

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

NRC STAFF'S PROPOSED FINDINGS OF FACT AND CONCLUSIONS OF LAW
CONCERNING CONTESTED ENVIRONMENTAL MATTERS

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April 24, 2009

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I. BACKGROUND AND INTRODUCTION

1.1. These findings and rulings address all outstanding issues with respect to Contentions EC 1.2, EC 1.3, and EC 6.0, concerning the application for an early site permit (ESP) filed on August 14, 2006, by Southern Nuclear Operating Company ("Southern" or "Applicant"). The Applicant submitted an application pursuant to 10 C.F.R. Part 52, Subpart A, in which it requested an ESP for a site within the existing Vogtle Electric Generating Plant ("VEGP") site near Waynesboro, Georgia ("Application").

1.2. Following the Nuclear Regulatory Commission ("NRC")'s receipt of the Southern application¹ and the NRC's decision to docket the application for review,² a notice of hearing and opportunity to petition for leave to intervene was published in the *Federal Register* on October 12, 2006. 71 Fed. Reg. 60,195 (Oct. 12, 2006). The Notice advised the Applicant and any person whose interest may be affected by the proceeding of their right to request a hearing.

¹ See Southern Nuclear Operating Company; Notice of Receipt and Availability of an Application for an Early Site Permit for the Vogtle ESP Site, 71 Fed. Reg. 51,222 (Aug. 29, 2006).

² See Southern Nuclear Operating Company; Notice of Acceptance for Docketing of Application for Early Site Permit (ESP) for the Vogtle ESP Site, 71 Fed. Reg. 56,187 (Sept. 26, 2006).

On December 11, 2006, several organizations filed a joint petition for leave to intervene, which contained several contentions challenging the Environmental Report (“ER”) filed as part of the Application. These organizations include the Center for a Sustainable Coast, Savannah Riverkeeper, Southern Alliance for Clean Energy, Atlanta Women’s Action for New Directions, and Blue Ridge Environmental Defense League (“Joint Intervenors”). The petitioners timely filed several contentions that they sought to litigate in this proceeding.

1.3. On December 15, 2006, this Atomic Safety and Licensing Board was established to rule on petitions for hearing and for leave to intervene and to preside over any adjudicatory proceeding that might be held in connection with the application. 71 Fed. Reg. 77,071 (Dec. 22, 2006).

1.4. On March 12, 2007, the Licensing Board issued its “Memorandum and Order (Ruling on Standing and Contentions),” in which the Board determined that the petitioners had demonstrated their standing to intervene in this matter, and that two of their contentions satisfied the Commission’s requirements for admission as contested issues in this proceeding. *See Southern Nuclear Operating Co. (Early Site Permit for Vogtle ESP Site), LBP-07-3, 65 NRC 237 (2006).*

1.5. The Board admitted two contentions, EC 1.2 and EC 1.3. EC 1.2, as admitted, was restated by the Board as follows:

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

Vogtle ESP, LBP-07-3, 65 NRC at 280. EC 1.3, as admitted, was restated by the Board as follows:

The ER fails to satisfy 10 C.F.R. § 51.45(b)(3) because its analysis of the dry cooling alternative is inadequate to address the

appropriateness of a dry cooling system given the presence of extremely sensitive biological resources.

Vogtle ESP, LBP-07-3, 65 NRC at 280.

1.6. On August 15, 2007, the Applicant revised its Application to include a request for a limited work authorization.³ Notice of this request, including a supplementary notice of hearing and opportunity to petition for leave to intervene, was published in the Federal Register on November 16, 2007. 72 Fed. Reg. 64,686 (Nov. 16, 2007).

1.7. In September 2007, the NRC staff published NUREG-1872, the "Draft Environment Impact Statement for an Early Site Permit (ESP) at the Vogtle Electric Generating Plant Site" ("DEIS").⁴

1.8. On October 17, 2007, the Applicant filed two motions, seeking summary disposition of Joint Intervenors' Contention EC 1.2 and EC 1.3, respectively. On January 15, 2008, the Licensing Board ruled on both motions, finding that summary disposition was not warranted for either contention. See *Southern Nuclear Operating Co. (Early Site Permit for Vogtle ESP Site)*, LBP-08-2, 67 NRC 54 (2008); *Southern Nuclear Operating Co. (Early Site Permit for Vogtle ESP Site)*, LBP-08-3, 67 NRC 85 (2008). In ruling on the Applicant's summary disposition motions, the Board held that with regard to chemical discharges, EC 1.2 was a contention of omission, and that this portion of the contention was now moot. *Vogtle ESP*,

³ Letter from J.A. "Buzz" Miller to U.S. NRC Document Control Desk, "Southern Nuclear Operating Company Vogtle Early Site Permit Application Supplement to Include Limited Work Authorization 2 Activities" August 15, 2007 (ML072330245).

⁴ The DEIS was made available to the Board and the parties to this proceeding on September 10, 2007. See Letter from J.M. Rund, NRC Staff Counsel, to Administrative Judges (September 10, 2007). See also Environmental Impacts Statements; Notice of Availability, 72 Fed. Reg. 52,557 (Sept. 14, 2007); Southern Nuclear Operating Company; Notice of Availability of the Draft Environmental Impact Statement for an Early Site Permit (ESP) at the Vogtle ESP Site and Associated Public Meeting, 72 Fed. Reg. 52,586 (Sept. 14, 2007).

LBP-08-2, 67 NRC at 65, 82. Consequently, the Board revised Contention 1.2 to read as follows:

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.

Id. at 83-84.

1.9. In August 2008, the NRC staff published NUREG-1872, the “Final Environment Impact Statement for an Early Site Permit (ESP) at the Vogtle Electric Generating Plant Site” (“FEIS”).⁵ Ex. NRC00001A, NRC00001B, NRC00001C, NRC00001D. On September 12, 2008, the NRC staff notified the Board and Parties of the availability of Errata to the FEIS.⁶ Ex. NRC00001E.⁷

1.10. On September 22, 2008, the Joint Intervenors filed a Motion to Admit a New Contention. The NRC staff and Applicant each filed an answer on October 6, 2008. On October 24, 2008, the Board admitted the new contention as environmental contention 6 (“EC 6.0” or “EC 6”). EC 6.0, as admitted, was restated by the Board as follows:

Because Army Corps of Engineers (Corps) dredging of the Savannah River Federal navigation channel has potentially significant impacts on the environment, the NRC staff’s conclusion, as set forth in the “Cumulative Impacts” chapter of the FEIS, that such impacts would be moderate is inadequately

⁵ The FEIS was made available to the parties and Board on August 14, 2008. See Letter from Patrick Moulding, Counsel for NRC Staff, to the Administrative Judges (August 14, 2008). See also Southern Nuclear Operating Company; Notice of Availability of the Final Environmental Impact Statement (EIS) for an Early Site Permit (ESP) Application at the Vogtle Electric Generating Plant Site, 73 Fed. Reg. 49,496 (Aug. 21, 2008); Environmental Impacts Statements; Notice of Availability, 73 Fed. Reg. 49,667 (Aug. 22, 2008).

⁶ See Letter from Patrick Moulding, Counsel for NRC Staff, to the Administrative Judges (September 12, 2008). See also Southern Nuclear Operating Company; Notice of Availability of Errata Sheet for the Final Environmental Impact Statement (FEIS) for an Early Site Permit (ESP) Application at the Vogtle Electric Generating Plant Site, 73 Fed. Reg. 54,436 (Sept. 19, 2008).

⁷ Due to the size of the document, the FEIS and the accompanying Errata were entered into evidence in this proceeding as five related exhibits (NRC00001A-1E).

supported. Additionally, the FEIS fails to address adequately the impacts of the Corps' upstream reservoir operations as they support navigation, an important aspect of the problem.

See *Southern Nuclear Operating Co.* (Early Site Permit for Vogtle ESP Site), ML082980417 (Oct. 24, 2008) (unpublished order) (slip op. at Appendix A) ("New Contention Ruling").

1.11. In accordance with the Licensing Board's general schedule, the parties submitted their witnesses' prefiled direct testimony on January 9, 2009, and their prefiled rebuttal testimony on February 6, 2009.

1.12. An evidentiary hearing with respect to the three contentions was held in Augusta, Georgia, on March 16-19, 2009, in accordance with a notice of hearing published in the *Federal Register*. 72 Fed. Reg. 15,913 (Apr. 3, 2007). Witnesses appeared on behalf of Southern, the NRC staff, and the Joint Intervenors, as summarized below. In addition, limited appearance statements were received from members of the public, in special sessions held in Waynesboro, Georgia, on March 22 and March 23, 2009.

1.13. These proposed findings of fact and conclusions of law present the Licensing Board's findings of fact with respect to the evidence presented at the March 16-19, 2009 hearing concerning Contentions EC 1.2, EC 1.3, and EC 6.0, and the Board's conclusions of law with respect thereto.

II. FINDINGS OF FACT

A. Background

2.1. As admitted by the Licensing Board, Contention EC 1.2 concerns "direct, indirect and cumulative impingement/entrainment and thermal effluent discharge impacts of the proposed cooling system intake and discharge structures on aquatic resources." *Vogtle ESP*, LBP-08-2, 67 NRC at 83-84. In an order dated January 15, 2008, the Licensing Board found that based on the Joint Intervenors' description of EC 1.2 in the initial intervention petition, the

contention's reference to "cumulative" impacts of the intake and discharge structure is limited to the impacts of the existing and proposed Vogtle units. See *Vogtle ESP*, LBP-08-2, 67 NRC at 77-78; see also *Southern Nuclear Operating Co.* (Early Site Permit for Vogtle ESP Site), ML090260734 (Jan. 26, 2009) (unpublished order) (slip op. at 2-4); *Southern Nuclear Operating Co.* (Early Site Permit for Vogtle ESP Site), ML090540779 (Feb. 23, 2009) (unpublished order) (slip op. at 2-3).

2.2. As admitted by the Licensing Board, Contention EC 1.3 concerns whether the analysis in the ER (and FEIS) of the dry cooling alternative is adequate "to address the appropriateness of a dry cooling system given the presence of extremely sensitive biological resources." In an order dated January 15, 2008, the Licensing Board found that based on the Joint Intervenors' description of EC 1.3 in the initial intervention petition, the Joint Intervenors' argument concerning hybrid cooling technologies was outside the scope of this contention. See *Vogtle ESP*, LBP-08-3, 67 NRC at 102-103. However, the "Joint Intervenors will be free to present arguments and evidence regarding the merits of dry cooling and the impact of a wet cooling system upon 'extremely sensitive biological resources.'" *Id.* at 102; see also *Southern Nuclear Operating Co.* (Early Site Permit for Vogtle ESP Site), ML090260734 (Jan. 26, 2009) (unpublished order) (slip op. at 4-5); *Southern Nuclear Operating Co.* (Early Site Permit for Vogtle ESP Site), ML090540779 (Feb. 23, 2009) (unpublished order) (slip op. at 4-5) (Holding that the Joint Intervenors' testimony concerning the North Anna Unit 3 hybrid cooling system is admissible for the purpose of rebutting arguments that dry cooling is infeasible, not for the purpose of putting it forth as an alternative.)

2.3. As admitted by the Licensing Board, Contention EC 6.0 concerns whether the NRC Staff's conclusion that the impacts of dredging of the Savannah River Federal navigation channel ("Savannah River FNC" or "FNC") could be moderate, as set forth in the "Cumulative

Impacts” chapter of the FEIS, is adequately supported. The Contention also concerns whether the FEIS adequately addresses possible impacts of the Corps’ upstream reservoir operations as they relate to use of the Savannah River FNC to support activities at the Vogtle ESP site. In an order dated January 26, 2009, the Licensing Board found that, based on the Joint Intervenors’ description of EC 6.0 in the initial intervention petition, arguments concerning either the cumulative environmental impacts of dredging the barge slip and intake channel (as opposed to dredging of the Federal navigation channel), or the potential environmental impacts of barge traffic, are outside the scope of this contention. *See Southern Nuclear Operating Co. (Early Site Permit for Vogtle ESP Site), ML090260734 (Jan. 26, 2009) (unpublished order) (slip op.)*.

B. Applicable Legal Standards

2.4. The contentions at issue in this case all arise under the National Environmental Policy Act (“NEPA”), and the NRC’s regulations that implement that statute. 42 U.S.C. §§ 4321 *et seq*; 10 C.F.R. Part 51. NEPA requires that an agency prepare an Environmental Impact Statement (EIS) before approving any major Federal action that will significantly affect the quality of the human environment. 42 U.S.C. Sec. § 4332(2)(C).

2.5. Under NEPA, the NRC is required to take a “hard look” at the environmental impacts of a proposed action, as well as reasonable alternatives to that action. *See Louisiana Energy Servs., L.P. (Claiborne Enrichment Center), CLI-98-3, 47 NRC 77, 87-88 (1998)*. This “hard look” is tempered by a “rule of reason” that requires agencies to address only impacts that are reasonably foreseeable – not remote and speculative. *See, e.g., Long Island Lighting Co. (Shoreham Nuclear Power Station, Unit 1), ALAB-156, 6 AEC 831, 836 (1973)*. “NEPA does not call for certainty or precision, but an *estimate* of anticipated (not unduly speculative) impacts.” *Louisiana Energy Servs. (National Enrichment Facility), CLI-05-20, 62 NRC 523, 536 (2005) (emphasis in original)*. Further, “NEPA gives agencies broad discretion to keep their

inquiries within appropriate and manageable boundaries.” *Louisiana Energy Servs., L.P.*, CLI-98-3, 47 NRC at 103.

2.6. In determining what impacts an agency must consider in an environmental analysis, the Supreme Court has held that NEPA does not call for a “worst-case” inquiry, a standard the Commission has emphasized. *Private Fuel Storage* (Independent Spent Fuel Storage Facility), CLI-02-25, 56 NRC 340, 352 (2002) (“PFS”) citing *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 354 (1989). Focusing on a worst-case analysis “simply creates a distorted picture of a project’s impacts and wastes agency resources.” *PFS*, CLI-02-25, 56 NRC at 352. In contrast, focusing the EIS on reasonably foreseeable impacts “will generate information of greatest concern to the public and of greatest relevance to the agency’s decision, rather than distorting the decisionmaking process by overemphasizing highly speculative harms.” *Id.* (quoting *Robertson*, 490 U.S. at 356). In its environmental analysis, therefore, it is appropriate for the NRC staff to focus on conditions that can reasonably be expected, rather than on highly unlikely scenarios.

2.7. Generally, an Applicant has the burden of proof in a licensing proceeding. 10 C.F.R. § 2.325. In cases involving NEPA contentions, however, the burden shifts to the NRC, because the NRC, not the Applicant, has the burden of complying with NEPA. See, e.g., *Duke Power Co.* (Catawba Nuclear Station, Units 1 and 2), CLI-83-19, 17 NRC 1041, 1049 (1983). However, because “the Staff, as a practical matter, relies heavily upon the Applicant’s ER in preparing the EIS, should the Applicant become a proponent of a particular challenged position set forth in the EIS, the Applicant, as such a proponent, also has the burden on that matter.” *Louisiana Energy Servs., L.P.* (Claiborne Enrichment Center), LBP-96-25, 44 NRC 331, 338-39 (1996), *rev’d on other grounds by Louisiana Energy Servs., L.P.* (Claiborne Enrichment Center)

CLI-97-15, 46 NRC 294 (1997) (citing *Pub. Serv. Co. of New Hampshire* (Seabrook Station, Units 1 and 2), ALAB-471, 7 NRC 477, 489 n.8 (1978)).

2.8. As the Commission has stated, “[o]ur Boards do not sit to ‘flyspeck’ environmental documents or to add details or nuances. If the ER (or EIS) on its face ‘comes to grips with all important considerations’ nothing more need be done.” *Exelon Generation Co.* (Early Site Permit for Clinton ESP Site), CLI-05-29, 62 NRC 801, 811 (2005) (quoting *Systems Energy Resources, Inc.* (Early Site Permit for Grand Gulf Site), CLI-05-4, 61 NRC 10, 13 (2005)).

C. Evidence Adduced at Hearing

1. EC 1.2

a. Witnesses Presented

2.9. An evidentiary proceeding on this contention was held on March 16-17, 2009. A total of eleven witnesses appeared on behalf of Southern, the NRC staff, and the Joint Intervenors, as set forth below. In addition to their prefiled direct testimony, the witnesses also provided prefiled rebuttal testimony. The witnesses also provided oral testimony upon examination by the Licensing Board. All of the witnesses were found to be qualified to present testimony on the matters they addressed.

i. Applicant Witnesses

2.10. The Applicant presented four witnesses in support of its position on Contention EC 1.2. They were: (1) Dr. Charles C. Coutant, a consultant to Southern on matters of aquatic ecology and fisheries biology; (2) Mr. Thomas C. Moorer, Southern’s Project Manager-Environmental, who is responsible for all environmental support activities for new plant and license renewal work for Southern, and who was responsible for developing the ER submitted by Southern as part of the ESP application, (3) Mr. Anthony R. Dodd, an Environmental

Specialist employed by Georgia Power Company, responsible for conducting field investigations of potential power plant impacts to aquatic resources at fossil fuel and nuclear electric production facilities, and (4) Mr. Matthew T. Montz, an Environmental Specialist employed by Southern, responsible for responding to NRC technical staff questions concerning the application and for completing and submitting environmental permits for new plant construction and operation.

2.11. Applicant witness Dr. Charles Coutant received a Ph. D. in Biology from Lehigh University. See “Southern Nuclear Operating Company's Testimony of Dr. Charles Coutant Concerning EC 1.2” [“Coutant Dir. EC 1.2”], Post Tr. 604 at 1;⁸ Ex. SNC000012 at 1. Dr. Coutant has many years of professional experience regarding thermal effect and cooling water studies, including work since 1970 at Oak Ridge National Laboratory on thermal effects from power plant cooling, and entrainment and impingement impacts on aquatic life from power generation facilities. Coutant Dir. EC 1.2, Post Tr. 604 at 1-2. Since 1971 he has also participated in preparation of NEPA Environmental Impact Statements, including EISs for nuclear power plants, in which issues related to thermal, entrainment and impingement impacts were analyzed. *Id.* The Licensing Board finds Dr. Coutant to be well-qualified as an expert witness on the subject of aquatic impacts from impingement and entrainment and from thermal discharge of cooling water systems.

2.12. Applicant witness Thomas Moorer received a Bachelor of Science degree in Environmental Science from Auburn University and a Bachelor of Science in Civil/Environmental

⁸ Page references herein to the hearing transcript refer to the final version of the transcript following incorporation of the transcript corrections approved by the Licensing Board in its Order dated April 9, 2009. Page references to portions of the prefiled direct and rebuttal testimony are identified by reference both to the transcript page where the testimony was bound into the record as if read, and to the page number of the prefiled testimony document (e.g., “Post Tr. 743 at 2” refers to the second page of the NRC staff prefiled direct testimony on EC 1.2, which is bound into the record at page 743 of the transcript).

Engineering from the University of Alabama. See “Southern Nuclear Operating Company's Testimony of Thomas Moorer Concerning EC 1.2” [“Moorer Dir. EC 1.2”], Post Tr. 610 at 1; Ex. SNC000014. Mr. Moorer has more than 30 years of experience in the environmental field, including more than 18 years of experience in environmental engineering, licensing, and regulatory compliance in nuclear power. Moorer Dir. EC 1.2, Post Tr. 610 at 1-2. This experience includes more than 15 years working in NEPA matters, including the development of Environmental Reports in support of applications for NRC licensing actions. *Id.* at 2. The Licensing Board finds Mr. Moorer to be well-qualified as an expert witness concerning the development and content of Southern's ESP application, in particular the ER, and concerning the environmental impacts at issue in Contention EC 1.2.

2.13. Applicant witness Anthony Dodd received a Bachelor of Science degree in Marine Biology from Troy University. “Southern Nuclear Operating Company's Testimony of Anthony Dodd and Matt Montz Concerning EC 1.2” [“Dodd/Montz Dir. EC 1.2”], Post Tr. 587 at 2; Ex. SNC000002. Mr. Dodd has more than 25 years of experience in the environmental field, specializing in aquatic biology. Dodd/Montz Dir. EC 1.2, Post Tr. 587 at 2. He has experience conducting and supervising fisheries-related investigations in the southeastern United States and is well-versed in fish collection methodologies, including hydroacoustic sampling, species identification, and quality control and quality assurance measures. *Id.* The Licensing Board finds Mr. Dodd to be well-qualified as an expert witness concerning the methods and results of studies conducted by Southern in 2008 to assess aquatic impingement and entrainment and discharge of the thermal plume, the significance of which are at issue in Contention EC 1.2.

2.14. Applicant witness Matthew Montz received a Bachelor of Science degree in Biology and a Master of Science degree in Environmental Management, both from Samford University. Dodd/Montz Dir. EC 1.2, Post Tr. 587 at 3; Ex. SNC000003. Mr. Montz has more

than 12 years of experience in the field of environmental biology. Dodd/Montz Dir. EC 1.2, Post Tr. 587 at 3. He has experience managing aquatic environmental monitoring programs and has 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 electric generating facilities in Mississippi and Florida. *Id.* The Licensing Board finds Mr. Montz to be well-qualified as an expert witness concerning the methods and results of studies conducted by Southern in 2008 to assess aquatic impingement and entrainment and discharge of the thermal plume, the significance of which are at issue in Contention EC 1.2.

ii. NRC Staff Witnesses

2.15. The NRC staff presented a panel of five witnesses in support of its position on Contention EC 1.2. These were: (1) Dr. Christopher B. Cook, a Senior Hydrologist in the Division of Site and Environmental Reviews in the Office of New Reactors (“NRO”); (2) Ms. Rebekah H. Krieg, a Senior Research Scientist in the Ecology Group, Environmental Sustainability Division, Energy and Environment Directorate of the Pacific Northwest National Laboratory (“PNNL”); (3) Ms. Anne “Nancy” R. Kuntzleman, an Aquatic Biologist in the Division of Site and Environmental Reviews, NRO; (4) Dr. Michael T. Masnik, a Senior Aquatic Biologist in the Division of Site and Environmental Reviews, NRO; and (5) Mr. Lance W. Vail, a Senior Research Engineer in the Hydrology Group, Environmental Sustainability Division, Energy and Environment Directorate of PNNL.

2.16. NRC staff witness Dr. Christopher Cook received a Bachelor of Science degree in Civil Engineering from Colorado State University, a Master of Science degree in Civil and Environmental Engineering from the University of California at Davis, and a Ph. D. in Civil and Environmental Engineering from the University of California at Davis. See “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” [“Staff Dir. EC 1.2”], Post Tr. 743 at “Christopher Bruce Cook - Statement of Professional Qualifications.” [“Cook SPQ”]. Dr. Cook is employed as a Senior Hydrologist in the Division of Site and Environmental Reviews in NRO. *Id.* at 2. As part of his official responsibilities, Dr. Cook assisted with the development of portions of the DEIS relating to hydrological alterations, water use, and water quality issues associated with the Vogtle ESP. *Id.* The Licensing Board finds Dr. Cook to be well-qualified as an expert witness on the subjects of hydrological alterations, water use, and water quality, which are at issue in Contention EC 1.2.

2.17. NRC staff witness Rebekah Krieg received a Bachelor of Science degree in Biology from Washington State University, and a Master of Science degree in Fisheries and Oceanographic Sciences from the University of Washington. Staff Dir. EC 1.2, Post Tr. 743 at “Resume – Rebekah Harty Krieg.” [“Krieg SPQ”]. Ms. Krieg is employed as a Senior Research Scientist in the Ecology Group, Environmental Sustainability Division, Energy and Environment Directorate of PNNL. *Id.* at 2. Ms. Krieg is a technical reviewer for PNNL’s contract with the NRC on aquatic resource issues associated with the ESP application. *Id.* She prepared 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. *Id.* at 3. Ms. Krieg has substantial experience at PNNL performing environmental impact analyses in support of NRC licensing actions, and was also the Deputy Team Lead for updating and revising NUREG-1555, the NRC staff’s *Environmental Standard Review Plan*. *Id.* at Krieg SPQ. The Licensing Board finds Ms. Krieg to be well-qualified as an expert witness on the subject of the NRC staff review of aquatic resource impacts at issue in Contention EC 1.2.

2.18. NRC staff witness Anne R. “Nancy” Kuntzleman received a Bachelor of Science degree in Biology from Pennsylvania State University, a Master of Science degree in Education from Temple University, and a Master of Science in Biology from the University of Michigan. Staff Dir. EC 1.2, Post Tr. 743 at “Anne ‘Nancy’ R. Kuntzleman - Statement of Professional Qualifications” [“Kuntzleman SPQ”]. Ms. Kuntzleman is employed as an Aquatic Biologist in the Division of Site and Environmental Reviews, NRO. *Id.* at 1. Ms. Kuntzleman is a technical reviewer for the NRC on aquatic and terrestrial resources issues associated with the ESP application. *Id.* She 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. *Id.* at 3. Her professional experience includes more than 10 years as an aquatic ecologist for environmental consulting firms, and more than 18 years as a senior biologist with the Department of the Navy, Engineering Field Activity Northeast (EFANE). *Id.* at Kuntzleman SPQ. The Licensing Board finds Ms. Kuntzleman to be well-qualified as an expert witness on the subject of the NRC staff review of aquatic resource impacts at issue in Contention EC 1.2.

2.19. NRC staff witness Dr. Michael Masnik received a Bachelor of Science degree in Conservation from Cornell University, a Master of Science in Zoology from Virginia Polytechnic Institute and State University, and a Ph. D. in Zoology from Virginia Polytechnic Institute and State University. Staff Dir. EC 1.2, Post Tr. 743 at “Michael T. Masnik - Statement of Professional Qualifications” [“Masnik SPQ”]. Dr. Masnik is employed as a Senior Aquatic Biologist in the Division of Site and Environmental Reviews, NRO, and is the lead technical reviewer for the NRC on the aquatic resources issues associated with the ESP application. *Id.* at 1. He provided technical oversight to the NRC and PNNL reviewers as well as performing aspects of the review concerning impacts to aquatic organisms due to interactions with the

proposed station intake and discharge structures. *Id.* at 3. In more than 34 years at the NRC (and at its predecessor, the Atomic Energy Commission), his work has included performing and overseeing NEPA reviews for numerous nuclear power reactor license applications, with responsibilities for analysis of aquatic impact matters such as impingement and entrainment and compliance with the Endangered Species Act. *Id.* at Masnik SPQ. The Licensing Board finds Dr. Masnik to be well-qualified as an expert witness on the subject of the NRC staff review of aquatic resource impacts at issue in Contention EC 1.2.

2.20. NRC staff witness Lance Vail received a Bachelor of Science degree in Environmental Resources Engineering from Humboldt State University and a Master of Science degree in Civil Engineering from Montana State University. Staff Dir. EC 1.2, Post Tr. 743 at “Statement of Professional Qualifications of Lance W. Vail” [“Vail SPQ”]. Mr. Vail is employed as a Senior Research Engineer in the Hydrology Group, Environmental Sustainability Division, Energy and Environment Directorate of PNNL. *Id.* at 2. He is a technical reviewer for PNNL’s contract with the NRC on hydrological alterations, water use, and water quality issues associated with the ESP application. *Id.* He is 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. *Id.* at 4. Mr. Vail has extensive experience on a broad spectrum of issues related to water resources, including NEPA assessments for the NRC of water use, water quality, and hydrologic impacts associated with the license renewal of several commercial nuclear plants. *Id.* at Vail SPQ. The Licensing Board finds Mr. Vail to be well-qualified as an expert witness on the subjects of hydrological alterations, water use, and water quality, which are at issue in Contention EC 1.2.

iii. Joint Intervenor Witnesses

2.21. The Joint Intervenors presented two witnesses in support of their position on Contention EC 1.2. They were: (1) Dr. Shawn P. Young, a member of the research faculty at

the University of Idaho and an environmental consultant to the Joint Intervenors; and (2) Mr. Barry W. Sulkin, an environmental consultant for the Joint Intervenors.

2.22. Joint Intervenor witness Dr. Shawn Young received a Bachelor of Science degree in Environmental Studies from Northland College, a Master of Science degree in Aquaculture, Fisheries, and Wildlife Biology from Clemson University, and a Ph. D. in Fisheries and Wildlife Biology from Clemson University. See “Re-Revised Pre-Filed Direct Testimony of Shawn P. Young In Support of EC 1.2” [“Young Dir. EC 1.2”], Post Tr. 814 at 1. He has eleven years of experience researching the effects of human activities on fisheries and aquatic ecosystems. *Id.* at 2. The Licensing Board finds Dr. Young to be well-qualified to testify in connection with Contention EC 1.2.

2.23. Joint Intervenor witness Barry Sulkin received a Bachelor of Arts degree in Environmental Science from the University of Virginia, and a Master of Science degree in Environmental Engineering from Vanderbilt University. See “Revised Prefiled Direct Testimony of Barry W. Sulkin In Support of EC 1.2” [“Sulkin Dir. EC 1.2”], Post Tr. 816 at 1. He has almost 14 years of experience with water pollution and water quality compliance with the State of Tennessee, and more than 18 years as a private consultant specializing in water quality matters and other environmental investigations primarily related to water. *Id.* at 2-3. The Licensing Board finds Mr. Sulkin to be well-qualified to testify in connection with Contention EC 1.2.

2.24. As more fully set forth below, having considered the testimony and other evidence presented by the parties, we find that the evidence supports a conclusion that the FEIS identifies and adequately considers the direct, indirect, and cumulative impingement and entrainment and thermal effluent discharge impacts of the proposed cooling system intake and discharge structures on aquatic resources. In doing so, we find that the NRC staff and Applicant have also refuted the Joint Intervenors’ underlying assertion that inadequate “baseline

information” concerning aquatic species has been provided in the record to appropriately evaluate important environmental impacts with respect to the intake and discharge structures of both the proposed Units 3 and 4 and the existing Vogtle Units 1 and 2. Therefore, with respect to the matters at issue in Contention EC 1.2, the Board finds that the NRC staff’s FEIS satisfies the applicable requirements of NEPA and the Commission’s regulations.

b. Factual Background

i. Sufficiency of Available Data Concerning Aquatic Species

2.25. In reaching its conclusions on the various elements of Contention EC 1.2, the Licensing Board has considered the general claim made by the Joint Intervenors that the ER and FEIS contain insufficient data and level of detail, particularly with respect to the life history of particular fish species, to evaluate environmental impacts to aquatic species under NEPA. For reasons explained below, the Licensing Board finds that the record demonstrates that ample information has been considered and presented concerning the aquatic species in the Savannah River to enable appropriate evaluation of the environmental impacts at issue in Contention EC 1.2.

2.26. Applicant witness Mr. Moorer testified concerning the sources that Southern considered in preparing the Environmental Report included with the Application. Moorer Dir. EC 1.2, Post Tr. 610 at 7. He explained that the ER was developed consistent with the guidance in Regulatory Guide 4.2, Preparation of Environmental Reports for Nuclear Power Stations, and NUREG-1555, *Environmental Standard Review Plan*. Moorer Dir. EC 1.2, Post Tr. 610 at 4. He testified that the Vogtle ER and associated responses to NRC staff Requests for Additional Information (RAIs) provided more than a hundred references describing the baseline conditions of the Savannah River in the area near Vogtle, and that the studies included in the ER and FEIS address various aspects of the river system. Moorer Dir. EC 1.2, Post Tr. 610 at 5-6; Tr. at 684

(Moorer). Mr. Moorer asserted that “the volume and quality of information available to establish the baseline of aquatic resources was more than adequate” and also stated that the area of the Savannah River in question has “been studied probably more than any area of a river in the southeast.” Moorer Dir. EC 1.2, Post Tr. 610 at 6; Tr. at 864 (Moorer).

2.27. Applicant witness Dr. Coutant likewise testified that the FEIS reflected consideration of relevant, representative, and scientifically acceptable information, the use of relevant analytical methods, and analysis at an appropriate level of detail given the level of impacts determined. Coutant Dir. EC 1.2, Post Tr. 604 at 10-11, 19, 21-22.

2.28. NRC staff witnesses testified that the data and level of detail presented in the FEIS concerning the presence and life history of aquatic species comports with NRC staff guidance provided in Regulatory Guide 4.2, Revision 2, *Preparation of Environmental Reports for Nuclear Power Stations* (NRC 1976); in Regulatory Guide 4.7, *General Site Suitability Criteria for Nuclear Power Stations*, and in applicable sections of NUREG-1555, *Environmental Standard Review Plan* (NRC 2000 & 2007) (“ESRP”). Staff Dir. EC 1.2, Post Tr. 743 at 11-13; Ex. NRC000007; Ex. NRCR00009; Ex. NRC000010. The NRC staff identified a range of sources of information relied on by the NRC staff to characterize the Savannah River in the vicinity of the site and asserted that these sources were both adequate and appropriately comprehensive to enable the NRC staff’s evaluation of environmental impacts. Staff Dir. EC 1.2, Post Tr. 743 at 9-10, 13-18, 29-32. These sources included historic compilations of information on the aquatic species of the Savannah River; data from studies by the Savannah River Site (“SRS”), a Department of Energy facility located across the river from the Vogtle site; recent studies brought to the NRC staff’s attention by the U.S. Fish and Wildlife Service, and various other studies used for background information or in the development of descriptions of specific species and their life histories. *Id.* at 14-18.

2.29. The NRC staff testified that among the many sources considered in its review for characterizing the general aquatic environment and determining fish species present in the vicinity of the site was "Fishes of the Middle Savannah River Basin" by Marcy et al. (Ex. NRC000006), a compendium of data based on more than 120 years of data collection from the Middle Savannah River Basin (MSRB) and 50 years for the SRS. Staff Dir. EC 1.2, Post Tr. 743 at 15. The Marcy et al. study itself cited over 33 pages of literature references used in its development. *Id.* Joint Intervenor witness Dr. Young indeed described this study as "the most comprehensive source of information on the fish species of the Middle Savannah River" and "an invaluable resource." See "Revised Prefiled Rebuttal Testimony of Dr. Shawn Young Concerning Contention EC 1.2" ["Young Reb. EC 1.2"], Post Tr. 814 at 7.

2.30. The NRC staff also considered reports published by the Academy of Natural Sciences of Philadelphia (ANSP) (Ex. NRC000002, NRC000003, NRC000004), which characterized its sampling program in the Savannah River as being "one of the most comprehensive ecological datasets available for any of the world's rivers." Ex. NRC000003 at v. Applicant witness Mr. Moorer likewise testified that consideration of the ANSP studies was appropriate and that indeed "it would not have been credible for the ER to ignore it." Moorer Dir. EC 1.2, Post Tr. 610 at 7.

2.31. Both the NRC staff and Applicant witnesses emphasized that the ANSP studies were only one of the sources relied on to determine the baseline from which environmental impacts of the new Vogtle units would be assessed. Coutant Dir. EC 1.2, Post Tr. 604 at 19; Moorer Dir. EC 1.2, Post Tr. 610 at 7; "Southern Nuclear Operating Company's Rebuttal Testimony of Tom Moorer Concerning EC 1.2" ["Moorer Reb. EC 1.2"], Post Tr. 612 at 3; Staff Dir. EC 1.2, Post Tr. 743 at 14-18; "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” [“Staff Reb. EC 1.2”], Post Tr. 744 at 8, 11-12; Tr. at 684, 685 (Moorer). For example, Applicant witness Mr. Moorer testified that “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.” Moorer Dir. EC 1.2, Post Tr. 610 at 7. Although Joint Intervenor witness Dr. Young challenged the precise value of the ANSP studies for the Applicant and NRC staff analyses, he did not disagree that these studies “provide useful information.” Young Reb. EC 1.2, Post Tr. 815 at 6.

2.32. The NRC staff witnesses further explained that the NRC staff’s focus on “important species” for the purpose of characterizing the aquatic environment is consistent with the definitions and guidance in the ESRP and in Regulatory Guide 4.2. Staff Dir. EC 1.2, Post Tr. 743 at 19-26.

2.33. Applicant witness Mr. Moorer explained that the ER gathered information from many sources and used an approach consistent with the ESRP guidance for estimating impacts. Moorer Dir. EC 1.2, Post Tr. 610 at 5-6, 13. Mr. Moorer also stated that the level of detail contained in the Vogtle ESP FEIS was indeed higher than in EISs prepared for previous Early Site Permits. Tr. at 714 (Moorer). Both NRC staff and Applicant witnesses emphasized that the FEIS’s consideration of already-available scientific information is consistent with NEPA, and that if available information is sufficient to enable appropriate estimates of environmental impacts, new site-specific field studies may not be necessary. Coutant Dir. EC 1.2, Post Tr. 604 at 7-8, 10, 17-18, 22; Moorer Dir. EC 1.2, Post Tr. 610 at 7-8; Staff Dir. EC 1.2, Post Tr. 743 at 13-18.

2.34. The NRC staff and Applicant witnesses reiterated that abundant information existed and was considered with respect to the Vogtle environmental review, and that these

sources provide information that is representative and sufficient for assessing relevant impacts from the proposed new units. Staff Dir. EC 1.2, Post Tr. 743 at 29-32; Tr. 676-678, 682 (Moorer/Coutant). Furthermore, these witnesses testified that additional sampling studies conducted by Southern had confirmed those assessments. Coutant Dir. EC 1.2, Post Tr. 604 at 14, 30; Moorer Dir. EC 1.2, Post Tr. 610 at 6; Staff Dir. EC 1.2, Post Tr. 743 at 38, 45, 55, 59-60; Tr. 680 (Moorer).

2.35. With respect to Contention EC 1.2, the Joint Intervenors did not contradict the NRC staff's explanation of what information or level of detail in an FEIS review is called for by the cited NRC staff guidance documents, nor did they specifically assert that the Applicant or NRC staff failed to follow the cited guidance in preparing the ER or FEIS. Indeed, in response to Licensing Board questioning concerning what data is necessary for a NEPA evaluation of entrainment impacts, Joint Intervenor witness Dr. Young conceded that he was not aware of any FEIS for nuclear power plant licensing that relied on the level of detail that he advocated with respect to aquatic distribution information. Tr. at 855-56 (Young). Rather, in response to Licensing Board questions, Dr. Young acknowledged that the information he was advocating be included in the FEIS was more like "the studies you would do to write scholarly papers," and not necessarily tied to what would be done under the guidance the NRC staff follows in preparing an EIS. Tr. at 882 (Young).

2.36. The Joint Intervenors criticized some aspects of the studies relied on by the Applicant and the NRC staff, in particular the ANSP reports. Young Dir. EC 1.2, Post Tr. 814 at 5. However, as noted above, Dr. Young did not disagree that the ANSP reports at least constitute "useful information," Young Reb. EC 1.2, Post Tr. 815 at 6, and his testimony does not demonstrate why his criticisms, even if accurate, would affect the reliability of the complete body of information considered in the FEIS analysis. Dr. Young also asserted that the FEIS

needed to discuss life history data of aquatic species in greater detail. Young Dir. EC 1.2, Post Tr. 814 at 6, 12; Young Reb. EC 1.2, Post Tr. 815 at 1-2. However, the NRC staff testimony explained that the level of detail in the FEIS regarding life history information was determined by the anticipated degree of impacts to particular species as well as by whether a species met the definition of “important species” in NRC guidance. Staff Dir. EC 1.2, Post Tr. 743 at 18-26. In response to Licensing Board questions, Dr. Young also alluded to further literature or reports that he suggests might have provided “more facts,” “better analysis,” or additional “good information.” Tr. at 944, 946 (Young). However, the Joint Intervenors have not persuasively explained how the NRC staff’s failure to consider any particular study has thereby rendered inadequate the considerable record of information that was used in the FEIS, or shown that the FEIS conclusions based on the totality of that information are unsupported or unreasonable.

2.37. The Licensing Board finds that the Applicant and the NRC staff have demonstrated that the information and level of detail contained in the FEIS comport with the necessary “hard look” required by NEPA. In particular, the Licensing Board agrees with the Applicant and the NRC staff that the characterization of the aquatic environment and depth of description of species and their life history is consistent with NRC staff guidance (as found in the ESRP and regulatory guides) and that the analysis relies on the type of technical information appropriately relied upon in NEPA environmental reviews. The Applicant and the NRC staff have described a wide array of studies and data consulted for characterizing the Savannah River in the vicinity of the Vogtle site, have explained why this information is reliable and appropriate for environmental assessments, and have explained why use of this information therefore provides a reasonable basis for estimating impacts from the proposed new units.

2.38. Given the lengthy list of studies and reports described and relied upon by the Applicant and the NRC staff, in combination with the Applicant and NRC staff testimony that

these sources are authoritative and that the NRC staff's consideration of this information comports with NRC staff guidance, the Joint Intervenors' general complaint that more information could have been considered (or their critiques of the limitations of certain studies, such as the ANSP reports) does not reveal any substantive inadequacy in the overall technical basis and baseline supporting the NRC staff analysis and conclusions.

2.39. Accordingly, the Licensing Board finds the testimony of the Applicant and NRC staff witnesses to be persuasive regarding the adequacy of the "baseline information" and level of detail found in the FEIS concerning the characterization of the Savannah River environment, including aquatic species. Furthermore, because this baseline information and level of detail were sufficient, the Licensing Board agrees that the Applicant and NRC staff have demonstrated that additional new "site-specific" studies were not necessary to provide an adequate basis for estimating impacts from the proposed new units.

ii. Impacts of Impingement and Entrainment

2.40. A second major element of Contention EC 1.2 concerns the adequacy of the FEIS evaluation of impacts due to impingement and entrainment. For reasons explained below, the Licensing Board finds that the record demonstrates that the FEIS adequately evaluates the direct, indirect, and cumulative impacts to aquatic species in the Savannah River due to impingement and entrainment from the proposed new units.

2.41. As the NRC staff witnesses explain, operation of nuclear power stations commonly requires the withdrawal of water, most often from surface waterbodies, to dispose of waste heat. As part of this process, water is circulated through various station components and heat exchangers. Impingement takes place when organisms are trapped against intake screens by the force of the water passing through the cooling water intake structure. Removal of material in the water column is typically accomplished by rotating traveling screens, with the

typical intake screen mesh size being 3/8 inch. Thus any debris and aquatic organisms that are larger than about 3/8 inch can potentially be "impinged" on the intake screens. Staff Dir. EC 1.2, Post Tr. 743 at 32-33.

2.42. 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. Staff Dir. EC 1.2, Post Tr. 743 at 32-33.

2.43. Witnesses for the Applicant testified in support of the FEIS conclusion that impacts from impingement and entrainment would be small.⁹ Dr. Coutant testified that 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." Coutant Dir. EC 1.2, Post Tr. 604 at 15. In describing the significance of these design features for evaluating impacts, Dr. Coutant explained that the plant's intake screens will be located in an offshoot canal perpendicular to the Savannah River (similar to existing Vogtle Units 1 and 2), that a submerged weir wall impedes benthic fish from entering the intake canal, and that the plant's design features thus result in low intake canal velocities and through-screen

⁹ As explained in the FEIS, to guide its assessment of environmental impacts of a proposed action or alternative actions, the NRC staff has established a standard of significance for impacts using Council on Environmental Quality guidance (40 CFR 1508.27). Ex. NRC00001A at xxiv, 1-4. Using this approach, the NRC established three significance levels - SMALL, MODERATE, or LARGE. *Id.* The definitions of these significance levels are presented in the FEIS. *Id.* at xxiv-v.

velocities. Coutant Dir. EC 1.2, Post Tr. 604 at 15-17. These features thus lessen the anticipated impacts from both impingement and entrainment.

2.44. Dr. Coutant emphasized that the FEIS relies on a number of factors to conclude that impacts from impingement and entrainment will be small. He identified these factors as including: “studies done for the existing [Vogtle units] 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, [and the] design of [the] intake canal including [the] bottom weir; results of reports to NRC pursuant to App. B. of the Environmental Protection Plan for Units 1 & 2; site visit[s] on March 8, 2007 and March 19, 2008; and impingement and entrainment studies that had begun at the time of preparation of the EIS.” Coutant Dir. EC 1.2, Post Tr. 604 at 16.

2.45. With regard to the last of those factors, the Applicant’s testimony also described in detail the methodology and results of impingement and entrainment field studies conducted at the existing Units 1 and 2 structures beginning in March 2008. The entrainment study sampled at the existing intake and also in the Savannah River to identify the distribution of organisms in the intake canal and in the source water. The impingement study collected and identified impinged fish from the operating intake traveling screens. Coutant Dir. EC 1.2, Post Tr. 604 at 23-24. Although the complete data from these studies were not available at the time the FEIS was issued, the Applicant testified that the results support the FEIS conclusion that impacts (including cumulative impacts of operating all four Vogtle units) from impingement and entrainment would be small. Coutant Dir. EC 1.2, Post Tr. 604 at 26-27.

2.46. The Applicant's witnesses explained that the entrainment study estimated that annually the Units 1 and 2 intake removed 315,641 +/- 13,261 (95% confidence interval) organisms. Coutant Dir. EC 1.2, Post Tr. 604 at 25-26. It found that the plant's mean daily make-up water intake pumping flow represented approximately 2.1% of the mean daily flow in the Savannah River at the plant, and that the estimated daily entrainment rate was 1,302 organisms compared to the estimated source water drift abundance of 312,039 organisms. Coutant Dir. EC 1.2, Post Tr. 604 at 26; Dodd/Montz Dir. EC 1.2, Post Tr. 587 at 12. These results demonstrate that the number of organisms entrained by the existing units is very small relative to the number of organisms passing in the Savannah River. Coutant Dir. EC 1.2, Post Tr. 604 at 26; Dodd/Montz Dir. EC 1.2, Post Tr. 587 at 12-13. Moreover, the results of the Units 1 and 2 sampling indicate that river ichthyoplankton is either not drawn into the existing intake canal in proportion to its occurrence in the river water or it is not entrained into the cooling system. Coutant Dir. EC 1.2, Post Tr. 604 at 26. No protected fish species were encountered in the source water or entrainment samples. Dodd/Montz at 14; Tr. at 630-31 (Dodd).

2.47. According to the Applicant, because the proposed intake will be designed similarly to that of the existing units, these results support the finding that impacts of entrainment at the new units' intake structure will be small and that if the results were doubled to represent both intakes operating, the cumulative impact would likewise remain small. Coutant Dir. EC 1.2, Post Tr. 604 at 26.

2.48. Relatedly, Applicant witness Mr. Moorer stated that studies conducted at the SRS 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. Moorer Dir. EC 1.2, Post Tr. 610 at 5. Dr. Coutant also provided an example using the American shad to illustrate how much smaller the

number of organisms or eggs entrained by the existing and proposed units would likely be compared to the number of organisms or eggs in the Savannah River. His testimony reflected that given the number of American shad estimated to be in the river (about 95,000 female shad), as a species that broadcasts its eggs (100,000 to 200,000 eggs per female), more than a billion shad eggs would be expected to be produced in a year in the river. Tr at 728, 735 (Coutant). Dr. Coutant indicated that such numbers provide perspective on how small a percentage of these eggs were entrained in the study done by Southern in 2008. Tr. at 728. These comparisons provide further support for the conclusion that impacts from the proposed Units would indeed be small.

2.49. The Applicant's 2008 impingement study estimated that the Units 1 and 2 impingement number for the first 10 months of the study is 2,421 fish, with an upper 95% confidence level of 3,882, and for biomass the extrapolation is about 30.1 pounds with an upper confidence limit of about 44.9 pounds. Dodd/Montz Dir. EC 1.2, Post Tr. 587 at 8. No state- or Federal-listed species were collected. *Id.* at 8. The study found that impingement at the existing units thus occurs at a very low rate and consists of mostly a few young-of-the-year fish as well as occasional large fish that already may be incapacitated. Coutant Dir. EC 1.2, Post Tr. 604 at 27. According to the Applicant, these results demonstrate that the impingement risk of the existing units is very small. Because the proposed intake will be designed similarly to that of the existing units, these results support the finding that impingement risk at the new units' intake structure will be small and that if the results were doubled to represent both intakes operating, the cumulative impact from impingement would likewise remain small. Coutant Dir. EC 1.2, Post Tr. 604 at 27.

2.50. Mr. Dodd also testified that the number of organisms impinged is many times smaller than historic impingement rates from the Savannah River Site (from 2600 fish per year

to more than 7000 fish per year), and cited SRS studies for having determined that those SRS rates did not result in an adverse effect on the Savannah River fishery. Tr. at 637-38. Mr. Dodd also noted that the estimated biomass impinged at the existing units (about 30 pounds per year) would be far less than the biomass from fish harvested by anglers in any given year, citing the more than 150,000 pounds harvested in 1988 as an example. Tr. at 635. Dr. Coutant stated that in his own experience, the estimated impingement rates from the 2008 sampling at Units 1 and 2 are “tiny,” far lower than rates that have occurred at power plants elsewhere, where impingement might be in the tens of thousands of fish. Tr. at 728-730. This comparison provides further support for the conclusion that impacts from the proposed Units would indeed be small.

2.51. Joint Intervenor witness Dr. Young challenged certain aspects of the Applicant’s entrainment sampling methodology, specifically the change in the location of the sampling within the intake canal (from the mouth to the middle of the canal) following the initial sampling events. Young Reb. EC 1.2, Post Tr. 815 at 3. However, the Licensing Board finds the Applicant’s explanation to be persuasive with regard to the practical reasons for the change in the sampling location and the consistency of the sampling results for the purpose of estimating entrainment impacts. Tr. at 622-30 (Dodd). First, Mr. Dodd explained the constraints with respect to getting the sampling boat to the mouth of the canal as a result of the stop log mechanism in the canal. Tr. at 622-27. He also explained that settlement of eggs and larvae near the mouth of the canal would not necessarily result in entrainment of those organisms in the cooling system, and he referred to past experience with sampling at the SRS, where fish species were identified in the intake canal for which eggs and larvae were not detected in the intake structure. Tr. at 628-30.

2.52. The Applicant witnesses Mr. Dodd and Mr. Montz also testified regarding the Applicant’s 2008 study concerning the hydraulic zone of influence at Units 1 and 2. They

testified that the study was conducted using broad-band acoustic echo information at a time when the Savannah River flow was 4,482 cubic feet per second (cfs) and the water withdrawal rate was 110 cfs for Units 1 and 2. Dodd/Montz Dir. EC 1.2, Post Tr. 587 at 15. They stated that under these conditions, the portion of the area of hydraulic influence extending beyond the intake canal into the Savannah River was only 0.14 acres and was only detectable in the river out to a distance of approximately 50 feet from the mouth of the canal. Dodd/Montz Dir. EC 1.2, Post Tr. 587 at 14-16. Mr. Moorer testified that since the study was done during a low flow period, the impact during normal flow periods would be even smaller. Moorer Dir. EC 1.2, Post Tr. 610 at 10. He stated that consideration of this information (along with the assumption used in the environmental analysis that drift organisms in the river are uniformly distributed) makes it likely that the effect of the intake on entrainment is significantly overstated and makes the uniform distribution assumption even more conservative. *Id.*

2.53. The testimony of the NRC staff witnesses regarding the basis for the determination of only small impacts from impingement and entrainment is consistent with the Applicant's testimony. The NRC staff testified that it evaluated both impingement and entrainment impacts for the ESP with particular consideration of the significant reductions in cooling water withdrawals and thermal discharges associated with a closed-cycle cooling system compared to a once-through cooling system. Staff Dir. EC 1.2, Post Tr. 743 at 33-34. In accordance with guidance in the ESRP, the NRC staff evaluated impacts from impingement and concluded that the impacts would be small. Staff Dir. EC 1.2, Post Tr. 743 at 35-37. Again, the NRC staff verified that this conclusion was based on a number of factors. These factors included the Applicant's use of closed-cycle cooling, which reduced river water withdrawal substantially compared to once-through cooling systems; the planned low through-screen intake velocity of less than 0.5 feet per second at the minimum river water level of 78 feet; a calculated

intake canal flow velocity towards the intake screens of about 0.1 feet per second; and the NRC staff's evaluation of life history data of aquatic species inhabiting the middle Savannah River. Staff Dir. EC 1.2, Post Tr. 743 at 35, 37-41.

2.54. The NRC staff also considered the past absence of significant impingement episodes at the existing intake of Units 1 and 2 along with the preliminary results of the recent VEGP Units 1 and 2 impingement sampling program, as well as the results of a past impingement study at the Savannah River Site. Staff Dir. EC 1.2, Post Tr. 743 at 35. The NRC staff's determinations regarding impingement applied relevant ESRP guidance. Staff Dir. EC 1.2, Post Tr. 743 at 35-37.

2.55. Regarding impingement impacts, the NRC staff found that there would be daily and seasonal variation in impingement and that the different life stages of organisms would experience varying susceptibility to impingement. Staff Dir. EC 1.2, Post Tr. 743 at 42-43. However, large numbers of impinged fish are unusual at riverine intakes like that for the Vogtle site, and adult fish of any of the "important species" that the NRC staff identified in the FEIS have burst swim speeds in excess of the through-screen flow velocities, which should enable them to avoid impingement. Staff Dir. EC 1.2, Post Tr. 743 at 42-44. Also, as already described above with respect to the Applicant's testimony, historic studies at the SRS indicated low impingement rates even at much higher withdrawal rates than those proposed for Units 3 and 4. Staff Dir. EC 1.2, Post Tr. 743 at 42-45. Therefore, the NRC staff concluded that the losses due to impingement, including to any of the "important species" identified, would not result in detectable changes to the Savannah River fishery. Staff Dir. EC 1.2, Post Tr. 743 at 42-45. Furthermore, the NRC staff cited the preliminary sampling data obtained by Southern since the issuance of the FEIS regarding both impingement and entrainment at the Units 1 and

2 intake structure as support for this conclusion, with primarily young-of-the-year and juveniles lost due to impingement. Staff Dir. EC 1.2, Post Tr. 743 at 43.

2.56. The NRC staff likewise followed ESRP guidance to evaluate impacts from entrainment. Staff Dir. EC 1.2, Post Tr. 743 at 46-51. Based on several factors, the NRC staff concluded that impacts from entrainment would be small. Since the amount of water withdrawn from the source waterbody greatly influences the degree to which entrainment affects aquatic biota, key factors in support of the NRC staff conclusion included the Applicant's use of a closed-cycle cooling system and the design and location of the cooling intake canal and structure, including use of a weir wall and skimmer wall at the mouth of the intake. Staff Dir. EC 1.2, Post Tr. 743 at 46, 48-55. The NRC staff also considered previous sampling data, the high fecundity of most species inhabiting rivers, and the high natural mortality rates of eggs and larvae. Staff Dir. EC 1.2, Post Tr. 743 at 46. Furthermore, the NRC staff considered previous sampling related to SRS operations, which indicates that historic operations of the SRS intake did not have a discernable impact on fish species in the Savannah River despite water withdrawals much greater than those anticipated for Units 3 and 4. Staff Dir. EC 1.2, Post Tr. 743 at 48-52.

2.57. Although the NRC staff determined that entrainment impacts (and possibly impingement impacts) could increase under very-low-flow conditions, the NRC staff determined that such flows and subsequent losses would be temporary and were unlikely to have any persistent long-term impacts on populations of aquatic organisms in the Savannah River. Staff Dir. EC 1.2, Post Tr. 743 at 73-74.

2.58. Furthermore, as noted above, additional sampling data available since the FEIS was issued demonstrates that eggs and larvae are several times more numerous in samples from the Savannah River than in samples from the Units 1 and 2 intake canal, which also

confirms the NRC staff entrainment analysis. Staff Dir. EC 1.2, Post Tr. 743 at 59-60; Ex. NRC000030; Ex. SNCR00005. Additionally, the National Marine Fisheries Service concurred with the NRC staff conclusions regarding impacts to the shortnose sturgeon, including the NRC staff's assumptions related to the potential loss of shortnose sturgeon eggs and larvae. Staff Dir. EC 1.2, Post Tr. 743 at 59-60; Ex. SNC000022.

2.59. The NRC staff also testified that the Applicant's 2008 study concerning the hydraulic zone of influence at Units 1 and 2 further confirmed the NRC staff analysis. That study indicated that at a river flow of 4,482 cfs and a water withdrawal rate of 110 cfs for Units 1 and 2, the Units 1 and 2 intake structure had an area of hydraulic influence of 0.14 acres and extended only about 1/6th of the way across the river in the vicinity of the VEGP site. Staff Dir. EC 1.2, Post Tr. 743 at 60; Ex. NRC000031. As stated in the Applicant's testimony, the river flow at the time of the study was representative of average river flows past the site even during a period of drought in the Savannah River, both Units were operating at or near 100% of their generating capacity, and the cooling water intake structure was operating in its normal pumping configuration. Dodd/Montz Dir. EC 1.2, Post Tr. 587 at 14-16; Dodd/Montz Reb. EC 1.2, Post Tr. 589 at 3-4. The NRC staff likewise testified that the Applicant's study was conducted on a day when the water withdrawal rate for Units 1 and 2 was significantly greater 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 for assessing the hydraulic zone of influence. Staff Reb. EC 1.2, Post Tr. 744 at 20-21. The NRC staff concluded that this study provided additional support for its conclusion in the FEIS that 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, the vast majority of organisms that are moving up or down the

river would not be adversely affected by the influence of the intake structures. Staff Dir. EC 1.2, Post Tr. 743 at 60-61.

2.60. Joint Intervenor witness Dr. Young asserted that the Applicant's hydraulic zone of influence study "lacks sufficient data and analysis" because it was conducted "while operation was only at 56% capacity" and during a "limited range of flows." Young Dir. EC 1.2, Post Tr. 814 at 10. However, as the Applicant explained, at the time of the study both Unit 1 and 2 were operating at or near 100% of their generating capacity, and the river flows were representative of flows past the site even during drought conditions. Dodd/Montz Reb. EC 1.2, Post Tr. 589 at 3-4. Mr. Dodd and Mr. Montz also testified that the 56% capacity referred to by Dr. Young reflects a comparison with the theoretical limit of all four Unit 1 and 2 pumps operating at full design capacity, not to the withdrawal rate during normal operation at full generating capacity. *Id.*

2.61. Accordingly, the Licensing Board finds persuasive the testimony of the Applicant and NRC staff that the conditions at the time of the study were representative (and likely conservative) for assessing the hydraulic zone of influence from the existing Units. The Licensing Board also agrees with the Applicant and the NRC staff that this information further supports the determination in the FEIS that entrainment impacts on aquatic species from the existing and proposed Units would be small, because only a relatively small portion of the river would be influenced by the water withdrawals from the cooling system intake structures.

2.62. The NRC staff also specifically evaluated the cumulative impacts to aquatic resources from impingement and entrainment associated with operation of all four Vogtle units. Staff Dir. EC 1.2, Post Tr. 743 at 76. In its cumulative impacts analysis, the NRC staff considered average river flows as well as low-flow and very-low-flow conditions.

2.63. In that evaluation, the NRC staff considered the percentage of water withdrawn and consumptively used by the four units. Joint Intervenor witness Mr. Sulkin argued that the cumulative impacts analysis should include analysis of impacts under maximum withdrawals by all four Vogtle units because such withdrawals represent the “plant parameter envelope that bounds the potential impacts.” Sulkin Dir. EC 1.2, Post Tr. 816. at 12. However, the NRC staff explained that because occurrences of maximum withdrawals are rare, and because closed-cycle wet cooling towers are able to operate at very stable flow rates, it is unlikely that maximum withdrawal rates would occur for more than one unit at any time. Staff Dir. EC 1.2, Post Tr. 743 at 79-80; Tr. at 783-84 (Vail). The Applicant’s witnesses Dr. Coutant and Mr. Moorner agreed that such simultaneous maximum withdrawals would be unlikely to occur. Coutant Dir. EC 1.2, Post Tr. 604 at 37; Moorner Reb. EC 1.2, Post Tr. 612 at 11. In particular, the NRC staff concluded that it would not be reasonable to evaluate impacts assuming the highest daily withdrawal rate observed (136 cfs at Units 1 and 2 in 2006), because using such outlier values would approach a worst-case assumption about withdrawals and distort the cumulative impacts analysis. Tr. 791 (Vail), 806-07 (Masnik/Vail).

2.64. Mr. Sulkin stated that “even short term maximum withdrawal conditions can result in significant cumulative impacts on water resources and aquatic species,” Sulkin Dir. EC 1.2, Post Tr. 816 at 12, but his testimony did not explain the basis for this claim, either with respect to the duration of such “short term” withdrawals or to the “significance” of the resulting cumulative impacts. In any event, as clarified in its testimony, the NRC staff accounted for the anticipated occasional occurrence of maximum withdrawals (by one or more of the four units while others remain in normal withdrawal mode) by taking the conservative approach of considering the combination of the normal water withdrawals for the proposed new units and the

maximum monthly average water withdrawals for Units 1 and 2. Staff Reb. EC 1.2, Post Tr. 744 at 2-5; Tr. at 790-791 (Vail); Ex. NRC000051.

2.65. The Licensing Board finds that the Applicant and the NRC staff have demonstrated that it is not reasonable to assume that all four Vogtle units would be simultaneously operating at maximum withdrawals and that therefore it is not necessary under NEPA to evaluate impacts under such a scenario. The Licensing Board finds that the NRC staff has demonstrated that the revised evaluation presented in its testimony, employing maximum monthly average water withdrawals for Units 1 and 2 (in combination with normal withdrawals for the proposed new units) in the cumulative impacts analysis, is a reasonable and conservative basis for that analysis.

2.66. Although the NRC staff considered the percentages of the river flow withdrawn and consumptively used by all four units, these percentages were not the only factor on which the NRC staff's conclusions regarding cumulative impacts from impingement and entrainment were based. Staff Dir. EC 1.2, Post Tr. 743 at 76-79; Staff Reb. EC 1.2, Post Tr. 744 at 5-7. With respect to cumulative impingement impacts for flows down to Drought Level 3, the NRC staff considered the location, design, and planned operation of the intake and cooling system, the life history characteristics of "important species," EPA requirements for intake design, and the characteristics of the watercourse near the Vogtle site. Staff Dir. EC 1.2, Post Tr. 743 at 76-77; Staff Reb. EC 1.2, Post Tr. 744 at 5-7. The NRC staff found no indication that the additional small and undetectable impact from Unit 3 and 4 impingement losses at these river flows would destabilize the Savannah River fishery. Staff Dir. EC 1.2, Post Tr. 743 at 76-77; Staff Reb. EC 1.2, Post Tr. 744 at 5-7.

2.67. The NRC staff's analysis of cumulative entrainment losses at flows down to Drought Level 3 relied more heavily than did the impingement analysis on consideration of

percentage withdrawal values under combined withdrawals by Units 1 through 4. Staff Dir. EC 1.2, Post Tr. 743 at 76-77; Staff Reb. EC 1.2, Post Tr. 744 at 5-7. However, entrainment impacts would be minor even from these cumulative withdrawals. Staff Dir. EC 1.2, Post Tr. 743 at 76-77; Staff Reb. EC 1.2, Post Tr. 744 at 5-7. The NRC staff's conclusion is supported by several factors, including the use of closed-cycle cooling; the design, location, and planned operation of the proposed intake; the characteristics of the watercourse in the vicinity of the intake; the distribution, abundance and life history data of aquatic species near VEGP; and previous impingement and entrainment studies at SRS. Staff Dir. EC 1.2, Post Tr. 743 at 76-77; Staff Reb. EC 1.2, Post Tr. 744 at 5-7. The NRC staff's conclusion is further supported by preliminary data from the impingement and entrainment sampling program at Units 1 and 2. Staff Dir. EC 1.2, Post Tr. 743 at 76-77; Staff Reb. EC 1.2, Post Tr. 744 at 5-7; Ex. NRC000030.

2.68. Finally, the NRC staff evaluated cumulative impacts from impingement and entrainment from all four Vogtle units under very-low-flow conditions. Staff Dir. EC 1.2, Post Tr. 743 at 77-79; Staff Reb. EC 1.2, Post Tr. 744 at 6-7. Water withdrawal percentages would increase, but the NRC staff again relied on a range of factors in its analysis. Staff Dir. EC 1.2, Post Tr. 743 at 77-79; Staff Reb. EC 1.2, Post Tr. 744 at 6-7. A small increase in impingement mortality might occur as a result of very-low-flow conditions, and there would also be a proportional increase in entrainment losses. Staff Dir. EC 1.2, Post Tr. 743 at 77-79; Staff Reb. EC 1.2, Post Tr. 744 at 6-7. However, such very-low-flow conditions would be temporary, and State resource agencies could also require mitigating actions to reduce withdrawals under such conditions. Staff Dir. EC 1.2, Post Tr. 743 at 77-79; Staff Reb. EC 1.2, Post Tr. 744 at 6-7. Many factors controlling impingement losses, such as fish behavior, would be relatively unaffected by very-low-flow conditions. Staff Dir. EC 1.2, Post Tr. 743 at 77-79; Staff Reb. EC 1.2, Post Tr. 744 at 6-7. Moreover, historic withdrawals from SRS were at percentages higher

than those estimated for all 4 Vogtle units even under very-low-flow conditions, but those entrainment losses did not result in observable adverse impacts to aquatic biota. Staff Dir. EC 1.2, Post Tr. 743 at 77-79; Staff Reb. EC 1.2, Post Tr. 744 at 6-7.

Use of the “Uniform Drift Distribution” Assumption in Entrainment Analysis

2.69. The Applicant’s witnesses also explained in their testimony why it was appropriate for the FEIS to use estimates of a “uniformly distributed drift community” in the Savannah River for evaluating entrainment impacts. Under this approach, rather than using spatially and temporally variable numbers of several entrainable species and life stages, an analyst takes a single high-end estimate of numbers, assumes them to be the same for all entrained water, and evaluates the scale of likely impact. Coutant Dir. EC 1.2, Post Tr. 604 at 41. Dr. Coutant testified that this is a reasonable and conservative assumption for estimating entrainment impacts, and he testified that under this approach, the details of actual drift community distribution would generally be considered only if a moderate to large impact appears and thus further analyses are warranted. *Id.*

2.70. Dr. Coutant emphasized that such more-detailed analysis of the drift distribution is not warranted for Plant Vogtle. This is due in part to the design features of the cooling system that ensure that using uniform distribution will tend to overestimate actual entrainment. Coutant Dir. EC 1.2, Post Tr. 604 at 42. For example, species that lay eggs in nests or whose eggs are adhesive will not enter the drift. Coutant Dir. EC 1.2, Post Tr. 604 at 42. Likewise, design features such as the weir wall minimize the likelihood of entrainment, which is conservative because the FEIS assumed uniform density and entrainment in proportion to water withdrawal. Coutant Dir. EC 1.2, Post Tr. 604 at 43. The conservatism of assuming uniform distribution is further shown by the results of Southern’s entrainment field study in 2008, which showed that

the numbers of drifting organisms in the intake canal were below the numbers in the river and had different species composition. Coutant Dir. EC 1.2, Post Tr. 604 at 43.

2.71. Dr. Coutant explained that assuming uniform distribution is a proper scientific approach and that the FEIS conclusion that impacts from entrainment would be small is supported by the analysis. Mr. Moorer similarly noted that this assumption is commonly used in performing section 316(b) assessments. Moorer Reb. EC 1.2, Post Tr. 612 at 6. Dr. Coutant further emphasized that a more detailed analysis accounting for variability in the drift densities would likely show less impact and would not be helpful for the purpose of NEPA assessment. Coutant Dir. EC 1.2, Post Tr. 604 at 43-44. Dr. Coutant also specifically stated that studies cited by Joint Intervenor witness Dr. Young (studies published in 1983 by Wiltz and by Nichols) did not negate the approach used in the EIS, in part because of design features that would be used at the Vogtle intake, and that the data presented in those studies indicate that assuming uniform distribution would almost certainly overestimate rather than underestimate entrainment. Coutant Dir. EC 1.2, Post Tr. 604 at 44-46.

2.72. As described above concerning the testimony of Dr. Coutant and Mr. Moorer for the Applicant, the NRC staff in evaluating entrainment impacts assumed both that entrainment is generally proportional to withdrawals and also that eggs and larvae are uniformly distributed throughout the water column. Staff Dir. EC 1.2, Post Tr. 743 at 48-51, 53-56. While the assumption of uniform distribution is not necessarily realistic for some species that are demersal spawners (with eggs that sink quickly and adhere), it is conservative for estimating entrainment at Vogtle even for those species because the intake system design would result in water from the middle of the water column preferentially entering the canal. Staff Dir. EC 1.2, Post Tr. 743 at 53-55, 56-58. Uniform distribution is also consistent with the assumption previously used in the Final Environmental Statement for Units 1 and 2, and with the assumptions made by the

Environmental Protection Agency in its Phase I final regulations. Staff Dir. EC 1.2, Post Tr. 743 at 53-56. This assumption is also conservative because times of year with higher ichthyoplankton densities correspond with periods of higher river flow, resulting in a lower percentage being entrained. Staff Dir. EC 1.2, Post Tr. 743 at 56-58. Accordingly, the uniform distribution assumption, in combination with the aforementioned intake design considerations and sampling data, supports the NRC staff's conclusions in the FEIS.

2.73. Joint Intervenor witness Dr. Young challenged the use of the assumption that the drift community near Plant Vogtle is uniformly distributed. Young Dir. EC 1.2, Post Tr. 814 at 7; Young Reb. EC 1.2, Post Tr. 815 at 8-9. He asserted that because recognized studies indicate that the drift community is not uniformly distributed, uniform distribution is not a reasonable assumption to make for purposes of the FEIS analysis. Young Dir. EC 1.2, Post Tr. 814 at 7; Young Reb. EC 1.2, Post Tr. 815 at 8-9. After considering the testimony of the Applicant and NRC staff witnesses describing why the use of the uniform distribution assumption in the Vogtle ESP analysis is in fact a conservative means of estimating impacts from entrainment at the Vogtle intake structure, the Licensing Board finds Dr. Young's position unpersuasive. Dr. Coutant explained specifically why the studies cited by Dr. Young do not negate the approach used in the FEIS or the conclusion that entrainment impacts would be small. Coutant Dir. EC 1.2, Post Tr. 604 at 44-46. Dr. Coutant also testified that the use of simplifying assumptions such as uniform distribution and impacts being proportional to the amount of water withdrawn is common and accepted practice for estimating the scale of impact to be expected. "Southern Nuclear Operating Company's Rebuttal Testimony of Dr. Charles C. Coutant On Environmental Contention 1.2" ["Coutant Reb. EC 1.2"], Post Tr. 605 at 5. He stated that because these assumptions are generally conservative and the estimated impacts from these conservative

assumptions are small, more detailed and realistic numbers are not necessary. Coutant Reb. EC 1.2, Post Tr. 605 at 5.

2.74. In summary, witnesses for both the Applicant and the NRC staff explained why the design of the intake (which preferentially selects water from the middle of the water column) and the relevant life history data of aquatic species (for example, many riverine species are demersal spawners or are considered “nesting” species and are less subject to entrainment) mean that assuming uniform distribution of the drift community will tend to overestimate the number of organisms entrained and hence the impacts of entrainment. Coutant Dir. EC 1.2, Post Tr. 604 at 42-44; Staff Dir. EC 1.2, Post Tr. 743 at 53-55, 56-58. Given these factors and the results of the recent entrainment sampling program at Units 1 and 2 that show lower densities of organisms in the intake canal than in the source water, the Licensing Board concludes that the use of the uniform distribution methodology is a reasonable and generally conservative approach to estimating entrainment impacts at the Vogtle site.

2.75. In response to Licensing Board questions, Dr. Young asserted that “the assumption of uniform distribution doesn’t really hold true to nature” and that the actual distribution of organisms in a river could change in both spatial and temporal ways – namely, that the distribution could change “hourly,” “between day and night,” and with different flows in the river, and would be affected by factors such as the number, abundance, and life history of species (including the number of eggs), and the location of spawning grounds. Tr. at 849, 856-859. Dr. Young further stated that, based on changes in these factors, the actual distribution of organisms in the river could also change from year to year. Tr. at 859.

2.76. In light of the variability that Dr. Young described, the Licensing Board is not persuaded that it would be feasible or necessary for NEPA purposes to obtain additional site-specific field studies to determine the precise spatial and temporal distribution of organisms in

the Savannah River during the anticipated life of the facility. Even if it were feasible to do so, the Licensing Board is not persuaded that requiring such studies would result in a more useful or accurate NEPA estimate of impacts than has been reached through use of the uniform distribution assumption. In any event, the Licensing Board finds that in light of the conservatisms involved in the use of the uniform distribution assumption in the FEIS analysis for Vogtle, the approach to determining entrainment impacts that is advocated by Dr. Young is not necessary for a reasonable evaluation of impacts consistent with NEPA.

2.77. The Licensing Board concludes for these reasons that the NRC staff's assumption of uniform drift distribution (as well as the corresponding NRC staff assumptions that entrainment is in proportion to water withdrawn by the intake and that entrained organisms experience 100% mortality¹⁰) as applied in the FEIS is scientifically sound and is fully consistent with the "hard look" at potential impacts that is required by NEPA.

Use of Water Withdrawal Percentage in Entrainment Analysis

2.78. Also in connection with the entrainment analysis, Joint Intervenor witness Mr. Sulkin asserted that the NRC staff was using the percentage of Savannah River water withdrawn by the intake structure – and specifically the value of 5% of the river flow at any given time – as a "threshold of significance" for determining whether or not entrainment impacts were small. Sulkin Dir. EC 1.2, Post Tr. 816 at 4. In particular, he asserted that the NRC staff was using this withdrawal percentage as a "surrogate method" for determining impacts to be small when the percentage was below this value. *Id.* He also asserted that the NRC staff was disregarding this methodology when withdrawal percentages (and particularly cumulative

¹⁰ In response to Licensing Board questions, Dr. Young agreed that the assumption of 100% mortality for entrained organisms is a conservative assumption, as it takes no credit for the ability of some organisms to escape after being drawn into the intake canal. Tr. at 841-42.

withdrawals by all four Vogtle units under scenarios of low-flow conditions in the Savannah River) exceeded that 5% value. “Revised Prefiled Rebuttal Testimony of Barry W. Sulkin Concerning Contention EC 1.2” [Sulkin Reb. EC 1.2], Post Tr. 817 at 6.

2.79. However, both the Applicant and the NRC staff testified that the percentage of water withdrawn by the Vogtle units was simply one of many factors considered in determining impacts. Moreover, the NRC staff explained that the NRC staff does not consider any particular percentage of water withdrawn to be a per se indicator of small impacts. Staff Dir. EC 1.2, Post Tr. 743 at 71-73; Staff Reb. EC 1.2, Post Tr. 744 at 30-33. Rather, the NRC staff simply acknowledged the EPA requirement regarding percentage withdrawal by new facility intake structures – a requirement that is based only on the annual mean flow from the source waterbody – and indicated that compliance with that requirement would be at least some indication of the potential impacts. Staff Reb. EC 1.2, Post Tr. 744 at 31-32. Applicant witness Mr. Moorer noted that it is common, accepted, and logical practice to use percent withdrawal as an indicator of relative aquatic impacts. Moorer Reb. EC 1.2, Post Tr. 612 at 12; Ex. SNC000055. Indeed, Mr. Sulkin agreed that percentage withdrawal is a potentially relevant consideration, stating that “there might be some scientific validity to looking at the percent of water taken in at any flow.” Tr. at 923 (Sulkin).

2.80. Accordingly, the Licensing Board concludes that no substantive dispute remains concerning the significance attributed to the 5% withdrawal value in the context of the NRC staff’s consideration of percentage of water withdrawn in the FEIS analysis of entrainment impacts. Contrary to the Joint Intervenors’ claims, it is clear that the description in the FEIS of water-withdrawal percentages at various flows has not been used as a simple “threshold test” for determining corresponding entrainment impacts. Nor has the NRC staff employed the EPA 5% requirement as a surrogate for assessing impacts in the FEIS under various flow regimes;

the NRC staff simply described the requirement to indicate whether that standard would be met by the proposed new units under annual mean flow conditions in the Savannah River, consistent with the EPA rule.

Conclusions Concerning Impingement and Entrainment Analysis

2.81. After considering the testimony on this portion of Contention EC 1.2, the Licensing Board finds that the Applicant and the NRC staff have presented sufficient evidence to support the FEIS conclusion that impacts to aquatic resources from impingement and entrainment will be small. The Licensing Board finds that this analysis is supported by the range of plant design factors, data, and biological characteristics described by the Applicant and the NRC staff, including the use of closed-cycle cooling; the planned low through-screen intake velocity and low intake canal flow velocity towards the intake screens; the design and location of the cooling intake canal and structure, including use of a weir wall and skimmer wall at the mouth of the intake; the identification and evaluation of aquatic species inhabiting the middle Savannah River, including life history data, the high fecundity of many species inhabiting rivers, and the high natural mortality rates of eggs and larvae; consideration of previous sampling data, including from the SRS; and the results of the recent impingement and entrainment studies conducted by the Applicant at Units 1 and 2.

2.82. Furthermore, considering the findings above concerning the cumulative impacts analysis, the Licensing Board finds that the Applicant and the NRC staff have demonstrated that the FEIS, as clarified by the NRC staff testimony concerning the withdrawal rates assumed for Units 1 and 2 (in combination with normal withdrawals for the proposed new units),¹¹ have

¹¹ See findings 2.64 and 2.65 above. With respect to the NRC staff testimony concerning the water withdrawal rates assumed for Units 1 and 2 in the FEIS cumulative impacts analysis – see, e.g., Staff Reb. EC 1.2, Post Tr. 744 at 1-7 – the NRC staff notes that to the extent the Licensing Board deems (continued. . .)

adequately considered the cumulative impingement and entrainment impacts of all four Vogtle units, including under low-flow and very-low flow conditions.

2.83. The Licensing Board also finds that the NRC staff analyses of impingement and entrainment impacts properly accounted for impacts to “important species,” including the State-listed robust redhorse, the shortnose sturgeon (Federally listed as endangered), and the Atlantic sturgeon (a Federal “candidate species”).¹² As noted earlier, consistent with NRC staff guidance, the NRC staff presented sufficient specific life history information for important species to demonstrate the requisite NEPA “hard look” at impacts. The Applicant and the NRC staff demonstrated that the life history information of these species does not make them unusually vulnerable to impingement or entrainment at the proposed units, that associated adverse effects on these species are unlikely even if the species are present in the stretch of the river near the Vogtle site, and that critical habitat is not present for these species in the vicinity of the site. Coutant Dir. EC 1.2, Post Tr. 604 at 19, 21; Coutant Reb. EC 1.2, Post Tr. 605 at 4, 10; Moorer Dir. EC 1.2, Post Tr. 610 at 8-10; Moorer Reb. EC 1.2, Post Tr. 612 at 4-5; Staff Dir. EC 1.2, Post Tr. 743 at 18, 20-21, 24-26, 31, 44, 51, 53-54, 57-59; Staff Reb. EC 1.2, Post Tr. 744 at 10, 13-14; Tr. 667-69 (Moorer/Coutant); Tr. 699-700 (Coutant); Tr. 702-05

(. . .continued)

appropriate, the Licensing Board in its decision has the ability to amend the FEIS pro tanto. See *La. Energy Servs.* (Claiborne Enrichment Center), CLI-98-3, 47 NRC 77, 89 (1998) (“In NRC licensing adjudications...it is the Licensing Board that compiles the final environmental “record of decision[.]” ... The adjudicatory record and Board decision ... become, in effect, part of the FEIS.”); *La. Energy Servs.* (National Enrichment Facility), LBP-05-13, 61 NRC 385, 404 (2005) (“[T]he ultimate NEPA judgments regarding a facility can be made on the basis of the entire record before a presiding officer, such that the EIS can be deemed to be amended pro tanto.”).

¹² With respect to the NRC staff testimony concerning the life history information of the Atlantic sturgeon as an “important species” and the associated NRC staff analysis of potential impacts to that species – see, e.g., Staff Dir. EC 1.2, Post Tr. 743 at 20-21, 24-26, 44, 58, 83 – the NRC staff notes that to the extent the Licensing Board deems appropriate, the Licensing Board in its decision has the ability to amend the FEIS pro tanto. See *Claiborne Enrichment Center*, CLI-98-3, 47 NRC at 89; *Nat'l Enrichment Facility*, LBP-05-13, 61 NRC at 404.

(Coutant); Tr. 767-68 (Krieg); Tr. 777-78 (Krieg/Masnik). The data and plant design considerations described above similarly support the FEIS conclusion that impacts to these “important species” from impingement and entrainment would also be small.

2.84. Based on the above, the Licensing Board finds that the record supports the analysis and conclusion in the FEIS that the direct, indirect, and cumulative impacts of the proposed new units’ cooling system intake structure with respect to impingement and entrainment will be small.

iii. Reasonableness of Range of Savannah River Flows Analyzed

2.85. Another underlying element of Contention EC 1.2 concerns whether the FEIS considered an appropriate range of Savannah River flows in evaluating the impacts from the intake and discharge structures on aquatic resources. For reasons explained below, the Licensing Board finds that the record demonstrates that the FEIS appropriately evaluates a representative range of flows, including ones that reflect conservative low-flow scenarios.

2.86. The Applicant’s witnesses testified concerning the flows that the NRC staff analyzed in the FEIS and asserted that these flows were appropriate and conservative. Dr. Coutant explained that although the NRC staff determined it was conservative to use “Drought Level 3” flows of 3,800 cfs in the EIS, the NRC staff also considered even lower river flows of 3,000 and 2,000 cfs, both of which are below the minimum flows for Drought Levels 1, 2, and 3 in the current U.S. Army Corps of Engineers (“USACE”) Drought Contingency Plan. Coutant Dir. EC 1.2, Post Tr. 604 at 38. Dr. Coutant explained that these flows of 3,000 and 2,000 cfs were considered even though there is only a low likelihood that very low flows would occur at times of high entrainment or high thermal risk. Coutant Dir. EC 1.2, Post Tr. 604 at 38.

2.87. Mr. Moorer likewise testified that annual average flows and the Drought Level 3 flow of 3,800 cfs were evaluated in the ER because they represent the range of flows most likely

to occur. Moorer Dir. EC 1.2, Post Tr. 610 at 10, Ex. SNC000016. He indicated that Drought Level 4 flow was not considered in the ER both because it has never been experienced and because the USACE Drought Plan at the time the ER was submitted did not define a specific flow regime for Drought Level 4. Moorer Dir. EC 1.2, Post Tr. 610 at 10-11. He also stated that the lowest river flows occur in late summer and fall and that the low flow period typically does not coincide with the spawning period. Moorer Dir. EC 1.2, Post Tr. 610 at 11; Moorer Reb. EC 1.2, Post Tr. 612 at 8.

2.88. Mr. Moorer further testified that the approach in the FEIS was even more conservative, also evaluating flows of 3,000 and 2,000 cfs. Moorer Dir. EC 1.2, Post Tr. 610 at 11; Moorer Reb. EC 1.2, Post Tr. 612 at 8. He stated that the flow record at the Vogtle site indicated that the frequency and duration of flow values below 3,600 cfs is extremely low and that no extended periods at or below this flow are known to exist. Moorer Dir. EC 1.2, Post Tr. 610 at 11-12; Ex. SNC000053. He considered the NRC staff's analysis of 3,000 cfs appropriate to represent an extreme low flow event and described the 2,000 cfs scenario as "excessively conservative," and he testified that the evaluation at each of these values supports the conclusion that impacts from impingement, entrainment, and thermal discharge are small. Moorer Dir. EC 1.2, Post Tr. 610 at 12.

2.89. Dr. Coutant also supported the NRC staff's use of discharge rates from the J. Strom Thurmond Dam in the FEIS as a surrogate for flows past the Vogtle site. Coutant Dir. EC 1.2, Post Tr. 604 at 39. He stated that this approach was reasonable given the accuracy of the measurement of releases at the Dam and the confirmatory information from other monitoring stations on the Savannah River. Coutant Dir. EC 1.2, Post Tr. 604 at 39. Similarly, Mr. Moorer emphasized that the local inflows that occur between the Thurmond Dam and the Vogtle site add a considerable amount of conservatism to the FEIS analysis. Moorer Reb. EC 1.2, Post Tr.

612 at 12; Ex. SNC000054. He also noted that due to these inflows, the 2,000 cfs value evaluated in the FEIS at the Vogtle site would correspond to a release rate of 1,500-1,700 cfs at Thurmond Dam, and that flows have never been experienced that low on the Savannah River since the impoundments were completed. Moorer Reb. EC 1.2, Post Tr. 612 at 12.

2.90. The NRC staff witnesses similarly testified that in evaluating impacts to aquatic resources, the NRC staff considered a range of flows, including normal flows as well as low-flow conditions. In the FEIS, the NRC staff determined it was conservative to base its low-flow analysis on Drought Level 3 flows of 3,800 cfs in the USACE Draft Drought Contingency Plan. Staff Dir. EC 1.2, Post Tr. 743 at 61-63. However, in part because of ongoing drought conditions as well as reservoir-release changes contemplated by the USACE, and also because of public comments on the DEIS, the NRC staff also evaluated very-low flows of 3,000 and 2,000 cfs. Staff Dir. EC 1.2, Post Tr. 743 at 61-63; Tr. at 1498 (Vail); Ex. NRC00001C at E-44. As the NRC staff explained, these values continue to bound recent seasonal release restrictions proposed by the USACE. Staff Dir. EC 1.2, Post Tr. 743 at 61-63; Ex. NRC000038; Ex. NRC000039.

2.91. The NRC staff testified that the FEIS analysis of these three low and very-low flow rates remains appropriate. The NRC staff witnesses also testified that the NRC staff does not believe that current drought conditions represent a new baseline condition for the Savannah River Basin or suggest the need to reconsider long-term normal flows, particularly for a NEPA review of an ESP that assumes the siting of a plant with a 40-plus year operating life. Staff Dir. EC 1.2, Post Tr. 743 at 63-64, 68-70.

2.92. With respect to flow measurements, the NRC staff determined that it was appropriate to use estimated releases from the Thurmond Dam as the basis of the NRC staff's analysis of impacts at the site. This is because the NRC staff found that primary discharges of

groundwater and surface water to the Savannah River between the Thurmond Dam and the site are likely to be approximately equivalent to consumptive loss from other upstream users, even under low-flow conditions. Staff Dir. EC 1.2 at 64-66; Ex. NRC000040, NRC000041, NRC000042. Moreover, groundwater discharges would likely increase at extremely low stream flows, while withdrawals would not. Staff Dir. EC 1.2, Post Tr. 743 at 64-66. For these reasons, and given the reliability of flow estimates at the Thurmond Dam, the NRC staff considered its use of the Thurmond Dam values to be reasonable. Furthermore, since issuance of the FEIS, the NRC staff considered additional recent flow data from the USGS gauge at Waynesboro, Georgia, showing flows at the Vogtle site in excess of the releases from the Thurmond Dam. Staff Dir. EC 1.2, Post Tr. 743 at 64-66; Ex. NRC000041. The Licensing Board agrees that these data support the NRC staff's view that the Savannah River generally gains water between the Thurmond Dam and the Vogtle site and thus that the use of the Thurmond Dam releases represents a reasonable bounding assumption for evaluating flows at the ESP site. Staff Dir. EC 1.2, Post Tr. 743 at 64-66; Tr. at 800-02 (Cook); Ex. NRC000041.

2.93. The NRC staff used these flow values to evaluate impacts to aquatic resources. The NRC staff analysis of operational impacts in FEIS Chapter 5 is based on maximum withdrawal rates for Units 3 and 4, which the NRC staff considers to be an additional conservatism because withdrawals at this rate would occur infrequently and only for short periods of time. Staff Dir. EC 1.2, Post Tr. 743 at 66-67. Moreover, the natural variation in flows at the VEGP site, even on a daily basis, is often greater than the normal and maximum withdrawal rates for the proposed new Units, and variation in river flow rates is considered normal and beneficial to riverine systems. Staff Dir. EC 1.2, Post Tr. 743 at 66-67. Also, the NRC staff relied on average-daily discharge flow and Drought Level 3 flows, even though flows

are generally higher in spring and early summer, when most fish spawning occurs. Staff Dir. EC 1.2, Post Tr. 743 at 66-67. This further supports the conservatism of the NRC staff assessment.

2.94. Using these flow values, the NRC staff determined the percentage of river flow that would be withdrawn and consumptively used by the proposed new units. The NRC staff identified these percentages not only for normal withdrawals and average river flows (8,830 cfs), but also for maximum withdrawals and for river flows of 3,800, 3,000 and 2,000 cfs. Staff Dir. EC 1.2, Post Tr. 743 at 70-71. While the NRC staff considered these percentages in evaluating impacts from impingement, the NRC staff also relied on several other factors, as discussed earlier. These factors (e.g., the type of cooling system and the intake structure design and operation) have greater potential for affecting impingement rates than do the kinds of flow variation expected in the Savannah River. Staff Dir. EC 1.2, Post Tr. 743 at 71-73. Likewise, the NRC staff's evaluation considered the percentage of water withdrawn from the Savannah River as one of several factors influencing entrainment impacts. Staff Dir. EC 1.2, Post Tr. 743 at 71-73. For example, the NRC staff noted that Units 3 and 4 withdrawals would meet the EPA regulations for withdrawals being no greater than five percent of the source water body annual mean flow under normal surface water consumption and normal annual mean flows. Staff Dir. EC 1.2, Post Tr. 743 at 72-73; Ex. NRC000035 at 65,277, 65,340. Thus the NRC staff considered these water withdrawal percentages, as well as other factors and data, in determining that impacts from impingement and entrainment on aquatic resources would be small. Staff Dir. EC 1.2, Post Tr. 743 at 73.

2.95. As discussed in the findings above regarding impingement and entrainment, although the NRC staff determined that entrainment impacts (and possibly impingement impacts) could increase under very-low-flow conditions, the NRC staff determined that such

losses were unlikely to have any long-term impacts on populations of aquatic organisms in the Savannah River. Staff Dir. EC 1.2, Post Tr. 743 at 73-74.

2.96. The Joint Intervenors' witnesses assert that the FEIS needs to consider even lower flows than those the NRC staff analyzed. Dr. Young has stated that the FEIS considers only flows of 8,830, 4,200, 4,000, and 3,800 cfs. Young Dir. EC 1.2, Post Tr. 814 at 11.

However, it is apparent that the FEIS does include analysis of impacts at even lower flows of 3,000 and 2,000 cfs (see, e.g., Ex. NRC00001A, 1B), so the Licensing Board does not believe that Dr. Young's claim is valid.

2.97. Dr. Young also asserts that the FEIS "fails to consider a sufficient range of flows" and that the FEIS "should, at the very least, include analysis of flows ranging from normal to Drought Level 4." Young Dir. EC 1.2, Post Tr. 814 at 10-11. Similarly, the testimony of Joint Intervenor witness Mr. Sulkin addressed flow rates corresponding not only to the flows identified by Dr. Young (8,830, 4,200, 4,000, and 3,800 cfs), and to the 3,000 and 2,000 cfs low-flow values analyzed by the NRC staff, but also to more recent Thurmond Dam discharges of 3,100 cfs, and also to what Mr. Sulkin defines as "Drought Level 4, the hypothetical unimpaired minimum flow if there were no dams or reservoirs (957 cfs)." Sulkin Dir. EC 1.2, Post Tr. 816 at 8.

2.98. In response to Licensing Board questions, Mr. Sulkin expressed his view that the "worst case assumption" should be used in NEPA analysis. Tr. at 925-26 (Sulkin). However, as described above in our statement of relevant legal standards, NEPA does not require consideration of worst-case scenarios. Although Mr. Sulkin subsequently stated that the worst-case scenario would be a flow of "zero" in the river, the Licensing Board finds that the flow scenario of 957 cfs described by Mr. Sulkin as "a hypothetical unimpaired minimum flow" is sufficiently unlikely that it is likewise encompassed by the category of "worst-case scenarios"

that are not required to be analyzed under NEPA. In any event, the Joint Intervenors have not presented evidence that would persuade us to disagree with the evidence presented by the Applicant and the NRC staff (particularly the flow data from the USGS Waynesboro gauge at the Vogtle site) that such a hypothetical minimum flow is not reasonably foreseeable at the Vogtle site and does not need to be analyzed in the FEIS to comply with NEPA.

2.99. Based on the above, the Licensing Board finds that the record confirms that the range of Savannah River flows considered by the NRC staff for its analysis of impacts to aquatic resources was reasonable. We find persuasive the NRC staff's explanation of the basis for the flow rates it analyzed, including its explanation of why data from the Waynesboro gauge confirms that a flow rate of 3,800 cfs is an appropriately conservative measure of what flow would be at the Vogtle site under likely low-flow scenarios. We agree with the Applicant and the NRC staff that the NRC staff's decision to discuss impacts at flows of 3,000 and 2,000 cfs to provide additional context for its analysis was extremely conservative and that such flows are not likely to occur at the Vogtle site. Given the representative range of flows considered by the NRC staff, we agree that the FEIS analysis based on those flows thus encompasses the associated impingement, entrainment, and thermal discharge impacts that would be considered reasonably foreseeable. NEPA does not require consideration of worst-case scenarios, and given the conservatism already reflected in the NRC staff analysis, the Licensing Board finds that NEPA does not require analysis of flows even lower than those evaluated by the NRC staff.

iv. Thermal Discharge Impacts from the Existing and Proposed Vogtle Units

2.100. The last major element of Contention EC 1.2 concerns the adequacy of the FEIS evaluation of thermal discharge impacts. For reasons explained below, the Licensing Board

finds that the record demonstrates that the FEIS adequately evaluates the thermal discharge impacts to aquatic species in the Savannah River from the proposed new units.

2.101. Several Applicant witnesses testified concerning thermal discharge impacts. Dr. Coutant testified that the FEIS appropriately analyzed potential impacts on the aquatic drift community from the cooling system thermal discharges. Coutant Dir. EC 1.2, Post Tr. 604 at 31. He explained that the FEIS estimates impacts based on the minimal size of the thermal plume in relation to the river, as well as the low discharge temperatures, and that the FEIS found that the impact would be small for organisms passing through the plume or needing to swim around it. *Id.*

2.102. Dr. Coutant explained that had the thermal plume covered a larger percentage of the river with temperatures more above ambient, or if the temperatures had been within the lethal doses of temperature and duration of exposure for species such as the American shad, then more extensive analysis might have been justified. *Id.* However, Dr. Coutant confirmed that based on his review of scientific literature (indicating, for example, that it would take 30 minutes of exposure to water temperatures 12 degrees Fahrenheit above ambient of 68 degrees to cause 50% mortality in larval and juvenile shad), the temperature and exposure times encountered by organisms at the thermal plume at Vogtle (about 8 minutes with a temperature rise of only a fraction of a degree Celsius) would not be sufficient to cause high temperature mortality. *Id.* Moreover, he explained that at the higher river flows and associated water velocities in spring when larvae would be present, the travel times would be even faster and the durations of exposure shorter. *Id.*

2.103. Dr. Coutant emphasized that duration of exposure to the thermal plume is important for determining mortality, and that Joint Intervenor witness Dr. Young had not mentioned duration of exposure in his testimony regarding the thermal plume impacts. Coutant

Reb. EC 1.2, Post Tr. 605 at 8-9. Dr. Coutant stated that for the 5°F above ambient thermal mixing zone described in the FEIS that was 97 feet in extent at a river velocity of 1.5 feet per second, that distance would be covered in 65 seconds, and any ichthyoplankton mixed into that plume along its length would receive a fraction of the maximum duration of exposure. Coutant Reb. EC 1.2, Post Tr. 605 at 9. Accordingly, the duration of exposure to any potentially lethal temperatures would likely be too brief to cause mortality, even if temperatures in the mixing zone were above the long-term lethal level at some points. *Id.* at 9-10. He also stated that the lethal temperatures cited by Dr. Young would not generally occur in the Savannah River during the spring and early summer when eggs and larvae of the ichthyoplankton are drifting past the Vogtle site (and possibly into the thermal plume). *Id.* at 8, 11. He also noted that in Southern's 2008 ichthyoplankton study, the majority of ichthyoplankton had passed by the site by June. *Id.* at 11. Additionally, Dr. Coutant stated, in response to Dr. Young's testimony, that shortnose sturgeon do not spawn in the vicinity of Vogtle, and so their eggs and larvae would not be present in the thermal plume. *Id.* at 10; Ex. SNC000005; Ex. SNC000051; Ex. JTI000013.

2.104. Dr. Coutant further testified that Southern used the EPA-approved CORMIX mixing model in preparing the plume analyses in its ER and that the NRC used this same approach in developing its independent assessment for the FEIS. Coutant Dir. EC 1.2, Post Tr. 604 at 32. In the ER, Southern compared the model's output of time-varying temperatures with data for representative organisms that might encounter the plume, and estimated that there would be no material mortality. *Id.* Dr. Coutant explained that the NRC staff reached similar conclusions in its independent assessment. *Id.*

2.105. Dr. Coutant further testified that to provide confirmation that the model predictions of plume size and temperatures are reasonable, the Applicant conducted a field study in August 2008 of temperature and water velocity at the thermal discharge from Units 1

and 2. *Id.* at 32. He testified that this study was undertaken when the river flow was low and ambient river temperatures high. *Id.* at 32-33. Dr. Coutant explained that this study found that under these summer conditions, only a small thermal plume was discernable, and actual warming of the river by the Units 1 and 2 thermal plume was no greater (and apparently much less) than natural solar heating. *Id.* at 33. Dr. Coutant testified that 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. *Id.* at 34. He also stated that passage and cooling are rapid, almost certainly not providing durations of exposure to high temperatures sufficient to cause mortality in the river. *Id.* at 34. Dr. Coutant asserted that this study confirms the conclusions from the CORMIX modeling and the FEIS determination of small impacts. *Id.* at 34-35.

2.106. Dr. Coutant also described the FEIS analysis of the CORMIX model's thermal plume at Savannah River flows of 3,800 cfs and at 2,000 cfs, and he stated his agreement with the FEIS conclusion that the plume dimensions would still be only a small percentage of the river and the effects not significant. *Id.* at 38. He testified that if the thermal analysis "indicates little or no biological impact to 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." *Id.* at 41. He indicated that the flows used in the FEIS analysis were highly representative of the range of flows at the Vogtle site, and he further stated that while "lower flows are theoretically possible," his opinion is that the conclusions would not change under these flows, and that "it would not be useful to assess such unlikely hypothetical extremes." *Id.* at 41. Dr. Coutant also stated, in response to a statement by Joint Intervenor witness Dr. Young, that the thermal plume would not extend to the Lower or estuarine Savannah River, as

the estuary is 120 miles away from Plant Vogtle. Coutant Reb. EC 1.2, Post Tr. 605 at 2; Tr. at 707-08.

2.107. Applicant witness Mr. Moorer similarly testified that the thermal impact from all four Vogtle units will be extremely small. Moorer Dir. EC 1.2, Post Tr. 610 at 14. Mr. Moorer emphasized that since the maximum blowdown at the point of discharge is estimated at 91 degrees Fahrenheit, this maximum temperature would only impact a small area until it mixed with ambient river water and dropped below the State of Georgia's 90 degree water quality standard. *Id.* at 14. He further stated that the FEIS estimated this area (i.e., the mixing zone above 90 degrees Fahrenheit) as being only 21 square feet, and that the duration of exposure to organisms even under this bounding case would be about 2 seconds. He stated that maximum temperatures would be unlikely to occur during the spring and early summer months when drift organisms are ordinarily present in the Savannah River, adding further conservatism to the ER and FEIS conclusion. *Id.* at 14. Mr. Moorer also emphasized the importance of the duration of exposure for determining impacts to fish traveling through the thermal mixing zone, and reiterated that the travel time is a few seconds for most organisms. Moorer Reb. EC 1.2, Post Tr. 612 at 8.

2.108. This point was reinforced by the testimony of Mr. Dodd and Mr. Montz, who likewise explained that the time of exposure for fish larvae and eggs that would be traveling through the discharge plume is measured in seconds, not minutes. "Southern Nuclear Operating Company's Rebuttal Testimony of Tony Dodd and Matt Montz Concerning EC 1.2" ["Dodd/Montz Reb. EC 1.2"], Post Tr. 589 at 5. Mr. Dodd and Mr. Montz also stated that because the plume is more buoyant than the surrounding water (because it is warmer than ambient waters), the buoyant nature of the plume "restricts it to the upper portions of the water column over a relatively short distance," and so "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.” Dodd/Montz Reb. EC 1.2, Post Tr. 589 at 6.

2.109. Mr. Dodd and Mr. Montz testified concerning the thermal plume study conducted for Units 1 and 2, including the methodology used for taking measurements of the plume. Dodd/Montz Dir. EC 1.2, Post Tr. 587 at 16-19. They introduced as evidence a graphical model to illustrate the shape and size of the thermal plume in the river. Dodd/Montz Dir. EC 1.2, Post Tr. 587 at 18; Ex. SNC000011. As discussed by Dr. Coutant, the data indicated that the measurable thermal discharge plume for Units 1 and 2 (at a <1°F above ambient isotherm) occupied a small zone (approximately 100 feet long by 75 feet wide) located immediately downstream of the Units 1 and 2 discharge pipe/outfall. Dodd/Montz Dir. EC 1.2, Post Tr. 587 at 19; Tr. at 638-40 (Dodd/Montz).

2.110. NRC staff witnesses also testified concerning the NRC staff’s evaluation of the cumulative impact to aquatic resources from discharge of heated cooling water associated with operation of Vogtle Units 3 and 4. The NRC staff witnesses explained that the NRC staff review followed ESRP guidance. Staff Dir. EC 1.2, Post Tr. 743 at 80, 81-83. Pursuant to that guidance, the NRC 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.” Staff Dir. EC 1.2, Post Tr. 743 at 82; Ex. NRCR00009 at 5.3.2.2-1. The ESRP also states that “the 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.” Staff Dir. EC 1.2, Post Tr. 743 at 82; Ex. NRCR00009 at 5.3.2.2-10.

2.111. In the FEIS, the NRC staff analyzed the interaction between the plume and the habitat and life history of important species, the potential impacts from cold shock, and the

potential for an increase in invasive or nuisance organisms due to increased ambient water temperatures. Staff Dir. EC 1.2, Post Tr. 743 at 80-83. In addition, a Biological Assessment describing the NRC staff's findings was prepared and sent to the National Oceanic and Atmospheric Administration for its review under Section 7 of the Endangered Species Act. Staff Dir. EC 1.2, Post Tr. 743 at 82; Ex. SNC000022.

2.112. The NRC staff's evaluation of thermal discharge impacts to aquatic biota employed the CORMIX numerical model to estimate the size and shape of the discharge plume. Staff Dir. EC 1.2, Post Tr. 743 at 80-85. The CORMIX model is used in environmental impact assessments of regulatory mixing zones resulting from continuous point source discharges and is considered to be an industry standard for such assessments. Staff Dir. EC 1.2, Post Tr. 743 at 85. The CORMIX modeling assessment as presented in Section 5.3.3.1 of the FEIS describes the areal extent of the plume. Staff Dir. EC 1.2, Post Tr. 743 at 84. In the FEIS, the NRC staff used the CORMIX assessment to consider discharges to the Savannah River under a variety of flow conditions, river temperatures, and discharge water temperatures; in its assessment the NRC staff also considered the design and location of the discharge and the width of the river at the VEGP site. Staff Dir. EC 1.2, Post Tr. 743 at 81-84.

2.113. As a conservative measure, the NRC staff's assessment considered the combined impact of discharges of heated water from all four units. Staff Dir. EC 1.2, Post Tr. 743 at 85. As further conservative measures, the analyses assigned the total effluent discharge for all four units to a single outfall pipe at maximum plant flows, maximum discharge temperatures and minimum ambient river temperatures which the NRC staff considered would produce the maximum single thermal plume. Staff Dir. EC 1.2, Post Tr. 743 at 85, 88-89. Further, in addition to the Drought Level 3 flows (3,800 cfs), the NRC staff considered thermal discharge impacts under very-low-flows of 2,000 cfs and 3,000 cfs. Staff Dir. EC 1.2, Post Tr.

743 at 85-88. These flow conditions resulted in the greatest plume size and the greatest impact and, although the NRC staff expects that the occurrence of such low flows would be extremely rare and of temporary duration, analysis of these flows was the NRC staff's attempt to provide additional conservative context for the analysis. Staff Dir. EC 1.2, Post Tr. 743 at 86; Tr. at 803 (Cook).

2.114. Utilizing the most conservative flow and discharge information, the maximum mixing zone size was found to be approximately 15 feet wide by 97 feet long. Staff Dir. EC 1.2, Post Tr. 743 at 82-83, 86. As the Savannah River is 312 feet wide at the location of the Vogtle ESP site, the NRC staff determined that the 5 degree Fahrenheit isotherm would occupy about 5% of the river cross section. Staff Dir. EC 1.2, Post Tr. 743 at 86.

2.115. In assessing the impact of the thermal plume on aquatic biota, the NRC staff in the FEIS described the aquatic environment and biota, including the types, life stages, and relative abundance of important biota in the vicinity of the VEGP. Staff Dir. EC 1.2, Post Tr. 743 at 81. Because the mixing zone is expected to be small in comparison to the width of the river, the NRC staff concluded that it would not impede up- or downstream migration of the important fish species of concern known to occur in the vicinity of the Vogtle ESP site, including the robust redhorse and the shortnose sturgeon, and that fish and other organisms would be able to avoid the elevated temperatures associated with the plume. Staff Dir. EC 1.2, Post Tr. 743 at 81-83. Because the Atlantic sturgeon has spawning characteristics similar to those of the shortnose sturgeon (Staff Dir. EC 1.2, Post Tr. 743 at 24-26), the NRC staff concluded that the thermal plume would also create no barrier to its up- or downstream migration. Staff Dir. EC 1.2, Post Tr. 743 at 83. The NRC staff also concluded that impacts to the South Carolina mussel species known to occur in the vicinity of the Vogtle ESP site would be minor. Staff Dir. EC 1.2, Post Tr. 743 at 83.

2.116. Neither cold shock nor heat shock was found to be of concern at the Vogtle site. Staff Dir. EC 1.2, Post Tr. 743 at 80-83. Cold shock occurs when organisms that have been acclimated to warm water are exposed to a sudden temperature decrease. Staff Dir. EC 1.2, Post Tr. 743 at 80-81. The potential for cold shock is greater when heated water is discharged into a confined body of water, or when all reactors are suddenly shut down, leading to a cessation of all thermal discharge to the waterbody. The NRC staff concluded that cold shock was less likely to occur at the Vogtle site due to the presence of multiple reactor units which would be unlikely to shut down suddenly and simultaneously leading to a dramatic drop in the temperature of the receiving water in the river. Staff Dir. EC 1.2, Post Tr. 743 at 83, 87. Also, at the Vogtle site, thermal discharges would be to a river where the volume of discharge is small in comparison to the total river volume. Staff Dir. EC 1.2, Post Tr. 743 at 80-81. Moreover, because fish have to actively swim to maintain position in a plume, the NRC staff believes it is unlikely that a fish would become acclimated to the higher station discharge temperatures, thereby avoiding the possibility of cold shock. Staff Dir. EC 1.2, Post Tr. 743 at 87.

2.117. Heat shock occurs when organisms are confined to an area in which water temperatures suddenly increase. Staff Dir. EC 1.2, Post Tr. 743 at 81. The potential for heat shock is greater when heated water is discharged into a confined body of water or when the thermal plume is sufficiently large as to prevent organisms from avoiding its effects. Staff Dir. EC 1.2, Post Tr. 743 at 80-81. Heat shock was considered to be unlikely to occur at the site due to the small size of the thermal plume relative to the river and the ability of aquatic biota to avoid the plume. Staff Dir. EC 1.2, Post Tr. 743 at 81-83.

2.118. The NRC staff also analyzed the potential impacts from the thermal plume with respect to invasive or nuisance organisms which have been observed to increase in numbers in the vicinity of thermal plumes. Staff Dir. EC 1.2, Post Tr. 743 at 81. Based on the absence of

an increase in invasive nuisance organisms in the vicinity of the thermal plume for VEGP Units 1 and 2, no increase in invasive or nuisance organisms is anticipated to occur due to the additional thermal impact for the proposed units. Staff Dir. EC 1.2, Post Tr. 743 at 81.

2.119. Based on its analysis of the interaction between the effluent plume and the habitat and life history of important species, the potential impacts from cold shock and heat shock, and the potential increase in invasive or nuisance organisms due to increased ambient water temperatures, the NRC staff concluded that impacts to aquatic organisms from thermal discharges from the proposed VEGP units 3 and 4 would be minor. Staff Dir. EC 1.2, Post Tr. 743 at 81.

2.120. The Joint Intervenor witnesses asserted generally that the FEIS inadequately evaluated thermal discharge impacts to aquatic species. As noted above, Dr. Young asserted that the FEIS failed to account for thermal stress and mortality for Savannah River fish species, indicating temperatures at which certain species' eggs and larvae "suffer mortality." Young Dir. EC 1.2, Post Tr. 814 at 12. Dr. Young also asserted that the FEIS "fails to consider all possible river conditions and rather, focuses on conservative river conditions." *Id.* Dr. Young also asserted that at flows lower than those modeled, the thermal plume dimensions might change and the drift community would be at greater risk of thermal discharge impacts due to river channel confinement. *Id.* at 11. Relatedly, he challenged the thermal study conducted by the Applicant in 2008, stating that more information was necessary concerning the ichthyoplankton distribution in the thermal plume, including seasonal variability. Young Reb. EC 1.2, Post Tr. 815 at 4.

2.121. However, having considered these claims, the Licensing Board finds that the Joint Intervenors have provided no persuasive evidence to controvert the thorough testimony and evidence of the Applicant and the NRC staff described above. We find persuasive the

Applicant and NRC's testimony concerning the size and extent of the mixing zone relative to the width of the river (even under very-low flow conditions of 2,000 cfs), the ability therefore of fish to avoid the mixing zone given the absence of any thermal block on the river, the various conservative assumptions the NRC staff used in its CORMIX modeling (with respect to flow conditions, combined discharge of all four units at a single discharge point, low ambient water temperature), the anticipated very short duration of exposure for those drift organisms that might be exposed to the mixing zone (compared to the longer exposure times that would likely result in detectable mortality), the assertion that the maximum temperatures are unlikely to occur at the times of year when ichthyoplankton are likely to be passing by the Vogtle site, and the actual extent of the thermal plume monitored for Units 1 and 2 in the thermal study the Applicant conducted in 2008. Accordingly, we are not persuaded by Dr. Young's position that additional discussion of fish species, their life history stages, or the distribution of ichthyoplankton in the river is necessary to adequately estimate thermal discharge impacts.

2.122. For the same reasons described in our findings concerning impacts from impingement and entrainment, we also agree with the Applicant and the NRC staff that employing the assumption of uniform drift distribution remains reasonable in the context of evaluating thermal discharge impacts. Likewise, we find persuasive the position of the Applicant and the NRC staff that the flows assumed in the FEIS's thermal discharge impacts analysis were conservative and would generally bound the flows that would be reasonably foreseeable at the Vogtle site. As described in Dr. Coutant's testimony, where the analysis demonstrates little or no biological impact under low-flow conditions, there can be confidence that the impacts at higher flows would also be small and that further inquiry and studies are not necessary or helpful to the NEPA analysis. See Coutant Dir. EC 1.2, Post Tr. 604 at 41.

Consequently, we do not find persuasive Dr. Young's claim that the FEIS analysis is somehow inadequate for having focused on "conservative river conditions."

2.123. For these reasons, we therefore agree with the Applicant and the NRC staff and find that the record demonstrates that the FEIS adequately supports the conclusion that thermal discharge impacts (including cumulative impacts from operation of all four Vogtle units) to aquatic resources would be small.

v. Changes Associated With Revision 16 of AP1000 Design Control Document

2.124. Lastly, the Licensing Board has considered the NRC staff's analysis reflecting that, following publication of the DEIS, Southern advised the NRC staff that flows related to cooling system operation would differ based on changes between Revision 15 and Revision 16 of the AP1000 Design Control Document. Staff Dir. EC 1.2, Post Tr. 743 at 90-91. In order to determine how the impacts evaluated for Revision 15 would be affected, the NRC 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 8,830 cfs, Drought Level 3 flows of 3,800 cfs, and also the very-low flows of 3,000 cfs and 2,000 cfs. *Id.* The NRC staff determined the relevant percentages for normal and maximum withdrawals and consumptive use by the proposed Units 3 and 4 as well as by all four Vogtle units. *Id.*; Ex. NRC000052.¹³

2.125. The NRC staff testified that the fluctuation in river flows at the VEGP site, even on a daily basis, is often greater than the normal and maximum withdrawal rates for the

¹³ To reflect the revised values assumed for water withdrawals by Units 1 and 2 in the NRC staff's cumulative impacts analysis (described earlier in the findings regarding cumulative impingement and entrainment impacts), the NRC staff provided as Exhibit NRC000052 the cumulative water withdrawal percentages associated with both Revision 15 and Revision 16. Staff Reb. EC 1.2, Post Tr. 744, at 5; Ex. NRC000052.

proposed VEGP Units 3 and 4. Staff Dir. EC 1.2, Post Tr. 743 at 26-28, 66, 91; Ex. NRC000041. Accordingly, the NRC staff argued that relative to the natural variability of the Savannah River, all of the percentage increases in water use associated with the change between Revision 15 and Revision 16 are exceedingly small. *Id.* at 90-91. 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 mixing zone analysis or its impact under all flow conditions considered. The NRC staff stated that 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. *Id.* The NRC staff testified that this 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. *Id.*

2.126. Having reviewed the testimony of the parties, the Licensing Board concludes that there is no substantive dispute that the magnitude of the changes in water use described between Revision 15 and Revision 16 (an increase of approximately 4 cfs) is small. Indeed, for example, Mr. Sulkin notes in his testimony that “a 14 cfs increase in withdrawal rate is tiny in comparison to the river flow” and that the resulting percentage difference is “slight.” Sulkin Dir. EC 1.2, Post Tr. 816 at 12-13. Accordingly, the Licensing Board finds persuasive the NRC staff’s explanation that these changes would not alter its conclusions in the FEIS concerning impacts from impingement, entrainment, or thermal discharge.

vi. Summary of Contention EC 1.2 Findings

2.127. For the reasons stated above, the Licensing Board finds that the FEIS both identifies and adequately considers the impacts of the proposed cooling system intake and discharge structures on aquatic resources with respect to impingement, entrainment, and

thermal effluent discharge. Furthermore, in these respects the Licensing Board finds that the FEIS adequately considers the cumulative impacts of operations of all four Vogtle units.

2. EC 1.3

a. Witnesses Presented

2.128. An evidentiary proceeding on this contention was held on March 17-18, 2009. A total of 11 witnesses appeared on behalf of Southern, the Staff, and the Joint Intervenors, as set forth below. In addition to their prefiled direct testimony, the witnesses also provided prefiled rebuttal testimony. The witnesses also provided oral testimony upon examination by the Licensing Board.

2.129. The Applicant presented four witnesses in support of Contention EC 1.3. They were: (1) Dr. Charles C. Coutant, a consultant to Southern on matters of aquatic ecology and fisheries biology; (2) Mr. Thomas C. Moorer; (3) Mr. James W. Cuchens; and, (4) Mr. Charles R. Pierce.

2.130. As discussed for Contention EC 1.2, the Licensing Board finds Dr. Coutant to be well-qualified as an expert witness on the subject of aquatic impacts from impingement and entrainment and from thermal discharge of cooling water systems. These are the same topics on which Dr. Coutant testified concerning Contention EC 1.3.

2.131. Similarly, as noted in the discussion for Contention EC 1.2, the Licensing Board finds Mr. Moorer to be well-qualified as an expert witness concerning the development and content of Southern's ESP application. In addition, the Licensing Board finds Mr. Moorer to be well-qualified as an expert regarding the potential environmental impacts of constructing a dry cooling tower at the Vogtle site.

2.132. Applicant witness James W. Cuchens is Principal Engineer for Southern Company Generation Engineering and Construction Services (SCG Engineering). Mr. Cuchens

received a Bachelor of Science in mechanical engineering from Mississippi State University. See “Testimony of James W. Cuchens on Behalf of Southern Nuclear Operating Company Concerning Environmental Contention 1.3” [“Cuchens Dir. EC 1.3”] Post Tr. 955 at 1; Ex. SNC000023 at 1. Mr. Cuchens has over 34 years of experience in all phases of power plant design and construction, including 27 years focusing largely on cooling system design. Cuchens Dir. EC 1.3, Post Tr. 955 at 1-2. The Licensing Board finds Mr. Cuchens to be well-qualified as an expert regarding the feasibility of using a dry cooling system with an AP1000 reactor design at the Vogtle site.

2.133. Applicant witness Charles R. Pierce is Licensing Manager for the Vogtle Project. Mr. Pierce received a Bachelors and Masters of Science in mechanical engineering from Mississippi State University. See “Rebuttal Testimony of Charles R. Pierce on Behalf of Southern Nuclear Operating Company Concerning Environmental Contention 1.3,” Post Tr. 971 at 1; Ex. SNC000058 at 1. Mr. Pierce has over 28 years of experience in nuclear power plant licensing, design-engineering, and retrofitting, including substantial experience with NRC licensing. *Id.* The Licensing Board finds Mr. Pierce to be well-qualified as an expert regarding the policy of standardization of nuclear power plant designs, and specifically the nuclear industry and NRC’s efforts to maintain a standardized design for the AP1000 nuclear power plant.

2.134. The NRC staff presented four witnesses in support of Contention EC 1.3. These were: (1) Dr. Christopher B. Cook; (2) Ms. Rebekah H. Krieg; (3) Dr. Michael T. Masnik; and (4) Mr. Lance W. Vail. Because the Staff’s testimony for Contention EC 1.3 concerns environmental topics that are substantially similar to those at issue in Contention EC 1.2, the Licensing Board finds the NRC Staff’s witnesses to be well-qualified as experts for Contention EC 1.3 for the reasons previously described.

2.135. The Joint Intervenors presented three witnesses in support of Contention EC 1.3. These were: (1) Dr. Shawn Paul Young; (2) Mr. Barry W. Sulkin; and, (3) Mr. William Powers. Because the testimony of Dr. Young and Mr. Sulkin for Contention EC 1.3 concerns environmental topics that are substantially similar to those at issue in Contention EC 1.2, the Licensing Board finds Dr. Young and Mr. Sulkin to be well-qualified as experts for Contention EC 1.3 for the reasons previously described.

2.136. Joint Intervenors' witness William Powers received a Bachelors of Science in mechanical engineering from Duke University and a Masters of Public Health in environmental sciences from the University of North Carolina. See "Revised Prefiled Direct Testimony of William Powers in Support of EC 1.3" ["Powers Dir. EC 1.3"], Post Tr. 1096 at 1; Ex. JTI000044 at 1. Mr. Powers has twenty five years of experience in various power plant technology projects including cooling system assessments. Powers Dir. EC 1.3, Post Tr. 1096 at 1-2. The Licensing Board finds Mr. Powers to be well-qualified as an expert to discuss the feasibility of using dry cooling technology at a nuclear power plant.

2.137. As more fully set forth below, we find that the NRC staff in its FEIS analyzed the alternative of a dry cooling system at the Vogtle site in sufficient detail. Because the aquatic impacts from the proposed wet cooling system were found to be small, it was sufficient for the NRC staff to perform a qualitative analysis of the dry cooling alternative. Further, the NRC staff found that the impact to "important species" – which includes the robust redhorse and shortnose sturgeon, the only species put forth by the Joint Intervenors as possible "extremely sensitive biological resources" – would be small. Because the impact to all species identified by Joint Intervenors as possibly being "extremely sensitive biological resources" was small, the NRC staff was not required to analyze dry cooling in greater detail. Because we find that the NRC

staff's analysis in the FEIS is sufficient, we do not have to reach the question of whether a dry cooling system would be feasible for the AP1000 design at the Vogtle site.

b. Factual Background

i. The FEIS Analysis of the Dry-Cooling Alternative was Adequate.

2.138. The NRC staff is required by 10 C.F.R. § 51.45(b)(3) to analyze alternatives to the proposed action; here, the proposed action is building two AP1000 reactors with a proposed wet cooling system. The Staff testified that it met this requirement with regard to reviewing alternatives to the proposed wet cooling system by following the guidance in section 9.4.1 of the ESRP. See "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" ["Staff Dir. EC 1.3"], Post Tr. 1062 at 6, 9-10; Ex. NRC000009; Ex. NRC000010.

2.139. The proposed heat dissipation system is a closed-cycle wet cooling system. In analyzing the dry cooling alternative, the NRC staff recognized that a dry cooling system would largely eliminate impacts on aquatic biota. Staff Dir. EC 1.3, Post Tr. 1062 at 6-7. However, the NRC staff also found that a dry cooling system would have some disadvantages with respect to land use, fuel use, spent fuel transport, and spent fuel storage. *Id.* at 8.

2.140. The Applicant agreed with the NRC staff's conclusion that a dry cooling system would have some negative environmental effects outside the area of impacts to aquatic biota. "Testimony of Thomas C. Moorer on Behalf of Southern Nuclear Operating Company Concerning Environmental Contention 1.3," Post Tr. 966 at 3-9. While the Joint Intervenors disagreed with the Applicant concerning the magnitude of the environmental impacts from operating a dry cooling system, the Joint Intervenors did not challenge the premise that there would be some environmental disadvantages from using a dry cooling system. "Revised

Prefiled Rebuttal Testimony of William Powers Concerning Contention EC 1.3,” Post Tr. 1098 at 2, 4.

2.141. Because the NRC staff found that the aquatic impacts from operation of the proposed wet cooling tower design were small, pursuant to section 9.4.1 of the ESRP the NRC staff did not perform a quantitative comparison of the impacts of a dry cooling system versus a wet cooling system. Staff Dir. EC 1.3, Post Tr. 1062 at 10-11; Tr. at 1069-70 (Vail). Rather, the NRC staff testified that if the impacts from the proposed wet cooling system had been determined to be moderate or large, then the NRC staff would have performed a detailed quantitative analysis. Tr. at 1070-1071 (Vail).

2.142. The Joint Intervenors’ witness Mr. Sulkin criticized the NRC staff’s analysis, asserting that the impacts from the proposed wet cooling system on aquatic biota would be greater than small. “Revised Prefiled Direct Testimony of Barry W. Sulkin in Support of EC 1.3,” Post Tr. 1100 at 4. However, as noted in our conclusion to Contention EC 1.2, we have found that the NRC staff’s conclusion that impacts to aquatic biota would be small is well supported by the record. Moreover, the Joint Intervenors provided no additional evidence to support a claim that the impacts from the proposed wet cooling system would be greater than small.

2.143. Ultimately, we find the NRC staff’s analysis in the FEIS of heat dissipation alternatives acceptable and consistent with NEPA’s requirements. Using Section 9.4.1 of the ESRP, the depth of the analysis in the FEIS was governed by the nature and magnitude of the impacts of the proposed design. As stated by the NRC staff witnesses, because the NRC staff found the impacts from the proposed wet cooling system design to be small, the NRC staff was not required to analyze other alternatives in greater depth. Staff Dir. EC 1.3, Post Tr. 1062 at 10-11. In light of the evidence presented by the Applicant and NRC staff witnesses here and in connection with Contention EC 1.2, the Joint Intervenors have not put forth persuasive evidence

that the NRC staff underestimated the aquatic impacts from the proposed wet cooling system design, or that the ESRP approach to evaluating cooling system alternatives is unreasonable.

- ii. The Proposed Cooling System Design Would Have Only a Small Impact on Extremely Sensitive Biological Resources.

2.144. In Contention EC 1.3, the Joint Intervenors challenge the analysis of dry cooling, given the presence of “extremely sensitive biological resources” (ESBR) in the vicinity of the Vogtle site. Specifically, in their initial petition to intervene, Joint Intervenors pointed to the robust redhorse and shortnose sturgeon as examples of ESBRs. The term ESBR comes from a 2001 rulemaking by the U.S. Environmental Protection Agency. National Pollutant Discharge Elimination System; Regulations Addressing Cooling Water Intake Structures for New Facilities, 66 Fed. Reg. 65,256, 65,282 (December 18, 2001); Ex. NRCR00035. In pertinent part, this rulemaking states:

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

Id.

2.145. The NRC staff and the Applicant, while both emphasizing that the term ESBR is not defined in the EPA rulemaking, described slightly different interpretations of the term ESBR as relevant to its use in Contention EC 1.3. The NRC staff did not attempt to define ESBR; instead, Dr. Masnik testified that the NRC staff’s term “important species” would encompass all ESBRs, and the NRC staff did not object to considering the robust redhorse and shortnose sturgeon as examples of ESBRs. Staff Dir. EC 1.3, Post Tr. 1062 at 12-13; Tr. at 1066-1068 (Masnik). The Applicant’s witness, Dr. Coutant, testified that ESBR meant more than a species

being present in the area, “but that they are sensitive to alterations of the environment in the vicinity of the proposed cooling system.” “Testimony of Dr. Charles C. Coutant on Behalf of Southern Nuclear Operating Company Concerning Environmental Contention 1.3,” Post Tr. 951 at 4. The Joint Intervenors’ witnesses provided no direct testimony on either the definition of ESBR or on what species they considered to be ESBRs. In rebuttal, however, Dr. Young criticized the Applicant’s definition, specifically challenging Dr. Coutant’s use of the term “significant risk.” “Pre-Filed Rebuttal testimony of Shawn P. Young Concerning Contention EC 1.3” [“Young Reb. EC 1.3”], Post Tr. 1102 at 2, 5-6. Dr. Young did agree that the EPA in its rulemaking was not attempting to create a new “category called extremely sensitive biological resources.” Tr. at 1176-77.

2.146. While the parties employ slightly different definitions for ESBR, the Board finds that these differences are not material to its decision on this contention. For purposes of this contention, we assume, *arguendo*, that the robust redhorse and shortnose sturgeon are ESBRs. While the Staff did not use the term ESBR in the FEIS, it is uncontroverted that it analyzed the impacts to all “important species.” Staff Dir. EC 1.3, Post Tr. 1062 at 12-14. This analysis of “important species” encompassed both the robust redhorse and the shortnose sturgeon. *Id.* at 13-14. The NRC staff found that the impact to both the robust redhorse and the shortnose sturgeon from the operation of the proposed cooling system design would be small. *Id.* at 18. Because the impacts to these species, and to all aquatic resources, from the proposed system were determined to be small, the NRC staff testified that in accordance with section 9.4.1 of the ESRP, the NRC staff was not required to analyze dry cooling in more detail. *Id.* at 20.

2.147. The Joint Intervenors’ witnesses assert that the NRC staff’s analysis of the impacts to robust redhorse and shortnose sturgeon was insufficient because the NRC staff failed to analyze important periods of each species’ development. Young Reb. EC 1.3, Post Tr.

1102 at 7. However, as discussed more fully in our opinion regarding Contention EC 1.2, the NRC staff has shown that it considered sufficient information to make an appropriate impacts conclusion regarding both the shortnose sturgeon and the robust redhorse.

2.148. Based on the reasoning set forth in our ruling on Contention EC 1.2, we find that the NRC staff's conclusion that the proposed cooling system design would not have a significant adverse impact on any important species is well supported. Because this conclusion included impacts to both the shortnose sturgeon and robust redhorse -- the only species identified by the Joint Intervenors as possible ESBRs -- we find that the discussion in the EPA rulemaking does not require the NRC staff under NEPA to analyze dry cooling in greater detail.

iii. Conclusion Regarding EC 1.3

2.149. As discussed more fully in Contention EC 1.2, we find that the FEIS conclusion that impacts to all aquatic resources, which would include resources likely to be considered ESBRs, from the operation of the proposed cooling system would be small is well-supported by the evidentiary record. Staff Dir. EC 1.3, Post Tr. 1062 at 19-20. Given this small impact and the fact that there are several environmental disadvantages to the dry-cooling alternative, it was appropriate for the NRC staff to determine that the dry-cooling alternative was not environmentally preferable to the proposed wet cooling system. *Id.* at 20. Thus, we find that the NRC staff, consistent with section 9.4.1 of the ESRP, was not required to analyze the dry-cooling alternative in greater depth, and that its analysis in the FEIS complied with NEPA.

2.150. Because we find the NRC staff's analysis of dry cooling in the FEIS is sufficient, we do not have to reach the Applicant's argument that a dry cooling system is not feasible for an AP1000 at the Vogtle site.

3. EC 6.0

a. Witnesses Presented

2.151. An evidentiary proceeding on this contention was held on March 18-19, 2009. A total of sixteen witnesses appeared on behalf of Southern, the NRC staff (including witnesses representing the United States Army Corps of Engineers), and the Joint Intervenors, as set forth below. In addition to their prefiled direct testimony, certain witnesses also provided prefiled rebuttal testimony. All the witnesses also provided oral testimony upon examination by the Licensing Board and were found to be qualified to present testimony on the matters they addressed.

i. Applicant Witnesses

2.152. The Applicant presented five witnesses in support of its position on Contention EC 6.0. They were: (1) Captain H. David Scott, president and principal surveyor for Southeastern Marine Surveying Company; (2) Mr. Benjamin Smith, operations manager for Steven's Towing Company; (3) Mr. Jeffrey Neubert, the acting manager of logistics for Westinghouse Electric Company; (4) Mr. Thomas C. Moorner, Southern's Environmental Project Manager, who was responsible for developing the ER submitted by Southern as part of the ESP application; and (5) Dr. Charles C. Coutant, a consultant to Southern on matters of aquatic ecology and fisheries biology.

2.153. Applicant witness Captain H. David Scott received a Bachelor of Science degree in Nautical Science from Maine Maritime Academy. "Southern Nuclear Operating Company's Testimony of Jeffrey Neubert, Benjamin Smith, and David Scott Concerning EC 6.0" ["Neubert/Smith/Scott Dir. EC 6.0"], Post Tr. 1290 at 3; Ex. SNC000045 (Captain H. David Scott Curriculum Vitae). Capt. Scott has over 30 years of experience in the shipping trade and maritime industry and holds licenses and certifications allowing him to pilot vessels on oceans

and the Savannah River. *Id.* Capt. Scott is a member of the National Association of Marine Surveyors (NAMS) and has spent the past 26 years with, and is the Owner and President of, Southeastern Marine Surveying Company. *Id.* In this capacity, he is the principal surveyor providing comprehensive marine surveying services to maritime interests. *Id.* The Licensing Board finds Capt. Scott to be well-qualified as an expert witness concerning the conduct of dredging surveys, in particular on the Savannah River, which is relevant to the issues in Contention EC 6.0.

2.154. Applicant witness Benjamin Smith received a Bachelor of Arts degree in History from The University of the South and a Masters of Business Administration from The Citadel. Neubert/Smith/Scott Dir. EC 6.0, Post Tr. 1290 at 2; Ex. SNC000044 (Benjamin B. Smith, Jr. Curriculum Vitae). Mr. Smith has over 20 years of experience planning and supervising both inland and offshore operations for a midsize barge transportation company. *Id.* Mr. Smith has supervised operations on all of the navigable rivers in the Southeast, including the Savannah River, delivering large manufactured pieces, transformers, generators, turbines, and chemical plant vessels, and he is experienced in shallow water tug and barge operations. The Licensing Board finds Mr. Smith to be well-qualified as an expert witness concerning the operation of shallow water tugs and barges, which is relevant to the issues involved in Contention EC 6.0.

2.155. Applicant witness Jeffrey Neubert received a Bachelor of Science degree in Engineering Mechanics from Pennsylvania State University and an Executive Masters of Business Administration from the University of Pittsburgh. Neubert/Smith/Scott Dir. EC 6.0, Post Tr. 1290 at 2; Ex. SNC000043 (Jeffrey L. Neubert Curriculum Vitae). Mr. Neubert has over 35 years of experience in all aspects of logistics management with extensive experience in transportation management, physical distribution and logistics. *Id.* Mr. Neubert has been involved in delivery of major components to more than 40 nuclear power plant construction

sites, including Vogtle Units 1 and 2, and is knowledgeable about all types of transportation. The Licensing Board finds Mr. Neubert to be well-qualified as an expert witness concerning the transportation methods considered by the Applicant for delivery of components at issue in Contention EC 6.0.

2.156. As discussed for Contention EC 1.2, Applicant witness Thomas Moorer has more than 30 years of experience in the environmental field, including more than 18 years of experience in environmental engineering, licensing, and regulatory compliance in nuclear power. “Southern Nuclear Operating Company’s Testimony of Thomas Moorer Concerning EC 6.0” [“Moorer Dir. EC 6.0”], Post Tr. 1291 at 2; Ex. SNC000014 at 2. This experience includes more than 15 years working in NEPA matters, including the development of Environmental Reports in support of applications for NRC licensing actions. The Licensing Board finds Mr. Moorer to be well-qualified as an expert witness concerning the development of the ER submitted by Southern as part of the ESP application and concerning the environmental matters at issue in Contention EC 6.0.

2.157. Similarly, as discussed for Contention EC 1.2, Applicant witness Dr. Charles Coutant has many years of professional experience in preparation of NEPA Environmental Impact Statements, including EISs for nuclear power plants, in which issues related to the impacts of construction (e.g., dredging) and operation on aquatic life were analyzed. “Southern Nuclear Operating Company’s Testimony of Dr. Charles Coutant Concerning EC 6.0” [“Coutant Dir. EC 6.0”], Post Tr. 1292 at 2; Ex. SNC000012 at 2. The Licensing Board finds Dr. Coutant to be well-qualified as an expert witness on the subject of aquatic impacts associated with construction and operation of nuclear power plants, including the impacts of dredging, which are at issue in Contention EC 6.0.

ii. United States Army Corps of Engineers Witnesses

2.158. As part of the NRC staff's presentation of its position on Contention EC 6.0, four witnesses from the United States Army Corps of Engineers ("USACE" or "Corps") gave testimony regarding matters at issue in Contention EC 6.0 and within the particular knowledge and expertise of the USACE. They were: (1) Mr. Lyle Maciejewski, Operations and Maintenance Project Manager for the Savannah Harbor and the Savannah River Below Augusta Project; (2) Ms. Carol Bernstein, Chief of the Coastal Branch, Regulatory Division, Savannah District; (3) Mr. William G. Bailey, Chief of the Savannah Planning Unit, Savannah-Mobile Regional Planning Center (Environmental Resources, Plan Formulation, and Economics); and (4) Mr. Stanley L. Simpson, Savannah District Water Control Manager, Engineering Division.

2.159. USACE witness Lyle Maciejewski received both Bachelor of Science and Master of Science degrees in Civil Engineering from South Dakota School of Mines and Technology. See U.S. Army Corps of Engineers Testimony of William G. Bailey, Carol L. Bernstein, Lyle J. Maciejewski, and Stanley L. Simpson Concerning Environmental Contention EC 6.0 ["USACE Dir. EC 6.0"], Post Tr. 1385 at 1, 2, 4, and "Relevant Work Experience - Lyle Maciejewski." Mr. Maciejewski has worked as an engineer within the U.S. Army Corps of Engineers since 1980. *Id.* Mr. Maciejewski has significant experience related to dredging activities performed by the Corps, has led hydrographic survey operations for dredging work in the Mississippi River and adjacent ports, and has worked as the Contracting Officers Representative for District maintenance and construction dredging contracts. *Id.* Since 1996, Mr. Maciejewski has served as the Operations and Maintenance Project Manager for the Savannah Harbor and the Savannah River Below Augusta Project. *Id.* at 4. In that capacity he is responsible for scheduling and developing harbor dredging contracts involving maintenance dredging of the harbor and river basin and served as head of the hydrographic survey section responsible for

planning, conducting, and producing the District hydrographic surveys. *Id.* The Licensing Board finds Mr. Maciejewski to be well-qualified as an expert witness on the subject of dredging activities in the Savannah River, which is relevant to Contention EC 6.0.

2.160. USACE witness Carol Bernstein received both a Bachelor of Science degree in Renewable Natural Resources from the University of Arizona and a Master of Science degree in Interdisciplinary Environmental Sciences Studies from Johns Hopkins University. USACE Dir. EC 6.0, Post Tr. 1385 at 1, 2, 4. Ms. Bernstein is employed as a Supervisory Biologist and serves as Chief of the Coastal Branch, Regulatory Division with the USACE, Savannah District. *Id.* Within the Army Corps of Engineers, Ms. Bernstein has served as Chief of the Hazardous, Toxic, & Radioactive Waste (HTRW) Section and the Planning and Environmental Services Branch for the Baltimore District. *Id.* Ms. Bernstein has also served as temporary Chief of the Planning Division in the Savannah District and as temporary Chief of the Regulatory Division in the Mobile District. *Id.* Since 2001, Ms. Bernstein has served as Chief of the Coastal Branch, Regulatory Division as a Supervisory Biologist. *Id.* Ms. Bernstein is responsible for planning, programming, administering and enforcing the Regulatory Program, including permit evaluation, enforcement, noncompliance, and mitigation under the Rivers and Harbors Act and the Clean Water Act. *Id.* at 2. Ms. Bernstein is also responsible for developing policy and ensuring compliance with a variety of statutes, executive orders, and environmental laws including NEPA, the Endangered Species Act, and the National Historic Preservation Act. *Id.* at 4. The Licensing Board finds Ms. Bernstein to be well-qualified as an expert witness on the subject of planning, programming, administering and enforcing the USACE Regulatory Program, including permit evaluation, enforcement, noncompliance, and mitigation related to possible dredging of the Savannah River Federal navigation channel (“Savannah River FNC” or “FNC”), which is at issue in Contention EC 6.0.

2.161. USACE witness William G. Bailey received a Bachelor of Science degree in Biology from SUNY College of Environmental Science and Forestry and a Bachelor of Science degree in Forestry from Syracuse University, as well as a Master of Science degree in Civil Engineering from North Carolina State University. USACE Dir. EC 6.0, Post Tr. 1385 at 1, 2, 4. Mr. Bailey is employed as a Physical Scientist and serves as Chief of the Savannah Planning Unit, Savannah-Mobile Regional Planning Center (Environmental Resources, Plan Formulation, and Economics) with the USACE. *Id.* Since 2001, Mr. Bailey has served as the Savannah District Planning Unit's technical expert on NEPA and other environmental issues. *Id.* Mr. Bailey is responsible for the comprehensive water resources development and management program of the Savannah District. In that capacity he evaluates the environmental impacts of complex civil works and regulatory projects, providing direction to and reviewing the work of environmental staff, preparing environmental compliance documents, including environmental assessments and environmental impact statements, coordinating projects and environmental documentation with Federal and state resource agencies, and negotiating environmental compliance issues with Federal and state natural resource agencies. *Id.* Mr. Bailey also manages the Savannah District Unit's floodplain management services and flood insurance studies. *Id.* The Licensing Board finds Mr. Bailey to be well-qualified as an expert witness on the subject of environmental impacts of complex civil works and regulatory projects, which is at issue in Contention EC 6.0.

2.162. USACE witness Stanley L. Simpson received a Bachelor of Science degree in Civil Engineering from Clemson University and has worked as an engineer within the U.S. Army Corps of Engineers since 1983. USACE Dir. EC 6.0, Post Tr. 1385 at 1, 2, 4, and "Statement of Professional Qualifications for Stanley L. Simpson." Since 1988, Mr. Simpson has served as the Savannah District Water Control Manager, Engineering Division. *Id.* In his capacity as the

Water Control Manager, Mr. Simpson provides technical support to Engineering, Planning and Operations Divisions and serves as the Systems Administrator for the Water Control Data System. *Id.* at 2. As the South Atlantic Division technical expert on water management and data dissemination, Mr. Simpson also provides project information, pool projections, weather forecasts and river forecasts to private and municipal entities. *Id.* The Licensing Board finds Mr. Simpson to be well-qualified as an expert witness on the subject of water management for the Savannah River Basin, which is at issue in Contention EC 6.0.

iii. NRC Staff Witnesses

2.163. The NRC staff presented a panel of five witnesses in support of its position on Contention EC 6.0. These were: (1) Dr. Christopher B. Cook; (2) Mr. Lance W. Vail; (3) Ms. Rebekah H. Krieg; (4) Ms. Anne “Nancy” R. Kuntzleman; and (5) Mr. Mark Notich, NRC Project Manager for the environmental review associated with the Vogtle ESP Application.

2.164. As discussed for Contention EC 1.2, NRC staff witness Dr. Christopher Cook is employed as a Senior Hydrologist in the Division of Site and Environmental Reviews in NRO. “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” [“Staff Dir. EC 6.0”], Post Tr. 1477 at 2, “Christopher Bruce Cook - Statement of Professional Qualifications.” [“Cook SPQ”]. As part of his official responsibilities, Dr. Cook assisted with the development of portions of the DEIS relating to hydrological alterations, water use, and water quality issues associated with the Vogtle ESP. *Id.* The Licensing Board finds Dr. Cook to be well-qualified as an expert witness regarding the NRC staff review of hydrological alterations, water use, and potential dredging of the Savannah River FNC, which are at issue in Contention EC 6.0.

2.165. Similarly, as discussed for Contention EC 1.2, NRC staff witness Lance Vail is a technical reviewer for PNNL's contract with the NRC on hydrological alterations, water use, and water quality issues associated with the ESP application. Staff Dir. EC 6.0 Post Tr. 1477 at "Statement of Professional Qualifications of Lance W. Vail" ["Vail SPQ"]. He is 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. *Id.* at 4. Mr. Vail has experience on a broad spectrum of issues related to water resources, including NEPA assessments for the NRC of water use, water quality, and hydrologic impacts associated with license renewal of several commercial nuclear plants. *Id.* at Vail SPQ. The Licensing Board finds Mr. Vail to be well-qualified as an expert witness regarding the NRC staff review of hydrological alterations, water use, and potential dredging of the Savannah River FNC, which are at issue in Contention EC 6.0.

2.166. Also, as discussed for Contention EC 1.2, NRC staff witness Rebekah Krieg is a technical reviewer for PNNL's contract with the NRC on aquatic resource issues associated with the ESP application. Staff Dir. EC 6.0 Post Tr. 1477 at 2, at "Resume – Rebekah Harty Krieg." ["Krieg SPQ"]. She prepared the descriptive information contained in Section 2.7.2 and performed the review of the impact to aquatic organisms due to potential dredging of the Savannah River FNC as presented in Section 7.5 of the FEIS. *Id.* at 3. Ms. Krieg has substantial experience at PNNL performing environmental impact analyses in support of NRC licensing actions, and was also the Deputy Team Lead for updating and revising NUREG-1555, the NRC staff's *Environmental Standard Review Plan*. *Id.* at Krieg SPQ. The Licensing Board finds Ms. Krieg to be well-qualified as an expert witness on the subject of the NRC staff review of potential aquatic resource impacts from potential dredging of the Savannah River FNC, which is at issue in Contention EC 6.0.

2.167. Again, as discussed for Contention EC 1.2, NRC staff witness Anne R. “Nancy” Kuntzleman is a technical reviewer for the NRC on aquatic and terrestrial resources issues associated with the ESP application. Staff Dir. EC 6.0, Post Tr. 1477 at 1, “Anne ‘Nancy’ R. Kuntzleman - Statement of Professional Qualifications” [“Kuntzleman SPQ”]. Ms. Kuntzleman 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. *Id.* at 3. Her professional experience includes more than 10 years as an aquatic ecologist for environmental consulting firms, and more than 18 years as a senior biologist with the Department of the Navy, Engineering Field Activity Northeast (EFANE) where she gained extensive experience with and knowledge of the Corps regulatory and permitting processes. As a senior biologist with EFANE, Ms. Kuntzleman served as the sole professional/technical authority 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. Ms. Kuntzleman 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 this time, Ms. Kuntzleman had signatory authority for permit applications and attendant issues involving dredging and dredged material disposal, waterfront construction, and new construction in or adjacent to wetlands in the northeastern U.S. *Id.* at Kuntzleman SPQ. The Licensing Board finds Ms. Kuntzleman to be well-qualified as an expert witness on the subject of the NRC staff review of potential aquatic resource impacts from potential dredging

of the Savannah River FNC and the Corps regulatory and permitting processes, which are at issue in Contention EC 6.0.

2.168. NRC staff witness Mark Notich holds a Bachelor of Science in Agricultural Chemistry from the University of Maryland. Staff Dir. EC 6.0 Post Tr. 1477 at “Mark. D. Notich - Statement of Professional Qualifications” [“Notich SPQ”]. Mr. Notich is currently employed as a Senior Project Manager in the Division of Site and Environmental Reviews, NRO, and served as the NRC Project Manager for the environmental review associated with the Vogtle ESP application. As the Environmental Project Manager for the Vogtle ESP, he has been deeply involved in all planning and management activities for pre-application activities, the acceptance review for the ER, public meetings, meetings with state and Federal agency stakeholders, site visits, review of Southern’s ER, development of RAIs, and development and publication of the Draft and Final Environmental Impact Statements for the ESP. He has also overseen the activities of the team specialists from PNNL and served as the Technical Monitor for tracking the financial and technical progress of the contractor’s task. The Licensing Board finds Mr. Notich to be well-qualified as an expert witness on the subject of the NRC staff review of the environmental impacts at issue in Contention EC 6.0.

iv. Joint Intervenor Witnesses

2.169. The Joint Intervenors presented two witnesses in support of their position on Contention EC 6.0., (1) Dr. Shawn P. Young, and (2) Dr. Donald F. Hayes.

2.170. As discussed for Contention EC 1.2, Joint Intervenor witness Dr. Shawn Young has eleven years of experience researching the effects of human activities on fisheries and aquatic ecosystems. “Revised Pre-Filed Direct Testimony of Shawn P. Young in Support of EC 6.0” [“Young Dir. EC 6.0”], Post Tr. 1569 at 2; Ex. JTI000042 at 2. The Licensing Board finds

Dr. Young to be well-qualified to testify in connection with the aquatic impacts at issue in Contention EC 6.0.

2.171. Joint Intervenor witness Dr. Donald F. Hayes received a Bachelor of Science degree in Civil Engineering and a Master of Science degree in Civil Engineering from Mississippi State University, as well as a Ph.D. in Civil Engineering from Colorado State University. “Revised Pre-Filed Direct Testimony of Donald F. Hayes in Support of EC 6.0” [“Hayes Dir. EC 6.0”], Post Tr. 1572 at 1; Ex. JTIR00045 at 2. Dr. Hayes has 27 years of experience as an engineer, much of it related to dredging and associated impacts. *Id.* The Licensing Board finds Dr. Hayes to be well-qualified to provide testimony on the dredging-related subjects which are at issue in Contention EC 6.0.

2.172. As more fully set forth below, having considered the testimony and other evidence presented by the parties, we find that the record supports the conclusion that the FEIS identifies and adequately considers the cumulative impacts of potential dredging of the Savannah River FNC. In particular, we agree that the evidence supports a conclusion that dredging of the Savannah River FNC is not necessary for the construction of Vogtle Units 3 and 4 and that such dredging does not represent a connected action within the meaning of NEPA. We also find that the record supports the NRC staff position that impacts to upstream reservoirs associated with water releases for the purpose of enabling barge transportation to the Vogtle site are not reasonably foreseeable and thus that such impacts did not need to be evaluated in the FEIS. The record also shows that the NRC staff’s conclusion that the environmental impacts of such potential dredging could be moderate was reasonable. Therefore, with respect to the matters at issue in Contention EC 6.0, the Board finds that the review satisfies the applicable requirements of NEPA and the Commission’s regulations.

b. Factual and Legal Background for EC 6.0

2.173. In reaching its conclusions on the various elements of Contention EC 6.0, the Licensing Board has considered the general claims made by the Joint Intervenors that dredging of the Savannah River FNC is necessary for the NRC's issuance of the ESP and LWA and that the FEIS contains insufficient data and level of detail to evaluate the environmental impacts of dredging under NEPA.

2.174. As noted in paragraph 2.5 above, an FEIS only must address impacts that are reasonably foreseeable – not remote and speculative. *Shoreham Nuclear Power Station, ALAB-156, 6 AEC at 836*. In its environmental analysis of the ESP application, which evaluates the impacts of the construction and operation of two additional reactor units at the Vogtle Electric Generating Plant, the Staff is required by NEPA to analyze cumulative impacts associated with that action and other “connected” Federal actions. See 40 C.F.R. § 1508.25. “Actions are connected if they: (i) [a]utomatically trigger other actions which may require environmental impact statements; (ii) [c]annot or will not proceed unless other actions are taken previously or simultaneously; or (iii) [a]re interdependent parts of a larger action and depend on the larger action for their justification.” *Id.* NEPA may require actions to be treated as “connected” if it would be “irrational, or at least unwise” to undertake one without the other. *Save the Yaak Comm. v. Block*, 840 F.2d 714, 720 (9th Cir. 1988).

2.175. As set forth below, in this proceeding, we find that the Applicant and NRC staff have demonstrated that dredging of the Savannah River FNC is not necessary for NRC approval of the ESP application and also that such dredging is not reasonably foreseeable; thus, we agree that it cannot be said to be connected to the NRC's action of reviewing this ESP application. Also, we find that the Applicant and the NRC staff have explained that rail and highway transportation are available options for transporting components to the Vogtle site if the

proposed reactors were eventually to be constructed. Accordingly, there is no reason to conclude that issuance of the ESP would be “irrational, or at least unwise” were dredging of the Savannah River FNC not to occur.

2.176. Actions may also need to be analyzed as “connected” under NEPA if they are “inextricably intertwined.” *Thomas v. Peterson*, 753 F.2d 754, 759 (9th Cir 1985). As set forth below, we agree that the Applicant and NRC staff have shown that because issuance of the ESP and LWA is not dependent on either the availability of barge transportation or on dredging of the Savannah River FNC, the ESP and LWA actions should not be considered “inextricably intertwined” with dredging of the Savannah River FNC. Therefore, we conclude that dredging of the Savannah River FNC is not a “connected” action under NEPA.

2.177. In summary, for reasons explained below, the Licensing Board finds that the record demonstrates that dredging of the Savannah River FNC and water releases from upstream reservoirs specifically to support barge transportation to the Vogtle site (i.e., other than those incidental to normal Corps reservoir operations) are not necessary for any activities authorized by the ESP and LWA. The Board has also considered the evidence presented concerning the foreseeability of releases from upstream reservoirs to enable barge delivery of components to the Vogtle site. The Licensing Board finds that sufficient information has been considered and presented concerning the potential environmental impacts of dredging the Savannah River FNC and to demonstrate that upstream water releases specifically to enable barge transportation to the Vogtle site are not reasonably foreseeable. Furthermore, as shown by the record in this proceeding, the NRC staff’s conclusion that the impacts of dredging the Savannah River FNC could be moderate, as discussed in Chapter 7 (“Cumulative impacts”) of the FEIS, was reasonable. The Licensing Board therefore agrees that in the FEIS the NRC staff

conducted an appropriate evaluation of the environmental impacts at issue in Contention EC 6.0.

i. Need for Dredging of the Savannah River Federal Navigation Channel

2.178. An underlying issue in Contention EC 6.0 is whether dredging of the Savannah River FNC is necessary for the issuance of an ESP or for any of the LWA activities requested as part of the ESP application. As explained below, after considering the testimony of the parties, the Licensing Board agrees with the Applicant and NRC staff that neither barging of components to the Vogtle site nor dredging of the Savannah River FNC are necessary for any activities authorized by the ESP and LWA.

2.179. Applicant witness Mr. Neubert testified that major components of Vogtle Units 1 and 2 were delivered to the Vogtle ESP site by use of barges on the Savannah River FNC in the 1970s and that the Applicant prefers this method for delivery of heavy components for Units 3 and 4. Neubert Dir. EC 6.0, Post Tr. 1290 at 4, 5. However, Mr. Neubert asserted that barging was not the only transportation mechanism available for delivery of heavy components to the Vogtle ESP site (*id.*) and that the Applicant has conducted detailed evaluations of alternatives to barge delivery and found that delivery of the heavy components could be achieved by utilizing highway or railroad routes in lieu of barging. Tr. at 1320-21. Mr. Neubert further testified that, if barging of heavy components was not possible during the scheduled delivery time, these components would be delivered to the Vogtle ESP site by railroad or highway transportation. Tr. at 1327.

2.180. Applicant witness Mr. Moorer also testified that barging was the preferred method for delivery of heavy components to the Vogtle ESP site. Tr. at 1339. Mr. Moorer also

reiterated the testimony of Mr. Neubert that the Applicant had also evaluated delivery of heavy components by highway and railroad. Tr. at 1315.

2.181. NRC staff witnesses testified that, in performing the FEIS analysis, they assumed that heavy components would be delivered to the Vogtle ESP site by use of barges on the Savannah River. Staff Dir. EC 6.0, Post Tr. 1477 at 5. The NRC staff further testified that this assumption was based, in part, on the Applicant's plan to refurbish and dredge the existing barge slip. *Id.* The NRC staff witnesses explained, however, that because the NRC staff recognized that railroad and highway routes are other transportation options, for the purposes of the FEIS analysis, the NRC staff did not assume that barging was the only possible option for bringing components to the Vogtle site; instead, the impacts of barging were evaluated because this was the transportation option being contemplated by the Applicant in the ER. *Id.* at 5, 7, 12; Tr. at 1493 (Vail), 1496 (Cook). The NRC staff witnesses further testified that they assumed, based on informal discussions with the Corps, that barge traffic was possible at high flows on the Savannah River. Staff Dir. EC 6.0, Post Tr. 1477 at 8. The NRC staff also testified that the potential impacts of dredging of the Savannah River FNC were added to the FEIS based on comments obtained on the draft EIS from members of the public and other Federal and state agencies. Staff Dir. EC 6.0, Post Tr. 1477 at 5-7, 11-13. In addition, the NRC staff witnesses testified that barge delivery of the heavy components was not considered necessary to support onsite activities associated with the LWA application. Tr. at 1523 (Notich). This is supported by the testimony of Applicant witness Mr. Moorer, who testified that dredging of the Savannah River FNC would have no impact on the activities contemplated in the LWA. Tr. at 1370.

2.182. Witnesses for the NRC staff testified that although delivery of heavy components by barge was anticipated to occur, and dredging of the barge slip was analyzed in the FEIS, the NRC staff's FEIS analysis did not assume that dredging of the Savannah River FNC was

required in order to deliver heavy components to the Vogtle site by barge. Staff Dir. EC. 6.0, Post Tr. 1477 at 7, 8. The NRC staff witnesses further testified that, even if barging were the only transport option available for delivery of large components to the Vogtle ESP site, they expected that those deliveries could occur during periods of naturally occurring high flow. Staff Dir. EC 6.0, Post Tr. 1477 at 8. Additionally, the NRC staff testified that, although waiting for naturally-high river flows to allow barge traffic could expose the Applicant to delays and financial risks, such considerations are not material to the NRC's review of environmental impacts. *Id.* As such, even if barging had been the only means of transporting components to the site, the NRC staff determined that dredging of the Savannah River FNC was not required in order to deliver heavy components to the Vogtle site. *Id.*

2.183. Witnesses for the Applicant testified that under current river flow conditions, parts of the Savannah River are not navigable and dredging would be required to facilitate barge traffic. Neubert/Smith/Scott Dir. EC 6.0, Post Tr. 1290 at 3, 6. However, they acknowledged that dredging might not be necessary if the river flow increased from the current levels. *Id.* at 10. Relatedly, the Applicant's testimony and exhibits emphasize that the dredging survey and associated report of Dr. Coutant are based on the low-flow river conditions at the time of the survey (i.e., 3,700 cfs). Tr. at 1303, 1322 (Neubert); Ex. SNCR20051. Witnesses for the USACE likewise testified that dredging of the Savannah River FNC would be required to facilitate barge traffic under current river conditions. USACE Dir. EC 6.0, Post Tr. 1385 at 5. However, the USACE witnesses acknowledged that several shipments of heavy components had been barged up the river (as far upstream as the Vogtle site) within the past 20 years, even though the river had not been dredged. *Id.* This testimony is fully consistent with the testimony of NRC staff witnesses that, even if barging were the only transport option available for delivery of large components to the Vogtle ESP site, the NRC staff expected that those deliveries by

barge could occur during periods of naturally occurring high flow. Staff Dir. EC 6.0, Post Tr. 1477 at 8.

2.184. On behalf of the Joint Intervenors, Dr. Hayes stated in his prefiled direct testimony that dredging of the Savannah River FNC to its authorized dimensions (9 feet deep by 90 feet wide) is required to allow barge traffic under normal flows in connection with the construction and operation of Units 3 and 4. Hayes Dir. EC 6.0, Post Tr. 1572 at 4. Dr. Hayes based his testimony on the Applicant's stated intention to ship its reactor components to the Vogtle ESP site by barge and the FEIS statement that the Savannah River FNC would need to be dredged to allow barge traffic during normal river flow. *Id.* However, Dr. Hayes' testimony did not address whether barging of heavy components could occur under higher flows, as described by the NRC staff and USACE witnesses.

2.185. Dr. Hayes further testified that he believed dredging of the Savannah River FNC was intended to support the LWA activities. "Revised Pre-Filed Rebuttal Testimony of Donald F. Hayes in Support of EC 6.0" ["Hayes Reb. EC 6.0"], Post Tr. 1573 at 2. However, Dr. Hayes acknowledged in response to Licensing Board questions that he is "not familiar with the NRC proceedings, and so those terms [limited work authorization and early site permit] don't mean anything. I don't really understand the context of how they fit[.]" Tr. at 1591. Following the Licensing Board's explanation of the proposed LWA activities, Dr. Hayes stated that, if no dredging is involved in the activities performed pursuant to the limited work authorization, then "that doesn't concern me." Tr. at 1592.

2.186. In summary, the Joint Intervenors presented no persuasive evidence or testimony to contradict the Applicant and NRC staff testimony that delivery of components to the Vogtle site by transportation methods other than barging is possible and, moreover, that barge delivery is not necessary to support any activities that would be authorized by the ESP or LWA.

Likewise, the Joint Intervenors did not present any specific evidence to contradict the Applicant, USACE, and NRC staff testimony that, under high flows, barging of components on the Savannah River to the Vogtle site would be possible without dredging of the Savannah River FNC.

2.187. In light of the above, the Licensing Board finds persuasive the testimony of the USACE, NRC staff and the Applicant, which supports the NRC staff's determination that neither barging nor dredging of the Savannah River FNC is necessary to support the ESP and LWA application. The Joint Intervenors' generalized statements to the contrary are not supported by the record. Accordingly, these NRC staff determinations are consistent with NEPA's rule of reason and are a logical basis for the evaluation in the FEIS.

ii. Consideration of Savannah River FNC Dredging in FEIS

2.188. Another primary issue raised in Contention EC 6.0 is whether the NRC staff was required to consider the potential impacts of dredging the Savannah River FNC in its cumulative impacts discussion. For the following reasons, the Licensing Board finds that given the absence of a formal dredging plan or dredging permit application, and the absence of details about what such a project would involve, the record supports the NRC staff position that such impacts are not reasonably foreseeable and thus NEPA did not require them to be analyzed in the NRC's FEIS.

2.189. Dr. Cook and Mr. Vail testified that, during the NRC staff review, based on informal conversations with representatives of the USACE, the NRC staff determined that no dredging plan had been developed and the NRC staff accordingly believed that dredging of the Savannah River FNC was not expected to occur. Staff Dir. EC 6.0, Post Tr. 1477 at 7, 8; Tr. at 1490, 1492, 1503, 1550-51 (Cook); 1491 (Vail). Also from these conversations with the Corps, the NRC staff concluded that it was possible to utilize barges on the river with higher flow

conditions and without dredging of the Savannah River FNC. Staff Dir. EC 6.0, Post Tr. 1477 at 6, 8-9; Tr. at 1490, 1503-4 (Cook).

2.190. NRC staff witnesses also stated that, in informal conversations with the Corps, members of the Corps had indicated that the Corps had received neither a formal request for the Corps to undertake dredging of the Savannah River FNC nor a permit application from Southern to do so itself. Staff Dir. EC 6.0, Post Tr. 1477 at 8, 13, 15; Tr. at 1492 (Cook). The NRC staff also noted that, in multiple informal conversations with the Applicant, the Applicant indicated it did not plan to submit an application to dredge the Savannah River FNC. Tr. at 1551, 1557-58 (Krieg); Tr. at 1552 (Kuntzleman).

2.191. This understanding is further supported by the testimony of witnesses for the Applicant who stated that no formal dredging request has been submitted to the Corps of Engineers. Moorer Dir. EC 6.0, Post Tr. 1291 at 6. Mr. Moorer further testified that the Applicant had no plan to submit an application to the USACE for a dredging permit for the Savannah River FNC. Tr. at 1316.

2.192. Further, the Corps witnesses testified that no dredging plan for the Savannah River FNC has been developed, nor has the Corps received a formal request or authorization for dredging of the Savannah River FNC in the near future to facilitate barge traffic as far north as the Vogtle site. USACE Dir. EC 6.0, Post Tr. 1385 at 5-6. In addition, witnesses for the USACE indicated that their current budget included no provision for review or preparation of a plan to dredge. *Id.* at 9. The NRC staff noted that the Applicant had said the Corps has a mandate to maintain the Savannah River FNC (Staff Dir. EC 6.0, Post Tr. 1477 at 8; Tr. at 1557-58 (Krieg)) and the testimony of Mr. Moorer and Mr. Neubert acknowledged that the Applicant expected the Corps to dredge the Savannah River FNC pursuant to the Corps' statutory authority. Tr. at 1314 (Moorer); Tr. at 1370 (Neubert). The Corps witnesses testimony

described in detail the Corps' processes for getting funding for dredging projects (even for maintenance dredging on an already-authorized project), the Corps' current budgetary restrictions, and the possibility that it would be necessary for the Corps to develop an EIS for such an undertaking. Tr. at 1394-1401 (Bernstein), 1410, 1417-1419 (Maciejewski), 1452-1455 (Bailey). It is the Licensing Board's opinion that, consistent with the NRC staff testimony, this USACE testimony highlighted the significant practical variables and uncertainties as to whether maintenance dredging of the Savannah River FNC is likely to occur as a Corps project.

2.193. The NRC staff testimony thus emphasized the multiple conversations that had occurred between either the NRC staff and the USACE or the NRC staff and Applicant. Staff Dir. EC 6.0, Post Tr. 1477 at 8, 13, 15; Tr. at 1492, 1550-51 (Cook/Notich); 1552 (Kuntzleman); 1551-52, 1557-58 (Krieg). The NRC staff explained that even though it was the NRC staff's view that dredging of the Savannah River FNC was not expected to occur, and that no plan had been submitted to the Corps for dredging of the Savannah River FNC, it did include an analysis of possible dredging impacts in the cumulative impacts section of the FEIS. The NRC staff testified that the potential impacts of dredging were included in the FEIS based on the receipt of comments on the draft EIS from members of the public and other Federal and state agencies. Staff Dir. EC 6.0, Post Tr. 1477 at 11, 16-17; Tr. at 1558-59 (Kuntzleman).

2.194. The Joint Intervenor witnesses did not assert that there is currently a plan or permit application before the Corps to dredge or maintain the Savannah River FNC.

2.195. Accordingly, the Licensing Board finds the record to be uncontroverted that a plan or permit application for dredging of the Savannah River FNC has not been prepared by or submitted to the USACE. The Licensing Board finds, further, that it was reasonable for the NRC staff to have concluded that the Applicant did not plan to submit its own permit application to the USACE to undertake dredging of the Savannah River FNC, that dredging of the Savannah River

FNC was unlikely to be performed by the Corps, and thus that dredging of the Savannah River FNC was not reasonably foreseeable. Accordingly, the inclusion of potential dredging impacts in the cumulative impacts portion of the FEIS was not required in order to satisfy the requirements of NEPA and NRC regulations.

iii. Upstream Water Releases for Navigation are not Necessary or Reasonably Foreseeable.

2.196. A third matter at issue in Contention EC 6.0 is whether the NRC staff sufficiently described potential impacts to upstream reservoirs from Corps reservoir operations to support barge navigation to the Vogtle site. For the following reasons, the Licensing Board finds persuasive the testimony of the Applicant and the NRC staff that water releases that would adversely affect upstream reservoirs are not reasonably foreseeable. Accordingly, it was not necessary to discuss such impacts in the FEIS, and the NRC staff analysis satisfied the requirements of NEPA in this respect.

2.197. Applicant witness Mr. Moorer testified that no upstream releases beyond normal reservoir operations would be required or requested by the Applicant to facilitate barging of components to the Vogtle site. Moorer Dir. EC 6.0, Post Tr. 1291 at 7; Tr. at 1336-37. Mr. Moorer further testified that “this project has been planned on on [sic] the concept of the Corps' water control plan, which is the way they operate their reservoirs. Whatever releases are available through their normal operations is what this movements will be made on. There won't be any special navigation releases then.” *Id.*

2.198. NRC staff witnesses testified that the FEIS environmental impact analysis assumed that reservoir operations would not be altered solely for the purpose of enabling barge navigation to the Vogtle site. Staff Dir. EC 6.0, Post Tr. 1477 at 6, 13; Tr. at 1537 (Vail), 1539 (Krieg). Instead, the NRC staff's analysis assumed that no barging would occur until the current

drought had ended and the reservoirs were sufficiently filled to result in naturally high flows without compromising conservation pools. Staff Dir. EC 6.0, Post Tr. 1477 at 6. Mr. Vail testified that the NRC staff did not assume that river flows would be altered to facilitate barging and that the FEIS analysis assumed that any water releases from upstream reservoirs would occur incidental to normal reservoir operations and only when such releases would not jeopardize the conservation pool. Tr. at 1537. Additionally, Dr. Cook testified that the water management plan in effect during the drought did not provide for upstream releases to facilitate barging. Tr. at 1538. The NRC staff further testified that, based on informal conversations with the Corps, the NRC staff concluded that navigation would be feasible during high flows and without dredging. Staff Dir. EC 6.0, Post Tr. 1477 at 8; Tr. at 1490 (Cook).

2.199. USACE witness Mr. Simpson provided testimony regarding the Corps' policy on releases of water from upstream reservoirs for the purpose of supporting barge traffic. Mr. Simpson testified that because the region is presently experiencing a drought, excess water is not available in the lakes for the purpose of releasing water from upstream reservoirs. USACE Dir. EC 6.0, Post Tr. 1385 at 9. Mr. Simpson reiterated that the Corps would not release water from upstream reservoirs to support barge traffic while the reservoirs were being operated under the Drought Contingency Plan. Tr. at 1440. This testimony was consistent with the assumptions described by the NRC staff testimony, namely that the Corps would not authorize water releases for navigation that would jeopardize the conservation pools.

2.200. Mr. Simpson also testified that water could be released from upstream reservoirs when sufficient water is available. Tr. at 1440. He explained that the reservoir system had come out of previous drought conditions sometimes as quickly as 2-3 months and that, in that case, water would be released from upstream reservoirs at non-damaging rates pursuant to the Corps' flood control practices. Tr. at 1441-1442. In response to Licensing Board questions, Mr.

Simpson indicated that since such water releases fall within the Corps existing authority, the potential environmental impacts of such water releases have been addressed in the Corps' previous environmental analyses of its operations (including for operations under the Corps drought plan). Tr. at 1451-52.

2.201. Mr. Simpson's testimony confirmed that barge navigation on the Savannah River has occurred incidental to normal Corps flood control operations. In particular, he testified that "[f]or the most part in the last 20 years, all navigation has been incidental to other operations, just our normal operation. So in times of flood control that's when they would make their shipments, when we had ample water to provide them with – there have been instances where we knew something was coming up and we actually stored some water in the flood pools for them." Tr. at 1440. Mr. Simpson also testified that all reservoirs have separate authorized pools (Tr. at 1441-1442) and, given adequate reservoir storage, the USACE would release as little water as possible to facilitate barge traffic. Tr. at 1445.

2.202. Mr. Simpson's testimony also reflected that upstream water releases during high flow periods have been sufficient to enable barge transport of reactor vessels. For example, Mr. Simpson testified that "[t]here have been instances where we've had more water in the river and they've had opposite problems. [T]hey had to actually draft their barges, fill them with water to get the barge low enough to go under [bridges on the river], but it was similar components that were going up to Barnwell to be disposed of here, reactor pressure vessels." Tr. at 1439-40. Additionally, Mr. Simpson stated "[t]here are other instances where we've had ample water and we hadn't had to do anything out of the ordinary. In that instance, we put water in the flood control pool to allow us to release for that period of time without getting down out of the flood control pool." Tr. at 1441.

2.203. Mr. Simpson specifically described a barge shipment of power plant reactor vessels that occurred within the last 10 years from Savannah Harbor for disposal at Barnwell, South Carolina. USACE Dir. EC 6.0, Post Tr. 1385 at 5, 9; Tr. at 1439-40. Mr. Simpson further testified that a river flow of about 10,000 cfs was required to support that barge shipment. USACE Dir. EC 6.0, Post Tr. 1385 at 5, 9; Tr. at 1438.

2.204. The USACE testimony thus was consistent with the assumptions described by the NRC staff testimony, namely that, based on informal conversations with the USACE, navigation would be feasible during high flows and without dredging. Staff EC 6.0 Dir., Post Tr. 1477 at 8; Tr. at 1490 (Cook).

2.205. In support of the NRC staff's position that barging could be achieved without additional upstream releases, Dr. Cook testified that river flows have been at or above 10,000 cfs for some period of time every year except for 2002. Tr. at 1541-42; Ex. NRC000028.

2.206. The Joint Intervenors provided no testimony to contradict the NRC, USACE and Applicant statements that barging could be achieved with higher river flows, without the need for special releases from upstream reservoirs.

2.207. The Licensing Board finds the testimony of the Applicant, the USACE, and the NRC staff witnesses supports the finding that special releases from upstream reservoirs are not required in order to facilitate barge traffic to the Vogtle site and accordingly that it is not foreseeable that any water releases for navigation will be authorized. Thus, it is not reasonably foreseeable that there will be adverse environmental impacts due to releases from upstream reservoirs. Furthermore, the USACE testimony indicates that it is possible for the river system to come out of drought conditions within a short time period and that higher river flows (about a 10,000 cfs discharge) have previously facilitated barging of a heavy reactor component as far upstream as the Vogtle site without dredging of the Savannah River FNC. The Licensing Board

finds that the record as a whole demonstrates that it was reasonable for the NRC staff to have concluded that barge transportation of heavy components to the Vogtle site would be possible under higher flows incidental to the Corps' normal flood control and reservoir operations.

iv. The NRC Staff's Conclusion Regarding Cumulative Impacts is Reasonable.

2.208. Also at issue in Contention EC 6.0 is whether the NRC staff's conclusion in the FEIS that impacts from dredging the Savannah River FNC could be moderate is reasonable and adequately supported.

2.209. NEPA does not require an agency to consider the environmental effects that speculative or hypothetical projects might have on a proposed project. See *Northcoast Env'tl. Ctr. v. Glickman*, 136 F.3d 660, 668 (9th Cir. 1998), citing *Kleppe v. Sierra Club*, 427 U.S. 390 (1976); see also *Sierra Club v. Marsh*, 976 F.2d 763, 767-68 (1st Cir. 1992). In interpreting *Kleppe*, the Commission has determined that for a NEPA analysis to be necessary, a future action "must at least constitute a 'proposal' pending before the agency" and "must be in some way interrelated with the action that the agency is actively considering[.]" See *Duke Energy Corp.* (McGuire Nuclear Station, Units 1 and 2; Catawba Nuclear Station, Units 1 and 2), CLI-02-14, 55 NRC 278, 295 (2002). As shown by the record in this proceeding, during the NRC staff's environmental review, no dredging plan or permit application was (or is) before the Corps in connection with dredging the Savannah River FNC. As explained below, the Licensing Board agrees that to require the NRC staff to have quantitatively analyzed the environmental impacts of potential dredging in the FEIS would require them to "do the impractical." *Wetlands Action Network v. U.S. Army Corps of Eng'rs*, 222 F.3d 1105, 1119 (9th Cir. 2000), *cert. denied* 534 U.S. 815 (2001) (The Corps was not required to complete NEPA analysis of all phases of a construction project within a single EA or EIS when details and planning decisions of all phases

had not been completed.). Moreover, it was reasonable for the Staff to base its analysis on the limited information then available concerning the possible future Corps action. See *Crouse Corp. v. Interstate Commerce Comm'n*, 781 F.2d 1176, 1193-96 (6th Cir. 1986), *cert. denied* 479 U.S. 890 (1986).

2.210. Thus, for the reasons described below, the Licensing Board finds persuasive the testimony of the Applicant and the NRC staff that, in light of the absence of a specific dredging plan or application, the undefined scope of the potential dredging, and the independent Corps environmental review that would have to occur if such dredging were to be undertaken, the NRC staff analysis and conclusion is reasonable and adequately supported. Accordingly, the NRC staff analysis satisfies the requirements of NEPA.

2.211. At the hearing in this matter, NRC staff witnesses testified that, although they did not consider that dredging of the Savannah River FNC was likely to take place, the potential impacts of such dredging were included in its discussion of cumulative impacts in Chapter 7 (Cumulative Impacts) of the FEIS. Staff Dir. EC 6.0, Post Tr. 1477 at 11-12. The NRC staff testified that this analysis was added to the FEIS pursuant to the receipt of comments on the DEIS, including from the USACE.¹⁴ Staff Dir. EC 6.0, Post Tr. 1477 at 5-7, 11-13; Tr. at 1558-59 (Kuntzleman), 1559 (Krieg).

2.212. Witnesses for the NRC staff, the Applicant and the USACE confirmed that no dredging plan had been submitted for either NRC or USACE review and no plan had been prepared by the USACE. Staff Dir. EC 6.0, Post Tr. 1477 at 10; USACE Dir. EC 6.0, Post Tr. 1387 at 5-6. Thus, prior to issuance of the FEIS, the NRC staff had no detailed dredging plan

¹⁴ The comment from the Corps did not indicate the existence of any plan for dredging of the FNC, either by the Corps or via a permit application from Southern, but it did note that the FNC is not maintained for navigation. Ex. NRC00001C at E-55; Tr. 1549-50, 1559 (Krieg), 1558-59 (Kuntzleman).

upon which to base an analysis of environmental impacts. Because there was no specific plan for dredging of the Savannah River FNC, the NRC staff witnesses testified that they were able to perform only a qualitative analysis of the expected impacts. Staff Dir. EC 6.0, Post Tr. 1477 at 15-16.¹⁵

2.213. The NRC staff witnesses testified that their qualitative analysis of potential dredging impacts assumed that the affected portion of the Savannah River would be dredged to the full extent of the Corps' authorization (9 feet by 90 feet). Tr. at 1486-87 (Krieg). Based on the limited information available for review, the NRC staff testified that dredging of the Savannah River FNC downstream of the VEGP site would likely have an effect on aquatic organisms, including such impacts as temporary loss of benthic habitat, disruption of spawning migrations, and resuspension of sediments that might be contaminated. Staff Dir. EC 6.0, Post Tr. 1477 at 13. The NRC staff also noted that there may be environmental effects associated with disposal of dredged materials. *Id.* As a result of its analysis, the NRC staff determined that the cumulative impacts to aquatic organisms from construction and dredging of the Savannah River FNC "could be moderate," depending on the type of mitigation measures. Staff Dir. EC 6.0, Post Tr. 1477 at 16. NRC staff witness Ms. Kuntzleman testified that because of the USACE review and permitting process, the NRC staff determination that impacts "could be moderate" was a conservative assessment of the potential dredging impacts. Tr. at 1526, 1558-59.

2.214. The NRC staff also testified that the NRC staff's impact determination was informed by the NRC staff reviewer's past professional experience with preparation and

¹⁵ The NRC staff testified that, had a dredging application been submitted by the Applicant to the Corps, the information in that application would have been reviewed and analyzed in the ESP FEIS. Tr. at 1494 (Vail).

coordination of Department of the Army permit applications, state wetland permit applications, and water quality certificate applications. Staff Dir. EC 6.0, Post Tr. 1477 at 13-14. In the FEIS, the NRC staff emphasized that any dredging of the Savannah River FNC would require a separate NEPA review, conducted by the Corps, of any dredging action which might be undertaken in order to maintain the Savannah River FNC. *Id.* at 17. The NRC staff anticipated that this review would be conducted by the Corps at the time an actual dredging project is formally requested or a permit application is submitted. *Id.* at 16. The NRC staff also provided detailed testimony regarding the anticipated process through which the Corps would evaluate a dredging application. *Id.* at 17-24; “NRC Staff Rebuttal Testimony of Anne R. Kuntzleman Concerning Environmental Contention EC 6.0” [“Kuntzleman Reb. EC 6.0”], Post Tr. 1479 at 3, 5-6.

2.215. NRC staff witness Ms. Kuntzleman explained that as part of the Corps’ environmental review of such an action, coordination with state and Federal agencies would be required and data for the proposed dredging locations would be collected and evaluated prior to the issuance of any dredging permit. Staff Dir. EC 6.0, Post Tr. 1477 at 17; Tr. at 1524, 1527. The NRC staff witnesses testified that they anticipated that the Corps and other Federal and state regulatory and resource agencies responsible for reviewing the dredging project would require project-specific mitigation measures to ensure that the cumulative impacts to aquatic organisms in the region would not be “large.” NRC Staff Dir. EC 6.0, Post Tr. 1477 at 16-19, 22-24. Ms. Kuntzleman also stated that because of the criteria that would be applied by the Corps in its review, including the Corps’ requirement to select the least environmentally damaging practicable alternative, it is unlikely that the impacts of any dredging of the Savannah River FNC, if it were to occur, would be greater than moderate. *Id.*; Tr. at 1526; Ex. NRC000048.

2.216. The Corps' environmental review process described by the NRC staff was confirmed by witnesses for the Corps who testified that, should the Corps undertake dredging itself as a federal project or an application be submitted by Southern to the Corps for a dredging permit, the Corps will conduct an analysis of environmental impacts. USACE Dir. EC 6.0, Post Tr. 1385 at 6-11; Tr. at 1394-1405 (Bernstein), 1412-1413 (Bailey). Such an environmental review would include evaluations under NEPA, the Clean Water Act and other environmental statutes. USACE Dir. EC 6.0, Post Tr. 1385 at 6. Corps witnesses testified that any Savannah River FNC dredging activities would require an analysis of environmental impacts which would be conducted in accordance with applicable statutes and regulatory guidelines, including Corps guidance, would reflect any additional permitting requirements resulting from coordination with other state and Federal agencies, and would require permits pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act. *Id.* at 6-9.

2.217. The Corps witnesses testified that, should the Corps elect to conduct dredging of the Savannah River FNC pursuant to their pre-existing authorization, a detailed impacts evaluation would be performed independently by the Corps personnel and would be documented in an EIS. USACE Dir. EC 6.0, Post Tr. 1385 at 6; Tr. at 1435 (Bailey), 1436 (Bernstein).

2.218. Following publication of the FEIS, the Applicant conducted a dredging survey of the Savannah River and prepared its own estimate of the amount of material that it asserts would need to be removed to enable barge transportation to the site. This was based on Capt. Scott's survey, which estimated locations where dredging might be needed and the amount of dredged material that would be removed. Neubert/Smith/Scott Dir. EC 6.0, Post Tr. 1290 at 8; Tr. at 1311 (Scott); Ex. SNC000046. The Applicant's witnesses estimated that the dredged needs would amount to 36,500 cubic yards dredged from eight (8) locations along the river.

Neubert/Smith/Scott Dir. EC 6.0, Post Tr. 1290 at 8. The Applicant witnesses testified that the total area that would be affected by this dredging would amount to no more than one mile of a 110 mile portion of river. *Id.*

2.219. Applicant witness Dr. Coutant testified that impacts on aquatic life from the dredging amounts identified by the Applicant's survey "will be localized, temporary and not biologically significant on a broad scale of geography or animal populations of the 110 miles of the Savannah River." Coutant Dir. EC 6.0, Post Tr. 1292 at 7. Dr. Coutant further supplied a report entitled "Analysis of Impacts of Navigation Channel Maintenance for Barge Delivery of Materials for Construction of Vogtle Units 3 and 4 on the Ecology of the Savannah River." Ex. SNCR20051. This report documents Dr. Coutant's assessment of the environmental impacts he expected would occur based on the estimated scope and locations of dredging as determined by the dredging survey prepared by Capt. Scott. Ex. SNC000046.

2.220. Joint Intervenor witness Dr. Hayes testified that the FEIS analysis of potential dredging of the Savannah River FNC should have provided a range of estimates for the amount of sediment removed and the duration of dredging activities based on reasonable assumptions and ranges of conditions. Hayes Dir. EC 6.0, Post Tr. 1572 at 6. In contrast, Dr. Coutant testified that without any basis on which to "narrow the range" of the potential scope of dredging, evaluating the possible dredging impacts would give results "from zero to maximum impacts." "Southern Nuclear Operating Company's Rebuttal Testimony of Dr. Charles C. Coutant on Environmental Contention 6.0" ["Coutant Reb. EC 6.0"], Post Tr. 1293 at 2. Dr. Coutant further testified that, given the limited information available, the NRC staff's conclusions were reasonable and adequately supported. Coutant Dir. EC 6.0, Post Tr. 1292 at 5.

2.221. Dr. Young, witness for the Joint Intervenors, testified that "[a]lthough the proposed dredging required for construction of the New Units will likely have very large and

severely negative impacts on the aquatic species located in the Middle, Lower, and estuarine Savannah River, these impacts are insufficiently assessed and analyzed.” Young Dir. EC 6.0, Post Tr. 1569 at 5-6. He also asserted that “the FEIS lacks sufficient data and analysis of the impacts on the freshwater mussels, shortnose sturgeon, Atlantic sturgeon, striped bass, robust redhorse and other catostomids, catfish species, and numerous benthic organisms, which may be affected by the dredging.” *Id.* Furthermore, Dr. Young testified that a site-specific mussel survey was required in order to determine dredging impacts. Young Dir. EC 6.0, Post Tr. 1569 at 5; “Rebuttal Testimony of Dr. Shawn P. Young Concerning Contention EC 6.0” [“Young Reb. EC 6.0”], Post Tr. 1570 at 4.

2.222. Dr. Young also criticized Dr. Coutant’s analysis of the dredging impacts described by Southern, stating that Dr. Coutant erred in relying on mussel survey information provided by a study performed on the Pee Dee River (Ex. SNC000066) rather than referencing a study by the same company performed on the Savannah River (Ex. NRC000005). Young Reb. EC 6.0, Post Tr. 1570 at 3-4.

2.223. Dr. Coutant testified that, contrary to Dr. Young’s assertions, a complete mussel survey of the Savannah River was not necessary in order to determine the potential impacts of dredging of the Savannah River FNC. Coutant Reb. EC 6.0, Post Tr. 1292 at 2-3. Dr. Coutant further testified that the Pee Dee Basin mussel study was more useful than that conducted on the Savannah River because it gave better baseline data for the types of habitats preferred by mussels in general. *Id.* at 3. Dr. Coutant stated that he based his estimate of dredging impacts on the survey conducted by Capt. Scott, which indicated that the dredging locations consisted of shifting sands at points in the river, and on the Pee Dee River mussel study, which indicated that mussels did not generally colonize such shifting sand habitats. *Id.*

2.224. NRC staff witnesses testified that the dredging survey and environmental impact report of Dr. Coutant, both submitted since preparation of the FEIS, did not provide enough detailed information to alter the NRC staff's conclusions in the FEIS regarding possible environmental impacts from dredging of the Savannah River FNC. Tr. at 1515, 1524-25, 1532 (Kuntzleman); Tr. at 1527 (Krieg). However, in response to Licensing Board questioning concerning the likelihood that the impacts from dredging of the magnitude identified by the Applicant's survey would be significantly less than those described in the FEIS, Ms. Kuntzleman agreed for example, that if Dr. Coutant was right in assuming that the material removed would be inert, uncontaminated sand, that would be "good." Tr. at 1527. Ms. Kuntzleman further testified that the scope of dredging described by the Applicant made her "confident in [her] conservative approach." Tr. at 1547.

2.225. Similarly, witnesses for the Corps testified that, based on their current knowledge regarding dredging of the Savannah River FNC, it is not clear whether undertaking dredging might require special permitting considerations such as those associated with the Coastal Zone Management Act, whether dredging might impact essential fish habitat, how much sediment may need to be removed, the quality of the sediment to be removed (type and possible contamination), where the sediment would be disposed, and possible mitigation measures which might be employed. USACE Dir. EC 6.0, Post Tr. 1385 at 10. This testimony is consistent with the NRC staff position that a more quantitative analysis of potential dredging impacts was not possible in the FEIS. Staff Dir. EC 6.0, Post Tr. 1477 at 16; Kuntzleman Reb. EC 6.0, Post Tr. 1479 at 2-5.

2.226. The Joint Intervenors' witness Dr. Young described a number of possible impacts from potential dredging of the Savannah River FNC, including disruption of food dynamics, effects on spawning success of aquatic species, re-suspension of contaminants, and impacts on

mussels. Young Dir. EC 6.0, Post Tr. 1569 at 4-5. However, we find that the NRC staff analysis in the FEIS acknowledges the possibility of such impacts if dredging were to occur. Dr. Young asserts that the FEIS should have included more detail concerning these potential impacts, including the specifics of potential mitigative efforts to relocate mussels. *Id.* Dr. Hayes similarly stated that he expected greater detail in the FEIS concerning potential impacts of Savannah River FNC dredging. Hayes Dir. EC 6.0, Post Tr. 1572 at 6; Tr. at 1593, 1626. However, because the record demonstrates that the details of any Savannah River FNC dredging project are not yet defined, we agree with the Applicant and the NRC staff that the qualitative analysis in the FEIS discloses the potential impacts to the extent reasonably possible.

2.227. In his testimony concerning impacts from potential dredging of the Savannah River FNC, Dr. Young asserted that impacts would be “more likely to be significant” than to be moderate, and he stated that, for example “[e]ven if only one mile of river is dredged, the dredged areas may be hotspots of high abundance for benthic organisms” or that the dredging alterations may cause changes in habitat. Young Reb. EC 6.0, Post Tr. 1570 at 1. He also asserted that more studies are necessary to determine likely effects in the aquatic environment. *Id.* at 4. However, the Joint Intervenors presented no testimony that would contradict the USACE and NRC staff’s characterization of the Corps environmental review process that would apply if dredging of the Savannah River FNC were to be undertaken (as a federal project or as a permit application). Nor did the Joint Intervenors contradict the NRC staff testimony concerning the criteria that the Corps would apply in making a determination on such an action, or the potential mitigation measures that might be employed in connection with the Corps’ review to minimize aquatic impacts.

2.228. After considering the record, the Licensing Board finds persuasive the Applicant and NRC staff testimony that, given the limited information regarding the scope or likelihood of any potential dredging of the Savannah River FNC available at the time the FEIS was drafted, the NRC staff's conclusion that the cumulative environmental impacts could be moderate is reasonable and adequately supported. The Licensing Board finds that the level of detail in the FEIS analysis appropriately reflected available information and the types of impacts that would be anticipated from potential dredging of the Savannah River FNC. Furthermore, in light of the NRC staff and USACE witnesses' testimony concerning the environmental review process and regulatory criteria that would be applied by the USACE if a dredging plan for the Savannah River FNC is considered by that agency (or a permit application to dredge the Savannah River FNC is submitted to it), the Licensing Board also finds reasonable the NRC staff's position that the impacts would be unlikely to be greater than moderate.

c. Conclusion Regarding EC 6.0

2.229. In summary, the Licensing Board finds that the potential dredging of the Savannah River Federal navigation channel is not necessary for the ESP and LWA application and does not constitute a connected action under NEPA. The Licensing Board further concludes that because the testimony supports the NRC staff's view that such dredging is not reasonably foreseeable, the NRC staff was not required to analyze the potential impacts in the FEIS, but that in any event, the NRC staff reasonably evaluated the potential environmental impacts associated with such a future action as a cumulative impact rather than as an impact of the NRC's action.

2.230. The Licensing Board agrees that the NRC staff's finding that cumulative impacts to aquatic resources from the construction of the proposed reactor units and dredging of the Federal navigation channel "could be moderate" was based on the professional experience and

judgment of the NRC staff, and it appropriately reflected the limited information available given the absence of a formal dredging plan or proposal and uncertainty as to the scope of the dredging if it were eventually to be undertaken. Furthermore, any dredging of the Savannah River Federal navigation channel would need to be authorized under the jurisdiction of the USACE, and the USACE would be required to perform an independent NEPA review of the environmental impacts of that project.

2.231. The record also demonstrates that the NRC staff reasonably assumed that releases of water from upstream reservoirs would occur only in response to the USACE's implementation of its normal flood control operations, and would not occur during drought conditions simply to enable navigation. Accordingly, the NRC staff appropriately found that impacts to upstream reservoirs were not reasonably foreseeable, and thus such impacts did not need to be discussed in the FEIS.

2.232. As a result, the Staff's analysis discloses impacts of such a project to the extent reasonably possible at this time. For these reasons, the Staff's analysis was consistent with the requirements of NEPA and with the NRC's regulations.

III. CONCLUSIONS OF LAW

3.1. The Licensing Board has considered all of the evidence presented by the parties on Contentions EC 1.2, EC 1.3, and EC 6.0. Based upon a review of the entire record in this proceeding and the proposed findings of fact and conclusions of law submitted by the parties, and based upon the findings of fact set forth above, which are supported by reliable, probative and substantial evidence in the record, the Board has decided all matters in controversy concerning this contention and reaches the following conclusions.

3.2. With respect to Contention EC 1.2, the FEIS identifies and adequately considers direct, indirect and cumulative impingement/entrainment and thermal effluent discharge impacts of the proposed cooling system intake and discharge structures on aquatic resources.

3.3. With respect to Contention EC 1.3, the FEIS satisfies 10 C.F.R. § 51.45(b)(3) because its analysis of the dry cooling alternative is adequate to address the appropriateness of a dry cooling system.

3.4. With respect to Contention EC 6.0, the NRC staff's conclusion, as set forth in the "Cumulative Impacts" chapter of the FEIS, that impacts of potential dredging of the Savannah River Federal navigation channel could be moderate is adequately supported. Additionally, upstream water releases specifically to enable barge transportation to the Vogtle site are not necessary for the ESP and LWA and are not reasonably foreseeable. Thus no impacts to upstream reservoirs are reasonably foreseeable in connection with the ESP and LWA. Accordingly, the FEIS adequately addresses the impacts of the Corps' upstream reservoir operations as they support navigation.

3.5. Therefore, we conclude that the FEIS complies with NEPA and with NRC's regulations in 10 CFR Part 51, in that the NRC staff has taken the requisite hard look at the direct, indirect, and cumulative environmental impacts of the proposed action, has identified and evaluated reasonable alternatives to the proposed cooling system, and has documented its analysis and conclusions in a manner consistent with NEPA's requirements. As such, we conclude that each of the three contentions must be denied.

Respectfully submitted,

/signed (electronically) by/

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Dated at Rockville, Maryland
This 24th day of April, 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))

CERTIFICATE OF SERVICE

I hereby certify that copies of the "NRC STAFF'S PROPOSED FINDINGS OF FACT AND CONCLUSIONS OF LAW CONCERNING CONTESTED ENVIRONMENTAL MATTERS" have been served upon the following persons by Electronic Information Exchange this 24th day of April, 2009:

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