UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

In the Matter of	Docket No. 52-011-ESP
SOUTHERN NUCLEAR OPERATING CO.	ASLBP No. 07-850-01-ESP-BD01
(Early Site Permit for Vogtle ESP Site)	April 24, 2009

JOINT INTERVENOR'S PROPOSED FINDINGS OF FACT AND CONCLUSIONS OF LAW

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Introduction

1. These findings of fact and conclusions of law address the three contested environmental issues with respect to the early site permit ("ESP") for proposed Units 3 and 4 at the Plant Vogtle site in Waynesboro, Georgia (the "VEGP site"), requested by Southern Nuclear Operating Company, Inc. ("SNC") in accordance with 10 C.F.R. Part 52, Subpart A.

2. Environmental contentions 1.2, 1.3, and 6.0 ("EC 1.2", "EC 1.3", and "EC 6.0" respectively) each challenge the adequacy of the Final Environmental Impact Statement (the "FEIS") for the requested ESP under the National Environmental Policy Act of 1969 ("NEPA").

3. For the reasons stated below, and based on the evidentiary record created from the hearing conducted in accordance with 10 C.F.R. Part 2, Subpart L (the "Evidentiary Hearing"), this Atomic Safety and Licensing Board (this "Board") finds that SNC and the

Nuclear Regulatory Commission (the "NRC") Staff have failed to meet their shared burden of proof with regard to EC 1.2, EC 1.3, and EC 6.0.[1] Joint Intervenors[2] have, however, shown the significance and materiality of each of these contentions under NEPA.[3]

4. Therefore, this Board concludes that (i) it cannot take a "hard look" at the impacts issuance of the ESP, and the actions connected thereto, will have on the environment, and (ii) based on the information available, a dry-cooling system is the appropriate alternative for proposed Units 3 and 4. Accordingly, pursuant to 10 C.F.R. § 52.24, this Board resolves each environmental contention in favor of Joint Intervenors and denies issuance of the ESP requested by SNC.

Procedural Background

5. On August 14, 2006, SNC submitted an ESP application to the NRC. As part of this application, SNC included an environmental report ("ER"). Joint Intervenors (then Joint Petitioners) filed a challenge to the ESP application on December 11, 2006, seeking to admit seven environmental contentions related to the adequacy of the ER, and ultimately the adequacy of the FEIS, under NEPA.

[1] Louisiana Energy Servs., L.P. (Claiborne Enrichment Center), LBP-96-25, 44 NRC 331, 338-9 (1996), rev'd on other grounds by Louisiana Energy Servs., L.P. (Claiborne Enrichment Center), CLI-97-15, 46 NRC 295 (1997), citing Pub. Serv. Co. of New Hampshire (Seabrook Station, Units 1 and 2), ALAB-471, 7 NRC 477, 489 n.8 (1978).

[2] Joint Intervenors 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.

[3] Exelon Generation Co. (Early Site Permit for Clifton ESP Site), CLI-05-29, 62 NRC 801, 811 (2005).

6. On March 12, 2007, this Board found that Joint Intervenors had standing to challenge the ESP and admitted two of the environmental contentions, designated as EC 1.2 and 1.3.[4]

(i) As admitted by this Board, EC 1.2 provides that "[t]he FEIS fails to identify and consider direct, indirect, and cumulative impingement/entrainment and thermal effluent discharge impacts of the proposed cooling system intake and discharge structures on aquatic resources."[5]

(ii) As admitted by this Board, EC 1.3 provides that "[t]he FEIS 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."[6]

7. On September 10, 2007, the NRC Staff issued its Draft Environmental Impact Statement ("DEIS").[7] Because EC 1.2 and EC 1.3, as admitted, were still applicable to the DEIS, Joint Intervenors chose not to amend them.

8. On October 17, 2007, SNC filed motions requesting that summary disposition be entered in its favor for EC 1.2 and EC 1.3.[8] On November 13, 2007, Joint Intervenors filed an answer to the SNC dispositive motions, which included a statement of material

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[4] See SNC (ESP for Vogtle ESP Site), LBP-07-03, 65 NRC 237, 259, 261 (Mar. 12, 2007).

[5] SNC (ESP for Vogtle ESP Site), LBP-07-03, 65 NRC 237, 280 (Mar. 12, 2007).

[6] Id.

[7] DEIS for an ESP at the VEGP Site, Office of New Reactors, NRC, NUREG-1872 (Sept. 2007).

[8] See SNC Motion for Summary Disposition on Intervenors' EC 1.2 (Cooling System Impacts on Aquatic Resources) (Oct. 17, 2007); SNC Statement of Undisputed Facts in Support of Applicant's Motion for Summary Disposition of Intervenors' EC 1.2 (Cooling System Impacts on Aquatic Resources) (Oct. 17, 2007); SNC Motion for Summary Disposition on Intervenors' EC 1.3 (Oct. 17, 2007); SNC Statement of Undisputed Facts in Support of Applicant's Motion for Summary Disposition on Intervenors' EC 1.3 (Oct. 17, 2007).

facts at issue and supporting affidavits, asserting that summary disposition was inappropriate in this instance.[9] This Board, agreeing with Joint Intervenors, found that genuine issues of material fact existed in connection with several matters raised by EC 1.2 and EC 1.3. Therefore, this Board upheld both contentions against the motions for summary disposition.[10]

9. Then, on August 14, 2008, the NRC Staff issued the FEIS.[11] In light of the new information disclosed in the FEIS, on September 23, 2008, Joint Intervenors submitted a motion (dated September 22, 2008) to admit a new environmental contention, designated as EC 6.0.[12]

10. On October 24, 2008, this Board admitted EC 6.0, finding that the contention met both standards of timeliness and admissibility.[13] As admitted by this Board, EC 6.0 provides that "[b]ecause the Army Corps of Engineers' (the "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 supported.

[9] See Joint Intervenors Answer Opposing SNC's Motion for Summary Disposition of EC 1.2 (Nov. 13, 2007).

[10] See SNC (ESP for Vogtle ESP Site), 67 NRC 54 (Jan. 15, 2008) (regarding Environmental Contention 1.2); SNC (ESP for Vogtle ESP Site), 67 NRC 54 (Jan. 15, 2008) (regarding Environmental Contention 1.3).

[11] See August 14, 2008 Letter from Patrick Moulding, NRC Staff Counsel, to Administrative Judges (notifying parties of availability of FEIS).

[12] See Joint Intervenors' Motion to Admit New Contention (Sept. 22, 2008).

[13] See Memorandum and Order (Ruling on Motion to Admit New Contention) (Oct. 24, 2008).

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."[14]

11. On January 9, 2009, and in preparation for the Evidentiary Hearing, SNC, the NRC Staff, and Joint Intervenors each filed an initial position statement and accompanying expert witness direct testimony regarding EC 1.2, EC 1.3, and EC 6.0.[15]

12. Then the three parties, on February 6, 2009, each filed a response statement and accompanying expert witness rebuttal testimony responding to the respective initial position statements and direct testimony of the other parties.[16]

13. The issues raised in the three admitted contentions, as discussed in the prefiled statements and testimony, were then subject to the Evidentiary Hearing which took place on March 16, 17, 18, and 19, 2009, in Augusta, Georgia.[17]

14. The following sets forth this Board's findings of fact with respect to evidence in the record and the testimony presented at the Evidentiary Hearing, as well as this Board's conclusions of law with respect thereto.

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[14] SNC (ESP for the Vogtle ESP Site), Memorandum and Order (Ruling on Motion to Admit New Contention), Slip. Op. at Appendix A (Oct. 24, 2008).

[15] See Joint Intervenors' Initial Position Statement (Jan. 9, 2009) (last revised Feb. 13, 2009); SNC's Initial Statement of Position on Intervenors' EC 1.2 (Jan. 9, 2009); SNC's Initial Statement of Position on Intervenors' EC 1.3 (Jan. 9, 2009); SNC's Initial Statement of Position on Intervenors' EC 6.0 (Jan. 9, 2009); Staff Initial Statement of Position on Joint Intervenors' Contentions EC 1.2, EC 1.3, and EC 6.0 (Jan. 9, 2009) (last revised Feb. 2, 2009).

[16] See Joint Intervenors' Response Statement (Feb. 6, 2009) (last revised Mar. 2, 2009); SNC's Response Statement on EC 1.2 (Feb. 6, 2009); SNC's Response Statement on EC 1.3 (Feb. 6, 2009); SNC's Response Statement on EC 6.0 (Feb. 6, 2009); Staff's Rebuttal Statement of Position on Joint Intevernors' Contentions EC 1.2, EC 1.3, and EC 6.0 (Feb. 6, 2009).

[17] See Memorandum and Order (Revised General Schedule) (Oct. 24, 2008).

Legal Standards

Evidentiary Hearing

15. Under the Part 52 licensing process, an entity may apply for an early site permit to resolve key site-related environmental, safety, and emergency planning issues.[18]

16. Any person whose interest may be affected by the issuance of the requested early site permit and who desires to participate in a proceeding regarding such issuance must file a written request for hearing and a specification of the contentions which the person seeks to have litigated.[19]

17. The hearing request will be granted if such person has standing and the contentions satisfy the requirements set forth in 10 C.F.R. § 2.309.

18. If the hearing request is granted, then, unless otherwise agreed that the hearing should be conducted pursuant to 10 C.F.R. Part 2, Subpart N, the hearing will be conducted in accordance with the informal hearing procedures of 10 C.F.R. Part 2, Subparts C and L.

19. At the hearing, the applicant alone usually has the burden of proof with respect to the contested issues.[20] If, however, the contested issues concern the adequacy of an environmental impact statement under NEPA, then the applicant and the NRC Staff share the burden.

20. After the hearing, the Board will issue its initial decision based upon information in the hearing record or facts officially noticed.[21]

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[18] See 10 C.F.R. Part 52.

[19] 10 C.F.R. § 2.309; see also id. § 52.21; 42 U.S.C. § 2339 (2006).

[20] 10 C.F.R. § 2.325.

[21] Id. § 2.1210.

Permit Issuance

21. In reaching its initial decision, the NRC may issue an early site permit, if it finds, among other things, that pursuant to 10 C.F.R. § 52.24(a):

(i) "Issuance of the permit will not be inimical to the common defense and security or to the health and safety of the public;

(ii) Any significant adverse environmental impact resulting from activities requested under § 52.17(c) [regarding limited work authorizations] can be addressed; and

(iii) The findings required by subpart A of 10 CFR part 51 [including, determination that the requirements of sections 102(2) (A), (C), and (E) of NEPA regarding environmental impact statements have been satisfied,[22] consideration of the environmental costs and benefits of the proposed action,[23] consideration of all alternatives,[24] and determination that all practicable measures have been taken to avoid or minimize environmental harm[25]] have been made."[26]

22. Therefore, the NRC regulations require the NRC (and thus this Board) to consider the environmental impacts of the proposed project before issuing the permit.[27] These regulations ensure that the NRC complies with its NEPA obligations.[28]

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[22] See id. § 51.105(a)(1).

[23] See id. § 51.105(a)(3).

[24] See id. § 51.103(a)(2).

[25] See id. § 51.103(a)(4).

[26] Id. § 52.24(a)(6)-(8).

[27] See, e.g., id. Part 51. See also 40 C.F.R. Part 1500 (Council on Environmental Quality regulations).

[28] See 42 U.S.C. § 4321 *et seq.*

23. NEPA requires the NRC, before issuing an early site permit, to take a "hard look" at the environmental consequences of the proposed project and its alternatives.[29] To comply with the "hard look" standard, the NRC must provide "a sufficiently detailed statement of environmental impacts and alternatives so as to permit informed decision making."[30]

24. While the "hard look" required by NEPA is tempered by a "rule of reason,"[31] an agency is still required to "describe the reasonably foreseeable environmental impacts of a proposed action."[32] Accordingly, the "rule of reason" does not excuse the NRC from considering in its environmental impact statement: (i) connected actions, (ii) reasonable alternatives, and (iii) direct, indirect, and cumulative impacts.[33]

Contentions

25. As further explained below, EC 1.2 contends that the FEIS fails to adequately consider the direct, indirect, and cumulative impacts of the proposed Units 3 and 4 on aquatic resources.[34] As for the failure to consider cumulative impacts, the Council on Environmental Quality (the "CEQ") explains that a cumulative impacts analysis must consider:

> … the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can

[29] Louisiana Energy Servs., L.P. (Claiborne Enrichment Center), CLI-98-3, 47 NRC 77, 87-88 (1998).

[30] Lands Council v. Powell, 395 F.3d 1019, 1028 (9th Cir. 2005).

[31] Louisiana Energy Servs., L.P. (Claiborne Enrichment Center), 45 NRC 367, 399 (1997).

[32] Id.

[33] See 40 C.F.R. § 1508.25.

[34] See id. § 1508.25(c).

> result from individually minor but collectively significant actions taking place over a period of time.[35]

26. As further explained below, EC 1.3 contends that the FEIS fails to adequately consider the feasibility of a dry-cooling alternative.[36] Pursuant to 10 C.F.R. §51.45(b)(3),

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

Thus, to take the requisite "hard look" under NEPA, an "appropriate range of alternatives" must be considered.[37]

27. As further explained below, EC 6.0 contends that the FEIS fails to adequately assess the impacts related to barging components of Units 3 and 4 to the VEGP site. Because these barging-related impacts are "connected" to the issuance of the ESP, they must be addressed in the FEIS. As further explained in the CEQ regulations, environmental impact statements must consider:

> Connected actions, which means that they are closely related and therefore should be discussed in the same impact statement. Actions are connected if they:
>
> (i) Automatically trigger other actions which may require environmental impact statements.
>
> (ii) Cannot or will not proceed unless other actions are taken previously or simultaneously.

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[35] Id. § 1508.7.

[36] See id. § 1508.25(b)(2).

[37] See In re Private Fuel Storage, L.L.C. (Independent Spent Fuel Storage), LBP-03-30, 58 NRC 454, 479 (2003) (quoting Headwaters Inc. v. BLM, 914 F.2d 1174, 1181 (9th Cir. 1990)).

(iii) Are independent parts of a larger action and depend on the larger action for their justification.[38]

PROPOSED FINDINGS OF FACT AND CONCLUSIONS OF LAW FOR EC 1.2

Findings of Fact

Ecological Baseline

1. In our Order admitting EC 1.2, this Board recognized that "litigation regarding its merits may involve the question of the adequacy of the baseline information provided by SNC."[39] Additionally, we noted that "the appropriate scope of the baseline for a project is a functional concept: an applicant must provide enough information and in sufficient detail to allow for an evaluation of important impacts."[40] In the context of EC 1.2, the baseline is the current condition of the aquatic biota and habitat "relative to the portion of the Savannah River that encompasses the project area associated with the intake/discharge structures for both the existing and proposed Vogtle facilities."[41] Thus, the baseline necessarily includes both the ongoing impacts of past actions, and the current impacts of ongoing actions, to the extent that they affect the aquatic biota of the Savannah River at Plant Vogtle.

2. In preparing the FEIS, the Staff properly focused its analysis on "important" species, pursuant to NRC guidance provided in Regulatory Guide 4.2 (Revision 2), Regulatory Guide 4.7, and applicable sections of the Environmental Standard Review

[38] 10 C.F.R. § 1508.25(a)(1).

[39] Memorandum and Order (Ruling on Standing and Contentions) (Mar. 12, 2007) at 18.

[40] Id. at 15-16, citing NUREG-1555, Environmental Standard Review Plan (NRC 2000 & 2007) ("ESRP"), Reg. Guide 4.7.

[41] Id. at 18.

Plan ("ESRP").[42] ESRP Section 2.4.2 instructs the reviewer to "identify the species and habitats that will be considered 'important' ecological resources of the site, vicinity... and offsite areas for evaluation of potential impacts on them, using Table 2.4.2-1 as a reference."[43] Regulatory Guide 4.2 defines a species as "important" if: "(a) the species is commercially or recreationally valuable, (b) the species is threatened or endangered, (c) the species affects the well-being of some important species within criteria (a) or (b), or (d) the species is critical to the structure and function of the ecological systems or is a biological indicator of radionuclides in the environment."[44]

3. At the Evidentiary Hearing, testimony regarding important species focused on aquatic species that are listed as threatened, endangered, or species of concern (collectively, "Special Status Species") under state or federal law, and, to a lesser extent, commercially or recreationally important fisheries. Special Status Species are considered important under NRC guidance because they are "rare" and therefore vulnerable to unacceptable impacts from construction or operation of nuclear power plants.[45] In other words, Special Status Species have a low baseline, whether caused by natural occurrences or human activities.

Shortnose Sturgeon

4. The shortnose sturgeon is listed as an endangered species by the federal government and the state of Georgia.[46] On the Savannah River, shortnose sturgeon

[42] See Staff Direct Testimony for EC 1.2 at A10-A13.

[43] NRC000009 at 2.4.2-6.

[44] NRC000007 at 2-3.

[45] NRC000009 at 2.4.2-6.

[46] NRC000001 at 2-86; see also SNC000041, SNC000042.

"utilize much of the river during spawning migrations and make extensive use of the upper estuary."[47] Adult shortnose sturgeon migrate past Plant Vogtle to spawn at sites upstream near Augusta.[48] After hatching, larval shortnose sturgeon migrate downstream to get to the estuary.[49]

5. In his Prefiled Rebuttal Testimony for EC 1.2, Dr. Masnik explained that organisms entrained in the cooling system "experience 100 percent mortality" and further noted that "organisms affected could include the larval stages of both the robust redhorse and the shortnose sturgeon."[50] Dr. Masnik then testified at the Evidentiary Hearing that, given their federal endangered status, "even the loss of one individual [shortnose sturgeon] may be important."[51]

6. The National Marine Fisheries Service ("NMFS") published a Recovery Plan for the shortnose sturgeon in 1998 (the "NMFS Recovery Plan").[52] Cooling water intakes are one of several factors identified in the NMFS Recovery Plan as affecting recovery of the shortnose sturgeon. According to NMFS, "electric power and nuclear power generating plants can affect sturgeon by impinging larger fish on cooling water intake screens and entraining larval fish."[53] The NMFS Recovery Plan further provides that

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[47] NRC000047 at 702.

[48] Coutant Rebuttal Testimony for EC 1.2 at A19; Evidentiary Hearing Transcript ("Tr.") 668: 19-21.

[49] JTI000026 at 26; Tr. 702: 18-25.

[50] Staff Rebuttal Testimony for EC 1.2 at A11.

[51] Tr. 1079: 24-25.

[52] See JTI000026.

[53] Id. at 53.

"documented mortalities of sturgeon have occurred" on the Savannah River, but it gives no additional details of the incident(s).[54]

7. Larval sturgeon (either shortnose sturgeon or Atlantic sturgeon) were collected in the vicinity of the VEGP site during ichthyoplankton surveys conducted between 1982 and 1985.[55] Given their location, the authors of these surveys concluded that some sturgeon could be entrained by the Savannah River Site ("SRS") cooling water intake, but were unable to provide an estimate.[56] In a different study, Marcy et al. indicated that historically the largest sources of entrainment in the middle-Savannah river basin have been the cooling water intakes for SRS and Plant Vogtle.[57] In fact, during the period that the SRS reactors were operating, SRS entrained between 8.3 and 12.3 percent of Savannah River ichthyoplankton.[58] Additionally, Specht found that SRS entrained approximately 25 million organisms per year.[59] When viewed collectively, these studies reveal that a significant number of shortnose sturgeon larvae were entrained while the SRS reactors were operating, and this contributed to the endangered status of the Savannah River population.

8. More recent population estimates of Savannah River shortnose sturgeon "indicate that adult population is increasing, but juveniles are still rare."[60] Thus, the shortnose

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[54] Id. at 55.

[55] SNC000012 at 3-112 – 113.

[56] Id.

[57] NRC000006 at 16.

[58] NRC000012.

[59] SNC000011.

[60] SNC000001 at 2-91.

sturgeon population of the Savannah River has not recovered, despite the closure of the SRS reactors. Other sources of mortality, including Plant Vogtle Units 1 and 2 and the SRS D-Area Powerhouse, are therefore likely impacting larval shortnose sturgeon. This "recruitment bottleneck" comports with the NMFS Recovery Plan's conclusion that cooling water intake structures impact shortnose sturgeon by entraining larval fish, and with Dr. Masnik's testimony that larval stages of shortnose sturgeon could be entrained by the Plant Vogtle intake structure. Moreover, the FEIS recognizes that at extremely low flow rates, "the cumulative effects of all four [Vogtle] units combined with the potential losses at the SRS" may result in "significant and detectable" entrainment of some species of fish.[61]

9. Although the limited field surveys conducted at Plant Vogtle in 2008 did not find any shortnose sturgeon entrained, based on the overwhelming weight of evidence, this Board nevertheless concludes that the existing Units 1 and 2 do in fact entrain a small, but not insignificant, number of larval shortnose sturgeon.[62] The addition of Units 3 and 4 will have an impact on shortnose sturgeon similar to the impact of the existing intake structure for Units 1 and 2, thereby doubling the total mortality caused by the Plant Vogtle facility.[63] Given the already severely depleted baseline population, and their endangered status, this Board finds that any additional loss of shortnose sturgeon will be "clearly noticeable and sufficient to destabilize important attributes of the resource."[64]

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[61] Id. at 7-24.

[62] SNC000005.

[63] Tr. 537: 6-10.

[64] Id. at xxv.

Therefore, the impact of the proposed Units 3 and 4 on shortnose sturgeon will be LARGE.[65]

Robust Redhorse

10. The robust redhorse is a large riverine catostomid (sucker) that is state-listed in Georgia as an endangered species.[66] The species was essentially lost to science until 1991, when five specimens were collected on the Oconee River near Tombsboro, Georgia.[67] Although the robust redhorse is not federally-listed, it is the subject of a Candidate Conservation Agreement with Assurances between Georgia Power Company and the U.S. Fish and Wildlife Service.[68]

11. The robust redhorse was first documented on the Savannah River in 1997 when a single adult fish was discovered near the VEGP site.[69] The size of the Savannah River robust redhorse population is unknown;[70] however, it is believed to be "small."[71]

12. River surveys of the Savannah River have discovered robust redhorse at numerous locations from Augusta (upstream of Plant Vogtle) to River Mile 119 (downstream of Plant Vogtle).[72] The robust redhorse is known to spawn at several gravel

[65] Id. at xxiv (citing 40 C.F.R. § 1508.27).

[66] Id. at 2-88.

[67] NRC00016 at 1.

[68] NRC000015; NRC000016; see also 64 Fed. Reg. 32726-32736; 50 C.F.R. §§ 13, 17.

[69] NRC00001 at 2-88.

[70] Id.

[71] Testimony of Dr. Charles Coutant Concerning Environmental Contention 1.3 at A11.

[72] NRC000015. A 2006 radio-telemetry study of adult robust redhorse revealed that individual fish moved as mush as 121 river miles from their release sites. NRC000017.

bars upstream of the VEGP site.[73] In the winter, robust redhorse disburse from their spawning grounds along the length of the river down to River Mile 56, and return to their spawning sites in the spring.[74]

13. The FEIS reports that, after spawning, "the eggs developed within the gravel and the larval fish remained there for approximately 7 days after hatching;" however, there is no discussion of the behavior of the larval robust redhorse upon leaving the gravel bed.[75] NRC witness Ms. Krieg testified that she simply assumed that the larvae "would likely move downstream" after emerging from the gravel.[76] In fact, the FEIS provides absolutely no information regarding the life history of larval or juvenile robust redhorse, with the exception of reporting that larvae are capable of swim speeds of 0.25 to 0.4 feet per second.[77] In light of their limited swimming ability, NRC Staff witness Dr. Masnik testified that robust redhorse larvae are susceptible to entrainment in the Plant Vogtle intake.[78]

14. During the spring and early summer of 2008, SNC conducted entrainment monitoring at the existing Plant Vogtle intake structure (the "SNC Entrainment Study").[79] Entrainment sampling was performed once every two weeks from March

[73] Tr. 858: 11-17.

[74] Id.

[75] NRC000001 at 2-88 – 89.

[76] Tr. 777: 16-17.

[77] NRC000001 at 2-88 – 89.

[78] Staff Rebuttal Testimony for EC 1.2 at A11; Tr. 833: 5-23

[79] SNC000005; Dodd and Montz Direct Testimony for EC 1.2 at A13.

through July of 2008, for a total of 20 sampling events.[80] SNC witnesses Mr. Dodd and Mr. Montz testified that "no protected fish species were encountered in source water or entrainment samples."[81] However, the sampling found that 20 percent of unidentified taxa were members of the catastomid (sucker) family, which includes the robust redhorse.[82] Moreover, at the evidentiary hearing, SNC's witnesses testified that the methodology employed to identify taxa could not distinguish catastomidea to the species level.[83]

15. All of the entrained catastomids found in the SNC Entrainment Study were post-yolk-sack-larvae.[84] This finding is consistent with the theory that robust redhorse spawn in gravel beds upstream of Plant Vogtle during the spring, become part of the drift community upon leaving the gravel, and drift downstream past the VEGP site, where a portion of the larvae are entrained in the intake canal. Therefore, this Board finds that the existing Plant Vogtle Units 1 and 2 likely entrain a small, but not insignificant, number of larval robust redhorse. Units 3 and 4 are anticipated to have an impact on robust redhorse similar to the impact caused by the existing intake structure for Units 1 and 2, thereby doubling the total mortality caused by the Plant Vogtle facility.[85] Given the already severely depleted baseline population, and their endangered status in Georgia, we find that any additional loss of robust redhorse will be "clearly noticeable and sufficient to

[80] Dodd and Montz Direct Testimony for EC 1.2 at A13.

[81] Id. at A19.

[82] Id. at A17.

[83] Tr. 631: 2-13, 737: 1-25.

[84] Id.

[85] Tr. 537: 6-10.

destabilize important attributes of the resource."[86] Therefore, the impact of the proposed Units 3 and 4 on the robust redhorse will be LARGE.[87]

State-Listed Mussels

16. Ten species of mussel historically found on the Savannah River in the vicinity of the VEGP site are Special Status Species in Georgia or South Carolina. The state of Georgia lists two Savannah River mussel species as either threatened or endangered, and the state of South Carolina lists nine Savannah River mussels as species of concern.[88] One species, the Savannah Lilliput, is listed as threatened by Georgia and as a species of concern by South Carolina.[89] Despite this, no mussel surveys were conducted by SNC in connection with this ESP proceeding.[90]

17. A 2007 mussel survey conducted by the Catena Group on behalf of the U.S. Fish and Wildlife Service found eight of the ten Special Status Species at a number of sites on the Savannah River, usually in very low numbers.[91] A ninth species, the Atlantic Pigtoe, was tentatively identified at two sites near Augusta pending genetic analysis.[92] The Catena Group study sampled 39 sites on the Savannah River, both upstream and

[86] Id. at xxv.

[87] Id. at xxiv (citing 40 C.F.R. § 1508.27).

[88] NRC000001 at 2-87 – 2-88.

[89] Id.

[90] Id.

[91] Id.; NRC000005 at 4-5.

[92] Id. at 18.

downstream of Plant Vogtle; however, none of the sites were in the vicinity of the VEGP site.[93]

18. Mussels deposit their larvae on fish host species and depend on these fish hosts for a part of their life history.[94] Thus, the fish host species "affects the well-being of" the Special Status mussel Species, and are themselves "important species" under NRC guidance.[95] While the section of the FEIS discussing important species includes a brief discussion of the state-listed mussels, it does not discuss, or even mention, the fish host species.[96] Joint Intervenors' witness, Dr. Young, testified that "because each mussel species has specific fish hosts and habitat requirements, a thorough discussion of each mussel species' life history is also required."[97]

19. At the Evidentiary Hearing, SNC witness Dr. Coutant testified that he "had not tried to correlate" host fish species for the Special Status mussel Species with the results of the impingement and entrainment studies conducted by SNC in 2008.[98] Similarly, SNC witness Mr. Dodd testified:

> Undoubtedly, . . . some of the fishes that we collect are likely to be host for certain species, but we didn't make any correlation to that effect for this study purpose.[99]

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[93] Id. at 5-11.

[94] Tr. 733: 4-25.

[95] NRC000007 at 2-3; see also Tr. 734: 1-12 (Dr. Coutant states that "the hypothesis, at least, that some of the mussel declines have been due to changes in fish populations is certainly out there and acceptable.").

[96] NRC000001 at 2-87 – 2-88.

[97] Young Revised Direct Testimony for EC 6.0 at A13.

[98] Tr. 734: 17-20.

[99] Tr. 736: 20-24.

20. This Board finds that some fish host species for state-listed mussels will likely be entrained or impinged in the intake structure for Units 1 and 2. As a result, the record cannot support a finding that the impacts of operating Units 3 and 4 will be SMALL. Without additional information, it is impossible to adequately evaluate the potential impacts of the proposed Units 3 and 4 on the state-listed mussel species or their fish hosts.

Conclusions of Law

1. Pursuant to the NRC's hearing notice of October 12, 2006, this Board finds that (1) the requirements of sections 102(2)(A), (C), and (E) of NEPA have not been satisfied in this case; (2) having conducted its own independent balancing of the conflicting environmental and other factors, that the overall balance does not support issuance of the ESP; and (3) protection of the environment requires denial of the ESP. Thus, we conclude that these factors require denial of the requested ESP.

2. We conclude that the FEIS is inadequate because the NRC Staff has failed to take the requisite "hard look" at the impacts of the proposed intake structure, particularly, the likely impacts of entrainment on important species. The NRC Staff has unduly ignored the potential impacts on state-listed mussel species and their host fish species, and minimized the risk to shortnose sturgeon and robust redhorse by failing to consider their depleted baseline.[100]

3. In determining whether a proposed project will have a significant impact on the environment, the NRC Staff must consider the reasonably anticipated cumulative impacts

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[100] Duke Energy Corp. (McGuire Nuclear Station, Units 1 & 2; Catawba Nuclear Station, Units 1 & 2), CLI-03-17, 58 NRC 419, 431 (2003).

of the project.[101] "Cumulative impact" is defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions."[102] The cumulative impacts analysis requires the NRC Staff "to assess 'the *present effects* of past actions.'"[103] In this instance, the FEIS wholly disregards the impacts of past actions which have depleted the baseline populations of "important species" to the point that they are threatened with extinction. Thus, we conclude that the NRC Staff failed to take a "hard look" at cumulative impacts of the proposed cooling water intake structure, combined with "other past, present, and reasonably foreseeable future actions," on shortnose sturgeon, robust redhorse, and state-listed mussels.

4. After taking a "hard look" at a proposed action, "a project might be disapproved entirely, on the grounds that its adverse impacts are too severe."[104] In this case, we have found that the impacts (direct and cumulative) to the shortnose sturgeon and robust redhorse from the proposed cooling water intake structure will be LARGE. Therefore, we conclude that the ESP should be denied.

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[101] 40 C.F.R. § 1508.27(7).

[102] 40 C.F.R. § 1508.7.

[103] See Ohio Valley Envtl. Coalition v. Hurst, 2009 U.S. Dist. LEXIS 26339, 26358 (S.D. W. Virginia 2009)

[104] Private Fuel Storage, L.L.C., (Independent Spent Fuel Storage Facility), LBP-02-8, 55 NRC 171, 191 (2002)

PROPOSED FINDINGS OF FACT AND CONCLUSIONS OF LAW FOR EC 1.3

Findings of Fact

Feasibility of Dry Cooling

Technical Feasibility

1. The standard design for the AP1000 can be modified to accommodate any cooling system, wet or dry, as long as the cooling system maintains steam turbine backpressure within the design limitations established by Westinghouse.[105]

2. If Vogtle Units 3 and 4 utilize dry cooling, then – to maintain the appropriate backpressure – the air cooled condenser (the "ACC") would likely require a high backpressure turbine.[106] While there are none currently in existence, such a turbine could be designed to handle the 8.4 million pounds per hour of steam to be produced by the AP1000.[107]

3. Moreover, a dry cooled turbine could support the 1,117 megawatt capacity of the AP1000. In fact, General Electric committed to build (but has not actually built) an exclusively dry cooled, triple exhaust turbine with a 1,500-plus megawatt capacity (the "ESBWR").[108] The ESBWR uses the same basic turbine design as the AP1000.[109]

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[105] Powers Direct Testimony for EC 1.3 at A12, A20; Tr. 1119:18-20; Tr. 1220:16-18; see also Tr. 982:9-11 (SNC's expert states that he doesn't "believe that the AP-1000, the standard plant, precludes any technology."); Tr. 1012:10-12 (SNC's expert states that cost aside, a dry-cooling system is feasible.); Tr. 1240:11-16 (SNC's expert states that "Westinghouse and GE are all advocating the standard concepts of their plants allowing the end user and the site specific[s] to determine the viability, feasibility of what type of cooling system to pursue according to their individual site specific[s].").

[106] Tr. 999:24-1000:2; Tr. 1203:20-22.

[107] Tr. 1119:18-20; Tr. 1210:9-15; Tr. 1212:3-23; see also Tr. 998:25-999:3 (SNC's expert states that there are suppliers that "would love to sell us that large of an air-cooled condenser ….").

[108] Tr. 1212:12-17; Tr. 1215:5-1216:1; 1219:25-1220:18; see also JTIR00050 and JTI000051.

[109] Tr. 1279:1-19.

4. The modifications required to the standard AP1000 design to accommodate a dry cooling system, utilizing a high backpressure turbine to support the 1,117 megawatt capacity, are not extensive.[110] Rather, the modification is very basic – all that is required is removal of the "last-stage bucket."[111] Removal of the "last-stage bucket" from a standard turbine to adapt it to a high backpressure turbine for use in an ACC design is a universally understood modification.[112] While such modification would require certain parts of the design control document to be reanalyzed, in light of the large scope of the proposed project, this additional analysis is relatively minor.[113]

5. To date, the largest power plant in the world utilizing high backpressure, ACC turbines is the Matimba plant in South Africa.[114] For over 15 years, Matimba has used 6 turbines, each operating at just under 700 megawatts, for a total capacity of 4,000 megawatts.[115] While the AP1000 has a 1,117 megawatt capacity, thus slightly exceeding the individual capacity of each turbine at Matimba, the Matimba plant (because of its 4,000 megawatt total capacity) still requires significantly more ACC cells than would be required to operate Vogtle Units 3 and 4 (with a total capacity of 2,234 megawatts).[116] Because Matimba's contiguous ACC has been constructed and operated on a much larger

[110] Powers Direct Testimony for EC 1.3 at A19.

[111] Tr.1160:25-1161:2; see generally Powers Direct Testimony for EC 1.3 at A19-A23.

[112] Tr. 1164:7-11.

[113] Tr. 1166:10-18.

[114] Tr. 978:25-979:2; Tr. 1210:22-25; see also Powers Direct Testimony for EC 1.3 at A26; see generally JTI000037.

[115] SNC000032; Tr. 1210:22-25; Tr. 1282:10; Cuchens Rebuttal Testimony for EC 1.3 at A9.

[116] Tr. 1282:2-10.

scale than what would be required at Plant Vogtle, concerns related to any "scaling-up" of the existing dry cooling technology to fit the AP1000 should be minimal.[117]

6. Large ACCs can be controlled and modulated to react to daily weather fluctuations, without impacting unit performance.[118] As demonstrated by the Matimba plant, installation of wind skirts can effectively mitigate against instantaneous five degree temperature shifts.[119] Moreover, as also demonstrated by Matimba, the "normal practice" of continuously operating all fans can further mitigate against the effects of temperature fluctuations.[120]

7. Thus, implementation of a dry cooling system would have little impact on the performance of Vogtle Units 3 and 4. While converting low backpressure turbines into high backpressure turbines could create a "slight impact on performance" in general,[121] any such impact would be most significant at the very high end of the ambient temperature range.[122] At all other ambient temperatures, the performance efficiency will not decrease significantly as a result of implementing dry cooling in place of the proposed wet cooling system.[123]

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[117] Tr. 1168:18-1169:2; Tr. 1282:2-10; Tr. 1282:25-1283:7.

[118] Tr. 1275:9-1276:6; Tr. 1278:8-22.

[119] Tr. 1275:9-17; Tr. 1278:8-22.

[120] Tr. 1275:18-1276:11.

[121] Tr. 1206:24.

[122] Tr. 1207:2; Tr. 1209:4-9.

[123] Id.

8. Furthermore, implementation of a dry cooling system would have no impact on the ability of the AP1000 to maintain a typical 95 percent capacity factor.[124] Due to the location of the fans and the incremental nature of repairs, necessary maintenance can be performed on a dry cooling system without compromising safety or operation.[125] Because individual fans can be isolated for maintenance, any necessary maintenance activities can occur while the nuclear power plant remains on-line.[126] Moreover, shutting down any individual fan, in a 200-plus fan system, will have an indistinguishable impact on backpressure or performance.[127]

Economic Feasibility

Operating Costs

9. In evaluating the cost difference between operating wet and dry cooling systems, parasitic operating loads and efficiency penalties are the most important considerations.[128] However, maintenance costs must also be considered.[129]

(i) When comparing mechanical draft wet cooling systems with mechanical draft dry cooling systems, or when comparing natural draft wet cooling systems with natural draft dry cooling systems, the differences in parasitic operating load and efficiency impacts are relatively minor.[130] In fact, under certain scenarios, the parasitic

[124] Tr. 1257:10-14.

[125] Tr. 1257:25-1258:6; Tr. 1259:11-22; Tr. 1260:17-1261:3.

[126] Tr. 1257:15-20; Tr:1257:25-1258:6; Tr. 1259:11-22; Tr. 1261:15-18; Tr. 1262:3-5.

[127] Tr. 1260:25-1261:3.

[128] Tr. 1247:2-5.

[129] See generally, Tr. 1247:7-11.

[130] Tr. 1223:1-1225:12; Tr. 1234:6-16.

load advantage goes to the dry cooling system.[131] Only an impacts comparison between a natural draft wet cooling system and a mechanical draft dry cooling system gives a substantial parasitic load and energy efficiency advantage to a wet cooling system.[132] Such a comparison is inaccurate and biased because it eliminates the fan load penalty only for the wet cooling system.[133]

(ii) There are significant maintenance costs associated with both wet and dry cooling systems.[134] Because ACCs operate in clean, ambient air, rather than the high total dissolved solids and high humidity environment of wet cooling systems, maintenance costs associated with dry cooling are likely less than, but in any event not exceptionally more than, the maintenance costs associated with wet cooling systems.[135]

10. In evaluating the cost difference between operating wet and dry cooling systems, the NRC Staff conceded that it did "not get into doing a detailed quantitative assessment."[136] In fact, the NRC Staff wholly failed to calculate the efficiency penalty of a dry cooling system – simply stating that there may be "some" penalty associated with dry cooling, but failing to state whether "some" constituted "a lot" or "a little."[137]

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[131] Tr. 1234:7-9.

[132] SNCR00024; Tr. 1233:23-1234:16; Tr. 1241:14-18.

[133] Tr. 1226:8-18; Tr. 1233:23-1234:16; Tr. 1243:17-1244:9.

[134] See generally Tr. 1247:7-11; Tr. 1250:20.

[135] Tr. 1250:24-1251:22.

[136] Tr. 1070:18-1071:9; see also Staff EC 1.3 Direct Testimony at A14; Powers EC 1.3 Revised Rebuttal Testimony at A4; see generally NRC000001 at 9-26 and 9-27.

[137] Tr. 1070:18-1071:11; see generally NRC000001 at 9-26 and 9-27.

Capital Costs

11. An ACC requires an additional $200 million in capital costs over a wet cooled system.[138] Each individual Vogtle Unit, however, will cost approximately $7 billion to build.[139] Thus, utilization of an ACC system would result in only a 2-3% increase in capital costs for each of the Vogtle Units.[140]

Land Development and Licensing Costs

12. Based on an assumption that the ACC will require 324 cells, SNC concluded that utilization of a dry cooling system could result in a 248.9 acre footprint.[141] However, the 324 cell system represents an unrealistic, worst-case scenario.[142] More likely, a state-of-the-art 202 cell ACC would be implemented at Vogtle Units 3 and 4.[143] The footprint of this 202 cell unit would be roughly two-thirds the size of a 324-cell unit.[144] With such a reduced footprint, SNC would not be required to develop significantly more land than that which it was planning to develop to house its proposed wet cooling system.[145] Accordingly, implementation of dry cooling would not result in substantial increases land development costs.[146]

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[138] Tr. 1152:13-1153:8 (citing SNCR00024).

[139] Tr. 1153:3-8; Tr. 1280:18-24.

[140] Tr. 1279:13 - 1280:24.

[141] Moorer Direct Testimony for EC 1.3 at A8 and A9 (citing Cuchens Direct Testimony for EC 1.3 at A22).

[142] Tr. 1024:10-22.

[143] Tr. 997:21-24; Tr. 1167:3-12; Powers Rebuttal Testimony for EC 1.3 at A5.

[144] Tr. 1025:8-11; Tr. 1057:24-25.

[145] Tr. 1025:8-11; Tr. 1057:24-25; see also Powers Rebuttal Testimony for EC 1.3 at A5.

[146] See generally, Powers Rebuttal Testimony for EC 1.3 at A4; Staff Rebuttal Testimony for EC 1.2 at A11.

13. There are likely no significant licensing costs associated with implementation of a dry cooling system. The biggest impact to licensing may be scheduling delays, but any such delays are purely speculative at this time.[147]

Impacts on Aquatic Species

14. The robust redhorse (a state-listed endangered species) and shortnose sturgeon (a federally-listed endangered species) are present around the Plant Vogtle site.[148] Construction and operation of a wet cooled system would likely impact these species.[149] In addition, the proposed wet cooling system could impact numerous other aquatic species, including mussels.[150]

15. Nevertheless, the NRC Staff concluded that impacts of a wet cooling system on all aquatic biota would be SMALL.[151] Based on this conclusion, it conducted only a cursory analysis of dry cooling impacts.[152] The NRC Staff conceded, however, that a more detailed analysis of the dry cooling alternative would have been required if the wet cooling system caused impacts on aquatic biota to exceed the SMALL threshold.[153]

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[147] Tr. 1256:20-1257:3.

[148] NRC00001 at 2-88 and 2-89; Young Rebuttal Testimony for EC 1.3 at A6; EC 1.2 Finding of Fact at 4 and 11; see also Staff Direct Testimony for EC 1.3 at A19; Coutant Direct Testimony for EC 1.3 at A6 (stating that the robust redhorse and shortnose sturgeon are present in the Savannah River watershed).

[149] EC 1.2 Findings of Fact at 9 and 15; see also Young Rebuttal Testimony for EC 1.3 at A3-5 and A7-11.

[150] EC 1.2 Finding of Fact at 20.

[151] NRC000001 at Chapters 4.0 and 5.0.

[152] Tr. 1070:18-20; Tr. 1071:7-9

[153] Staff Direct Testimony for EC 1.3 at A16; Tr. 1071:23-1072:2; Tr. 1072:23-24.

16. Dry cooling would largely eliminate impacts on all aquatic biota, by eliminating thermal and chemical discharges as well as losses of organisms due to impingement and entrainment.[154]

Conclusions of Law

1. NEPA requires the NRC to analyze all reasonable alternatives to the actions proposed by SNC, including alternatives to the dry cooling system.[155]

2. While section 316(b) of the Clean Water Act does not require air cooling as the best available technology, consideration of dry cooling has not been wholly removed from the requisite NEPA analysis. Rather, pursuant to the Environmental Protection Agency (the "EPA") in its December 18, 2001 rulemaking entitled "National Pollutant Discharge Elimination System; Regulations Addressing Cooling Water Intake Structures for New Facilities; Final Rule" (the "EPA Rulemaking"), when "extremely sensitive biological resources" are present, "dry cooling may be the appropriate cooling technology."[156]

3. Although the EPA Rulemaking fails to fully define the term "extremely sensitive biological resources," at the least this term includes endangered species.[157] Accordingly, the robust redhorse and shortnose sturgeon (both of which are federally or state listed endangered species) are "extremely sensitive biological resources."

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[154] NRC000001 at 9-26 and 9-27; Staff Direct Testimony for EC 1.3 at A10.

[155] 42 U.S.C. § 4332(2) (2006); ESRP (NUREG-1555), 9.4.1 (July 2007); 10 C.F.R. § 51.90 (incorporating by reference 10 C.F.R. §51.71; 10 C.F.R. § 51.45(b)(3)).

[156] 66 Fed. Reg. 65,256, 65,282 (Dec. 18, 2001) (NRCR00035).

[157] 66 Fed. Reg. 65,256, 65,282 (Dec. 18, 2001) (NRCR00035) (providing as an example of extremely sensitive biological species, "endangered species, specially protected areas."); see also Tr. 1068:2-19.

4. Because NEPA requires an analysis of cooling alternatives, and because "extremely sensitive biological resources" are present at the VEGP site, utilization of a dry cooling system must be meaningfully considered. The viability of a dry cooling alternative, however, cannot be viewed in isolation. Rather, the impacts of a dry cooling system and a wet cooling system should be weighed against each other.[158]

5. Based on the inaccurate conclusion that the impacts of a wet cooling system would be SMALL, the NRC Staff and SNC inappropriately and prematurely dismissed dry cooling from consideration. As noted in the EC 1.2 Findings of Fact, the impacts of wet cooling on aquatic biota may actually be LARGE.[159]

6. By contrast, dry cooling, which is both technically and economically feasible, will largely eliminate impacts on aquatic biota, including "extremely sensitive biological resources."[160]

7. The burdens associated with dry cooling, when compared to wet cooling, include a slight reduction in energy efficiency, a small increase geographical footprint, and a relatively insignificant increase in capital costs. The benefits associated with dry cooling, when compared to wet cooling, include the almost complete elimination of impacts to aquatic biota, including "extremely sensitive biological species." In this instance, the benefits associated with a dry cooling system outweigh the burdens. Accordingly, dry cooling should be implemented at Plant Vogtle.

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[158] 66 Fed. Reg. 65,256, 65,282 (Dec. 18, 2001) (NRCR00035); 10 C.F.R. § 51.90, referencing 10 C.F.R. § 51.71, referencing 10 C.F.R. §51.45(b)(3); see also Tr. 1049:14-1050:6.

[159] EC 1.2 Findings of Fact at 9 and 15; see also EC 1.2 Findings of Fact at 20.

[160] NRC000001 at 9-26 and 9-27.

8. Pursuant to the NRC's hearing notice of October 12, 2006, this Board therefore finds that (1) the requirements of sections 102(A), (C), and (E) of NEPA regarding consideration of alternatives have not been satisfied in this case; (2) having conducted its own independent balancing of the conflicting environmental and other factors, that the overall balance does not support issuance of the ESP with a wet cooling system; and (3) protection of the environment requires denial of the ESP.

9. Thus, because the benefits of dry cooling outweigh the burdens, this Board cannot issue the ESP as requested, with a wet cooling system. Accordingly, and pursuant to 10 C.F.R. §52.24(a), we conclude that the ESP should be denied.

EC 6.0 PROPOSED FINDINGS OF FACT AND CONCLUSIONS OF LAW

Findings of Fact

Connected Actions

1. SNC intends to barge the large nuclear reactor components of Units 3 and 4 on the Savannah River Federal Navigation Channel (the "FNC") to the VEGP site because of the ease of delivery, cost, and accessibility of barging.[161] In fact, both before and after the filing of the ESP application, SNC made plans and investments in anticipation of barging.[162]

2. Neither SNC nor the NRC Staff has meaningfully considered any mode of

[161] Tr. 1331:2-1332:3; Tr. 1342:19-1343:24; see also Neubert, Smith, and Scott Direct Testimony for EC 6.0 at A6 (testifying that barging is the most efficient and cost effective means of transporting reactor components).

[162] See SNC ESP Application, Part 3, Environmental Report ("ER") at 3.9-3, 3.9-5 (ESP application includes design for barge slip and haul road); Neubert, Smith, and Scott Direct Testimony for EC 6.0 at A20 (indicating that SNC planned to construct a barge slip and hired surveyors to assess the dredging necessary to render the FNC navigable); Tr. 1311:20-23 (SNC hired Captain Scott to monitor the Federal Navigation Channel before and during barging).

transporting large reactor components to the VEGP site other than barging.[163]

3. Transportation of large reactor components upstream by barge at current river flows is not possible due to the shallow river depths.[164] Under the current condition of the FNC, previous shipments have required a flow of 10,000 cfs.[165]

4. While there are no studies regarding the minimum river flow needed to support the barging proposed by SNC without dredging, given recent drought conditions, a significant amount of rain would be required to sufficiently increase river flows.[166] As many as 60 barge trips may be required over a period of two to three years to transport the large reactor components, and it is unreasonable to expect increased flows to last for the requisite duration.[167] In addition, due to shipment scheduling concerns, SNC does not find it prudent to "wait on it to rain."[168] Accordingly, to support barging, dredging is required.[169]

5. The FNC has not been dredged in thirty years.[170] Absent a request from SNC to

[163] Tr. 1322:17-18; see also Tr. 1369:15-1370:6 (indicating that the infrastructure upgrades required for transportation by truck or rail have not been analyzed); Tr. 1522:22-1523:15 (indicating that trucking and rail as an alternative to barging was only considered by the NRC Staff to the extent of general construction equipment being brought onto the site or leaving the site; it was not considered as an alternative for transportation of large components).

[164] Corps Direct Testimony for 6.0 at A7; see also Staff Direct Testimony for EC 6.0 at A14 (providing that barging is possible only during high flow periods); Neubert, Smith, and Scott Direct Testimony for EC 6.0 at A14 (providing that navigation would be feasible only during high flows).

[165] Corps Direct Testimony for EC 6.0 at A7 and A15; Tr. 1330:3; Tr. 1440:25-1441:1.

[166] Corps Direct Testimony for EC 6.0 at A15; Tr. 1328:24-25; Tr. 1349:13-1350:2.

[167] Tr. 1304:22; Tr. 1324:15-18; Neubert, Smith, and Scott Direct Testimony for EC 6.0 at A7.

[168] Tr. 1349:25.

[169] Neubert, Smith, and Scott Direct Testimony for EC 6.0 at A18, A20; Tr. 1349:22-25.

[170] NRC000001 at 4-27; Tr. 1340:5; Tr. 1450:4; Staff Direct Testimony for EC 6.0 at A13.

dredge the FNC to support its barging, the Corps would not pursue dredging.[171]

6. While a formal dredging proposal or permit application was not submitted by SNC to the Corps regarding dredging of the FNC,[172] the absence of such a formal request does not negate the facts set forth in 1-5 above – namely, that (i) SNC intends to barge large reactor components to the VEGP site, and thus dredge the FNC, and (ii) absent a request, the Corps would not pursue such dredging. SNC strategically refrained from submitting a formal request to the Corps until the Plant Vogtle project was certified by the Georgia Public Service Commission.[173] Thus, the absence of a formal request simply represents a business strategy relating to timing and not an indication of SNC's intent to dredge.

NRC Staff's Consideration of the Environmental Impacts of Dredging in the FEIS

7. The NRC Staff did not meaningfully analyze the environmental impacts of dredging the FNC in the FEIS;[174] instead, it chose to rely solely on statements made by SNC that no dredging would be required.[175] However, any such statements made by SNC run counter to SNC's ESP application,[176] and subsequent testimony, [177] which

[171] Tr. 1450:11-13.

[172] Corps Direct Testimony for EC 6.0 at A8.

[173] Tr. 1371:14-20. Such a certification was received on March 17, 2009.

[174] See generally NRC000001 at 7-20 (noting that "a detailed analysis [of dredging impacts] has not been conducted …").

[175] Tr. 1484:16-24; Tr. 1485:14-15; Tr. 1556:19-22; Tr. 1558:20-21.

[176] ER at 2.5-10 ("SNC plans to utilize the Savannah River Navigation channel to support delivery of large components and modules for construction of Units 3 and 4."); see also ER at 3.9-5 ("Large module component shipments will arrive by barge, be offloaded at the barge facility, and transported over the heavy haul road to the fabrication assembly area.").

[177] Tr. 1304:21-22; Tr. 1331:8; Tr. 1349:22-25.

provide that barging is SNC's preferred method of transporting large reactor components (requiring approximately 60 shipments), and barging would require dredging.

8. Moreover, the NRC Staff's conclusion that dredging would not be required (and thus a meaningful impacts analysis in the FEIS was not necessary), was in direct opposition to comments to the DEIS submitted by the Corps and other environmental agencies.[178] The NRC Staff, however, gave no weight to these comments.[179] In fact, upon receipt, the NRC Staff did not contact the Corps or the commenting agencies.[180]

9. In addition, the NRC Staff did not issue any requests for additional information ("RAIs") to SNC to clarify the apparent inconsistency between SNC's claim that no dredging of the FNC would be required, and the Corps' and other environmental agencies' claims that dredging was reasonably foreseeable.[181] Furthermore, the NRC Staff did not ask SNC how many barge trips it estimated making on the FNC – a number important if the NRC Staff actually believed that increased river flows could support the barging without the need for dredging.[182] The NRC Staff conceded that such RAIs should have been issued.[183]

10. Not only did the NRC Staff fail to investigate the likelihood of dredging in preparing the FEIS, the NRC Staff also failed to complete any quantitative studies to

[178] NRC000001 at E-56; Tr. 1486:6-13; Tr. 1492:1-11; Tr. 1556:3-17.

[179] Tr. 1492:1-9; Tr. 1497:11-16; Tr. 1557:19-1558:2.

[180] Tr. 1553:12-15; Tr. 1556:3-17.

[181] Tr. 1495:9-18; Tr. 1556:19-22; 1560:17-21.

[182] Tr. 1496:6-1497:1; Tr. 1557:24-1558:2.

[183] Tr. 1560:21.

determine the potential environmental impacts of dredging.[184] Such failure can be attributed to a lack of information.[185] The NRC Staff conceded that it did not have the information and project details required to conduct an adequate qualitative analysis.[186] Thus, the NRC Staff reached its conclusion that dredging impacts "could be moderate" based solely on its determination that (i) contrary to all indications, SNC would not likely dredge the FNC, and (ii) the FNC had not been dredged since 1979.[187] This weakly substantiated "conclusion" represents more of a potential range of impacts, instead of a scientifically supported impact prediction.[188]

11. The NRC Staff also failed to consider mitigation measures; instead, it simply listed potential mitigation measures that may be instituted, based not upon concrete data or analysis, but rather upon the NRC Staff's "previous experience."[189]

12. Thus, rather than giving serious consideration to the likelihood of dredging the FNC, the potential impacts of such dredging, and possible mitigation measures, the NRC Staff simply set forth in the FEIS "a general idea about the kinds of impacts" dredging could have and the "potential mitigation measures" that could be imposed.[190] This cursory treatment of dredging impacts was made to appease the Corps and other

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[184] NRC000001 at 7-20 and 7-21; Tr. 1526:10-13; Tr. 1487:9-10; Tr. 1554:12-1555:10.

[185] See generally NRC000001 at 7-21 ("At the present time the dredging project is incompletely defined, the amount of material to be removed is unknown, and the locations of the dredged material disposal areas have not been identified.").

[186] Tr. 1526:10-13.

[187] Tr. 1554:12-1555:10.

[188] Tr. 1526:10-13.

[189] NRC000001 at 7-21; Staff Direct Testimony for EC 6.0 at A32; Tr. 1562:204.

[190] NRC000001 at 7-21; Tr. 1486:6-13; Tr. 1562:204.

commenting agencies, not to serve as a true impacts analysis.[191]

13. The NRC Staff justified its cursory treatment of dredging impacts in part because it assumed that "these impacts would be evaluated in more detail in the NEPA analysis that would need to be conducted by the [Corps]."[192]

Additional Information Regarding Dredging Impacts Introduced after Publication of the FEIS

Navigation Survey

14. In July 2008, at the request of SNC, Capt. Scott conducted a navigational survey of the FNC and noted locations with depths of less than 6 feet.[193] Based on this survey, SNC projected that there were "8 locations along the Savannah River where a total of only approximately 36,500 cubic yards of dredged material would need to be removed."[194]

15. This projection is flawed because (i) it is based upon insufficient data, (ii) it presumes an unrealistic and unsafe under-keel clearance, and (iii) it relies upon SNC's depth requirements while presuming the Corps will conduct the dredging.

(i) In conducting the survey, Capt. Scott collected data every tenth of a

[191] Tr. 1560:10-16.

[192] NRC000001 at 7-21.

[193] Nuebert, Smith, and Scott Direct Testimony for EC 6.0 at A13 and A1; Tr. 1301:25-1302:1. In the February 9, 2009, version of his Prefiled Direct Testimony, Capt. Scott testified that the survey noted locations with depths of 5 feet – not 6 feet. The change to 5 feet was made in the March 6, 2009, version. This is a significant change, given that the barge is predicted to have an operational draft of 5.5 feet. Neubert, Smith, and Scott Direct Testimony for EC 6.0 at A19; Tr. 1301:21-22. Mr. Neubert testified that this change was a simple error, because "we were looking for depths that were less than six feet, which meant that anything that was in the five foot range was something we wanted to take a closer look at, and so we had that five foot in our mind …." Tr. 1301:25-1302:3.

[194] Nuebert, Smith, and Scott Direct Testimony for EC 6.0 at A5.

mile.[195] While such data may be sufficient for navigation purposes, Capt. Scott conceded that the survey is not accurate enough to "calculate finite areas of dredging to determine total cubic yards of spoil that are removed."[196] Thus, the survey is only "preliminary" and cannot be used to provide "precise and comprehensive information regarding the extent of dredging."[197]

(ii) Although the barge is predicted to have an operational draft of 5.5 feet,[198] SNC reasoned that locations with depths of more than 6 feet would not require dredging because 0.5 feet of under-keel clearance was presumed to be sufficient.[199] However, 0.5 feet is "far less than recommended by EM 1110-2-1100 (USACE 2002) to compensate for vessel squat and safety clearance."[200] According to Dr. Hayes, "[s]afe vessel passage under these conditions [with only 0.5 feet of clearance] may be difficult. A dredging depth of 7 feet or greater is probably more realistic."[201] In addition, the operational draft was calculated when the vessel was standing still.[202] While underway, the barge's draft will increase, reducing even further the amount of under-keel clearance, and thus making safe passage even less certain.[203]

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[195] Tr. 1313:14-15.

[196] Tr. 1313:17-22; Tr. 1314:11-12.

[197] Moore Direct Testimony for EC 6.0 at Q12 & A12.

[198] Tr. 1301:21-22.

[199] Tr. 1312:8-9.

[200] Hayes Rebuttal for EC 6.0 at A5.

[201] Hayes Prefiled Rebuttal at A5; Tr. 1584:21-22.

[202] Tr. 1373:8-9.

[203] Tr. 1583:20-23.

(iii) SNC expects the Corps to dredge the FNC.[204] Based on the Corps usual practice, it would likely dredge the FNC to its authorized depth of 9 feet – not the 6 feet proposed by SNC and reflected in the survey.[205]

16. Moreover, the NRC Staff concluded that the survey is insufficient for its impact analysis.[206]

Sediment Studies

17. No analysis of the sediment at the potential dredging sites has been conducted to determine (i) whether contaminated sediments will be disrupted during dredging, and (ii) the possible environmental impacts resulting from such disruption.[207]

18. No analysis has been conducted to determine the impacts of disposal of the dredged spoil, including impacts resulting from the opening of a spoil disposal facility.[208] While the NRC Staff conceded that it was important to consider such impacts, the NRC Staff did not have the necessary information to conduct an impacts analysis.[209]

Mussel Studies

19. Within the shifting sand habitats (the likely habitat of the proposed dredged sites), mussels – including species of concern – can be present in fairly high abundance.[210]

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[204] Tr. 1316:18-25; Tr. 1558:21-24.

[205] Tr. 1320:8-10.

[206] Tr. 1533:12-17.

[207] Tr. 1528:5-9.

[208] Tr. 1525:15-22; Tr. 1346:13-16; see generally NRC000001 at 7-20 ("At the present time … the locations of the dredged material disposal areas have not been identified.").

[209] NRC 000001 at 7-20; Tr. 1525:15-22.

[210] Tr. 1600:13-1601:16 (explaining NRC000005); Tr. 1602:18-21.

However, SNC did not conduct mussel surveys at the proposed dredge sites.[211] Accordingly, the specific species and number of mussels located at the proposed dredging sites remains unknown, and thus the impacts of dredging on these mussels cannot be assessed.[212]

Snag Removal

20. To permit barging, SNC estimates that approximately 277 snags will need to be removed at 180 different locations along the FNC.[213]

21. The snags and woody debris currently provide shear and velocity breaks for aquatic species.[214] The robust redhorse, other fish species, and mussels tend to congregate in the trees around the breaks.[215] In fact, the robust redhorse often nests in a specific tree, migrates down stream to spawn, and then later returns to the exact same tree.[216]

22. No study has been conducted that denudes or removes snags and woody debris from a robust redhorse habitat and monitors the impacts on the fish.[217] Without such a study, it is scientifically unreasonable to conclude – in light of the robust redhorse's practice of faithfully returning to the same trees – that snag removal would not impact the

[211] Coutant Rebuttal for 6.0 at A6.

[212] Tr. 1528:24-1529:1.

[213] SNCR00051; Neubert, Smith, and Scott Direct Testimony for EC 6.0 at A20.

[214] Tr. 1361:7-12; Young Rebuttal Testimony for EC 6.0 at A4.

[215] NRC000017; Tr. 1612:15-18.

[216] Tr. 1613:1-7 (explaining NRC000017).

[217] Tr. 1615:12-14.

vulnerable species.[218]

Releases from Upstream Reservoirs

23. The NRC Staff did not consider environmental impacts from upstream releases in the FEIS for purposes of barging the FNC because the NRC Staff assumed that barging would be feasible during "high flows."[219] The NRC "Staff assumed these high flows would occur as a result of the Corps' implementation of the flood control release curve, rather than being scheduled for the specific purpose of allowing barging."[220]

24. In making this assumption, the Staff did not determine the minimum river flow necessary to support the barging by SNC.[221] In fact, the minimum river flows necessary to support barging generally have not even been established by the Corps.[222] The NRC Staff just assumed that whatever flow was required would be made available by the Corps as a result of normal operation.[223]

25. The last barge shipment on the FNC required a release of 10,000 cfs for about two weeks to support navigation without dredging.[224] Two-week sustained releases of 10,000 cfs into the FNC have occurred only three to four times in the past 20 years.[225]

26. Because SNC intends to make 60 barge trips, releases would be required not over

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[218] Tr. 1613:16-18.

[219] Staff Direct Testimony for EC 6.0 at A14.

[220] Staff Direct Testimony for EC 6.0 at A14; see also Tr. 1538:14-19; Tr. 1540:3-1541:7.

[221] Staff Direct Testimony for EC 6.0 at A15.

[222] Corps Direct Testimony for EC 6.0 at A15.

[223] Staff Direct Testimony for EC 6.0 at A14 and A15; Tr. 1538:14-19.

[224] Corps Direct Testimony for EC 6.0 at A7 and A15; Tr. 1440:2-1441:14.

[225] Tr. 1441:17-18.

a two week period, but rather over a 2-3 year period.[226] The amount of water required to support the requisite flows over the extended duration would cause serious concern to the Corps, especially in drought conditions.[227] Moreover, such releases could cause significant environmental impacts to aquatic species, including disrupting spawning patterns and critical habitat.[228]

Conclusions of Law

1. With respect to EC 6.0, this Board has determined that dredging the FNC is a "connected action" to the NRC's issuance of the ESP to SNC.[229]

2. Because dredging the FNC is a "connected action" to the issuance of the ESP, this Board is required, under NEPA, to take a "hard look" at the environmental impacts arising from dredging.[230]

3. NEPA requires evaluation of proposals for prospective federal action.[231] Consequently, the NRC must take its hard look at the environmental impacts stemming from the issuance of the ESP before the ESP is issued.

4. This Board cannot take the requisite hard look at the environmental impacts of dredging because (i) the NRC Staff's consideration of the environmental impacts of dredging in the FEIS was insufficient, and (ii) subsequent studies purporting to address

[226] Tr. 1324:15-18; Neubert, Smith, and Scott Direct Testimony for EC 6.0 at A7.

[227] Tr. 1448:25-1449:3.

[228] Tr. 1449:4-25.

[229] 10 C.F.R. § 1508.25(a)(1)(i) & (iii); NUREG-1555 at 4.2.2, 4, 5.

[230] 42 U.S.C. § 4332(2)(C) (2006); 10 C.F.R. Part 51; id. § 1508.25(a)(1)(i), (iii); NUREG-1555 at 4.2.2, 4, 5.

[231] 42 U.S.C. § 4332(2)(C); Richland Park Homeowners Assoc. v. Pierce, 671 F.2d 935, 941 (5th Cir. 1982) (observing that "the basic thrust of … NEPA … is to provide assistance for evaluating proposals for prospective federal action").

the environmental impacts associated with dredging – including navigation, sediment, mussel, and snag removal studies – were inadequate.

5. Given that the Board cannot take the requisite hard look at the environmental impacts of dredging now, before the ESP is issued, subsequent studies of the environmental impacts of dredging by the Corps or any other entity would not satisfy the NRC's obligations under NEPA.

6. With respect to mitigation, the FEIS presents a list of potential measures which may be implemented to ameliorate the negative impacts of dredging the FNC, and the NRC Staff concludes that the impacts "could be MODERATE, depending on the type of mitigation."[232] In their Pre-Filed Direct Testimony for EC 6.0, the NRC Staff similarly speculates about mitigation measure the Corps might take.[233] However, "'mere listing of mitigation measures, without supporting analytical data," is insufficient to support a finding that impacts will be MODERATE.[234] This Board may not defer to the NRC Staff's "bald assertions that mitigation will be successful."[235] As a result, the NRC Staff failed to take a "hard look" at the foreseeable impacts of dredging the FNC. Moreover, this defect was not cured by testimony and evidence presented at the evidentiary hearing. Thus, this Board is unable to take the requisite "hard look" at the potential impacts.

7. Finally, this Board concludes that, in addition to assessing the environmental impacts of dredging, we must also take a "hard look" at the environmental impacts of

[232] NRC000001 at 7-20

[233] Staff Direct Testimony for EC 6.0 at A32.

[234] National Parks & Conservation Ass'n v. Babbitt, 241 F.3d 722, 734 (9th Cir. 2001) (internal quotations and citations omitted).

[235] Wyoming Outdoor Council v. United States Army Corps of Eng'rs, 351 F. Supp. 2d 1232, 1252.

upstream releases under NEPA.[236] In the event dredging does not occur, upstream releases of waters into the FNC will be required to support navigation, and are accordingly "connected actions" to the issuance of the ESP.[237] The record, however, lacks any analysis of the environmental impacts of upstream releases. Consequently, this Board cannot take the requisite "hard look" at the environmental impacts of upstream releases.

8. Because this Board cannot satisfy its NEPA obligations with respect to assessing the environmental impacts related to dredging and upstream water releases, pursuant to 10 C.F.R. § 52.24(a), we hereby deny issuance of the ESP.

For the foregoing reasons, it is [on this date], ORDERED, that, in accordance with 10 C.F.R. § 2.340(f), this decision to deny issuance of the ESP shall become effective immediately. Further, in accordance with 10 C.F.R. § 2.713, this decision shall constitute the final decision of the NRC forty (40) days from the date of issuance, unless a petition for review is filed in accordance with 10 C.F.R. § 2.341, or unless the NRC directs otherwise.

[236] 42 U.S.C. § 4332(C).

[237] 10 C.F.R. § 1508.25(a)(1)(i), (iii); NUREG-1555 at 4.2.2, 4, 5.

Respectfully submitted this 24th day of April, 2009,

/signed (electronically) by/

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

In the Matter of	)	
	)	
SOUTHERN NUCLEAR OPERATING COMPANY	)	Docket No. 52-011-ESP
	)	
	)	
(Early Site Permit for the Vogtle ESP Site)	)	April 24, 2009

CERTIFICATE OF SERVICE

I hereby certify that copies of the foregoing **JOINT INTERVENORS' PROPOSED FINDINGS OF FACT AND CONCLUSIONS OF LAW** were served upon the following persons by Electronic Information Exchange and/or electronic mail.

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