorse in our evaluation and that's
5 how we came up with our small impact.
6 DR. COOK: I'd also like to add too, from
7 the hydrologic resource part of what we did as well
8 was we talked with the local federal and state
9 agencies as well. So in addition to the information
10 that was provided to us by the applicant, we also
11 talked to the resource agencies that are there, that
12 are involved in the water management, that are
13 involved in the developing the drought protection plan
14 and talked to them very early in the process to try to
15 discover for water, for example, what the plan was,
16 how they were looking at the situation and what kind
17 of management plans were going to be in place and how
18 they were managing the system.
19 JUDGE JACKSON: I just have two more quick
20 questions. One relates to Answer 6 which is on page 7
21 of your pre-filed testimony right down at the end of
22 that answer near the bottom of the page, just before
23 Section 2. The testimony states, "In addition under
24 very low flow conditions, Southern could be directed
25 by the state resource agencies to reduce power or

1 cease power operations, actions which could reduce
2 water withdrawal significantly for reasons including
3 increased impingement rates or to protect aquatic
4 biota during a critical spawning period".
5 So I suppose that the permit holder could
6 do something like this. I guess the question is would
7 -- does it make any sense for NRC to be taking some
8 action like this instead of relying on a state agency,
9 a permitting agency, to do it?
10 DR. MASNIK: First of all, Judge, I'd like
11 to say that this is probably a pretty extreme
12 situation. We have had state agencies require the
13 cutback of power for thermal conditions, I wouldn't
14 say on a regular basis but quite often. The NRC is
15 not in the position to make requirements or put
16 requirements on licensees in the area of water
17 quality. So it would be unlikely that we would be the
18 agency that would make that sort of requirement.
19 And I think we believe that it's probably
20 best left up to the state agencies because they're the
21 ones here and close by and have probably a better
22 understanding of the ecology of the river anyway.
23 JUDGE JACKSON: Okay, thank you.
24 JUDGE BOLLWERK: Was that a can't or won't
25 or don't? Maybe that's a better -- you can't put

1 those conditions on or you don't put those conditions
2 on? It's a question of authority versus your
3 willingness to implement a policy, I guess, is the
4 question.
5 DR. MASNIK: This goes to what we've
6 referred to as the Yellow Creek Decision in which we
7 were prohibited from putting requirements related to
8 water quality on licensees. I'm a little out of my
9 area of expertise here and it's perhaps more a legal
10 issue than a technical issue.
11 JUDGE JACKSON: This is the last question
12 I'd like to bring up. It relates to Answer 19, page
13 26, rebuttal testimony and let's see, I guess, Mr.
14 Vail, it looks like this is one that you had answered.
15 You state in there that drought Level 3 has never
16 been exceeded. I believe that's -- yeah. Drought
17 Level 3 which has never been exceeded. The past year,
18 what has been the release rate from Thurmond Dam?
19 MR. VAIL: The release rate basically
20 started targeted around the 3600. The Corps had made
21 an adjustment based on a temporary deviation plan to
22 drop that to 3100. Since that point, the Corps in
23 consultation with other agencies, had decided to bring
24 that back up to 3600 CFS.
25 JUDGE JACKSON: Is that where it is now?

1 MR. VAIL: That's where it's going to
2 apparently, you know, would be the targeted flow for
3 the near term.
4 JUDGE JACKSON: So it's been Drought Level
5 3 prime or modified somewhat is what's been happening;
6 is that --
7 MR. VAIL: Yeah, the drought level doesn't
8 -- you know sort of triggers certain flows. The
9 drought level is really based on the reservoir in the
10 pool. That's the definition of the drought level. So
11 it's --
12 JUDGE JACKSON: It's the depth.
13 MR. VAIL: It's the depth of the water and
14 how much water do you have before you lose your
15 conservation pool in the reservoir. That's sort of
16 the useable storage that you can actually operate with
17 and that's what defines the drought level and then
18 the Corps had sort of set targets when they were at
19 certain drought levels and at certain times of the
20 year. For instance the 3100 was just targeted for
21 selected times of the year when they thought -- I'm
22 not sure exactly the motivation but I think it was
23 some spawning concerns. They didn't want it during
24 this period.
25 So it had a limited window where they go

1 to the 3100. They've since revised that and moved
2 back onto the 3600.
3 JUDGE JACKSON: It may not have been
4 exceeded, but it was less than traditionally.
5 MR. VAIL: Well, within Drought Level 3.
6 JUDGE JACKSON: Within Drought Level 3 and
7 the flows had been less than traditional.
8 MR. VAIL: And we've had flows less than
9 what were traditionally -- were proposed in the
10 original draft Contingency Plan because that had been
11 modified by the Corps in this temporary Deviation
12 Plan.
13 JUDGE JACKSON: Okay. Any other comments
14 on that?
15 DR. COOK: The only comment that I may
16 have is that during this period of time, looking at
17 the Waynesboro Gauge, which is at the site, that flows
18 during that time even when Thurmond Dam was released,
19 never dropped below 3800 CFS except for two days
20 during that period. And I believe they were less than
21 4,000 CFS for less than -- for approximately 49 days.
22 So even though the flows were reduced, the river
23 system is a gaining river. It is gaining discharge as
24 it goes down stream from surface water, groundwater,
25 recharge coming in.

1 And so the flows at the site were, even
2 during this drought period, above 3800 CFS except for
3 those two days.
4 JUDGE JACKSON: Okay, thank you. Judge
5 Bollwerk, those were my questions.
6 JUDGE BOLLWERK: But my understanding is,
7 again, with respect to the Waynesboro Gauge, and
8 correct me if I'm wrong, you don't really rely heavily
9 on that because it hasn't been in effect or hasn't
10 been operating long enough? I mean, I keep hearing
11 about it but I keep hearing that it's not the best
12 either. I'm sort of --
13 DR. COOK: Your Honor, the gauge was put
14 in, in I believe 2005. And when this review had
15 started in 2006, there was only a year's worth of data
16 at that time. And again, looking at this in the scope
17 of a NEPA context where we're supposed to not bias it
18 on the short-term, we thought is was more important to
19 look at the longer term period and that kind of
20 information was available at the Augusta Gauge,
21 upstream and also available at Thurmond Dam.
22 So we based it on the gauges with the
23 longer period of record so we could have that longer
24 information and we weren't biasing it on the short
25 period of time. Now that we have four years of data,

1 we can continue to do the retrospective but for the
2 purposes of the study, it was based on the gauges
3 where we had multi-year period of history.
4 JUDGE TRIKOUROS: Are you all comfortable
5 with not having any requirement to measure
6 temperature, that the assumption that the thermal
7 plume will be minimal, that there's no need to measure
8 any type discharge or compare discharge to river or
9 anything like that?
10 MR. VAIL: Your Honor, as Dr. Masnik
11 mentioned, the ASLB in the Yellow Creek Ruling
12 basically made it clear, we can't require those and --
13 JUDGE TRIKOUROS: I wasn't asking you
14 that. Does that -- does this seem unusual to you in
15 any way to just simply trust some model that was done
16 some time back and --
17 DR. COOK: Well, your Honor, we -- the
18 NPDES permit that you talked about does not -- that is
19 currently what Georgia State is requiring. There are
20 no temperature requirements, monitoring requirements,
21 I should correct that, monitoring requirements in that
22 permit. We didn't feel it was our -- you know, it was
23 for us reasonable. You know, we cannot question
24 another state, so we didn't feel that that was our
25 ability to do.

1 So what we did, when we looked at this in
2 terms of water quality analysis, that's why we looked
3 at very, sort of conservative conditions for both the
4 discharge quantity, the difference between the ambient
5 water temperature and the blow-down temperature and we
6 were able to, by using very -- I wouldn't say
7 bounding, but very conservative values able to then
8 sort of put this thermal plume into context and to
9 then go forward with an impact level so we could come
10 to a decision for our NEPA analysis, or our EIS
11 analysis.
12 JUDGE TRIKOUROS: Okay.
13 JUDGE BOLLWERK: Just a question, you
14 mentioned that you'd done a lot -- looking at a lot of
15 other EIS's with respect to this one or in terms of
16 the -- is that sort of situation where there is no
17 requirement to monitor the temperature of the plume?
18 Is that unusual for -- or fairly standard? I don't
19 know, what in terms of across the state?
20 MR. VAIL: I would say it's less typical.
21 Typically, there is a requirement for monitoring the
22 discharges' temperature. However, in the case of
23 North Anna, for instance, there is not currently a
24 temperature requirement, so you know, there are
25 instances we've run into where that's not been a

1 requirement.

2 JUDGE BOLLWERK: And then you're basically

3 in the monitoring -- not the monitoring, excuse me,

4 the modeling mode to the case of the thing that was

5 done here which is looking at CORMIX or whatever and

6 coming up with a model, to a degree.

7 MR. VAIL: Yeah, also since this is an

8 ESP, we're working on a sort of -- they've provided

9 information on what their maximum blow-down

10 temperature was going to be and that's what we used in

11 our assessment. How that would be enforced is not a

12 question I could answer.

13 JUDGE BOLLWERK: Okay, all right, any

14 other questions from the Board at this point? All

15 right, at this point we're almost at a quarter to

16 5:00. Why don't we give the parties about 15 minutes

17 to give us any questions they might have for this

18 particular panel? And I should mention, we've got two

19 sets of questions with respect to the other panel and

20 we were intending to treat these as we did the others,

21 which is they remain confidential and put them on the

22 record after the initial decision is issued. I would

23 ask however, that if the parties that submitted these

24 could provide them to me as they did before by e-mail,

25 I'll make sure we've kept them and that way we'll have

1 a consistent practice throughout.

2 I could scan these but it's better if I

3 get a document from you like the others and we'll do

4 it that way. And let me just ask, has Dr. Powers

5 arrived yet?

6 FEMALE PARTICIPANT: I don't know, my cell

7 phone is still off.

8 JUDGE BOLLWERK: Okay, all right, maybe

9 you can check if you have a second when we take a

10 break here. We're going to take about a 15-minute

11 break. Does that give you all enough time?

12 MR. SANDERS: I'll go and check the

13 schedule. I've got it in my car.

14 JUDGE BOLLWERK: Okay, I'd appreciate it.

15 All right, it's almost quarter till. So let's just

16 way we'll come back at 5:00 o'clock and see what the

17 parties, if anything have as well as if the Board has

18 thought about it and have come up with any additional

19 questions we want to ask. So why don't we take a

20 break until 5:00 o'clock? Thank you.

21 (Whereupon, a short recess was taken.)

22 JUDGE BOLLWERK: All right, let's go back

23 on the record, if we could, please. All right, we've

24 taken a brief break, allowed the parties an

25 opportunity to generate any other additional questions

1 for this particular panel. We did not I don't think
2 receive any from the staff or the applicant. We
3 received one question from the joint interveners and
4 Judge Jackson, if you wouldn't mind.
5 JUDGE JACKSON: Yes, this question is for
6 you, Mr. Vail. You testified that in 2006 withdrawal
7 rates of 136 CFS occurred at least once. Could this
8 withdrawal and other similar rare events when viewed
9 cumulatively, have long-lasting impacts on aquatic
10 species? That's the first question.
11 MR. VAIL: Actually, I'm not an aquatic
12 biologist, so to make an assessment about the aquatic
13 impacts --
14 JUDGE JACKSON: Is there someone on the
15 panel that would make more sense, then, to answer
16 this?
17 DR. MASNIK: This is Mike Masnik. The
18 withdrawal of water from the river is not likely to
19 increase, the withdrawal of water up to 136 CFS, is
20 not likely to have any adverse effect on the aquatic
21 biota. The increase relative to the flow of the river
22 is relatively small and as a result, you wouldn't
23 expect it to have an impact.
24 Additionally, as Lance has said, this is
25 not going to be a frequent occurrence.

1 JUDGE JACKSON: Okay, I guess the
2 question, the issue that was being pursued is aren't
3 these appropriate to be considered in a cumulative
4 impacts analysis then? Your view then is that there
5 is --
6 DR. MASNIK: Again, as Lance said, looking
7 at extremely high values is not appropriate, we don't
8 believe, for a cumulative analysis.
9 JUDGE JACKSON: And then a follow-up on
10 that?
11 JUDGE BOLLWERK: So is what you're saying
12 that this is sort of an outlier and therefore, it
13 doesn't have an impact in terms of the cumulative
14 analysis? Is that -- my understanding that's the
15 basic thrust of your response.
16 MR. VAIL: Yes.
17 JUDGE JACKSON: Okay, thank you.
18 JUDGE BOLLWERK: All right, then, let me
19 check. I think we're almost done with you all. Let
20 me just check one thing. Mr. Powers, Dr. Powers here.
21 MR. SANDERS: I think he's a Mr. Powers
22 and I think we're expecting him at 7:00 p.m. tonight.
23 JUDGE BOLLWERK: Okay.
24 MR. SANDERS: And you might be thinking of
25 Dr. Hayes, our 6.0 witness.

1 JUDGE BOLLWERK: Okay, maybe I've got the
2 -- well, anyway, I've got the list. I'm sorry.
3 MR. SANDERS: Yeah, our witness for EC 6.0
4 will be -- even though we had originally told you he
5 will be available on Wednesday and Thursday, we
6 actually arranged to get him here tomorrow afternoon.
7 So if we get to 6.0 tomorrow, he'll be available.
8 JUDGE BOLLWERK: Let me check my list.
9 Okay. Well, I guess the question is, if 1.3 goes over
10 into Wednesday, is Mr. Powers available, that's the
11 question?
12 MS. GOLDSTEIN: Yes, yes, he should be.
13 JUDGE BOLLWERK: That's not a problem
14 then. I mean, it's now going on a little after 5:00
15 o'clock. I think the Board's preference would be to
16 adjourn and start tomorrow with the intervener
17 witnesses, joint interveners, Dr. Young and Mr.
18 Sulkin. Having said that, if there's a problem with
19 any of the intervener witnesses on 1.3 being available
20 on Wednesday, we obviously, don't want to let them get
21 away without having talked with them.
22 MR. SANDERS: I appreciate that and I
23 really don't think it will be a problem.
24 JUDGE BOLLWERK: All right. It's been a
25 long day. It's already -- we started at 8:30. I

1 think we intend to start again at 8:30 tomorrow. I
2 think there's a lot of information we need to glean
3 tomorrow on 1.3, but we need to finish up with 1.2
4 obviously, and that may take -- that may well take
5 several hours. So -- but if the witnesses are
6 available on 1.3 on Wednesday assuming we don't get
7 done tomorrow then that should alleviate that problem,
8 I think. Let me see if the other Board members
9 believe that's an appropriate way to -- right, the
10 only problem -- what Judge Jackson has raised with me
11 is could we go ahead and put the panel on for the
12 joint interveners and put the exhibits in.
13 We can do that. The only problem is then
14 you're going to have all their testimony split off
15 from their -- their pre-filed and -- all their direct
16 testimony will be bound in a different version of the
17 transcript than the -- all their other testimony. So
18 it sort of splits it up, it makes it more difficult to
19 read. You have to split between one copy of the
20 transcript and another. So what's -- anybody have a
21 preference? I can -- you all are the ones that will
22 have to deal with the transcript, so to some degree.
23 MR. MOORE: We don't have any objection to
24 having to go look at two different volumes if we need
25 to.

1 JUDGE BOLLWERK: All right.

2 MR. SANDERS: We would just as soon
3 continue with at least swearing our folks in and
4 getting the testimony and evidence on the record. And
5 then also I just have to remind you that Mr. Sulkin is
6 leaving tomorrow afternoon and he's one of our 1.3
7 experts as well as 1.2.

8 JUDGE BOLLWERK: Okay, we definitely --
9 all right, this was what we -- that was somebody we've
10 forgotten, all right. When is Mr. Sulkin leaving
11 tomorrow?

12 MR. SANDERS: His flight is at 5:40.

13 JUDGE BOLLWERK: Then we definitely --
14 okay, that's a fact not in evidence as the saying
15 goes, so we need to -- we're definitely going to need
16 to proceed tonight then. All right, let me turn back
17 to the staff panel. I think at this point, we have
18 received your testimony. We appreciate you making
19 yourselves available being of service to the Board.

20 You remain sworn, subject to being
21 recalled. But again, thank you very much for
22 appearing before us and we appreciate your efforts.
23 Thanks. All right, let's go ahead then and we'll
24 proceed with the panel for Joint -- I'm sorry, the two
25 individuals for Joint Interveners, Dr. Young and Dr.

1 Sulkin, Dr. Young and Mr. Sulkin, excuse me.
2 Everybody is getting a title. I have to be careful.
3 All right, given the other panels we had,
4 you all look kind of lonely up there all by
5 yourselves, but, all right, Mr. Sanders, why don't we
6 go ahead and --
7 MR. SANDERS: I'm going to have Ms. Porter
8 do the honors.
9 JUDGE BOLLWERK: All right.
10 MS. PORTER: Okay, I'll begin by
11 identifying the witnesses. If they'll just raise
12 their hands for the record. Mr. Barry Sulkin sitting
13 on the left and Dr. Shawn Young next to him.
14 JUDGE BOLLWERK: All right, and I think
15 the Court Reporter has got that. If we want to go
16 ahead then and deal with the testimony and we should
17 go ahead and do -- I believe Dr. Young was listed
18 first, I think. It really doesn't make a difference,
19 however you want to do it.
20 MS. PORTER: Okay, your Honor, if you'd
21 like to swear them in.
22 JUDGE BOLLWERK: Okay.
23 (Witnesses sworn.)
24 JUDGE BOLLWERK: Thank you very much.
25 MS. PORTER: Okay, could we have the pre-

1 filed testimony of Dr. Young brought up, please. Dr.
2 Young, do you recognize this testimony as your pre-
3 filed direct testimony for EC 1.2?
4 DR. YOUNG: Yes, I do.
5 MS. PORTER: And is this testimony
6 entitled Re-revised Pretrial Direct Testimony of Shawn
7 P. Young, in support of EC 1.2 and dated January 9th,
8 2009, revised on February 2nd and then re-revised on
9 February 13th which has been provided to the Court
10 Reporter in electronic form under file name Young 1.2
11 Direct Testimony and that was prepared under your
12 supervision and direction and is true and correct to
13 the best of your knowledge; is that right?
14 DR. YOUNG: Yes.
15 MS. PORTER: Could we have Dr. Young's
16 Pre-filed Rebuttal Testimony for EC 1.2 brought up,
17 please? Dr. Young, do you recognize this testimony as
18 your pre-filed rebuttal testimony for EC 1.2?
19 DR. YOUNG: Yes.
20 MS. PORTER: And the testimony entitled
21 revised pre-filed rebuttal testimony of Dr. Shawn P.
22 Young concerning Contention EC 1.2 and dated February
23 6th, 2009 revised on March 2nd, 2009 which has been
24 provided to the Court Reporter in an electronic format
25 under file name Young 1.2 rebuttal testimony was

1 prepared under your supervision and direction and is
2 true and correct to the best of your knowledge, is
3 that right?
4 DR. YOUNG: Yes, it is.
5 MS. PORTER: Could we have the pre-filed
6 Direct Testimony of Mr. Sulkin for EC 1.2 brought up,
7 please? Mr. Sulkin, do you recognize this document as
8 your pre-filed direct testimony for EC 1.2?
9 MR. SULKIN: Yes.
10 MS. PORTER: And the testimony entitled
11 revised pre-filed direct testimony of Barry W. Sulkin
12 in support of EC 1.2 and dated January 9th, 2009,
13 refiled on February 2nd, 2009, which has been provided
14 to the Court Reporter in electronic format under file
15 name Sulkin 1.2 Direct Testimony was prepared under
16 your supervision and direction and is true and correct
17 to the best of your knowledge; is that right?
18 MR. SULKIN: Yes.
19 MS. PORTER: Mr. Sulkin, do you recognize
20 this document as your pre-filed rebuttal testimony on
21 Environmental Contention 1.2?
22 MR. SULKIN: Yes.
23 MS. PORTER: And the testimony entitled
24 Revised Pre-filed Rebuttal Testimony of Barry W.
25 Sulkin concerning contention EC 1.2 and dated February

1 6th, 2009 refiled March 2nd, 2009 which has been
2 provided to the Court Reporter in electronic format
3 under file name Sulkin 1.2 rebuttal testimony was
4 prepared under your supervision and direction and is
5 true and correct to the best of your knowledge; is
6 that right?
7 MR. SULKIN: That's right.
8 MS. PORTER: Thank you.
9 MS. PORTER: Your Honor, we request that
10 this evidence or this testimony, excuse me, is moved
11 into evidence?
12 JUDGE BOLLWERK: All right, any objection?
13 Hearing none then the direct prefiled testimony of
14 Dr. Shawn P. Young, shall be entered into the record
15 as if read as DDMS-Item ID 59312, 59312.
16 Young Direct (DDMS-59312)
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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<br><br>SOUTHERN NUCLEAR OPERATING CO.<br><br>(Early Site Permit for Vogtle ESP Site) | Docket No. 52-011-ESP<br><br>ASLBP No. 07-850-01-ESP-BD01<br><br>Originally Filed: January 9, 2009<br>Revised: February 2, 2009<br>Re-Revised: February 13, 2009 |

**RE-REVISED PRE-FILED DIRECT TESTIMONY OF SHAWN P. YOUNG IN SUPPORT OF EC 1.2**

**Q1: Please state your name and current business address.**

**A1:** My name is Shawn Paul Young, and my current business address is 103A Natural Resources Building, University of Idaho, Moscow, ID 83844.

**Q2: What is your educational background?**

**A2:** I received a B.S. degree in Environmental Studies from Northland College (Ashland, WI) in 1996. I received a M.S. degree in Aquaculture, Fisheries, and Wildlife Biology (Fisheries emphasis) from Clemson University (Clemson, SC) in 2001. I received a Ph.D. in Fisheries and Wildlife Biology (Fisheries emphasis) from Clemson University (Clemson, SC) in 2005.

**Q3: For whom do you work and in what capacity?**

**A3:** I am currently Research Faculty of Fisheries Biology at the University of Idaho (Moscow, ID). I also currently hold Adjunct Faculty status at Clemson University (Clemson, SC).

**Q4: What is your professional background?**

**A4:** A copy of my curriculum vitae has been provided to the Board and other parties previously and is attached to this testimony as JTI000042. Briefly, I have eleven years of experience researching the effects of human activities on fisheries and aquatic ecosystems, including six years of experience studying fisheries in the Savannah River Basin. In addition to the faculty positions I currently hold, I was previously a visiting Assistant Professor of Fisheries Biology at Purdue University.

**Q5: Have you published or presented in the fields of fisheries and aquatic ecology?**

**A5:** Yes; I have in publication, in press, and in review twenty-seven peer-reviewed articles relevant to fisheries and aquatic ecology. I have presented scientific presentations at numerous professional meetings, academic seminars, and citizen fishing association functions.

**Q6: Have you testified as an expert previously in any jurisdiction or proceeding?**

**A6:** Yes; I have been recognized as an expert in fisheries and aquatic ecology. I provided scientific review and affidavit opinion on the potential environmental impacts of nuclear expansion on the North Anna/Pamunkey River (VA) and Tennessee River (AL). I am currently involved in fisheries issues pertaining to the Federal Energy Regulatory Commission ("FERC") re-licensing of Tillery Dam on the Yadkin-Pee Dee River (NC). Also, I provided review on a draft petition to designate critical habitat for the endangered Goldline Darter and Blue Shiner.

**Q7: Do you have a written summary of your education, employment, experience and background, and papers and presentations you have made over your career?**

**A7:** The copy of my curriculum vitae attached as JTI000042. to this testimony supplies such a summary.

**Q8: What materials have you reviewed and actions have you taken in preparation for your testimony?**

**A8:** I am familiar with the application of Southern Nuclear Operating Company ("SNC") for an Early Site Permit ("ESP") at the Vogtle Electric Generating Plant ("VEGP") site. I have reviewed excerpts of the Final Environmental Impact Statement ("FEIS") prepared by the staff of the Nuclear Regulatory Commission ("NRC"), including those sections describing water intake, water consumption, and thermal discharge into the Savannah River associated with the proposed additional nuclear power generating units ("Units 3 and 4"), the cumulative impacts of Units 3 and 4 operation, and the subsequent potential impacts of Units 3 and 4 on the fish assemblage of the Savannah River, together with related documents submitted in this matter.

**Q9: Have you given affidavits or declarations in support of or in connection with any of Joint Intervenors' contentions in this ESP proceeding?**

**A9:** Yes, I submitted a declaration in support of the petition to intervene in December 11, 2006. (JTI0000023). I submitted an affidavit in opposition to SNC's motion for summary disposition of EC 1.2 on November 13, 2007. (JTI0000003). Also I submitted a declaration in support of admission of contention EC6.0 on September 22, 2008. (JTI000005)

**Q10: What are the topics of your testimony?**

**A10:** I will testify on two topics to a reasonable degree of scientific certainty. I will testify on the deficiencies, in data, quantitative analysis, field studies, and logic, of the FEIS conclusions

regarding (1) the potential impacts of entrainment and impingement, and (2) the thermal effluent discharge impacts on aquatic species. My testimony will support Environmental Contention 1.2, which provides that the FEIS fails to adequately discuss the impacts of the proposed cooling system intake on the aquatic species of the Savannah River.

Entrainment and Impingement

**Q11: Please summarize your opinion of the FEIS conclusions regarding the potential impacts of entrainment and impingement on aquatic resources.**

**A11:** The FEIS lacks sufficient field surveys and quantitative analysis to assess baseline habitat conditions, species diversity, and species abundance in the vicinity of the VEGP site. In addition, the FEIS discussion of the direct, indirect, and cumulative impacts of entrainment and impingement is inadequate and relies on incorrect assumptions.

**Q12: Does the FEIS contain sufficient data to analyze the construction and operation impacts on the fish species located in the Middle, Lower, and estuarine Savannah River?**

**A12:** No. The FEIS does not contain sufficient data to analyze the construction and operation impacts on fish species located in the Middle, Lower, and estuarine Savannah River. In order to accurately evaluate the construction and operation impacts, the causes of the population decline must be articulated. The FEIS, on pages 2-81 through 2-91, sets forth certain information regarding the six fish species located in the Middle, Lower, and estuarine Savannah River that are experiencing population decline and considered most imperiled and/or most important to Savannah River fisheries. However, the FEIS provides very little information regarding the causes for such population decline. Also, the FEIS lacks adequate discussion of the other fish

species that may be at risk of population decline, as a result of construction and operation of Units 3 and 4.

**Q13: Does the FEIS provide sufficient data to substantiate conclusions regarding the impacts of entrainment on the fish species located in the Middle, Lower, and estuarine Savannah River in the vicinity of the VEGP site?**

**A13:** No. Although the FEIS does contain some survey data from the Academy of Natural Sciences of Philadelphia ("ANSP"), the ANSP surveys are not an adequate indicator of the construction and operation impacts on the fish species located in the Middle, Lower, and estuarine Savannah River. For example, the ANSP surveys lack detailed data of the life history stages of fish species near the Plant Vogtle site, the migration timing of each species' life history, distribution patterns in the immediate vicinity of Plant Vogtle, or population numbers. Notably, no such studies have been conducted since the mid-1990s, as is evidenced by NRC000003 (ANSP 2001) and NRC000004 (ANSP 2003). Moreover, several parts of the existing – albeit outdated – ANSP research, including ichthyoplankton surveys, were performed on a limited basis, only a few times per year, and during alternating years. For instance, the FEIS relies on portions of ANSP's research (JTI000002 (ANSP 2003)) where fish investigations were conducted once per year, during three days in September, at a limited number of sampling stations. This sampling protocol is grossly insufficient to supply information needed to draw appropriate conclusions regarding the impact of Units 3 and 4 on fish species.

**Q14: When analyzing entrainment, is it important to consider the life history of the fish species that inhabit the Savannah River near Plant Vogtle or pass by Plant Vogtle as part of the drift community?**

**A14:** Yes. Data for early life history of fish that inhabit the Savannah River near Plant Vogtle, or pass by Plant Vogtle as part of the community drift, is of paramount importance when analyzing entrainment. The 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. In general, fish eggs have no mobility and larval fish have very little mobility. They utilize the inertia of flowing water for passive transport to conserve energy. Since fish eggs and larval fish have limited capacity for avoidance, they are inherently vulnerable to entrainment.

**Q15: Are the larval fish that inhabit the Savannah River near Plant Vogtle or pass by Plant Vogtle as part of the drift community capable of avoiding the predicted water intake velocities?**

**A15:** No. Not all of the larval fish that inhabit the Savannah River near Plant Vogtle or pass by Plant Vogtle as part of the drift community are capable of avoiding the predicted water intake velocities. The FEIS at 5-30 states that "species and life stages evaluated in various studies could endure a velocity of 1ft/sec." However, many of the endangered or important fish of the Savannah River cannot endure that water intake velocity. For example, the FEIS on page 2-83 notes that the larval fish of the Robust Redhorse, a state-listed endangered species, are only capable of swimming speeds that range from 3 to 5 inches/sec. Thus, the larval fish of the Robust Redhorse are not capable of swimming through the affected area, given the predicted water intake velocities.

Furthermore, the FEIS discussion is inadequate because it lumps all categories of larval fish together. Some larvae are better swimmers than others. Thus, a group conclusion regarding the swimming abilities of larvae in is vague, at best.

**Q16: Is it reasonable to assume that the drift community near Plant Vogtle is uniformly distributed?**

**A16:** No. It is not reasonable to assume that the drift community near Plant Vogtle is uniformly distributed. The FEIS makes this assumption at 5-31, even though the most widely recognized studies indicate that the drift community is not uniformly distributed. For example, JTI000006 (Wiltz (1983)) studied fish egg and larval drift, and JTI000007 (Nichols (1983)) surveyed macroinvertebrate drift distribution near Plant Vogtle during pre-operation monitoring. Both found that the drift community, including eggs and larvae of 34 fish species, were non-uniformly distributed and varied over time and space in the vicinity of Plant Vogtle. Further, JTI000004 (Paller (1995)) studied American Shad egg distribution at the Savannah River Site intakes which are near Plant Vogtle. Paller found a higher abundance of American Shad eggs along the Georgian Bank than the South Carolina bank, reaffirming that the drift community is not uniformly distributed.

**Q17: Does entrainment correspond directly with the percent of flow withdrawn, when the drift community is not uniformly distributed?**

**A17:** No. When the drift community is not uniformly distributed, entrainment will not correspond directly with the percent of flow withdrawn. Impacts due to entrainment may be greater during periods when the drift community is highly concentrated.

**Q18: Does the FEIS provide sufficient data and analysis to substantiate its conclusion that the current and future operation of Units 3 and 4 will have a minor impact on the ichthyoplankton community near Plant Vogtle?**

**A18:** No. The FEIS fails to provide any baseline data regarding species composition, abundance, and distribution to support its conclusions. The FEIS states that American shad are the most dominant ichthyoplankton in the river, but its analysis of the American shad population is limited. In addition, on page 2-82 of the FEIS, the staff illogically relies on oxbow population data, which is not relevant to its analysis of the mainstream ichthyoplankton community. Moreover, the FEIS states that American shad eggs are concentrated along the bottom of the water column, and then concludes – because of such concentrations – that the current and future operation of VEGP will result in only minor impacts. This conclusory statement is inadequate because it fails to take into consideration other factors which might affect the American shad eggs distribution and in turn, the ichthyoplankton community near Plant Vogtle. Also, it fails to take into account Paller's 1995 study of the horizontal distribution of American shad eggs in the drift near Plant Vogtle. Paller found a higher abundance of American shad eggs along the Georgian bank, and stated that the study results revealed "the importance of site specific assessments of ichthyoplankton distribution near existing or proposed water intakes using statistical designs that permit sensitive resolution of spatial patterns." (JTI000004 (Paller 1995)).

**Q19: What is the most effective method to determine the composition, distribution, and vulnerability to entrainment of the ichthyoplankton species in the vicinity of the VEGP site?**

**A19:** The most effective method to determine current ichthyoplankton species composition, distribution, and vulnerability to entrainment in the vicinity of the VEGP site is an

ichthyoplankton-net collection. Many widely recognized studies have relied upon ichthyoplankton-net collections (JTI000008 (Bilkovic et al. 2002); JTI000009 (Overton and Rulifson 2007); JTI000010 (Perez-Ruzafa 2007)). Ichthyoplankton collections should be conducted at equal intervals from riverbank to riverbank, surface to bottom, during a stratified sampling period occurring day and night several times per week during each month of the year. These collections will give a more accurate depiction of the drift community that may be entrained.

**Q20: Does the FEIS provide sufficient data and analysis to support its conclusion that the fish and shellfish located in the vicinity of the VEGP site are adapted to survival in varying flow regimes and velocities?**

**A20:** No. The FEIS lacks sufficient data and analysis to support its conclusion that the fish and shellfish located in the vicinity of the VEGP site are adapted to survival in varying flow regimes and velocities (NRC000001 (FEIS Table 2.7)). The FEIS discussion of variability fails to distinguish between natural variability and human-induced variability. While it is true that fish and shellfish can adapt to natural variability, human-induced variability produces different results. This case concerns human-induced variability, since the New Units' additional water intake produces the variability. Studies demonstrate that human-induced variability, combined with related anthropogenic stressors such as increased entrainment mortality, is the primary cause of decreased freshwater biodiversity (e.g., fish, mollusks, macroinvertebrates) in the United States. JTI000016 (Vaughn and Taylor 1999); JTI000017 (Ricciardi and Rasmussen 1999); JTI000018 (Cosgrove and Hastie 2001); JTI000019 (Layzer and Scott 2006); JTI000020 (Williams et al. 1993).

**Q21: Does the FEIS consider a sufficient range of flows in its analysis of water intake percentages and their affect on entrainment and impingement?**

**A.21:** No. The FEIS fails to consider a sufficient range of flows in its analysis of water intake percentages and their affect on entrainment and impingement (NRC000001 (FEIS 7-24)). The FEIS lacks sufficient analysis of entrainment and impingement during low flows, even though low flows are reasonably likely to occur. The FEIS should, at the very least, include analysis of flows ranging from normal to Drought Level 4.

**Q22: Does entrainment increase as river levels drop?**

**A22:** Yes. There is evidence of increased entrainment as river levels drop, because when river levels drop, the concentration of eggs and larvae in the river increases. As previously discussed, the early life stages of fish are the most susceptible to entrainment because they have limited capacity for avoidance.

**Q.23: Does the Hydraulic Zone Influence study conducted by SNC in support of this proceeding provide sufficient data and analysis?**

**A.23:** No. The Hydraulic Zone Influence study lacks sufficient data and analysis because the study was conducted while operation was only at 56% capacity during a limited range of flows. In order to provide complete and accurate analysis, the modeling should also include the impact at full capacity under different flows. The modeling should include the impact at full capacity under different flows because the volume of water intake will change, depending on the percentage of facility operation capacity. For example, operation at 100% capacity will require more water withdrawal , thus increasing the zone of influence further into the river channel and increase intake velocities, than operation at 56% capacity.

**Q.24: Does the FEIS consider a sufficient range of flows?**

**A.24:** No. The FEIS fails to consider a sufficient range of flows. The FEIS considers only the following flows: average conditions (8830 cfs), Drought Level 1 (4200 cfs), Drought Level 2 (4000 cfs), and Drought Level 3 (3800 cfs). Currently, the level is below Drought Level 3, the lowest level considered. Thus, the area is experiencing extreme drought conditions not contemplated by the FEIS.

Thermal Impacts

**Q.25: If the current river flow is less than the flows that were modeled, how will the discrepancy distort the results?**

**A.25:** Lower river flow or volume means less volume to dissipate the heat from the thermal discharge. Plus, the thermal plume will constitute a larger proportion of the river volume in that area. The lower flow may also change, likely reduce, the flow velocity of the river, which may lead to a change in thermal plume dimensions.

**Q.26: How does reduced flow impact aquatic species?**

**A.26:** Reduced flow places more of the drift community at danger of thermal impacts due to river channel confinement. That is, low water levels confine organisms to a smaller habitat, concentrating the number of organisms per unit of area in the vicinity of the thermal plume. Further, low-flow reduces the river volume, and thus, the ability for the heat to be dissipated across time and space. This confinement increases the vulnerability to thermal stress and mortality.

**Q.27: Does the FEIS provide sufficient data and analysis of thermal stress and mortality for the fish species located in the Middle, Lower, and estuarine Savannah River?**

**A.27:** No. The FEIS does not provide sufficient data and analysis of thermal stress and mortality for the fish species located in the Middle, Lower, and estuarine Savannah River. The FEIS fails to consider all possible river conditions and rather, focuses on conservative river conditions. The FEIS lacks analysis under elevated temperatures. High water temperature kills the early life history stages of several highly-valued fish found near VEGP, and most likely also causes mortality in many less-studied and less-desired Savannah River fish species. For example, American shad eggs suffer mortality at 80.1°F, and larvae suffer mortality at 87°F (JTI000011 (Steir and Crance 1985)). Blueback herring eggs and larvae suffer mortality at 85.5°F (JTI000012 (Pardue 1983)). The federally endangered shortnose sturgeon's eggs suffer mortality at 75°F, and larvae suffer mortality at 85°F (JTI000013 (Crance 1986)). Striped bass eggs suffer mortality at 75°F, and larvae suffer mortality at 85°F (JTI000014 (Bain and Bain 1982); JTI000015 (Fay et al. 1983)). JTI000015 (Fay et al. (1983)) also provides data and synthesis from a number of studies on the effects of thermal pollution discharge on early life stages of striped bass, "Most early striped bass life stages show significant elevated mortality when exposed to rapid changes in water temperature (such as that in a thermal discharge plume)." The studies found in JTI000015 (Fay et al. (1983)) provide evidence that striped bass larval survival is significantly affected by sudden temperature elevations of 18°F, and mortality exceeds 50% when water temperatures reach 90°F.

**Q.28: Does the FEIS provide a comprehensive analysis of potential thermal impacts on the vulnerable life history stages of fishes located in the Middle, Lower, and estuarine Savannah River?**

**A.28:** No. The FEIS only discusses fish species and life history stages that provide a supportive argument that additional units will not affect fish species. The FEIS analysis is inadequate because it fails to adequately list, discuss, and assess potential thermal impacts on the vulnerable life history stages. Fish thermal tolerance and mobility changes across life history stages. Eggs have no mobility and reduced thermal tolerance during embryonic development. Further, no data detailing spatial distribution of ichthyoplankton drift in the vicinity of the thermal plume is presented to determine impacts.

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)
Dr. Shawn Young
University of Idaho, Fish and Wildlife Resources
103A Natural Resources Building
Moscow, ID 83844
Phone: (208) 885-6001
Email: syoung@uidaho.edu

1 MS. PORTER: The rebuttal testimony of Dr.
2 Shawn P. Young shall be entered at this point into the
3 record as if read as DDMS Item ID 59366.
4 Young, Rebuttal (DDMS-59366)
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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

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| In the Matter of<br>SOUTHERN NUCLEAR OPERATING CO.<br>(Early Site Permit for Vogtle ESP Site) | Docket No. 52-011-ESP<br>ASLBP No. 07-850-01-ESP-BD01<br>Originally Filed: February 6, 2009<br>Re-Filed: March 2, 2009 |

# REVISED PREFILED REBUTTAL TESTIMONY OF DR. SHAWN YOUNG CONCERNING CONTENTION EC 1.2

## Rebuttal of Prefiled Direct Testimony of Mr. Moorer

**Q1: Do you agree with Mr. Moorer's assertion, in answer 7 of his prefiled direct testimony that the ER/EIS successfully identifies and considers the impacts of the proposed cooling system intake because the Vogtle ER and responses to the RAIs provided more than a hundred references describing the baseline conditions of the Savannah River in the area near Vogtle?**

**A1:** I do not agree with Mr. Moorer's assertion that the ER/EIS successfully identifies and considers the impacts of the proposed cooling system intake. The EIS contains a woefully poor summary of the aquatic life stages of those organisms living in the Savannah River. The EIS even omitted vulnerable life history attributes of these organisms. So for Mr. Moorer to

conclude that the EIS successfully identifies the impacts of the proposed cooling system intake, based on the references cited, does nothing to resolve the glaring omissions and inadequacies of the EIS in regards to aquatic life stages.

**Q2: Mr. Moorer, in answer 7 of his prefiled direct testimony, agreed with the SRS staff who concluded that at intake flows many times larger than those proposed for Vogtle, impingement and entrainment impacts remain small and do not result in any quantifiable impact to the fishery or the general aquatic community. Do you also agree with the SRS conclusions?**

**A2**: No I do not agree with the SRS staff conclusions. This is not my opinion, but the opinion of leading scientists who study the Savannah River; including, M. H. Paller who is a SRS fish biologist, author of some of the SRS studies and co-author of the Fishes of the Middle Savannah River Basin, the text listing nuclear power plants, including SRS and VEGP, as having negative impacts on Savannah River fisheries. As co-author of Fishes of the Middle Savannah River Basin, M. H. Paller would not have or should not have included the passage if he/she did not support this claim concerning their employer.

**Q3: Do you agree with Mr. Moorer's assertion in answer 9 of his prefiled direct testimony that the ANSP studies were appropriate for determining the aquatic baseline because these studies are an ongoing annual study for the past 50 years?**

**A3:** I do not agree with Mr. Moorer's assertion that the ANSP studies were appropriate for determining the aquatic baseline. These studies occur for only three days in September every year. This brief amount of time is simply not enough to legitimately determine the status of fisheries, particularly anadromous and migratory species.

**Rebuttal of Prefiled Rebuttal Testimony of Mr. Montz and Mr. Dodd**

**Q4: In answer 14 of their prefiled direct testimony, Mr. Montz and Mr. Dodd described their entrainment study at VEGP. Do you agree with how they conducted this study and the accuracy of its results?**

**A4:** I do not agree with some aspects of how Mr. Montz and Mr. Dodd conducted their entrainment study at the VEGP and at the site of intake for Units 3 and 4. I disagree with the accuracy of its results. First, the two first started their study of entrainment at the mouth of the canal and then switched to the middle of the canal. They never explain why they decided to make this switch and such an explanation is needed given that the mouth of the canal is the best indicator of entrainment. Also as acknowledged by Mr. Montz and Mr. Dodd, due to sampling mid-canal, eggs might have settled near the mouth before they were vulnerable to their sampling mid-canal. Settlement of eggs withdrawn from the main channel would still lead to mortality of most species. Further, significantly fewer ichthyoplankton samples were taken at the site of the proposed intake for Units 3 and 4. Given the importance of predicting impacts from the proposed additional units, there should have been an equal sampling effort to acquire an adequate data set concerning the drift community at the proposed intake for new units. Yet for some reason, this did not occur.

**Q5: In answer 17 of their prefiled direct testimony, Mr. Montz and Mr. Dodd stated that because no eggs were observed in the entrainment samples that these eggs likely settled out of the water column due to sediment catchment, and would not be entrained. Do you agree with this conclusion?**

**A5**: No, I do not agree with this conclusion. If this conclusion regarding sediment catchment was right, then the entrainment would be higher than the results indicate. A settled

egg of most species would likely die. For example, American shad eggs die if they experience siltation.

**Q6: Please describe the methodological inadequacies of Mr. Montz and Mr. Dodd's study of the VEGP thermal plume.**

**A6**: In answer 23 of their prefiled direct testimony, Mr. Montz and Mr. Dodd never calculated what the impact of the hydraulic zone influence would be at full-capacity operation or at drought flow levels. In answer 24 of their prefiled direct testimony, the two never discussed the ichthyoplankton drift distribution in the thermal plume. In answer 26 of their prefiled direct testimony, the two never included any analysis of other seasons of the year beyond summer. An analysis of spring conditions during which the highest ichthyoplankton biomass is present would have been most appropriate. Additionally, in answer 29 of their prefiled direct testimony, the two neglected to include what the ichthyoplankton distribution was in relation to the thermal plume at any time of the year.

**Rebuttal of Prefiled Direct Testimony of Dr. Charles Coutant**

**Q7: Dr. Coutant stated in answer 51 of his prefiled direct testimony that there is no causal link between entrainment and impingement in cooling water and effects on fish populations in the middle Savannah River? How do you respond?**

**A7**: Dr. Coutant is wrong. This is not my opinion, but the opinion of leading scientists who study the Savannah River; including, M. H. Paller who is a SRS fish biologist and co-author of the Fishes of the Middle Savannah River Basin, the text listing nuclear power plants, including VEGP, as having negative impacts on Savannah River fisheries. NRC000006. As co-authors of this text, M. H. Paller and the other distinguished scientists would not have or should

not have written about this subject if they did not agree with the statement or were unable to substantiate the claim.

**Q8: Dr. Coutant stated in answer 67 of his prefiled direct testimony that low river flows are not likely to coincide with high ichthyoplankton density or high temperature risks. How do you respond to this assertion?**

**A8**: Dr. Coutant's assertion is not true. I have seen the Savannah River at low flows during spring spawning season, where flow regulation has left sucker spawning beds dry in a colleague's field studies. This has been discussed in a recent publication by my colleagues. JTI000046.

**Rebuttal of Prefiled Direct Testimony of the Staff**

**Q9: In their answer to question four, the staff testifies regarding the latest surveys that were conducted on the Savannah River in the vicinity of the Vogtle site by the ANSP. Specifically, the surveys occurred at River mile 122 and 161. In your opinion, are these surveys sufficient to identify the species composition and habitat conditions at River mile 151, the location of the proposed intake structure?**

**A9**: Surveys conducted at other locations on the river provide some simple information on diversity and abundance which can be extrapolated, in a general way, to the site of the intake at RM 151. In my opinion, however, it is incorrect to presume that a single survey performed in the fall of 2001 at sites at least 10 miles distant from the Vogtle site are representative of conditions at the site. First, habitat conditions can be highly variable from site to site and as a result there could be significant variation in habitat type, utilization, and species composition. Second, the ANSP study provides only a snapshot of conditions in the fall of 2001 but tells us nothing about other seasons of the year. Third, the EIS and Staff testimony discuss only the

most abundant and common species. The baseline conditions include both common and rare species and in many instances we are more concerned with potential impacts on the uncommon and rare. We also need to know whether species we expect to find are absent because this gives us information on the baseline habitat conditions.

**Q10: In your opinion, does the description of baseline population and habitat conditions in the FEIS comply with the directive in the ESRP, discussed in answer 6 of the Staff's prefiled direct testimony, to describe the aquatic environment and biota *at* the Vogtle site?**

**A10**: No, the FEIS includes no data from recent surveys conducted at the Vogtle site. As indicated in my answer to the previous question, the ANSP (and other) studies conducted in the vicinity of the Vogtle site provide useful information but are insufficient to draw definitive conclusions about habitat and species at the site. Also, the ANSP study that the Staff relies on so heavily was conducted in the fall, and therefore does not comply with the ESPR mandate that the analysis be based on at least one year of data.

**Q11: Do you agree with the Staff's opinion in answer 9 of their prefiled direct testimony that the ANSP studies provide a current understanding of the species of fish and mollusks present in the vicinity of the Vogtle site?**

**A11**: No, I do not. As I said earlier, the ANSP studies do provide useful data but, in my opinion, the Staff overstates the value of these studies. The last reported ANSP data was collected in 2000 at some distance from the Vogtle sites. Both the location of the sites and the age of the data make me highly suspicious of the reliability of the ANSP studies for this purpose.

**Q12: Does Exhibit NRC000006 (Marcy et al. 2005) specifically address species composition and abundance or habitat conditions in the stretch of river adjacent to the Vogtle site?**

**A12**: No, it does not. As the Staff notes in answer 9 of their prefiled direct testimony, Marcy et al. is not an impact assessment, and therefore does not address conditions specific to plant Vogtle. Marcy et al. is the most comprehensive source for information on the fish species of the Middle Savannah River and is an invaluable resource. However, it does not have the level of specificity necessary for an analysis of potential impacts of two addition Units at the Vogtle site.

**Q13: Do agree with the Staff, in answer 14 of their prefiled direct testimony, that aquatic organisms inhabiting rivers and streams flowing into the Atlantic are preadapted to tolerate large variation in water flow?**

**A13:** Yes, the species of the Savannah River have evolved to tolerate the range of conditions they experience in nature, including periodic extreme low flows. Construction of Thurmond Reservoir eliminated the extremely low flows that would normally occur in nature, and this is one of the causes of decline in populations of some native species. Many species don't just "tolerate" large variations in flow, they *require* variable flow to thrive. The Staff's answer also disregards the frequency, rise and recession rates, and duration of low flows, which is at least as important as the rate of flow.

**Additional Rebuttal Testimony**

**Q14: In your opinion, have cooling water intake structures contributed to the decline of shortnose sturgeon populations?**

**A14:** Yes, the Recovery Plan for the shortnose sturgeon attributes power plant cooling water intakes as a source of sturgeon mortality. Exhibit JTI000026. The recovery plan states that "Documented mortalities of sturgeon have occurred in the Delaware, Hudson, Connecticut, Savannah and Santee rivers."

**Q15: In your opinion, is it significant that no incidents of unusual fish kills at the Unit 1 and 2 intake have been reported by Southern to NRC?**

**A15:** Just because no incidents have been reported, does not mean that the intake is not a significant cause of mortality to the already-depleted sturgeon population of the Savannah River. The shortnose sturgeon Recovery Plan documents one case where impingement occurred at a nuclear power plant, but was not reported by the plant operator to the NRC. Exhibit JTI000026. In addition, the plant operators would not see or report losses of early life stage fish that are entrained in the intake structure.

**Q16: Does Southern's application include at least one year of data collected at the Vogtle site?**

**A16:** No, it does not. After admission of Intervenors' contentions for litigation, Southern studied impingement and entrainment at the existing intake canal for Units 1 and 2. These studies are limited in scope and do not include a full year of data.

**Q17: Dr. Young, is the uniform drift distribution assumption contained within the FEIS accurate? Exhibit NRC0000001 at 5-31.**

**A17:** No, the uniform drift distribution assumption is incorrect. The most widely recognized studies indicate that the drift community is not uniformly distributed. For example, JTI000006 (Wiltz (1983)) studied fish egg and larval drift, and JTI000007 (Nichols (1983)) surveyed macroinvertebrate drift distribution near Plant Vogtle during pre-operation monitoring.

Both found that the drift community, including eggs and larvae of 34 fish species, were non-uniformly distributed and varied over time and space in the vicinity of Plant Vogtle. Further, JTI000004 (Paller (1995)) studied American Shad egg distribution at the Savannah River Site intakes which are near Plant Vogtle. Paller found a higher abundance of American Shad eggs along the Georgian Bank than the South Carolina bank, reaffirming that the drift community is not uniformly distributed.

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 February 6, 2009.

Executed in Accord with 10 C.F.R. 2.304(d)
Dr. Shawn Young
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1 JUDGE BOLLWERK: In addition, the direct
2 testimony of Barry W. Sulkin shall be entered into the
3 record at this point as if read as DDMS Item ID 59840.
4 Sulkin Direct (DDMS 59840)
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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

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| In the Matter of<br>SOUTHERN NUCLEAR OPERATING CO.<br>(Early Site Permit for Vogtle ESP Site) | Docket No. 52-011-ESP<br>ASLBP No. 07-850-01-ESP-BD01<br>Originally Filed: January 9, 2009<br>Refiled: February 2, 2009 |

**REVISED PREFILED DIRECT TESTIMONY OF BARRY W. SULKIN IN SUPPORT OF EC 1.2**

**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 Contention 1.2 ("EC 1.2"), which concerns the impacts of the cooling water intake and discharge 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.

**Q10: Would you elaborate further?**

**A10:** EC 1.2 (and EC 1.3, as I discuss in my testimony in support of that contention) challenges 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.

**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.

**Q25: Does the Staff's analysis account for future reductions in flow?**

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

**A27:** 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 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.

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
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1 JUDGE BOLLWERK: And finally, the rebuttal
2 testimony of Barry W. Sulkin shall be entered into the
3 record at this point as if read as DDMS Item ID 59365.
4 Sulkin Rebuttal Testimony (DDMS-59365)
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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<br><br>SOUTHERN NUCLEAR OPERATING CO.<br><br>(Early Site Permit for Vogtle ESP Site) | Docket No. 52-011-ESP<br><br>ASLBP No. 07-850-01-ESP-BD01<br><br>Originally Filed: February 6, 2009<br>Re-Filed: March 2, 2009 |

**REVISED PREFILED REBUTTAL TESTIMONY OF BARRY W. SULKIN CONCERNING CONTENTION EC 1.2**

**Q1. Do you agree with the Staff in answer 28 of their prefiled direct testimony that the two new Units would withdraw between 0.9 and 2.2% of the total flow of the Savannah River depending on the river stage?**

A1. No, not exactly. As discussed in answer 18 of my direct testimony, I obtained a different result using the revised withdrawal figures from the DCD revision 16.

**Q2. In your opinion, is the staff correct, in answer 28 of their prefiled direct testimony, that the normal withdrawal rate of 83 cfs represents 1.2% of the annual mean flow of 6991 cfs at the Waynesboro gage?**

A2. I have no reason to doubt the stance calculation and that 83 cfs is 1.2% of 6,991 cfs. However, the testimony is somewhat misleading. First, as I stated in answer 17 of my prefiled direct testified, the DCD revision 16 withdrawal rate is 86.5 cfs. Second, and of much greater importance, is the fact that the Waynesboro gage includes only four years of data. This is the

reason why the Staff chose to use the discharge from Thurmond dam to estimate the flow in the first place. Third, flows on the Savannah River are controlled by the Corps' reservoir management, except during flood control operations. As a result, the annual mean since construction of the reservoirs does not reflect the natural conditions. So, while the Staff calculation may be correct, it is still not very meaningful.

**Q3. Did you calculate the annual mean discharge from Thurmond Dam in 2008?**

A3. Yes, approximately. I obtained the daily and monthly average discharge from the U.S. Army Corps of Engineers website (http://water.sas.usace.army.mil/cf/AvgDaily/Z.cfm) and then averaged the monthly means. The mean of the monthly means is 3,567 cfs, which is several hundred cfs lower than the Drought Level 3 flow. JTI000047

**Q4. Did you calculate the annual mean discharge from Waynesboro gage in 2008?**

A4. Yes, I did. The U.S.G.S. website has a tool that performs calculations on gage data. I navigated to the page for the Waynesboro gage (http://waterdata.usgs.gov/ga/nwis/annual/?search_site_no=021973269&agency_cd=USGS&referred_module=sw&format=sites_selection_links) and calculated the annual mean for 2005 – 2008. The annual mean in 2008 was 5,682 cfs. JTI000048.

**Q5. Did you calculate the normal withdrawal, using the DCD Revision 16 rate, as a percentage of the mean Thurmond Dam discharge and mean Waynesboro flow in 2008?**

A5. Yes, normal withdrawal (86.5 cfs) is 2.7% of the 2008 mean discharge from Thurmond Dam and the 1.5% of the 2008 mean flow at Waynesboro.

**Q6. What is the significance of these calculations, in your opinion?**

A6. This is an example of the inherently flawed nature of the Staff analysis. Throughout the FEIS, the Staff uses the Thurmond Dam discharge as a surrogate for the actual river flow at

Plant Vogtle. This presumption is inaccurate, as the data clearly shows. Once the Staff, however, decided to use the Thurmond discharge as the standard for making calculations, it should have done so consistently. It is misleading to base all of the calculations in the FEIS on the Thurmond discharge and then switch to the Waynesboro gage in the testimony.

**Q7. Are there other methods to estimate the flow at the Vogtle site that would be more accurate?**

A7. Yes, the Corps has a Hydrologic Engineering Center ("HEC") computer model of the Savannah Basin, which could be easily adapted for this use. The computer model accounts for the operational rules of the upstream reservoirs, as well as major withdrawals and discharges on the river. The HEC program can be used to accurately predict flows at the Plant Vogtle site. Even more importantly, it can be used to model different weather and water use scenarios to predict conditions under different scenarios.

**Q8. Do you agree with the Staff's conclusion in answer 33 of their prefiled direct testimony that the timing of the striped bass and American shad spawn relates to seasonal periods of higher river flow, when the fraction of water used by the proposed Units 3 and 4 is smaller?**

A8. No, this not the case when the Corps' Drought Contingency Plan is in effect. The Drought Contingency Plan does not provide for higher discharge during spawning season. Last year provides a good example. As you can see from the Corps' data in JTI000047, the monthly average discharge in 2008 never exceeded 3,700 cfs in any month. During the March-April spawning season, the daily maximum discharge was never greater than 3,900 cfs.

**Q9. Do you agree with the Staff conclusion that SNC's calculation of the entrainment rate at Units 1 and 2 (and therefore proposed Units 3 and 4) is minor when compared to the estimates by Specht of entrainment at SRS in 1984 and 1985.**

A9. The rate of entrainment calculated by SNC is 1,302 organisms per day, while Specht's figures are 64,000 per day and 71,000 per day. So, SRS likely had a greater impact when all of the SRS reactors were running than Vogtle Units 1 and 2 have today. However, this does not necessarily mean that doubling the Vogtle impact by adding two additional Units will have only minor impacts. That claim requires information about the current baseline conditions.

Specht found that SRS entrained approximately 25 million organisms per year. Over the decades of operation, SRS entrained billions of organisms. The first question that needs to be answered is whether the chronic loss of millions of organisms had any impact on species composition or population numbers. Then, the next question is whether populations have stabilized, or recovered, since SRS stopped most of its withdrawals. While 1,302 (or 2,600) organisms per day may seem small, especially in comparison to the huge SRS impacts, this is not necessarily the case if the current baseline is severely depressed as a result of past withdrawals at SRS. Without doubt, SNC's results are encouraging, but they are insufficient to support a conclusion regarding the potential cumulative impacts of the additional Units.

**Q10. In answer 35 of their prefiled direct testimony, the Staff testifies that it did not base its low-flow analysis on Drought Level 4 flows because the Drought Contingency Plan does not contain explicit flows and because of the likelihood that such flows will change in the future. In your opinion, is the Staff's approach reasonable?**

A10. No, in my opinion it is not reasonable to wholly discount the possibility of flows lower than Drought Level 3. As I testified on direct examination, the theoretical minimum flow, which is equivalent to the Drought Level 4 flow, is well known.

In addition, it is not reasonable for the Staff to presume that Drought Level 4 will change in the future. In answer 35 of its pre-filed direct testimony for E.C. 1.2, the Staff testifies that it used the release policies described in the Drought Contingency Plan "because it represented the most current understanding of future operations and releases by the Corps." In the case of Drought Level 3, the Staff bases its calculations on the Drought Contingency Plan, in spite of the fact that the discharge from Thurmond Dam has in fact been lower than the prescribed flow of 3,800 cfs during the ongoing drought. In my opinion, it is unreasonable for the Staff to adhere strictly to the Drought Contingency Plan on the Drought Level 3 flows in one case, and then throw out the Drought Contingency Plan entirely in the other case.

**Q11. Do you agree with the Staff testimony in answer 37 of their pre-filed direct testimony for E.C. 1.2 concerning the appropriateness of using the discharge from Thurmond Dam as the basis for the Staff's analysis of impacts at the site, given the withdrawals and releases upstream between Thurmond Dam and the Vogtle site?**

A11. Overall, my opinion is that the release from Thurmond Dam is a poor surrogate for estimating the potential impacts, especially cumulative impacts, of two additional Units at Plant Vogtle. In answer 24 of my pre-filed direct testimony for E.C. 1.2, I address the inherent weakness of the Staff's methodology. Also, as noted in my answer to questions 3-6 above, the flow at the Vogtle site (at the Waynesboro gage) was significantly higher than the Thurmond discharge in 2008.

The Staff testifies, in answer 37 of its pre-filed direct testimony for E.C. 1.2, that the flow at the Vogtle site will exceed the Thurmond discharge "as long as the inflow from tributaries and groundwater exceed the consumptive water losses by users between Thurmond reservoir and the VEGP site." This statement is undoubtedly true, but almost entirely beside the point. The FEIS identifies impingement and entrainment as potential impacts of the new Units

**Q12. In answer 50 of its pre-filed direct testimony for E.C. 1.2, the Staff testifies that water withdrawal percentages are 5.8% at 3,000 cfs and 8.7% at 2,000 cfs. Do you agree with the Staff conclusion it is inappropriate to heavily weight these percentage withdrawals under very low conditions?**

A12. No, this is an example of the Staff disregarding its stated methodology when the results are inconvenient. The Staff relies on the 5% threshold as long as it is not exceeded, but when withdrawal percentage is greater than 5% the Staff concludes that the result is unimportant. In my opinion, the percentage withdrawals under very low conditions deserve added weight, not less, because the drift community is more concentrated, the zone of influence of the intake is greater, the through-screen velocity is higher, and the biota are generally more stressed because of the dry conditions. These impacts resulting from very low conditions potentially amount to more than the "minor" impacts asserted by SNC on page 23 of the SNC Position Statement.

The Staff claims, in answer 50 of its pre-filed direct testimony for E.C. 1.2, that it is appropriate to discount very low flows because "they are expected to be temporary, on the order of days or weeks, rather than months." This statement is misleading, at best. At Drought Level 3 (3,800 cfs), the combined normal withdrawal percentage is 4.6%, which approaches the 5% threshold of significance. Exhibit JTI000021. Except during and immediately after rain, discharge from Thurmond Dam has been consistently below 3,800 cfs since December 2006. On

December 1, 2008, the Corps reduced the Thurmond discharge to 3,100 cfs. At that flow, the normal withdrawal percentage is 5.7%. If four Units were currently operating at Plant Vogtle, combined withdrawals would have exceeded the 5% threshold for more than two years, with no end in sight.

**Q13. Do you agree with Dr. Coutant's assertion in answer 64 of his pre-filed direct testimony for E.C. 1.2 that the approach in the EIS of selecting an extreme low flow is more reliable than the 7Q10 flow under the regulated flow regime of the Savannah River?**

A13. Yes, I agree with Dr. Coutant that 7Q10 flows are "rather meaningless" on a dam-controlled river like the Savannah. Today's Savannah River flows are a function of long- and short-term precipitation, as well as Corps management and operation of the upstream reservoir projects. As I discuss above in answer 2, the same logic applies to the annual mean flow calculation on dam-controlled rivers.

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 February 6, 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

1 JUDGE BOLLWERK: All right, and in terms
2 of the evidentiary material, the different exhibits.
3 MS. PORTER: Sure. We'll follow in the
4 footsteps of the NRC staff and identify each one
5 individually for the record and then move them in
6 together.
7 JUDGE BOLLWERK: Okay.
8 MS. PORTER: So beginning with JTIR00003
9 titled Affidavit of Young in support of Joint
10 Intervener's Answer to SNC's Motion for Summary
11 Disposition of Environmental Contention 1.2 dated
12 November 13th, 2007.
13 (The document referred to was
14 marked as Exhibit Number
15 JTIR00003 for
16 identification.)
17 JUDGE BOLLWERK: Let the record reflect
18 that Exhibit JTIR00003 has been marked for
19 identification.
20 MS. PORTER: JTI000004 titled Paller, M.
21 H., Tucker RC and W.M. Starkel, 1995 Statistical
22 Methods for Detecting Ichthyoplankton a density matter
23 patterns that influence entrainment mortality.
24 (The document referred to was
25 marked as Exhibit Number

1 JTI000004 for identification.)

2 JUDGE BOLLWERK: All right, then the

3 record should reflect that Exhibit JTI000004 has been

4 marked for identification.

5 MS. PORTER: All right, JTI000006 by J.W.

6 Wiltz titled Vogtle Electric Generating Plant,

7 Savannah River Larva Fish Study in Burke County,

8 Georgia from January through August 1974, Operating

9 License Stage Environmental Report Technical Document.

10 (The document referred to was

11 marked as Exhibit Number

12 JTI000006 for identification.)

13 JUDGE BOLLWERK: The record should reflect

14 that Exhibit JTI000006 has been marked for

15 identification.

16 MS. PORTER: JTI000008 D.M. Bilkovic, J.A.

17 Oney and C.E. Hershner, (phonetic) spawning of

18 American shad and striped bass in the Mattaponi and

19 Pamunkey Rivers, Virginia Fisheries Bulletin.

20 (The document referred to was

21 marked as Exhibit Number

22 JTI000008 for identification.)

23 JUDGE BOLLWERK: The record should reflect

24 that JTI -- Exhibit JTI000008 has been marked for

25 identification. What about 7?

1 MS. PORTER: Yeah, I just skipped that.

2 JUDGE BOLLWERK: That's fine.

3 MS. PORTER: Let's go back to 7.

4 JTI000007 M.C. Nichols, 1983 Vogtle Electric

5 Generating Plant survey of the drifting

6 macroinvertebrates of the Savannah River, Burke

7 County, Georgia, from September 1980 through August

8 1981.

9 (The document referred to was

10 marked as Exhibit Number

11 JTI000007 for identification.)

12 JUDGE BOLLWERK: The record should reflect

13 that Exhibit JTI000007 has been marked for

14 identification.

15 MS. PORTER: JTI000009, A.S. Overton and

16 R.A. Wolfason, Evaluation of Plankton Surface Push

17 Nets and Oblique Tows for Comparing the Catch of

18 diadromous (phonetic) larval fish, Fisheries Research.

19 (The document referred to was

20 marked as Exhibit Number

21 JTI000009 for identification.)

22 JUDGE BOLLWERK: The record should reflect

23 that Exhibit JTI000009 has been marked for

24 identification.

25 MS. PORTER: JTI000010, entitled Detecting

1 Changes Resulting from Human Pressure in a Naturally
2 Quick Changing and Heterogenous Environment, Spacial
3 and Temporal Scales of Variability and in Coastal
4 Lagoons.
5 (The document referred to was
6 marked as Exhibit Number
7 JTI000010 for identification.)
8 JUDGE BOLLWERK: The record should reflect
9 that Exhibit JTI000010 has been marked for
10 identification.
11 MS. PORTER: JTI000011, Habitat
12 Suitability Index Models and In-Stream Flow
13 Suitability Curves American Shad.
14 (The document referred to was
15 marked as Exhibit Number
16 JTI000011 for identification.)
17 JUDGE BOLLWERK: The record should reflect
18 that Exhibit JTI000011 has been marked for
19 identification.
20 MS. PORTER: JTI000012, Habitat
21 Suitability Index Models Alewife and Blueback herring.
22 (The document referred to was
23 marked as Exhibit Number
24 JTI000012 for identification.)
25 JUDGE BOLLWERK: The record should reflect

1 that Exhibit JTI000012 has been marked for
2 identification.
3 MS. PORTER: JTI000013 Habitat Suitability
4 Index Models and In-Stream Flow Suitability Curves
5 Shortnose Sturgeon.
6 (The document referred to was
7 marked as Exhibit Number
8 JTI000013 for identification.)
9 JUDGE BOLLWERK: The record should reflect
10 that Exhibit JTI000013 has been marked for
11 identification.
12 MS. PORTER: JTI000014, Habitat
13 Suitability Index Models Coastal Stocks of Striped
14 Bass.
15 (The document referred to was
16 marked as Exhibit Number
17 JTI000014 for identification.)
18 JUDGE BOLLWERK: The record should reflect
19 that Exhibit JTI000014 has been marked for
20 identification.
21 MS. PORTER: JTI000015 Species Profiles
22 Life Histories and Environmental Requirements of
23 Coastal Fisheries and Invertebrates, Striped Bass.
24 (The document referred to was
25 marked as Exhibit Number

1 JTI000015 for identification.)

2 JUDGE BOLLWERK: The record should reflect

3 that Exhibit JTI000015 has been marked for

4 identification.

5 MS. PORTER: JTI000016, Impoundments and

6 the Decline of Fresh Water Mussels, A Case Study of

7 Extinction Gradient.

8 (The document referred to was

9 marked as Exhibit Number

10 JTI000016 for identification.)

11 JUDGE BOLLWERK: The record should reflect

12 that Exhibit 00 -- I'm sorry, JTI000016 has been

13 marked for identification.

14 MS. PORTER: JTI000017 Extinction Rates

15 North American Fresh Water Fauna, Conservation

16 Biology.

17 (The document referred to was

18 marked as Exhibit Number

19 JTI000017 for identification.)

20 JUDGE BOLLWERK: The record should reflect

21 that Exhibit JTI000017 has been marked for

22 identification.

23 MS. PORTER: JTI000018, Conservation of

24 Threatened Fresh Water Pearl Mussel Populations, River

25 Management, Mussel Trans-Location and Conflict

1 Resolution.

2 (The document referred to was

3 marked as Exhibit Number

4 JTI000018 for identification.)

5 JUDGE BOLLWERK: The record should reflect

6 that Exhibit JTI000018 has been marked for

7 identification.

8 MS. PORTER: JTI000019, Restoration and

9 Colonization of Fresh Water Mussels and Fish in the

10 Southeastern United States Tail Water.

11 (The document referred to was

12 marked as Exhibit Number

13 JTI000019 for identification.)

14 JUDGE BOLLWERK: The record should reflect

15 that Exhibit JTI000019 has been marked for

16 identification.

17 MS. PORTER: JTI000020, Conservation

18 Status of Fresh Water Mussels of the United States and

19 Canada.

20 (The document referred to was

21 marked as Exhibit Number

22 JTI000020 for identification.)

23 JUDGE BOLLWERK: The record should reflect

24 that Exhibit JTI000020 has been marked for

25 identification.

1 MS. PORTER: JTI000021, Sulkin Tables in
2 Support of Sulkin Pre-File Direct Testimony dated
3 January 9th, 2009.
4 (The document referred to was
5 marked as Exhibit Number
6 JTI000021 for identification.)
7 JUDGE BOLLWERK: The record should reflect
8 that Exhibit JTI000021 has been marked for
9 identification.
10 MS. PORTER: JTI000022, Excerpts from
11 NUREG 1437 -- 1347, excuse me, to Generic
12 Environmental Impact Statement for License Renewal of
13 Nuclear Plants, Supplement 34 regarding Vogtle
14 Electric Plant Units 1 and 2 Final Report.
15 (The document referred to was
16 marked as Exhibit Number
17 JTI000022 for identification.)
18 JUDGE BOLLWERK: The record should reflect
19 that Exhibit JTI000022 has been marked for
20 identification.
21 MS. PORTER: JTI000023, Declaration of
22 Young in Support of Joint Intervener's Petition for
23 Intervention Dated December 11th, 2006.
24 (The document referred to was
25 marked as Exhibit Number

1 JTI000023 for identification.)

2 JUDGE BOLLWERK: The record should reflect

3 that Exhibit JTI000023 has been marked for

4 identification.

5 MS. PORTER: JTI000025, Letter from SNC to

6 US Nuclear Regulatory Commission, Document Control

7 Desk enclosing SNC comments to the VEGP Draft

8 Environmental Impact Statement dated December 26th,

9 2007.

10 (The document referred to was

11 marked as Exhibit Number

12 JTI000025 for identification.)

13 JUDGE BOLLWERK: The record should reflect

14 that Exhibit JTI000025 has been marked for

15 identification. And let me just check with Mr. Wilke,

16 this was a resubmitted one, so there was a second copy

17 of this one, I believe. Right?

18 MS. PORTER: Okay, JTIR00031 Affidavit of

19 Sulkin in support of Joint Intervener's Answers to

20 SNC's Motion for Summary Disposition of Environmental

21 Contention 1.2, dated November 9th, 2007.

22 (The document referred to was

23 marked as Exhibit Number

24 JTIR00031 for identification.)

25 JUDGE BOLLWERK: The record should reflect

1 that Exhibit JTIR00031 has been marked for
2 identification.
3 MS. PORTER: JTI000042, Curriculum Vitae
4 of Shawn Young.
5 (The document referred to was
6 marked as Exhibit Number
7 JTI000042 for identification.)
8 JUDGE BOLLWERK: The record should reflect
9 that Exhibit JTI000042 has been marked for
10 identification.
11 MS. PORTER: JTI000043, CV of Barry
12 Sulkin.
13 (The document referred to was
14 marked as Exhibit Number
15 JTI000043 for identification.)
16 JUDGE BOLLWERK: The record should reflect
17 that Exhibit JTI000043 has been marked for
18 identification.
19 MS. PORTER: JTI000046, Effects of Flow
20 Fluctuations on the Spawning Habitat of a Riverine
21 Fish.
22 (The document referred to was
23 marked as Exhibit Number
24 JTI000046 for identification.)
25 JUDGE BOLLWERK: The record should reflect

1 that Exhibit JTI000046 has been marked for
2 identification.
3 MS. PORTER: JTI000047, US Army Corps of
4 Engineers 2008 Thurmond Project Outflow Cubic Feet per
5 Second.
6 (The document referred to was
7 marked as Exhibit Number
8 JTI000047 for identification.)
9 JUDGE BOLLWERK: The record should reflect
10 that Exhibit JTI000047 has been marked for
11 identification.
12 MS. PORTER: And last but not least,
13 JTI000048, USGS Surface Water Annual Statistics for
14 Georgia, Annual Mean Discharge at Waynesboro Gauge,
15 2005 through 2008.
16 (The document referred to was
17 marked as Exhibit Number
18 JTI000048 for identification.)
19 JUDGE BOLLWERK: The record should reflect
20 that Exhibit JTI000048 as identified by counsel, has
21 been marked for identification. Okay, all right, we
22 can now -- would you like to move them into evidence?
23 MS. PORTER: Yes, your Honor, may we move
24 these aforementioned exhibits into evidence.
25 JUDGE BOLLWERK: Any objections? Hearing

1 none, then Exhibits JTIR00003, Exhibits JTI000004,
2 JTIR00005 -- no, I'm sorry, strike that.
3 JTI-00 -- JTI000006 as well as 07, 08, 09,
4 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22,
5 23, 25, JTIR00031, JTI000042, 43, 45 -- I'm sorry 46,
6 excuse me, not 45, 46, 47 and 48 are admitted into
7 evidence.
8 (The documents referred to
9 having been previously
10 marked as Exhibits JTIR00003,
11 JTI000004, 06, 07, 08, 09, 10,
12 11, 12, 13, 14, 15, 16, 17, 18,
13 19, 20, 21, 22, 23, 25, JTIR
14 00031, JTI000042, 43, 46, 47
15 and 48 for identification were
16 received in evidence.)
17 JUDGE BOLLWERK: Any problems with that?
18 Let me just check with Ms. Bu? Any problems, did we
19 get everything? All right, those are all admitted
20 into evidence then. Thank you very much.
21 All right, at this point, it's about 5:30.
22 My suggestion was given Mr. Sulkin's -- have I got
23 the right witness? Yes, status tomorrow, maybe we
24 should proceed at least for a little while and go
25 forward with some questions and we'll see where we're

1 at and what might be a good breaking point at some
2 point so everybody can get out of here and get some
3 dinner, too. Judge Jackson?
4 JUDGE JACKSON: Thanks, Judge Bollwerk.
5 Every time he reads those in, I get the feeling I'm at
6 a narcolepsy convention.
7 JUDGE BOLLWERK: I'm the head narcoleptic.
8 JUDGE JACKSON: I'd like to begin with
9 some questions related to your direct testimony, Dr.
10 Young and I notice that several times in your pre-
11 filed testimony you state that the FEIS lacks enough
12 detailed data, information, analysis to support its
13 conclusions as I've seen that theme. Is that a fair
14 characterization?
15 DR. YOUNG: Yes. I stated that numerous
16 times.
17 JUDGE JACKSON: Okay, I'd like to explore
18 that and use a couple of your answers maybe to try to
19 get a better handle on it. I notice that in --
20 starting in your response, or starting in question 14,
21 you said, "When analyzing entrainment is important to
22 consider the life history of the fish species that
23 inhabit the Savannah River near Plant Vogtle or pass
24 by Plant Vogtle as part of the drift community and
25 there's an answer there and then this is kind of

1 carried on in question 15. "Are the larval fish that
2 inhabit the Savannah River near Plant Vogtle or pass
3 by Plant Vogtle as part of the drift community capable
4 of avoiding the predicted water intake velocities.
5 Now, in your answer, read your answer
6 because I'd like to ask a few questions and that's one
7 way to kind of get at this issue. You responded, "No,
8 not all of the larval fish that inhabit the Savannah
9 River near Plant Vogtle or pass by Plant Vogtle as
10 part of the drift community are capable of avoiding
11 the predicted water intake velocities. The FEIS at 5-
12 30 states that species and life stages evaluated in
13 various studies could endure a velocity of one foot
14 per second. However, many of the endangered or
15 important fish of the Savannah River cannot endure
16 that water intake velocity. For example, the FEIS on
17 2-83 notes that the larval fish of the robust RedHorse
18 state listed endangered species are only capable of
19 swimming speeds that range from three to five inches
20 per second. That's the larval fish of the robust
21 redhorse are not capable of swimming through the
22 effected area given the predicted water intake
23 velocities."
24 Okay, that's kind of the backdrop and you
25 -- in your answer you reference the final

1 environmental impact statement at 5-30 and I would
2 like to refer to that section that I think you're
3 drawing from. It's page 5-30 of the FEIS says, "A
4 second factor, the intake design through screen
5 velocity greatly influences the rate of impingement of
6 fish at the facility. The higher the through screen
7 velocity, the greater the number of fish that are
8 impinged."
9 Then an important part I want to ask you
10 about, it says, "EPA has established a national
11 standard for the maximum design through screen
12 velocity of no more than .5 feet per second. EPA
13 determined that species and life stages evaluated in
14 various stages can endure a velocity of one foot per
15 second and then applied a safety factor of two to
16 derive the threshold of .5 feet per second. Southern
17 has stated that the proposed Unit 3 and 4 intake
18 structure would have a design through screen velocity
19 of less than .5 feet per second at a minimum river
20 water level of 23.8 meters of MSL".
21 Okay, that's quite a long start to this
22 question but I really wanted to ask several questions
23 that that we ran out I wanted to get that background
24 out as a starting point. And the first question is,
25 as I look and read 5-30, I was wondering why you

1 didn't use a half foot per second as the through
2 screen velocity instead of the foot per second that
3 you quoted in your answer of 15.
4 It says that --
5 DR. YOUNG: Well, in this case, I just
6 used that one foot per second they had established.
7 However, in terms of the robust redhorse, I
8 specifically selected that as an example of a fish
9 that could not endure even the 0.5 foot per second
10 threshold which was supposed to be set as a safety
11 measure according to the excerpt, because if they can
12 only swim three to five inches per second, of course,
13 that's less than half a foot and thus, they couldn't
14 avoid even the 0.5 feet per second threshold. And
15 that was just indicative that the 1.0 foot per second
16 appeared to be a generalization and even the 0.5 feet
17 per second safety limit still seemed to be a
18 generalization that probably some of the species that
19 would pass by there have the mobility to escape the
20 0.5 feet per second. However, the robust redhorse in
21 itself was a good example that some species have very
22 little mobility and could not even escape the safety
23 limit of 0.5.
24 JUDGE JACKSON: Okay, but the -- do you
25 agree that the through screen velocity is .5 feet per

1 second and that EPA limit is that?

2 DR. YOUNG: In this case, I was -- I would

3 refer to the 0.5, the safety measure that they were

4 trying to be conservative in this case.

5 JUDGE JACKSON: Okay, well, I just thought

6 that the .1 and the .5 were really referring back to

7 the EPA rule, I guess is the right way to put it, that

8 had set that limit and I wanted to clarify that and it

9 just seemed like I couldn't understand why you were

10 using one instead of .5 but just to go on. You say

11 then or you stated that the robust redhorse are not

12 capable of swimming, I guess what does it say, through

13 the effected area, through the affected area. And I

14 guess my question is, what do you mean by the affected

15 area?

16 DR. YOUNG: In this case, I was referring

17 to the early life stages that would be drifting

18 through down river through the area that eggs have no

19 mobility and the larvae have very limited mobility.

20 And that's what I was referring to in that, and that

21 refers back to several statements made throughout the

22 FEIS, one in particular where the staff stated that

23 larval fish are capable swimmers and that statement in

24 itself is contradictory to fisheries ecology and

25 behavior and that stemmed the discussion of this whole

1 elaboration on the swimming ability of larval fish in
2 particular.
3 JUDGE JACKSON: Okay, so this -- I'm
4 trying to understand that in your statement where you
5 said they're only capable of swimming speeds that
6 range from three to five inches per second, which were
7 you referring to there, the larval or the --
8 DR. YOUNG: That's the larval stage of
9 robust redhorse which was stated in the FEIS by the
10 staff, I believe in another excerpt.
11 JUDGE JACKSON: Okay.
12 DR. YOUNG: That also goes back to another
13 point I was making that there were several
14 contradictory statements where they would state that
15 larval fish in general are capable swimmers which is
16 erroneous in most instances and then the EPA is listed
17 giving the safety standards for entrainment and
18 impingement but the give an example of a species that
19 is of important concern that can't meet those
20 criteria.
21 JUDGE JACKSON: Okay, I guess I'm still
22 just trying to understand what you mean by swim
23 through the area. Do you mean out in the river, or do
24 you mean in the canal?
25 DR. YOUNG: The area that is affected, the

1 hydraulic zone of influence or if they are drifting in
2 the ichthyoplankton drift and they're moving passed
3 the facility and they hit the thermal plume, they have
4 a very limited amount of mobility. They can't just
5 avoid you know, those elevated temperatures.
6 JUDGE JACKSON: Okay, now if it's -- I
7 didn't want to necessarily jump to the thermal impact.
8 I was thinking more of the --
9 DR. YOUNG: The entrainment.
10 JUDGE JACKSON: -- the entrainment and
11 impingement right now. I believe that the velocity,
12 the water velocity in the inlet canal is a tenth of a
13 foot per second; is that -- does that sound right to
14 you?
15 DR. YOUNG: I'm not aware that it's that
16 low. I don't recall seeing that current velocity in
17 the canal listed anywhere. However, in previous
18 entrainment studies -- in the original operation and
19 construction and in the recent entrainment,
20 catostomids were collected which robust redhorse is a
21 catostomid, so obviously, there are several or at
22 least one catostomid species that cannot avoid these
23 low velocities.
24 JUDGE JACKSON: Okay. I just -- I had
25 read that the water velocity in the inlet canal was a

1 tenth of a foot per second, which is maybe whatever an
2 inch and -- a little over an inch per second and so I
3 didn't know if you were saying that this -- that would
4 overwhelm the ability of a larval fish that could swim
5 three to five inches per second. And so that's why I
6 said, what are you talking about? I didn't know if
7 you were talking about right up against the inlet
8 screen or you're talking about coming up through that
9 long canal.
10 DR. YOUNG: I was referring to the
11 original entrainment right at the mouth that the
12 organism being brought out of the natural drift of the
13 river into the water intake.
14 JUDGE JACKSON: And so your testimony is,
15 is once they get in there, even if it's a tenth of a
16 foot per second, they wouldn't be able to resist that
17 or --
18 DR. YOUNG: Well, if it was a tenth of a
19 foot, that would be less than what they potentially
20 could be capable of. Some of them could escape but if
21 you look at the results of several entrainment
22 studies, they entrained and impinged some catostomids
23 in other species, so some of those larval fish
24 obviously cannot overcome even those very low
25 velocities.

1 JUDGE JACKSON: Okay. In the pre-filed
2 information it states that the -- I was going to say
3 the flow velocity is a tenth, so I think it is in
4 there. I just looked at my notes. I can't
5 necessarily point to where I saw it, but I believe
6 it's in there.
7 You consider the design with the inlet
8 canal and the skimmer wall and the weir wall and so
9 on, are those important features in your view in terms
10 of any amelioration of entrainment or not?
11 DR. YOUNG: In some fashion with some
12 species, they probably are reducing some of the
13 entrainment. However, one of my concerns with the
14 entrainment study that was just conducted is that even
15 those features, if they block the eggs from being
16 pulled into the intake canal, and they do cause a
17 settling of a high number of eggs, even though they're
18 not being taken, you know, into the canal and through
19 the facility, just the mere causing of some species'
20 eggs to settle and then silt over will still cause
21 mortality. So even though it may aid in you know,
22 preventing entrainment of some species, there's still
23 a cause of settling in mortality of others or there's
24 that potential. They did not sample there at the
25 beginning, you know, for a long period of time or you

1 know, quickly vacated that strategy, so there's no way
2 of knowing if a large number of eggs settled in that
3 vicinity like the American shad for one would be a
4 candidate species for that concern, that they were
5 able to show that there were a large number of
6 American shad eggs and they did tend to be in the
7 bottom of the water column, so if they were pulled in
8 by the water intake, they likely would hit those
9 structures or the sheet piling and settle out.
10 Well, one problem with that is that if
11 American shad eggs settle out and our silted, they're
12 still going to die. So even though they weren't
13 impinged or pulled into the facility, they would still
14 suffer mortality.
15 JUDGE JACKSON: Does that only happen in
16 intakes or does this settling out phenomenon occur
17 elsewhere in a normal river environment?
18 DR. YOUNG: It could occur in other, you
19 know, river environments which is a concern in other
20 rivers with just regulated flow, is that if you
21 fluctuate or cause variation in the flow, even on a
22 daily basis, you could cause the eggs to settle out in
23 an improper environment and they would silt and then
24 they would die.
25 JUDGE JACKSON: Would that happen around

1 all these hundreds of snags then that we hear about? I
2 mean, the water impinges on those and I assume has
3 some impact on boulders, I guess that's what Judge
4 Trikouros was asking? So it doesn't just happen at a
5 wall, does it? It happens any time there's an
6 obstruction of flow of some kind.
7 DR. YOUNG: If they experience siltation
8 or can no longer be caught up in some flow velocity,
9 then, yes, there would be some natural mortality in a
10 similar fashion.
11 JUDGE JACKSON: Okay, I guess my question
12 in looking at -- and I was talking about getting more
13 detail and swimming speeds and so on, in terms of the
14 entrainment study, it was my understanding that the
15 assumption was in the analysis that if an organism was
16 entrained, it was assumed that there would be 100
17 percent mortality. So in terms of entrainment, did
18 you -- do you believe that there was credit being
19 taken for the swimming ability of the entrained
20 organisms?
21 DR. YOUNG: I couldn't speculate on that
22 because they didn't sample at the mouth of the canal
23 to show what came into the canal and the compare it to
24 what they captured mid-canal on the traveling screens
25 to see what number of organisms came into the canal

1 originally and then escaped. So I couldn't answer
2 that.
3 JUDGE JACKSON: Okay, I guess let me ask
4 it a different way. If you make the assumption that
5 every say larval fish that's entrained or egg or
6 whatever, experiences 100 percent mortality, then
7 probably the details of their mobility gets overtaken
8 by that conservative assumption. Would you agree with
9 that or not and I guess if not, why not?
10 DR. YOUNG: I guess I wouldn't agree that
11 it automatically equals 100 percent mortality. If
12 some organisms are post-larvae or even moving into an
13 advanced stage, they would be acquiring some extra
14 mobility and they may be able to escape. However, in
15 terms of the eggs, if it is a particular species that
16 can withstand being in a low velocity, high sediment
17 area, they may fall into the canal and may actually
18 survive and then be able to escape.
19 However, if you're a shad egg that cannot
20 survive that environment, then, yes, every one that is
21 pulled out of the natural drift of the river likely
22 will die.
23 JUDGE JACKSON: Well, I'm just saying that
24 I believe that was the assumption in the model. So
25 I'm just saying, given that assumption, would you

1 consider that a conservative assumption? It in
2 essence, takes no credit for your ability if you're --
3 if you're entrained to --
4 DR. YOUNG: Yeah, I understand what you're
5 saying. Yes, that would be a conservative assumption.
6 It comes in, then it dies.
7 JUDGE JACKSON: Okay, thank you. Let's go
8 to Question 16. It says, "Is it reasonable to assume
9 that the drift community near Plant Vogtle is
10 uniformly distributed?" And your answer says, "No, it
11 is not reasonable to assume the drift community near
12 Plant Vogtle is uniformly distributed." And the staff
13 has said that this is a, you know, fairly common
14 assumption for this type of FEIS analysis. Do you
15 dispute this? Do you have evidence that there are
16 many FEIS analyses that are based on spacial
17 distribution of the drift community or is this uniform
18 drift community a pretty common assumption in these
19 types of analyses?
20 DR. YOUNG: I have no knowledge of a
21 previous assumption of uniform drift of
22 ichthyoplankton aquatic organisms. It pretty much
23 contradicts the known phenomena in aquatic ecology
24 that aquatic organisms, especially ichthyoplankton
25 drift, are patchy and they're not uniformly

1 distributed.

2 JUDGE JACKSON: Yeah, I mean, I realize

3 most things in nature are not uniform. But it's a

4 common assumption for analysis and I guess my question

5 was, do you know, of other power plant FEIS analyses

6 done on rivers where they have had the spacial -- I

7 know from the scientific viewpoint you can certainly

8 say that it's not going to be uniform. The question

9 is, is this a typically used assumption and an

10 accepted and acceptable assumption in terms of

11 accuracy for this type of an analysis?

12 DR. YOUNG: I do not know if it is the

13 accepted assumption for this type of analysis. If it

14 is common and accepted, I would have to say though,

15 it's erroneous, that even if it's accepted, it should

16 be changed.

17 JUDGE JACKSON: Well, what's the basis for

18 that? I mean, it's -- analysts all the time make

19 simplifying assumptions and get acceptable results. I

20 mean, that's how engineers work, right?

21 DR. YOUNG: Well that may be how engineers

22 work but it's not correct to make an assumption that

23 goes against the grain of known science that, in this

24 case if it was a uniform distribution, meaning that

25 all organisms were spaced equally across the river, it

1 definitely would not be the conservative way to
2 conduct an analysis because you're assuming that you
3 have this certain hydraulic zone of influence and only
4 a certain number of organisms potentially could be in
5 there, when, in fact, a large proportion of the
6 organisms could be in that small area of hydraulic
7 influence but at the same time they could be on the
8 other side of the river. So there's really no way to
9 know unless you conduct a proper study which was later
10 then conducted but with this uniform distribution it's
11 just not correct.
12 And that's proven that it's erroneous by
13 previous study what they did, the Wiltz, I believe
14 1983 for the original operating and construction that
15 showed that the ichthyoplankton distribution was
16 patchy and it had peak abundance only at certain times
17 of the year. So the evidence was already there that
18 uniform distribution as an assumption wasn't correct,
19 even --
20 JUDGE JACKSON: What about the vertical
21 distribution and spacial distribution? Is it true
22 that the drift community tends to be more near the
23 bottom? Would that be a fair assumption?
24 DR. YOUNG: With most of the fish eggs and
25 larvae from the Wiltz study, the current entrainment

1 study as it's listed and from the Paller, I believe --
2 Paller et al, 1995, it did tend to be towards the
3 bottom of the water column. And in the Paller study
4 they also exemplified that even though it was slightly
5 up river, near the SRS intakes that most of the
6 ichthyoplankton, especially American Shad eggs, was on
7 the Georgia side. So that piece of evidence right
8 there would nullify assuming this uniform
9 distribution.
10 JUDGE JACKSON: I was asking about the
11 vertical distribution and --
12 DR. YOUNG: Well, the vertical
13 distribution is skewed also.
14 JUDGE JACKSON: And recognizing that if
15 you had a -- if you had the inlet canal structured
16 like that inlet canal with the weir wall and so on in
17 it, so it would tend to draw more of the water from
18 more of the center of the water column would that --
19 would you think that would be conservative at least in
20 the vertical distribution sense?
21 DR. YOUNG: It very well could be but at
22 the same time, it could still draw those eggs or
23 larvae from the bottom of the water column. And
24 again, if they are drawn towards the canal and they
25 hit the structures, the bottom weir wall, it could

1 cause the settling of a high number of organisms. So
2 it could be an advantage for some species but it could
3 also be detrimental to a number of other species,
4 especially the American shad eggs.
5 JUDGE JACKSON: Okay, have you had a
6 chance to look at that inlet canal and these --
7 DR. YOUNG: Yes, sir, I have --
8 JUDGE JACKSON: -- barriers and things
9 that they have in there?
10 DR. YOUNG: Well, I've been at the mouth
11 of the canal on several occasions doing field work for
12 my graduate studies at Clemson and also part of my
13 several colleagues' field work, so I haven't been on
14 the actual grounds or inside the canal but I've been
15 at the mouth, near the screen on several occasions.
16 JUDGE JACKSON: Okay, thank you.
17 JUDGE TRIKOUROS: Dr. Young, what -- if
18 one did not use uniform drift as an assumption, what
19 do you think would be more appropriate?
20 DR. YOUNG: Well, the standard for
21 fisheries and aquatic ecology is to perform a natural
22 survey so that you have knowledge of what is the
23 drift, the composition and timing.
24 JUDGE TRIKOUROS: Now from, you know, I
25 can give you a nuclear engineer's perspective. You

1 would have to convince me prior to that, that the
2 behavior is uniform, that there's homogeneity. In
3 other words, if I take a sample at a given date and a
4 given time and it shows that they're here --
5 JUDGE BOLLWERK: Here being low?
6 JUDGE TRIKOUROS: Well, I'm pointing --
7 you know, they're somewhere in the river, say in the
8 center of the river. How do I know that a month
9 later, they're not someplace else? The -- and if, in
10 fact, they are someplace else, then the integral of
11 that would end up being uniform distribution. If
12 they're randomly placed at different times in
13 different locations, wouldn't that then be uniform
14 distribution? Am I missing something?
15 DR. YOUNG: The meaning of uniform
16 distribution in plain terms is that organisms would be
17 equally spaced in time and space. So if I could use
18 the board, I think visually I would be able to better
19 explain. Do you mind?
20 JUDGE BOLLWERK: Please.
21 DR. YOUNG: Can you all make a shot?
22 Thank you.
23 JUDGE BOLLWERK: We're all a fan of
24 boards.
25 Judge Trikouros likes white boards, he

1 might get up there with you in a second. I'm not
2 sure.
3 DR. YOUNG: So in terms of the uniform
4 distribution at the fisheries.
5 JUDGE BOLLWERK: If you could just turn
6 that. They're fairly directional so I think if you
7 speak sort of that direction you probably will work
8 out all right.
9 DR. YOUNG: How is this?
10 JUDGE BOLLWERK: That's good.
11 DR. YOUNG: So I'll draw a picture of what
12 a fishery scientist who studies organisms would
13 consider the meaning of uniform distribution. And my
14 second example will be what is known to be the -- how
15 animals actually act, especially the pattern of
16 ichthyoplankton drift in river systems. Something to
17 that effect. So in terms of modeling, visually you
18 could see how the assumption is erroneous in terms of
19 how it could effect aquatic organism in terms of
20 entrainment or any type of impact. Is that -- if you
21 have a zone of influence, in the uniform distribution,
22 you would be spreading the organism out equally across
23 a cross section of the river and fewer would be
24 entrained. However, if they are highly patchy in the
25 vicinity of say the water intake, or any intake

1 structure, they're much more vulnerable.

2 A higher proportion could be pulled in at

3 any instant.

4 JUDGE TRIKOUROS: Okay, I understand. The

5 -- however, could you then say that every species of

6 egg on any given day summed over a year would look

7 exactly like that or would it be that the zone of high

8 impact might be for some other species at some other

9 time be on the other side of the river, for example,

10 or be in the middle of the river or be skewed to the

11 bottom versus to the top? Are you basically saying

12 that there would be a zone of influence that would be

13 consistent for all species, all the time?

14 DR. YOUNG: No, that's -- again, what

15 you're saying in itself is contradictory to the

16 meaning of uniform distribution that no, the patches

17 might change hourly. They might -- they will change

18 from between day and night, which has been shown in

19 the entrainment studies. They could change with

20 different, you know, flows and it will also vary by

21 species. That's why the assumption of uniform

22 distribution doesn't really hold true to nature.

23 JUDGE JACKSON: But the point is that if

24 it changes over time, on the average it might look

25 uniform. The next day, it's moved over here or the

1 next day it's moved up here. And you say, "Well, over
2 a year it's moved all around but let's make the
3 assumption of being uniform", and beyond -- let me ask
4 you this; let's say you did an enormous study and you
5 went right to where this new inlet canal was going to
6 be placed. Would the very fact that you then dug an
7 inlet canal there maybe have an impact on the
8 distribution?
9 DR. YOUNG: Well, in any case, if you're
10 modeling and using mean location or mean distribution,
11 then it should be based on an entirely different
12 terminology. The mean location of an organism at any
13 given time or over hours or days, that's not -- that
14 does not mean -- you would not use the term, "uniform
15 distribution". So --
16 JUDGE JACKSON: Well, as you know, when
17 you do analysis, you do all kinds of time and space
18 averaging. Numerical analysis is full of this, as
19 you're well aware. And when you set up the difference
20 equations, you're always going to have assumptions and
21 that non-uniformity can vary around, if you don't have
22 a realistic way to get a second-by-second, blow-by-
23 blow, species-by-species, fish-by-fish accounting of
24 it, why isn't a uniform distribution a sensible way to
25 go for this type of analysis?

1 DR. YOUNG: Well, as I just explained,
2 with the proper ichthyoplankton study like the one
3 that was eventually performed, they were able to
4 identify that there were changes between day and night
5 at different sections. If you could model and take
6 differentials and means over time, why not create a
7 model based on the real data with time of day as a
8 factor and create models based on the true
9 distribution instead of --
10 JUDGE JACKSON: The true distribution, if
11 you knew the true -- you don't know the true
12 distribution, do you?
13 DR. YOUNG: Well --
14 JUDGE JACKSON: At two years -- five
15 years from now when there's a canal there that there
16 isn't there now and the flow changes, you're going to
17 know the true distribution then? We're trying to make
18 a decision now, aren't we?
19 DR. YOUNG: Well, that is the value of
20 long-term monitoring in performing field studies which
21 weren't done previous to these hearings and so we
22 don't know. And that's one of the cruxes of my
23 argument throughout all my --
24 JUDGE JACKSON: Well, Dr. Young, I don't
25 understand how that answers the issue of how -- the

1 impact if you put in the inlet canal. If that's going
2 to change it, I don't care, you could monitor the next
3 50 years and then the year after that dig a canal.
4 Couldn't that potentially change the results of your
5 previous 50 years of monitoring?
6 DR. YOUNG: I don't understand your
7 question, sir. I would like to -- if you could
8 elaborate, I would like to answer your question. So
9 what you're saying is, as things are right now if you
10 alter the environment, they would change and you don't
11 necessarily know that. Is that what --
12 JUDGE JACKSON: Yeah, I'm saying that in
13 an ESP where we are trying to make an evaluation
14 that's sensible and reasonable on an impact for a
15 facility that is yet to be built. Is that correct?
16 DR. YOUNG: Yes, sir.
17 JUDGE JACKSON: And when that facility is
18 built, for example, an inlet canal that could have an
19 impact on perhaps the drift pattern.
20 DR. YOUNG: Okay, now I understand fully.
21 JUDGE JACKSON: I'm saying, you don't know
22 today what that might look like downstream and you
23 could study it in excruciating detail and that might
24 be totally swamped by the impact of -- so I'm just
25 saying, you make reasonable assumptions to look into

1 the future without having the precision that goes
2 beyond what's justified or warranted.
3 DR. YOUNG: Well, I would --
4 JUDGE JACKSON: Does that make sense to do
5 you understand what I'm --
6 DR. YOUNG: I understand what you're
7 asking but I would disagree with that. Especially in
8 this case, they performed an entrainment study for the
9 current Units 1 and 2 so they did the cross section at
10 the current water intake and they did elaborate
11 sampling but yet, at the site, just up river, where
12 the proposed intake would be located, I believe they
13 only sampled seven times, a handful of times. So I
14 would question why did they not intensively sample the
15 transect where the new structure would be so that they
16 could extrapolate a real world situation to predict
17 the effects when that structure goes in instead of
18 continuing to use models that don't follow natural
19 phenomena?
20 JUDGE JACKSON: I guess I don't
21 understand your reasoning because they were trying to
22 compare the flow in the river with what was coming in
23 the inlet canal right there, not compare what was
24 coming in the inlet canal with what was happening some
25 other position in the river for the purposes of this

1 study.

2 DR. YOUNG: Well, the purpose of this

3 study is to try to gauge if you build a similar

4 structure here, this would be your reference site.

5 Here's what's happening here. So if we go up here and

6 we assume that we're going to have the same flow

7 dynamics and such for a similar facility, and here's

8 what happens when the ichthyoplankton drift has this

9 particular pattern, you could better determine the

10 impacts just upstream if you know what the pattern of

11 ichthyoplankton looks like up there. If it's similar,

12 you would base it that you're going to have similar

13 results.

14 If it was skewed to the other side of the

15 river, you could then with very high confidence say

16 that we probably would have less entrainment

17 impingement or if you found that the ichthyoplankton

18 community was even more skewed to where that new

19 structure would potential entrain them, then you could

20 -- then you would assume or come to the conclusion

21 that you would have more entrainment. See, it's based

22 on real data and not just model assumptions. And

23 that's the standard that fisheries and aquatic ecology

24 is --

25 JUDGE JACKSON: Is that the standard

1 that's used in this kind of --

2 DR. YOUNG: Yes, sir.

3 JUDGE JACKSON: -- of Environmental Impact

4 Statement? Can you give me some examples then?

5 DR. YOUNG: As far as I know --

6 JUDGE JACKSON: That's what I originally

7 asked. Do you know of other FEIS's for power plants

8 on rivers that have -- that have had done their

9 analysis with detailed distributions like you've

10 talked about? Could you tell me what those are so I

11 can look them up?

12 DR. YOUNG: Well, I believe that numerous

13 examples in probably the 316, Section 316B where they

14 discuss numerous power facilities that had large-scale

15 entrainment problems. Frequently those types of

16 studies are contracted out to private fisheries

17 consultants who go in and they perform these types of

18 surveys so that energy companies or any type of

19 industry that withdraws water, can come up with the

20 impacts of their activities based on real data.

21 JUDGE JACKSON: Do you know of a nuclear

22 power plant that's --

23 DR. YOUNG: Personally, I do not.

24 JUDGE JACKSON: -- used this approach?

25 DR. YOUNG: I personally don't, sir, but

1 I'm relatively inexperienced. I know --

2 JUDGE JACKSON: Have you been involved in

3 any power plant considerations that --

4 DR. YOUNG: The actual sampling for it?

5 JUDGE JACKSON: -- evaluations, preparing

6 these FEIS's and so on?

7 DR. YOUNG: No, sir, I have not but I have

8 been part of the ichthyoplankton sampling for

9 numerous endangered species to try to understand their

10 ecology or determine if different energy development

11 projects or the operation of hydro-power plants has

12 been the cause of their depletion and that's the

13 standard, is to collect real world data to come up

14 with cause and effect relationships.

15 JUDGE JACKSON: The standard for what,

16 doing EIS's or for doing scientific studies?

17 DR. YOUNG: Well, for doing scientific

18 studies which ultimately in some cases led to FEIS's

19 on different species of concern.

20 JUDGE TRIKOUROS: Dr. Young, what -- let's

21 focus on your non-uniform distribution diagram. What

22 would that be a function of?

23 DR. YOUNG: It would be a function of

24 flow.

25 JUDGE TRIKOUROS: Hang on, hang on. Flow?

1 DR. YOUNG: Yes.

2 JUDGE TRIKOUROS: Okay, what else?

3 DR. YOUNG: And flow would be affected by
4 time of year or different practices of flow
5 regulation.

6 JUDGE TRIKOUROS: So the date, time of
7 year.

8 DR. YOUNG: Yes, time of year, which time
9 of year would also influence in this case on the
10 Savannah River, the number of species that are
11 spawning at that particular time.

12 JUDGE TRIKOUROS: So the number of
13 species.

14 DR. YOUNG: Yes.

15 JUDGE TRIKOUROS: Okay.

16 DR. YOUNG: And the abundance of each of
17 those species spawning.

18 JUDGE TRIKOUROS: Okay, so I've got
19 abundance of species. What else was it a function of?

20 DR. YOUNG: In this case also the location
21 of spawning grounds and then on top of that, what
22 particular life history --

23 JUDGE TRIKOUROS: I'm sorry, repeat -- I
24 didn't hear what you said.

25 DR. YOUNG: The location of spawning

1 grounds.

2 JUDGE TRIKOUROS: Spawning grounds.

3 DR. YOUNG: Yes.

4 JUDGE TRIKOUROS: Are spawning grounds

5 fixed or do they change with time?

6 DR. YOUNG: Yes, they are somewhat fixed

7 but they can be -- there can be multiple spawning

8 grounds that a particular species will utilize such as

9 the robust redhorse, since we've been discussing that

10 in its entirety, is that you hears that the robust

11 redhorse pretty much spawn at the Augusta Shoals.

12 Well, that's not accurate. A portion of the

13 population spawns at the Augusta Shoals. A portion of

14 the fish spawn below New Savannah Bluff Lock and Dam

15 at a large gravel bar and actually probably an even

16 larger number of those adults spawn at another gravel

17 bar about halfway between the lock and dam and the

18 Vogtle facility. So --

19 JUDGE TRIKOUROS: All right, so the

20 location of spawning grounds is a parameter but that

21 in and of itself is a function of other parameters.

22 DR. YOUNG: Yes, sir.

23 JUDGE TRIKOUROS: Okay. Is there anything

24 else?

25 DR. YOUNG: And then the life history of

1 the species, that some will broadcast their eggs and
2 will be dominate -- actually a predominant number of
3 their gametes will be broadcast and will stay within
4 the water column.
5 JUDGE TRIKOUROS: So --
6 DR. YOUNG: And for prolonged periods of
7 time.
8 JUDGE TRIKOUROS: So number of eggs.
9 DR. YOUNG: The number of eggs and how
10 long they would need to remain in the water column.
11 JUDGE TRIKOUROS: Okay. All right, so is
12 there anything else or is that it? Do you want to go
13 on?
14 DR. YOUNG: Yeah, I'll leave it at that
15 for now.
16 JUDGE JACKSON: Would you like to go on?
17 JUDGE TRIKOUROS: Yeah, I want to just
18 develop this a little bit. So let's assume that I did
19 a study where I looked at every location within a mile
20 of the Vogtle site, I mean every cubic centimeter
21 within a mile of the Vogtle site and I characterized
22 it for one full year. Would that then be a
23 distribution that I can rely on forever?
24 DR. YOUNG: No, it could change from year
25 to year.

1 JUDGE TRIKOUROS: All right, so if I spent
2 $40 million and did this enormous study, it would only
3 be good for the moment I did it.
4 DR. YOUNG: Not just for the moment that
5 you did it, it would be a -- it would give you the
6 characterization of the species composition. That
7 should be relatively stable from year-to-year. You
8 would know what species are coming past your facility.
9 That will remain fairly stable.
10 The number of eggs or larvae could
11 fluctuate from year-to-year. That could be due to a
12 number of factors. The actual spacial distribution
13 could also vary somewhat from year-to-year based on
14 what the flow is and that type of abiotic variable.
15 However, most of the time you would find most of your
16 ichthyoplankton following the fallway or that main
17 channel or where most of the velocity is because the
18 velocity is going to be carrying the eggs and that
19 shouldn't change too much from year-to-year unless
20 your channel structure is completely altered.
21 JUDGE TRIKOUROS: Okay, and when I do this
22 characterization, how does that help me understand the
23 entrainment, impingement, entrainment issue because I
24 need distribution for that, right?
25 DR. YOUNG: Yes, sir. You would have a

1 very good idea of how many organisms and of what
2 species at what life stage are coming past your
3 facility and that would better represent what the
4 resource is in the vicinity of your facility and that
5 would aid you in making the proper decisions or coming
6 to more -- be more confident in your conclusions.
7 JUDGE TRIKOUROS: I guess what I'm trying
8 to say is that when you're trying to build a model
9 that -- in this particular case it's take data that's
10 a function of seven different variables, at least one
11 or two of which are functions of other variables,
12 you're getting into a situation where it becomes
13 pretty much impossible to do. Now, Judge Jackson
14 asked you if this had ever been done anywhere and
15 guess the answer was not to your knowledge.
16 I would venture to say that it hasn't been
17 done anywhere because -- I mean, I've worked with
18 models for many years and when you have this many
19 variables, it becomes enormously difficult. It's kind
20 of an infinity of data becomes required even when you
21 only have two or three variables that are functions of
22 other variables. So I'm trying to understand where
23 the bang for the buck is here and how that really
24 disputes that uniform drift theory which may, in fact,
25 be correct if there's such -- if this -- these changes

1 are occurring all the time.

2 I mean, I've got seven variables that are

3 changing that distribution maybe over the course of a

4 year for all I know, they -- it would start to look

5 more like the uniform above. I don't know, but I

6 haven't -- go ahead.

7 DR. YOUNG: Well, I agree with you that it

8 becomes so complex, so the bang for the buck is that

9 if you perform the field study, you know the actual

10 resource, the actual distribution. That's the bang

11 for the buck is that you have real world data.

12 JUDGE TRIKOUROS: I don't think so. I

13 think from what you've told me, I can perform a field

14 study that would show me that everything is on the

15 other side of the river --

16 DR. YOUNG: Potentially.

17 JUDGE TRIKOUROS: -- and then I would make

18 a determination that I'm not damaging anything with

19 this plant and in fact, that's likely not going to be

20 true.

21 DR. YOUNG: Well, that's what they found

22 in the Paller 1995 is that SRS, you had the potential

23 to be even more harmful than it was but one of the

24 saving graces was that the ichthyoplankton drift was

25 on the Georgia Bank and not directly on the South

1 Carolina Bank. And that's why Paller says in his
2 paper it's important to do site specific field studies
3 to determine entrainment because even fine scale
4 changes or adjustments could drastically change
5 entrainment rates.
6 JUDGE TRIKOUROS: Okay, well, let's jump
7 to NEPA now. Let's take all of this and move to NEPA.
8 You know, NEPA doesn't -- as I understand it, does
9 not require this level of scientific investigation on
10 a site specific basis. The NEPA requires -- does
11 allow the use of existing data. It seems to me that
12 if you set the bar to be a percentage of uniform
13 drift, in other words, if you assume uniform drift and
14 set the bar to be a low percentage of that, would you
15 not say that you're probably catching most of this.
16 That even if you've done a significant amount of
17 studies, you might be a few percentage off but you
18 wouldn't be -- you know, you wouldn't be saying
19 there's a five percent impact and when you do the
20 studies it actually is a 95 percent impact, would you?
21 I'm asking.
22 DR. YOUNG: So if you did the model, it
23 shows five percent and in the study, an actual field
24 study, it shows it could be 95 percent? Is that what
25 you --

1 JUDGE TRIKOUROS: Yeah, I'm saying how far
2 off would the uniform drift assumption be versus the
3 actual distribution, if you knew it, if you set the
4 bar on the damage estimate for the uniform drift to be
5 very low? So you know, EPA, I guess uses five
6 percent. If I knew the actual distribution, it would
7 be in essence saying the river is half as wide and I
8 discount all the flow on the other side, assume
9 everything is in half that river.
10 Now, in this particular case on an annual
11 mean -- on an annual average flow, if I'm at two
12 percent for this plant, I would be at four percent, if
13 I discounted half the river. But four percent is
14 still not a very big number. So I'm trying to
15 understand how the time and effort spent in this
16 distribution generation would be worth it in terms of
17 the safety of the environment.
18 DR. YOUNG: Well, yes. If your modeling
19 assumes it's uniform distribution throughout the river
20 cross-section, so you take into account all the water,
21 and you find out that 95 percent of your drift is
22 right in front of the intake structure, and are being
23 entrained and up here you assume that maybe it was
24 five or 10 percent, using the uniform distribution
25 model, because you placed over time or in some mean

1 location that your organisms were somehow brought away
2 from the structure, or remained at these equal distant
3 points --
4 JUDGE TRIKOUROS: Well, I think that
5 that's the argument. I think that's the argument that
6 led the applicant to do the study they did was, I'm
7 assuming it was an argument like that, that they
8 didn't feel comfortable refuting without having at
9 least some data. But somehow, you know, you can
10 always take it to the next level. If they did a study
11 at that location and you're saying you should have
12 also done a study at a location downstream, if there
13 was -- if this thing made sense, if it was not open-
14 ended, and if the distribution was something you could
15 really rely on when you did get it -- I mean, for all
16 I know, if the study were repeated in 2010, it would
17 give a different answer. Right?
18 DR. YOUNG: There is that potential. That
19 is a natural variability of things.
20 JUDGE TRIKOUROS: So for NEPA, my sense is
21 that we don't have to go into this enormous level of
22 scientific investigation.
23 DR. YOUNG: Well, if you stick to a
24 uniform model, you would assume this happens year
25 after year. So what if one year you only really do

1 entrain five percent but then next year the conditions
2 change and the ichthyoplankton does shift slightly and
3 now you're entraining 50 percent. You would have
4 these variable -- these years of high entrainment that
5 you're not aware of or not identifying because you're
6 sticking to this uniform model. If you did some
7 actual field studies you could get a better handle on
8 what does this actual ichthyoplankton drift look like.
9 You could potentially model and say, "Well, next year
10 at a certain flow, the velocity moves a little bit
11 more in the channel. We would predict there to be
12 less entrainment", or at a higher flow you model that
13 the velocity moves slightly closer to your facility,
14 you could then conclude that you might actually
15 entrain more organisms.
16 JUDGE TRIKOUROS: But I'm just trying to
17 understand a boundary to your concern. I'm trying --
18 and I'm trying to understand what would be needed to
19 correct your concern, and right now, I'm getting the
20 impression that what would be needed to correct your
21 concern would be a significant amount of plant
22 specific study at one specific location and that you
23 could turn around after that study is done, and refute
24 it. You could turn around and say that the river is
25 now flowing faster; therefore, your study is no good

1 or I can pick seven variables and you could point out
2 any one of them and say, "Well, that's no longer the
3 case with the study you did".
4 That's where my problem is. It's
5 basically -- you know, it's a coin that has heads on
6 both sides, so to speak. There has to be a fairness
7 here.
8 DR. YOUNG: Well, I agree with that. And
9 I believe that is one of the crux of the discussion of
10 these flow scenarios is extrapolating some known data
11 to what happens at different flows. And in this case,
12 having some real data, would give you that option of
13 being able to extrapolate at a higher confidence than
14 this uniform distribution assumption.
15 JUDGE TRIKOUROS: But there is some -- but
16 data was taken.
17 DR. YOUNG: Yes, and I agree with that.
18 And so after two years, they finally decided to have
19 the actual study and for the most part, the study was
20 conducted in a proper manner with the appropriate
21 results. From my perspective of fisheries and
22 aquatics ecologists, there were just a few
23 shortcomings that I addressed. One was the fact that
24 they didn't sample at the mouth of the intake to know
25 what was initially going in. There's the potential

1 that maybe not very many organisms were going in there
2 so maybe the entrainment is very low.
3 If some of those shortcomings were
4 addressed or would have been addressed, I probably
5 wouldn't have any question with some of their results.
6 If they would have just run more transects just
7 slightly up river over the same time period, to say,
8 well, it appears that the drift at the current intake
9 and at the proposed intake are actually quite similar,
10 so we would assume that based on real data, we're
11 going to get similar results.
12 Now, see, as a scientist, I would be much
13 more comfortable and conclude that I would probably
14 agree with them if they would have conducted that.
15 There are similarities and if there are similarities,
16 you can come up with similar conclusions. So those
17 were some of the shortcomings. And the major
18 shortcoming is that they actually don't represent any
19 of the spacial data that they collected. They give us
20 the numbers and they tell us there were some
21 differences between day and night, but at no point do
22 they provide any such diagrams that I've provided here
23 to show where was the dominant number of organisms
24 located in relation to the current water intake
25 structure. And if they would have run more extensive

1 sampling at the proposed intake, they could have given
2 us the same diagram. And from that, as a scientist, I
3 would be able to properly or at least be more
4 confident in any type of conclusions.
5 And that data might be available but it
6 wasn't presented in the reports.
7 JUDGE TRIKOUROS: The problem I have is
8 that I would disagree with that and the reason I would
9 is because of all these seven variables. I would
10 certainly agree with it at the moment it was done, but
11 I know that there's seven variables that are going to
12 effect that entire study. Therefore, as soon as one
13 or two or three of them changes, I really don't have
14 any data I can hang my hat on, so to speak. That's my
15 concern here and for all I know, the integral of all
16 of this ends up being uniformity. Usually when you
17 have a bunch of -- if you take a random homogeneous,
18 or heterogeneous groups, if you take enough of those,
19 you end up with homogeneity. So that's my problem.
20 DR. YOUNG: Well, nature is not
21 homogeneous and I guess coming from a more scientist
22 oriented, my concern is that your -- how do you come
23 up with your uniform distribution? I mean, how do you
24 even come up with a distribution to say it's uniform
25 when you didn't have any actual data of the real

1 world? You know, I mean, there is not data to say
2 here's how we come up with a uniform distribution. So
3 going back to the source of the problem is that you're
4 concerned about field studies not being somewhat
5 homogeneous over time, I guess previous to that is
6 that I don't and never did see any data to even create
7 a uniform distribution. So maybe for now using the
8 current entrainment study, you could use that to
9 create a uniform distribution model but I don't know
10 what data they used originally to come up with a
11 uniform distribution model. So that's why I'm saying
12 that real world data definitely is the way to go, it's
13 much more reliable than this supposed uniform
14 distribution model that we don't know any -- we've
15 never seen any data behind that model.
16 I don't know how they constructed it. I
17 don't know the data they used to put into that model.
18 Where did it come from? Did it come from another
19 river? I don't even know if it's Savannah River data.
20 So that's another concern.
21 JUDGE TRIKOUROS: Okay, thank you.
22 JUDGE JACKSON: Why don't we shift gears
23 and try something that's maybe a little more concrete.
24 JUDGE BOLLWERK: It's about 6:30. Are you
25 going to come to a stopping spot in the next hopefully

1 half hour? Is that --

2 JUDGE JACKSON: You bet.

3 JUDGE BOLLWERK: Okay.

4 JUDGE JACKSON: I'll stop when you say

5 stop. (Laughter)

6 JUDGE BOLLWERK: I'll put it this way, if

7 you're on roll and you've got a subject matter you

8 want to explore, I definitely want you to be able to

9 finish that. The question is, someplace where it's a

10 good stopping point. So I'll leave that up to you to

11 let me know.

12 JUDGE JACKSON: Okay, well, I wanted to

13 take a look at your answer, Answer 20 on page 9 and

14 this gets back to data. The question that you were

15 addressing says, "Does the FEIS provide sufficient

16 data and analysis to support its conclusion that the

17 fish and shellfish located in the vicinity of VEGP

18 site are adapted to survival and bearing flow regimes

19 and velocities"? And you said, "No". So again, I was

20 interested in what data were you using to say no, and

21 down in your answer you say, "Studies demonstrate the

22 human induced variability combined with related

23 anthropogenic stressors such as increased entrainment

24 mortality as the primary cause of decrease fresh water

25 bio-diversity",

1 And so you gave some references for that
2 and I only looked up the first one, Vaughn and Taylor,
3 and I was a little surprised to find out that it had
4 to do with dams, the impact of putting dams on some
5 river in Oklahoma. And I guess my question is, you're
6 kind of a stickler for having accurate data. How did
7 the data from dams on a river in Oklahoma relate to
8 this intake structure and withdrawing water from the
9 Savannah River? I guess when I looked at the
10 reference, I said, how does this reference lead me to
11 say so? Are the conditions the same? Do I know the
12 fisheries are similar, the river a similar size? Is a
13 dam the same as putting an inlet canal? And I had
14 trouble seeing that that was the case, so maybe you
15 could help me understand how this applies, that
16 reference applies to your conclusion.
17 DR. YOUNG: Well, that and several others
18 applies that directly a human activity that withdraws
19 water or causes this human induced variation has
20 negative impacts on aquatic organisms. In this case,
21 you might say, "Well, this was just a dam and not a
22 nuclear power facility", and I can't argue that.
23 However, there's two activities that do affect the
24 flow regime. They do affect the temperature regime
25 and so it's just an example of if you do change flow,

1 you do change temperature, it does have negative
2 effects on aquatic organisms.
3 JUDGE JACKSON: Okay, so these are not
4 river specific. It doesn't necessarily depend on the
5 river and the conditions of the fishery and a lot of
6 the other of the seven variables that you've been
7 talking about? I mean, I can think of 20 variables.
8 Do they have to be lined up in order to make a strong
9 conclusion and no answer based on this kind of
10 information or --
11 DR. YOUNG: Well, this phenomenon -- I
12 mean, every major river in the United States is dammed
13 and altered in numerous ways and it is a known
14 phenomena that most of our aquatic organisms are in
15 decline. Over 40 percent of the fish in North America
16 are in decline and it's from a variety of reasons but
17 the common cause or the common denominator from all
18 these different facilities regardless of type from
19 hydropower, nuclear, coal, irrigation is that the
20 human activity changes flow. It consumes water. It
21 changes temperature regimes and that type of
22 variability affect aquatic organisms in a negative
23 manner.
24 And so that and several other of my
25 references were to just reaffirm that phenomena that

1 is a known fact in science.

2 JUDGE JACKSON: Okay, they've done the

3 separation of variables. It's not pollution or acid

4 rain or something that's really doing it and not the

5 dam. I mean, they -- the scientists have separated

6 all these variables and know that it's flow and --

7 DR. YOUNG: Well, that is a difficult task

8 and one of the major problems with aquatic ecology and

9 aquatic management these days is that if you're on a

10 river that has multiple facilities for multiple

11 purposes, it is very difficult to tease out which one

12 is causing which impact directly. We know that the

13 overriding effect is that we are causing the decline

14 of our aquatic organisms. That's not disputed. But it

15 is very difficult to say this facility is causing

16 this. This facility causes that, and I believe that

17 is one of the major cruxes behind this evaluating

18 cumulative impacts is that when you put all the

19 different things we do to any given ecosystem,

20 especially rivers, streams, it has major effects on

21 the biota. And so that's why I was presenting this as

22 an example that withdrawing water and thermal

23 discharge and those changes have negative impacts.

24 JUDGE JACKSON: It always comes down to

25 the matter of degree, doesn't it? I mean --

1 DR. YOUNG: Yes, and in the Savannah it is
2 very confounded. I'll admit that. From my research
3 it's difficult to say that the hydropower system isn't
4 the majority of the problem but at the same time
5 there's a lock and dam facility that has been there
6 for at least 50 plus years. Savannah River Site has
7 been you know, a source of pollution for 50 years.
8 Industrial pollution and sewage pollution from
9 Augusta, other energy production facilities. I mean,
10 there's been dams on Stevens Creek and other places
11 for 100 years. So just adding more human induced
12 variations, just compounds the problem.
13 JUDGE JACKSON: Okay, let me move on.
14 Answer 27, page 11, you state that, "The FEIS does not
15 provide sufficient data and analysis of the thermal
16 stress and mortality for the fish species located in
17 the middle lower and estuarine Savannah River". Could
18 you help me? Where's the boundary between the middle
19 and the estuarine portion of the river?
20 DR. YOUNG: That boundary is just up from
21 Savannah Harbor and see, I added that in because like
22 you have the shortnose sturgeon, you may have striped
23 bass. Those fish, even though they're in residents of
24 Savannah Harbor, some of them will migrate up here to
25 reproduce. So they place their offspring in direct

1 harm's way of the Vogtle Plant and other facilities up
2 river.
3 JUDGE JACKSON: So you're bringing that up
4 obviously not because the thermal impacts would extend
5 there but because --
6 DR. YOUNG: Right.
7 JUDGE JACKSON: -- because of their
8 migratory passage, past the plume?
9 DR. YOUNG: Yes, even though they're
10 considered an estuarine species and they're, you know,
11 anadromous is the proper term. So they live in the
12 estuary as adults but to complete the life cycle to
13 propagate the species, that habitat around Vogtle and
14 the other plants is all equally important in survival
15 to reproduce the next generation, so --
16 JUDGE JACKSON: I guess I'm just a little
17 confused because we're trying to evaluate what goes on
18 in the vicinity and the migratory fish are going by.
19 It seems likely we would catch that in that
20 evaluation and --
21 DR. YOUNG: Well, they do go by and then
22 their eggs and larvae come back through.
23 JUDGE JACKSON: Right, I understand that.
24 I'm just --
25 DR. YOUNG: Yes.

1 JUDGE JACKSON: -- saying you catch that
2 when you look at the vicinity and --
3 DR. YOUNG: Well, in many cases the
4 studies that have been used in FEIS don't catch that.
5 Like the ANSP studies, they do not catch that
6 migration. They come in three days in September.
7 There's no way they ever catch the migration of
8 sturgeon and striped bass for American shad because
9 that occurs in the spring. So they miss a dominant
10 portion of the fish population moving through the
11 vicinity and then also their early life history coming
12 back down through the facility.
13 So by the time they show up in September,
14 they're only getting a representation of the resident
15 fish species. And on top of that, some of their
16 sampling methods still don't adequately sample to get
17 a true picture of the resident fish assemblage. Like
18 folks discussed electrofishing a little earlier.
19 Well, it's fairly effective in a more shallow habitat
20 but in the deep parts of the Savannah River, it really
21 isn't that effective. I've used it multiple times to
22 -- with colleagues to try to sample robust redhorse.
23 If those fish are in deeper than 15 feet of water,
24 which most of the Savannah Channel is deeper than
25 that, we don't collect those fish.

1 We don't collect sturgeon. We can't
2 capture most deep water fish. So do you just presume,
3 well, they're not there, when in reality they may
4 actually be there and you're just not sampling
5 correctly. And so --
6 JUDGE JACKSON: ANSP studies, were there
7 not multiple studies?
8 DR. YOUNG: In the later years, the three
9 that I reviewed, I believe 2001, 2003, 2005, they did
10 not. They came for three days in September and that
11 was the extent of it. And I believe in 2005 they
12 didn't even have any extensive results from that
13 survey.
14 JUDGE JACKSON: Well, that's another
15 issue.
16 DR. YOUNG: Well, it is.
17 JUDGE JACKSON: I didn't mean to ask you
18 about that but I mean, there are a lot of -- there are
19 a lot of those studies and I think to be fair, we
20 probably need to look at the whole scope of them and
21 for the whole time that they were taken, but that
22 seems like another issue.
23 DR. YOUNG: Reviewing some of the older
24 studies just briefly finding only certain portions, it
25 appears that they still missed and did not identify

1 the decline of numerous species. I wasn't able to
2 find anywhere where they discussed decline of sturgeon
3 or decline of American Shad, decline of striped bass
4 and again, those are migratory species that weren't
5 being captured in their sampling methodologies.
6 JUDGE JACKSON: Okay, let's --
7 DR. YOUNG: With a shortcoming in some
8 other folk's --
9 JUDGE JACKSON: Before Judge Bollwerk says
10 stop, let me try to get a couple more questions in.
11 Look at your Answer 27, you state, "The FEIS fails to
12 consider all possible river conditions and rather
13 focuses on conservative river conditions." In
14 preparing an EIS is it required or even sensible to
15 consider all possible river conditions? Take the
16 first part, is that a required part of an EIS to
17 consider all possible river conditions?
18 DR. YOUNG: I am not aware whether it is
19 or is not a requirement, just again, as a scientist
20 typically, I'm required to do a more exhaustive, you
21 know, analysis to insure that I'm thorough and if
22 you're going to evaluate the impacts of activities, to
23 me it makes common sense and usually in the scientific
24 community it's required that you cover your bases and
25 you try to cover the range of, you know, potential

1 conditions that could be out there in nature.

2 JUDGE JACKSON: Would you consider a

3 completely dry river as a possible future --

4 DR. YOUNG: Well, with the flow

5 regulations from the hydro-power system, it's not

6 likely but it's not to say that it couldn't happen in

7 our future. It's --

8 JUDGE JACKSON: That's why I said

9 possible.

10 DR. YOUNG: You know with inter-basin

11 transfers going on in different parts of the Southeast

12 where piping water to different regions of the United

13 States. The Rio Grande basically is dewatered before

14 it, you know, comes to its confluence. I don't see it

15 happening in the Savannah River but it has happened

16 other places in the United States. And there's

17 numerous endangered species in the Rio Grande basin

18 because of that mismanagement.

19 JUDGE JACKSON: I'm just trying to

20 understand when you said all possible, that would be

21 everything from complete flood to no water at all. I

22 mean, it's all possible. So I think you did say you

23 have to at least use -- wouldn't you say you have to

24 use some good sense in looking at ranges that are

25 probable?

1 DR. YOUNG: Well, yeah, I mean --

2 JUDGE JACKSON: There's nothing in the
3 regs that says say you have to look at all possible,
4 that you know of is, is there?

5 DR. YOUNG: Not that I know of.

6 JUDGE JACKSON: Okay. What do you mean by
7 conservative river conditions?

8 DR. YOUNG: For the Savannah River that is
9 most likely five to 10,000 CFS. That appears to be a
10 mean that it usually runs when it's not in flood stage
11 and it's not in drought stage.

12 JUDGE JACKSON: That's what you mean by
13 conservative? I wasn't quite sure of the --

14 DR. YOUNG: Well, in my -- in terms of
15 what I'm saying, conservative, when you want to
16 evaluate what the most severe impact could be, I think
17 legitimately going down to 2,000 CFS in the current,
18 you know, condition of the Southeast, would be a
19 viable analysis.

20 JUDGE JACKSON: Okay.

21 DR. YOUNG: Just to cover your base and
22 say if things became as bad as they possibly could be,
23 here would be the potential impact.

24 JUDGE JACKSON: Okay, well, this question
25 is a little long. What do you think are we about --

1 JUDGE BOLLWERK: It's quarter to 7:00.

2 JUDGE JACKSON: Where are you, Judge
3 Trikouros? I probably could -- I think I've asked
4 enough. A lot of these questions have just been to
5 probe your views on how much is enough, how much is
6 appropriate, because I did see the theme, always the
7 theme, we need more data, we need more analysis, and I
8 was trying to understand what your viewpoint is and it
9 sounds --

10 DR. YOUNG: Yes, and --

11 JUDGE JACKSON: -- like it's more of a
12 scientific analytical viewpoint, the studies you would
13 do to write scholarly papers, perhaps and not
14 necessarily tied to the guidance that the staff needs
15 to follow in preparing an EIS. Would that be fair?

16 DR. YOUNG: Oh, I -- yes, is that I do
17 come with a slightly different mind-set, a different
18 viewpoint than if you're in engineering and I believe
19 that's why the interveners hired me was to bring a
20 different perspective to analyze life history of the
21 fish, what the potential impacts could be in terms of
22 you know, from the mind of an actual ecologist versus
23 from the mind of an engineer. And I don't know what
24 the future holds but --

25 JUDGE JACKSON: Well, you know what they

1 say about engineers, we're people that are pretty good
2 with numbers, but don't have enough personality to
3 become accountants. (Laughter)
4 JUDGE BOLLWERK: I think it's time to --
5 with that, I'll have to think about that all night.
6 All right, it is just about quarter to 7:00. We need
7 to get everybody out of here, so you can get some
8 dinner and get some sleep because we're going to be
9 back here at 8:30 in the morning to start over again.
10 Mr. Sulkin, we didn't get as chance to
11 hear from you at all but --
12 MR. SULKIN: I appreciate that.
13 (Laughter)
14 JUDGE BOLLWERK: -- your chance will come
15 tomorrow, I'm sure. So let's see anything among the
16 parties that we need to talk about at this point?
17 Anybody have any concerns? Again, I recognize 8:30 is
18 an early start given how late we're going but given
19 Mr. Sulkin's only with us tomorrow, we really need to
20 try to get him to maximize his time with us. So we
21 will be -- I will be more efficient tomorrow in
22 getting the exhibits in, although I think we've got
23 most of them in already, so that should move along
24 rather rapidly.
25 And I appreciate your understanding, we

1 were trying a new system. We learned a lot of things
2 today about some things we will do or won't do next
3 time around, but again, I think it's been a good day
4 for the panel in terms of the information we've
5 received and we will be back tomorrow morning at 8:30
6 to hear from you all one more time. So we'll see you
7 at 8:30. Everyone have a good evening and again, 8:30
8 tomorrow morning is when we'll start, thank you.
9 (Whereupon, at 6:45 p.m., the above-
10 entitled matter recessed to reconvene at 8:30 a.m. on
11 March 17th, 2009.)
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## CERTIFICATE

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of: Southern Nuclear Operating Co

Name of Proceeding: Early Site Permit

Docket Number: 52-011-ESP;

ASLB No. 07-850-01-ESP-01

Location: Augusta, Georgia

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and, thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.

Tobias Walter
Official Reporter
Neal R. Gross & Co., Inc.