UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	**)**	**Docket No. 52-011-ESP**
	)	
Southern Nuclear Operating Company	**)**	**ASLBP No. 07-850-01-ESP-BD01**
	)	
(Early Site Permit for Vogtle ESP Site)	**)**	**May 22, 2009**

SOUTHERN NUCLEAR OPERATING COMPANY'S PROPOSED FINDINGS OF FACT AND CONCLUSIONS OF LAW REGARDING UNCONTESTED ISSUES

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Pursuant to 10 C.F.R. § 2.712(a)(1) and the Atomic Safety and Licensing Board's ("ASLB" or "Board") Nov. 13, 2008 scheduling order,[1] Southern Nuclear Operating Company ("SNC") submits its Proposed Findings of Fact and Conclusions of Law Regarding Mandatory Hearing Topics ("Proposed Findings and Conclusions") relative to SNC's application for an Early Site Permit ("ESP") and Limited Work Authorization ("LWA") for two nuclear power plants at the Alvin W. Vogtle Electric Generating Plant site near Waynesboro, Georgia.

The Proposed Findings and Conclusions address all findings required by the Notice of Hearing[2] and conclude all involved uncontested issues.

The Proposed Findings and Conclusions are based on the evidentiary record in this proceeding, and pursuant to 10 C.F.R. § 2.712(c), the proposed findings of fact and conclusions of law are set out in numbered paragraphs, with corresponding citations to the Mandatory Early Site Permit Hearing (the "Mandatory Hearing") that occurred March 23-25, 2009, in

[1] *Southern Nuclear Operating Co.* (Early Site Permit for Vogtle ESP Site), Docket No. 52-011-ESP, Memorandum and Order (Revised General Schedule) (Nov. 13, 2008) ("Nov. 13, 2008 Order").

[2] Notice of Hearing and Opportunity to Petition for Leave to Intervene on An Early Site Permit for the Vogtle ESP Site," 71 Fed. Reg. 60,195 (Oct. 12, 2006) ("Notice of Hearing").

Waynesboro, Georgia. Transcript of SNC Early Site Permit Hearing (March 23-25, 2009) ("Transcript" or "Tr.-M-").

I. Procedural Background

1. On August 14, 2006, SNC submitted an Early Site Permit application in accordance with 10 C.F.R. Part 52 requesting approval for siting one or more new nuclear reactors at the existing Vogtle Electric Generating Plant ("VEGP" or "Vogtle") site.

2. SNC's application, which was accepted on September 19, 2006, included a Site Safety Analysis Report ("SSAR") and an Environmental Report ("ER").[3] The SSAR was prepared pursuant to 10 C.F.R. § 52.17(a)(1). The ER was prepared pursuant to 10 C.F.R. § 51.50(b). SNC's SSAR and ER are based on the Westinghouse AP1000 design, which was certified by the Commission and was promulgated as Appendix D to 10 C.F.R. Part 52. A request for an LWA pursuant to 10 C.F.R. § 52.17(c) and 10 C.F.R. § 50.10 was submitted in August 2006 seeking authority to perform excavation of the site and install engineered backfill and rebar for subsurface foundations for the nuclear island. The LWA request was amended on August 15, 2007, to eliminate pre-construction, or "LWA 1," activities after the revision to the LWA rule (Limited Work Authorizations for Nuclear Power Plants), 72 Fed. Reg. 57,416 (October 9, 20007) and on November 30, 2007, to eliminate the installation of rebar from the scope of the LWA.[4]

3. On October 12, 2006, pursuant to 10 C.F.R. § 2.104, the Nuclear Regulatory Commission ("Commission" or "NRC") issued the Notice of Hearing which notified interested parties that a hearing would be held to consider SNC's application for an ESP.[5]

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[3] In November 2006, SNC submitted a revised ER. Exhibit SNC000001.

[4] Limited Work Authorizations for Nuclear Power Plants, 72 Fed. Reg. 57,416 (October 9, 2007).

[5] Notice of Hearing, 71 Fed. Reg. 60,195.

4. The Commission appointed the Board pursuant to delegation by the Commission and the Commission's regulations.[6]

5. On December 11, 2006, Joint Intervenors[7] (then Joint Petitioners) filed a Petition for Intervention seeking to have seven contentions admitted arising under the National Environmental Policy Act ("NEPA"), two of which were admitted by the Board as Environmental Contentions ("EC") 1.2 and 1.3.[8] This initiated the contested portion of the hearing.

6. On August 30, 2007, the NRC Staff released the Safety Evaluation Report pursuant to NUREG-0800[9], which included open items.

7. On September 10, 2007, as part of its obligations under NEPA, the NRC Staff released its Draft Environmental Impact Statement ("DEIS"), which incorporated data from the original and subsequently revised ER, SNC's responses to the RAIs,[10] and information the NRC Staff compiled from other sources.[11]

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[6] *Southern Nuclear Operating Co.* (Early Site Permit for Vogtle ESP Site), Docket No. 52-011-ESP, Order (Establishment of Atomic Safety and Licensing Board) (Dec. 15, 2006); "Authority of Atomic Safety and Licensing Board to Rule on Certain Petitions," 37 Fed. Reg. 28,710 (Dec. 29, 1972); *see* 10 C.F.R. §§ 2.104, 2.300, 2.303, 2.309, 2.311, 2.318, and 2.321.

[7] Joint Intervenors include Atlanta Women's Action for New Directions, Blue Ridge Environmental Defense League, Center for a Sustainable Coast, Savannah Riverkeeper, and Southern Alliance for Clean Energy.

[8] *See In re Southern Nuclear Operating Co.* (Early Site Permit for Vogtle ESP Site), LBP-07-03, 65 NRC 237, 257 (2007); *Southern Nuclear Operating Co.* (Early Site Permit for Vogtle ESP Site), Docket No. 52-011-ESP, Memorandum and Order (Ruling on Dispositive Motion and Associated Motions to Strike Regarding EC 1.2) (Jan. 15, 2008); *Southern Nuclear Operating Co.* (Early Site Permit for Vogtle ESP Site), Docket No. 52-011-ESP, Memorandum and Order (Ruling on Motion to Admit New Contention) (October 24, 2008).

[9] "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Plants," NUREG 0800, Rev. 2 (June 1987).

[10] The NRC Staff issued, and SNC responded to, certain Requests for Additional Information ("RAIs"). In addition, SNC further revised its ER to supplement its earlier analysis.

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

8. On August 14, 2008, the NRC Staff issued the Final Environmental Impact Statement ("FEIS").[12]

9. In the FEIS, the NRC Staff concluded that "the potential cumulative impacts resulting from construction and operation would be SMALL and that mitigation would not be warranted" and also that "there are no environmentally preferable or obviously superior sites [and] that the construction activities defined at 10 C.F.R. § 50.10(a) and described in the site redress plan would not result in any adverse significant impact that cannot be redressed." The NRC Staff also concluded "that none of the alternative sites assessed is obviously superior to the VEGP site" and concluded by recommending to the Commission that, related to the environmental aspect of the proposed action, the ESP and LWA should be issued.[13]

10. Following publication of the FEIS, Joint Intervenors filed a motion to admit a new contention, EC 6.0, which was admitted by the Board on October 24, 2008, and was addressed in the contested portion of the mandatory hearing.[14]

11. On October 17, 2008, the Board issued a Memorandum and Order proposing initial written questions and potential presentation topics associated with the environmental portion of the mandatory hearing.[15] The topics contemplated by the Board in the October 17, 2008 Order were: (1) Water Use Impacts, (2) Radiological Impacts, (3) Environmental Impact of

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[12] Office of New Reactors, "U.S. NRC, [FEIS] for an [ESP] at the [VEGP] Site," NUREG-1872 (August 2008).

[13] Exhibit NRC000001 at § 11.7.

[14] Beginning in January 2009, the Board accepted pre-filed direct and rebuttal testimony on the contested issues, and the hearing on contested issues was held on March 16-19, 2009. Pursuant to the November 13, 2008 Order, the NRC Staff and SNC filed its Proposed Findings of Fact and Conclusions of Law Regarding Environmental Contentions on April 24, 2009.

[15] *Southern Nuclear Operating Co*. (Early Site Permit for Vogtle ESP Site), Docket No. 52-011-ESP, Memorandum and Order (Providing Initial Questions and Potential Presentation Topics Associated with Mandatory Hearing on Environmental Matters) (Oct. 17, 2008 Order).

Alternatives, (4) Seismic Evaluation, (5) Limited Work Authorization and Site Redress Plan, and (6) Deferrals to COL.

12. In the October 17, 2008 Order, the Board, after having reviewed the FEIS, submitted to SNC and NRC Staff a list of 30 specific questions regarding the FEIS. The Order explained that, while SNC could file responses, the NRC Staff was considered the principal respondent. SNC and the NRC Staff filed separate responses to the October 17, 2008 Order on November 7, 2008.

13. Following public comment on the open items in the Safety Evaluation Report, SNC's response to the Safety Evaluation Report open items, and the Advisory Committee on Reactor Safeguards ("ACRS") consideration of the Safety Evaluation Report with open items, NRC Staff released the Advanced Safety Evaluation Report ("ASER") on November 12, 2008 with no open items.

14. On December 5, 2008, the Board issued a Memorandum and Order providing initial written questions and potential presentation topics regarding the Safety Evaluation Report.[16] The topics contemplated by the Board in the December 5, 2008 Order were: (1) Seismic Evaluation, (2) Accidental Release and Transport of Radioactive Liquid Effluents, (3) Groundwater Impacts on Safety-related Structures, (4) Site Emergency Plan, (5) Deferrals to/Action Items for COL, and (6) Permit Conditions.[17]

15. In the December 5, 2008 Order, the Board, after having reviewed the ASER, set out a list of 32 specific questions regarding safety related issues, explaining that, while SNC

[16] *Southern Nuclear Operating Co.* (Early Site Permit for Vogtle ESP Site), Docket No. 52-011-ESP, Memorandum and Order (Providing Initial Questions and Potential Presentation Topics Associated with Mandatory Hearing on Safety Matters) (Dec. 5, 2008) ("Dec. 5, 2008 Order")

[17] *Id.*

could file responses, the NRC Staff was considered the principal respondent. SNC and the NRC Staff filed separate responses to the December 5, 2008 Order on January 16, 2009.

16. On December 3-4, 2008, the ACRS reviewed the Final Safety Evaluation Report and questioned SNC and NRC Staff regarding its contents. Based on its review of the safety issues, the ACRS concluded that the permit should be issued.[18]

17. On February 5, 2009, NRC Staff released the Final Safety Evaluation Report ("FSER").[19] No contentions were submitted regarding safety issues.

18. In the FSER, the NRC Staff concluded that VEGP site characteristics comply with the requirements of 10 C.F.R. Part 100, "Reactor Site Criteria," subject to the limitations and conditions proposed in the SER, that the proposed Vogtle Units 3 and 4 can be constructed and operated without undue risk to the health and safety of the public, and that the proposed inspections, tests, analyses and acceptance criteria ("ITAAC") for emergency planning are necessary and sufficient to assure that the facility will be constructed and operated in conformity with the license and the requirements of the Atomic Energy Act. Accordingly, the NRC Staff concluded in the FSER that issuance of the ESP will not be inimical to the common defense and security or to the health and safety of the public.[20]

19. In an order dated February 23, 2009,[21] the Board established the following list of topics for presentation at the Mandatory Hearing:

- Presentation 1: Water Use Impacts (Environmental)

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[18] Exhibit NRC000056 at § 18.0.

[19] Exhibit NRC000056, Safety Evaluation of the [ESP] Application in the Matter of [SNC] for Vogtle [ESP] Site (Feb. 2009).

[20] Exhibit NRC000056 at § 19.0.

[21] *Southern Nuclear Operating Co.* (Early Site Permit for Vogtle ESP Site), Docket No. 52-011-ESP, Memorandum and Order (Additional Administrative and Scheduling Information) (Feb. 23, 2009).

- Presentation 2: Radiological Impacts (Environmental & Safety)
- Presentation 3: Groundwater Impacts on Safety-Related Structures (Safety)
- Presentation 4: Environmental Impact of Alternatives (Environmental)
- Presentation 5: LWA and Site Redress Plan (Environmental)
- Presentation 6: Site Emergency Plan (Safety)
- Presentation 7: Seismic Evaluation (Safety)
- Presentation 8: Severe Accident Mitigation Design Alternatives (Environmental)
- Presentation 9: Deferrals to COL
- Presentation 10: Permit Conditions
- Presentation 11: AP1000 Design Certification Revisions

20. Pursuant to the Board's scheduling order, on March 23, 2009, the Board convened an evidentiary hearing regarding all the above-listed Mandatory Hearing topics, which concluded on March 25, 2009.

II. Generally Applicable Legal Standards

1. The Commission's regulations at 10 C.F.R. Part 52 provide that qualified applicants may seek an early site permit, which is defined as "a Commission approval, issued under subpart A of this part, for a site or sites for one or more nuclear power facilities. An early site permit is a partial construction permit."[22] Because it is only a partial construction permit, and does not seek Commission authorization to construct a nuclear power plant, 10 C.F.R. § 52.17 defines the information necessary for and ESP applicant to demonstrate that the site in question is a suitable site for a nuclear power plant and to comply with the requirements of the Commission's regulations implementing the National Environmental Policy Act.[23] An applicant

[22] 10 C.F.R. § 52.1.

[23] 10 C.F.R. § 52.17.

is required to submit as part of its application a Site Safety Analysis Report ("SSAR"), which describes the technical information required by Commission regulations for determining safety issues, and an Environmental Report, which describes the physical characteristics of the site and assesses the environmental impacts of the construction and operation of the proposed nuclear power plants. In addition the applicant must either provide the major features of, or a complete and integrated emergency plan that satisfies the requirements of 10 C.F.R. § 50.47 and 10 C.F.R. Part 50 Appendix E.[24] SNC's application satisfies the requirements of 10 C.F.R. § 52.17.

2. In addition, 10 C.F.R. § 52.17(c) provides that an ESP applicant may request an LWA under 10 C.F.R. § 50.10 be issued in conjunction with the ESP. An LWA authorizes the holder to perform certain safety-related work, including installation of safety-related subsurface foundations, in advance of the issuance of a construction permit or combined license.[25] The SSAR must include a safety assessment of the LWA activities to be undertaken and the Environmental Report must evaluate the environmental impacts from those activities.

A. Required Findings to be Made by the Board

3. In the October 6, 2006 Notice of Hearing, the Commission set forth the safety findings to be made by the Board under the Atomic Energy Act[26] and the environmental findings under NEPA.[27] In addition, 10 C.F.R. § 52.24, which was promulgated after the Notice of Hearing was issued, provides that the Commission must make certain required findings in order to issue an ESP.

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[24] *Id.*

[25] 10 C.F.R. § 50.10.

[26] 42 U.S.C. § 2011 *et seq*.

[27] Notice of Hearing, 71 Fed. Reg. at 60,195.

4. The findings required by 10 C.F.R. § 52.24 and the Notice of Hearing are substantially similar, since 10 C.F.R. § 52.24 includes analogous provisions to those removed in revisions from the former 10 C.F.R. § 2.104 referenced by the Notice of Hearing. Furthermore, SNC prepared and revised its ESP and LWA applications with reference to 10 C.F.R. § 52.24. Thus, the substantive findings are the same regardless of whether the Board makes them in reference to the Notice of Hearing or in reference to 10 C.F.R. § 52.24. Because the substantive considerations for both regulatory sources are so similar, the Board will make the findings required by both.

5. In order to issue an ESP, the Board must find that the ESP application meets the applicable standards, requirements, and Commission regulations.[28] The Board must further find that notifications required to be made to other agencies or bodies have been made and that SNC is technically qualified to perform the activities authorized by the ESP.[29]

i. Required Safety Findings

6. In the Notice of Hearing, the Commission set forth the two safety issues the Board must address in the mandatory portion of the proceeding. The Board must determine without conducting a *de novo* review "[w]hether the application and the record of the proceeding contain sufficient information, and the review of the application by the Commission's staff has been adequate to support a negative finding on Safety Issue 1…and an affirmative finding on Safety Issue 2 [.]"[30]

[28] 10 C.F.R. § 52.24(a)(1).

[29] 10 C.F.R. § 52.24(a)(2) and (4).

[30] Notice of Hearing, 71 Fed. Reg. at 60,195.

7. Safety Issue 1 is "[w]hether the issuance of an ESP will be inimical to the common defense and security or to the health and safety of the public[.]"[31] This issue is consistent with the 10 C.F.R. § 52.24(a)(6) requirement that "Issuance of the permit will not be inimical to the common defense and security or to the health and safety of the public[.]"[32]

8. Safety Issue 2 is "[w]hether, taking into consideration the site criteria contained in 10 C.F.R. Part 100, a reactor, or reactors, having characteristics that fall within the parameters for the site, can be constructed and operated without undue risk to the health and safety of the public[.]" This issue complements the Commission's regulations at 10 C.F.R. § 52.24(a)(3), which require that "[t]here is reasonable assurance that the site is in conformity with the provisions of the [Atomic Energy] Act, and the Commission's regulations[.]"[33]

9. The ESP must contain any terms and conditions of the ESP deemed appropriate by the Commission, and prior to issuing a COL referencing the ESP, the Commission shall either find that the relevant terms and conditions have been met or that they could not be met by the time of COL issuance and will be included as terms and conditions of the COL.[34] Furthermore, "[t]he proposed inspections, tests, analyses and acceptance criteria … are necessary and sufficient, within the scope of the [ESP], to provide reasonable assurance that the facility has been constructed and will be operated" according to the license and NRC rules and regulations.[35]

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[31] *Id.*

[32] *Id.*

[33] *Id.*

[34] 10 C.F.R. § 52.24(b).

[35] 10 C.F.R. § 52.24(a)(5).

ii. Required Environmental Findings

10. The Notice of Hearing specifies that the overarching environmental issue to be addressed pursuant to NEPA is "[w]hether, in accordance with the requirements of subpart A of 10 C.F.R. Part 51, the ESP should be issued as proposed."[36] As described above in the procedural history paragraph number 15, the Board has already held the contested portion of the environmental proceedings. For the remaining, uncontested portion of the environmental analysis, the Notice of Hearing requires that the Board:

> (1) Determine whether the requirements of Section 102(2)(A), (C), and (E) of NEPA and subpart A of 10 C.F.R. part 51 have been complied with in the proceeding; (2) independently consider the final balance among the conflicting factors contained in the record of the proceeding with a view to determining the appropriate action to be taken; (3) determine, after considering reasonable alternatives, whether the ESP should be issued, denied, or appropriately conditioned to protect environmental values.[37]

11. This requirement encompasses the identical contents of 10 C.F.R. § 52.24(a)(8), which mandates that, in order for an ESP to be issued "[t]he findings required by subpart A of 10 C.F.R. Part 51 have been made." The guidelines for determining the acceptability of the proposed action in accordance with 10 C.F.R. Part 51 are the "Standard Review Plan for Environmental Reviews for Nuclear Power Plants," NUREG-1555 (July 2007) and "Processing Applications for Early Site Permits," NRC Review Standard RS-002 (May 3, 2004).

12. As to the "baseline" NEPA issues, the Board must "independently consider the final balance among conflicting factors contained in the record of the proceeding," meaning that the Board "need not rethink or redo every aspect of the NRC staff's environmental findings or

[36] Notice of Hearing, 71 Fed. Reg. at 60,195.

[37] *Id.*

undertake [its] own fact-finding activities" but it should "reach [its] own independent determination."[38]

13. Section 102(2) of NEPA requires all federal agencies to prepare detailed statements assessing the environmental impact of and alternatives to major federal actions significantly affecting the environment.[39] "NEPA generally requires that federal agencies consider the environmental impacts of their proposed actions, and take these considerations into account in their decision making process."[40]

14. "Together, [NEPA] and [Subpart A of 10 C.F.R. Part 51] require an applicant and the NRC Staff to consider the potential environmental effects of the proposed action."[41]

15. "[W]hen reviewing a license application filed by a private applicant . . . an agency may give substantial weight to the stated preferences of the applicant with regard to issues such as site selection and facility design."[42] "The agency thus may take into account the 'economic goals of the project's sponsor.'"[43] "Congress did not expect agencies to determine for the applicant what the goals of the applicant's proposal should be."[44] NEPA "does not require the

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[38] *Id.* at 44.

[39] *See* 42 U.S.C. § 4322.

[40] *See In re La. Energy Servs., L.P.* (Claiborne Enrichment Center), LBP-97-8, 45 NRC 367, 399 (1997), *aff'd in part, rev'd in part on other grounds* CLI-98-3, 47 NRC 77 (1998) (cited by *In re La. Energy Servs., L.P.* (Nat'l Enrichment Facility), LBP-05-13, 61 NRC 385, 403 (2005), *aff'd in part, rev'd in part on other grounds,* CLI-05-20, 62 NRC 523, 536 (2005)).

[41] *In re La. Energy Servs., L.P.* (Nat'l Enrichment Facility), LBP-05-13, 61 NRC at 403.

[42] *Id.*

[43] *City of Grapevine v. Dept. of Transp*., 17 F.3d 1502, 1506 (D.C. Cir.), *cert. denied*, 513 U.S. 1043 (1994); *see also Citizens Against Burlington, Inc. v. Busey*, 938 F.2d 195, 196 (D.C. Cir. 1991) ("the agency should take into account the needs and goals of the parties involved in the application"); *In re Hydro Resources, Inc*., CLI-01-04, 53 NRC 31, 55 (2001).

[44] *Grapevine*, 17 F.3d at 1506 (citing *Burlington,* 938 F.2d at 199).

selection of the most environmentally benign alternative."[45] An agency is not constrained by NEPA from deciding that other values (such as economic considerations) outweigh environmental issues.[46] "[W]hether it is 'reasonable' to bear a particular cost may well depend on the resulting benefits[.]"[47]

16. An EIS is sufficient and satisfies NEPA if it contains "an adequate compilation of relevant information, has analyzed it reasonably, has not ignored pertinent information, and has made disclosures to the public."[48] NEPA does not require agencies to "elevate environmental concerns over other appropriate considerations. Rather it require[s] only that the agency take a 'hard look' at the environmental consequences before taking a major action."[49]

17. NEPA does not require an EIS to "be exhaustive to the point of discussing all possible details bearing on the proposed action," as there is "undoubtedly always room for additional consideration of most potential environmental impacts."[50] The NRC's guidance provides that "[t]he degree of detail should be modified according to the anticipated magnitude of the potential impacts."[51]

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[45] *In re Private Fuel Storage*, LBP-03-30, 58 NRC 454, 479 (2003).

[46] *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 350 (1989).

[47] *Entergy Corp. v. Riverkeeper, Inc.*, 129 S. Ct. 1498, 1509-10 (2009) (finding that the EPA reasonably employed a cost-benefit analysis in determining the best technology available for minimizing cooling water intake structures' adverse environmental impact).

[48] *Vt. Public Interest Research Group v. U.S. Fish & Wildlife Serv*., 247 F. Supp. 2d 495, 517 (D. Vt. 2002) (internal quotations omitted).

[49] *Balt. Gas & Elec. Co. v. Natural Res. Def. Council*, 462 U.S. 87, 97 (1983) (internal citation omitted); *In re La. Energy Servs., L.P.*, (Nat'l Enrichment Facility), LBP-05-13, 61 NRC at 403.

[50] *Vt. Pub. Interest Research Group v. U.S. Fish & Wildlife Serv*., 247 F. Supp. 2d at 518, 524.

[51] "Standard Review Plans for Environmental Reviews for Nuclear Power Plants," NUREG-1555 (July 2007) at 2.4.2-2.

18. In other words, the "hard look" requirement is tempered by a "rule of reason."[52] The Supreme Court has characterized the "rule of reason" as such:

> [A]n EIS is required to furnish only such information as appears to be reasonably necessary under the circumstances for evaluation of the project rather than to be so all-encompassing in scope that the task of preparing it would become either fruitless or well nigh impossible.[53]

19. Agencies are given "broad discretion" in establishing how thoroughly an issue should be analyzed "and may decline to examine issues the agency in good faith considers 'remote and speculative' or 'inconsequentially small[.]'"[54]

20. With respect to the discussion of environmental impacts, "NEPA does not call for certainty or precision, but an *estimate* of anticipated (but not unduly speculative) impacts."[55]

21. NEPA requires analysis only of "reasonable alternatives."[56]

22. Accordingly, environmental documents need not discuss alternatives which depend on unproven or non-existent technology, or which would prove impractical for the

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[52] *See In re La. Energy Servs*., L.P. (Claiborne Enrichment Center), LBP-97-8, 45 NRC at 399.

[53] *New York v. Kleppe*, 429 U.S. 1307, 1311 (1976), (citing *Natural Res. Def. Council v. Callaway*, 524 F.2d 79, 88 (2d Cir. 1975)).

[54] *See In re La. Energy Servs., L.P.* (Claiborne Enrichment Center), CLI-98-3, 47 NRC at 103; *In re La. Energy Ser*vs*., L.P.* (Nat'l Enrichment Facility), LBP-05-13, 61 NRC at 403.

[55] *In re La. Energy Servs., L.P.* (Nat'l Enrichment Facility), CLI-05-20, 62 NRC at 536.

[56] *Midcoast Interstate Transmission, Inc. v. FERC*, 198 F.3d 960, 967 (D. C. Cir. 2000); *Vt. Yankee Nuclear Power Corp. v. Nat. Res. Def. Council*, 435 U.S. 519, 551 (1978); *In re La. Energy Servs*., LBP-05-13, 61 NRC at 403 (citing *In re Long Island Lighting Co*. (Shoreham Nuclear Plant), CLI-90-8, 32 NRC 201, 206 (1990) ("[T]here is no need to consider alternatives of speculative feasibility[.]")); *see also Envtl. Law and Policy Center v. NRC*, 470 F.3d 676, 682-83 (7th Cir. 2006).

project.[57] Similarly, environmental documents may exclude alternatives in situations in which the applicant would be "in no position to implement [the] measures."[58]

23. As the Commission has held: "NEPA does not require the consideration of alternatives that are impractical, that present unique problems; or that cause extraordinary costs. . . . An agency's consideration of alternatives is sufficient if it considers an appropriate range of alternatives, even if it does not consider every available alternative."[59] Furthermore, the courts have held that the "Rule of Reason" limits not just the "range of alternatives" the agency's environmental documents must discuss, but also "the extent to which [the agency] must discuss them."[60]

24. If the Board finds that the FEIS should have contained additional information, then it may consider the record as a whole. The Commission has consistently held that the adjudicatory record and the Board decision become part of the FEIS.[61]

25. If information arises after issuance of an ESP, then it will be subject to the new and significant information standard. If the information is determined to be new and significant, then it would be addressed in the Combined Operating License NEPA analysis.[62]

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[57] *See Kelley v. Selin,* 42 F.3d 1501, 1521 (6th Cir. 1995) (finding the NRC properly held that alternatives to dry casks for storing nuclear fuel, neither proven nor practical, did not belong in an environmental document); *Grapevine*, 17 F.3d at 1506; *see also Burlington*, 938 F.2d at 195 (requiring discussion of every conceivable alternative would turn environmental documents into "frivolous boilerplate").

[58] *Envtl. Law and Policy Center*, 470 F.3d at 684.

[59] *Private Fuel Storage*, LBP-03-30, 58 NRC at 479 (citations and quotation marks omitted).

[60] *Grapevine*, 17 F.3d at 1506 (citing *Burlington*, 938 F.2d at 195) (emphasis added).

[61] *See, e.g., In re La. Energy, L.P. (*National Enrichment Facility*),* CLI-06-15, 63 NRC 687, 707 n.91 (2006); *La. Energy Servs., L.P.* (Claiborne Enrichment Center), CLI-98-3, 47 NRC at 89; *In re La. Energy Servs.,* LBP-05-13, 61 NRC at 404.

[62] *See* 10 C.F.R. § 52.39(c).

iii. Findings Required for Limited Work Authorization

26. Pursuant to 10 C.F.R. § 52.17(c), an Applicant for an ESP may request an LWA under 10 C.F.R. § 50.10. Accordingly, 10 C.F.R. § 52.24(a)(7) requires that "[a]ny significant adverse environmental impact resulting from activities requested under Sec. 52.17(c) can be redressed[.]"

27. In order for a LWA to be issued, the FEIS for the LWA must have been issued.[63] In addition, the same NEPA analysis outlined above for the ESP must be performed for the LWA.[64]

28. Furthermore, there may be "no unresolved safety issues relating to the activities to be conducted under the [LWA] that would constitute good cause for withholding the authorization."[65]

B. Scope of the Board's Review

29. In the uncontested portion of this ESP proceeding, the scope of the Board's review is to "merely 'decide whether the staff's review has been adequate to support [its] findings.'"[66]

30. In a mandatory hearing on uncontested issues, Boards:

> "should conduct a simple 'sufficiency' review of uncontested issues, not a de novo review…when considering safety and environmental matters not subject to the adversarial process – so-called 'uncontested' issues – the boards should decide simply whether the safety and environmental record is 'sufficient' to support license issuance. In other words, the boards should inquire whether the

[63] 10 C.F.R. § 50.10(e)(i).

[64] 10 C.F.R. § 51.105(c).

[65] 10 C.F.R. § 50.10(e)(1)(iv).

[66] *In re Exelon Generation Co., LLC, et al.*, CLI-05-17, 62 NRC 5, 36 (2005) (quoting *Gulf States Utilities Co.* (River Bend Station, Units 1 and 2), ALAB-444, 6 NRC 760, 774 n.26 (1977) (emphasis in original)).

NRC Staff performed an adequate review and made findings with reasonable support in logic and fact."[67]

31. The question of whether the Staff's review was sufficient does not require the Board "demand that all possible views and facts relating in any way to the matters in question must be placed in the evidentiary record."[68] Sufficiency requires only "that the evidentiary record contains evidence sufficient to allow [the Board] to make a decision on the ultimate question."[69]

32. In a mandatory hearing, "de novo review of uncontested issues is prohibited, whether the issues arise under the [Atomic Energy Act] or NEPA."[70] The Board's function is to "carefully probe [the uncontested NRC Staff findings] by asking appropriate questions and by requiring supplemental information when necessary."[71] Although the Board is acting as a check on the NRC Staff's findings, even where independent licensing board judgments are required, "the NRC staff's underlying technical and factual finds are not open to Board reconsideration unless, after a review of the record, the board finds the NRC staff review inadequate or its findings insufficient."[72]

33. The ESP and LWA sought by SNC extend to approval of site suitability, and are partial construction permits. They do not authorize the construction of a nuclear power plant.[73]

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[67] *Exelon Generation Co., LLC, et al*., CLI-05-17, 62 NRC at 39.

[68] *Id.* at 41 (emphasis in original).

[69] *Id.* at 42.

[70] *Id.* at 39.

[71] *Id.* at 40.

[72] *Id.* at 39-40.

[73] 10 C.F.R. § 52.10 ("[ESP] means a Commission approval, issued under Subpart A of this part, for a site or sites for one or more nuclear power facilities. An early site permit is a partial construction permit.").

III. Findings of Fact

1. Based on the Affidavit of Mr. Charles R. Pierce and the other information in the record of this proceeding, SNC and the NRC Staff jointly stipulated that (1) SNC's application for an ESP meets the applicable standards and requirements of the Atomic Energy Act and the Commission's regulations; (2) required notifications to other agencies or bodies regarding the application for the ESP have been duly made; and (3) the applicant is technically qualified to engage in any activities authorized by the ESP and LWA that are the subject of this proceeding. Exhibit SNC000099; Exhibit SNC000100.

2. The Board accepts this stipulation, and finds that the requirements of 10 C.F.R. § 52.24(a)(1),(2), and (4) have been met.

3. Further, SNC and the NRC Staff provided testimony and legal argument that the new Aircraft Impact regulation, which has been approved by vote of the Commission, but has not yet taken effect, does not affect SNC's application for an ESP. The Board finds that because the pending Aircraft Impact rule will apply to COL applicants and applicants for design certification, but not to ESP applicants, no further factual findings are required regarding aircraft impacts in this proceeding. Tr.-M-2396-97; s*ee also* "Consideration of Aircraft Impacts for New Nuclear Power Reactor Designs," 72 Fed. Reg. 56,287 (Oct. 3, 2007) (proposed rule); Rulemaking Issue Notation Vote, "Final Rule—Consideration of Aircraft Impacts for New Nuclear Power Reactor Designs," SECY-08-0152 (Oct. 15, 2008); Memorandum Regarding Staff Requirements – Affirmation Session, 1:25 P.M., Tuesday, February 17, 2009, From the Secretary of the Commission (Feb. 17, 2009) (noting changes made by the Commission to the Staff's proposed final rule SECY-08-0152).

A. Safety

4. The FSER documents the NRC Staff's "technical evaluation of the proposed VEGP site for construction and operation of a nuclear power plant(s) falling within the design parameters that SC specified in its application," *i.e.*, Design Control Document ("DCD") Rev. 15 for the Westinghouse AP1000. The FSER also "documents the results of the staff's technical evaluation of the limited construction activities proposed under SNC's LWA request." In performing its technical evaluation, the NRC Staff followed NRC Review Standard (RS)-002, "Processing Applications for Early Site Permits," and applicable provisions of NUREG 0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants." The FSER sets forth the NRC Staff's "position on all safety issues associated with the [Vogtle Units 3 and 4] early site permit application and limited work authorization request." No safety review required for issuance of the ESP or LWA has been deferred to the COL stage. Exhibit NRC000056 at Abstract n.1, § 1-1; Tr.-M-2197.

i. General Description – FSER Chapter 1

5. Chapter 1 of the FSER describes the proposed site. "This safety evaluation report documents the staff's technical evaluation of the suitability of the proposed VEGP site for construction and operation of a nuclear power plant(s) falling within the design parameters that SNC specified in its application." It also "documents the results of the staff's technical evaluation of the limited construction activities proposed under SNC's LWA request." Although issuance of the ESP and LWA does not constitute approval of a reactor design, the NRC Staff considered design parameters of the AP1000 certified design referenced by SNC in order to make its ESP findings concerning site suitability. SNC's SSAR references the Westinghouse AP1000 Certified Design. NRC Staff considered the design parameters of the AP1000 design in order to make its findings regarding the suitability of the Vogtle site and in its review of the

proposed LWA activities. NRC Staff will review SNC's COLA, which references a pending amendment to the AP1000 certified design, to determine whether that design falls within the design parameters and site characteristics of the ESP. Tr.-M-2377-79, 2393; Exhibit NRC000056 at § 1.1-1.3.

ii. Site Characteristics – FSER Chapter 2

6. Chapter 2 of the FSER provides the NRC Staff's evaluation of SNC's SSAR regarding site geography and demography (including population distribution); nearby industrial, transportation, and military facilities (including identification and consideration of potential hazards and potential accidents in the site vicinity); meteorology; hydrologic engineering (including groundwater and contamination pathways analysis), geology, seismology, and geotechnical engineering (including a tectonic analysis, seismic source zones, and vibratory ground motion). Exhibit NRC000056 at § 2.1-2.4.

7. The NRC Staff conducted a technical review with an independent investigation and analyzed the information provided by SNC on the site location and description; the authority to regulate access and activity on the Vogtle ESP site; population distribution surrounding the site; and location and separation distance of the site from industrial, military, and transportation facilities and routes in its vicinity. The NRC Staff also thoroughly reviewed the information provided by SNC regarding probability analyses of potential accident sequences involving hazardous materials or activities on or in the vicinity of the proposed ESP site; climatic conditions and regional meteorological phenomena; local meteorological parameters; the onsite meteorological measurements program; atmospheric dispersion estimates for postulated accidental airborne releases of radioactive effluents; atmospheric dispersion estimates for routine releases of radiological effluents; and the hydrologic description. Exhibit NRC0000056 at § 2.1 – 2.4.

8. In addition, as detailed in Chapter 2 of the FSER, the NRC Staff independently confirmed the information provided by SNC regarding historical flooding, potential dam failure and the hydrometeorological design basis evaluating ice-induced hazards, flood protection, and potential hazard to the safety-related facilities due to the effects of probable maximum surge and seiche and tsunami. SNC also provided information analyzed by the NRC Staff regarding hydraulic design basis for canal and reservoirs used to transport and impound water supplied to the safety-related structures, systems, and components; stream channel diversions; flooding protection requirements; and low water considerations. The NRC Staff further conducted a technical evaluation of the information provided by SNC regarding the hydrogeological characteristics of the site (including in terms of the effects of accidental releases of radioactive liquid effluents in ground and surface waters) and the reliability of safety-related water supply and dewatering systems. Exhibit NRC0000056 at § 2.4.

9. The NRC Staff's review was conducted in accordance with the regulatory guidance in 10 C.F.R. Parts 50, 52 and 100, and RS-002. Exhibit NRC000056 at § 2.1-2.4.

10. Based on its independent review, the NRC Staff concluded the information provided by SNC was adequate and acceptable to meet the requirements of 10 C.F.R. Parts 50, 52 and 100. Exhibit NRC000056 at § 2.1-2.4. The NRC Staff's conclusion is logical and supported by the evidence.

a. Accidental Release of Radioactive Liquid Effluents

11. At the hearing, pursuant to the Board's December 5, 2008 Order, SNC and the NRC Staff provided a presentation regarding potential groundwater impacts on safety related structures resulting from construction of Vogtle Units 3 and 4. Exhibits SNC0000070, SNC0000073, and NRC0000060.

12. In accordance with the Board's December 5, 2008 Order, the NRC Staff and SNC presented testimony and documentary evidence regarding the radiological impacts of the Vogtle Units 3 and 4. Tr.-M-1776-58.

13. SNC presented testimony and documentary evidence for the safety review of the radiological impacts of Vogtle Units 3 and 4. SNC's witness was Dr. Angelos N. Findikakis. Dr. Findikakis is a registered Professional Engineer ("PE") with the Bechtel Corporation. He earned his Ph.D. in civil engineering from Stanford University and has over 35 years of experience working with groundwater flow and transport, modeling, environmental hydraulics and hydrology, and water resources. He is a Bechtel fellow, which is the highest technical recognition at the company, and he has authored or co-authored numerous publications, including 32 papers in peer-reviewed journals and 56 papers in technical conference proceedings. Exhibit SNC000074.

14. NRC Staff presented the following panel of witnesses in support of its evaluation of the radiological impacts at the Vogtle site: Dr. Charles Kincaid and Dr. Hosung Ahn. A staff scientist at the Pacific Northwest National Laboratory, Dr. Kincaid has been extensively published, with a focus on soil physics and groundwater studies and specialty in the area of computational fluid mechanics of environmental systems. Regarding nuclear-specific projects, he has contributed to site-specific applications of models for the purpose of assessing the long-term performance of a variety of wastes at the Department of Energy's ("DOE") Hanford site. Dr. Ahn earned an M.S. and Ph.D. in Hydrology and currently is employed by the NRC as a Hydrologist in the Hydrologic Engineering Branch of the Office of New Reactor's Division of Site and Environmental Reviews. Dr. Ahn has over 24 years experience working with federal and state governments in the areas of water resources management, ecosystem restorations,

power plant siting, and reactor licensing. With experience reviewing the SSARs for three ESP applications, he has focused on potential extreme hydrologic hazards, such as flood, drought, dam break, tsunami, and subsurface radionuclide contamination. Exhibits NRC000071 and NRC000077; Tr.-M-1892.

15. The Savannah River is located to the north and east of the proposed Vogtle Units 3 and 4, and the Vogtle Units 3 and 4 site is surrounded by local streams that drain into the Savannah River. Mallard Pond sits to the north of the site of Vogtle Units 3 and 4 and flows into an unnamed creek that eventually flows into the Savannah River. Three aquifers – the water table aquifer, tertiary aquifer, and cretaceous aquifer – underlie the Vogtle site. The water table aquifer is an aqueduct for the other two, and they are isolated hydraulically from the water table aquifer by a thick layer of material of very low permeability, the Blue Bluff Marl, which separates the water table aquifer from the tertiary aquifer. Tr.-M-1778; Exhibit SNC000073 at 6-7.

16. The water table aquifer consists of the Barnwell Group, which includes sands, clays, and silts of the Barnwell Formation, as well as discontinuous deposits of the Utley limestone. The bottom of the water table aquifer is defined by the properties of the Blue Bluff Marl, and the outcrop of the Blue Bluff marl along the Savannah River to the south and southwest of the site defines the edge of the water table aquifer. The depth of the water table aquifer at the site of Vogtle Units 3 and 4 is sixty feet or greater. Tr.-M-1779-80; Exhibit SNC000073 at 8.

17. The groundwater flow at the site was determined by analyzing groundwater level data collected from 22 monitoring wells between June 2005 and July 2007, and the data collected by SNC demonstrated a relatively small seasonal variability of 1.7 feet. From the power block

area of Vogtle Units 3 and 4, the groundwater flows to the north towards Mallard Pond. The highest water level on the site forms a groundwater divide, so the flow from that area is to the south. Tr.-M-1780-81; Exhibit SNC000073 at 8-9.

18. From June 2005 to June 2007, there was very little variability in the water levels at the monitoring wells, which indicates that the flow of the water does not change over time. Tr.-M-1782-83; Exhibit SNC000073 at 11.

19. In order to determine hydraulic conductivity, SNC reviewed data from the construction of Vogtle Units 1 and 2. This included five pumping tests, seven falling head tests, and four constant head tests at the Utley limestone. In addition, two constant head tests and three laboratory tests were conducted at Barnwell sands, while four tests were conducted for the backfilling material that was used for the construction of Vogtle Units 1 and 2. Also, nine slug tests were conducted at the site of Vogtle Units 3 and 4, and the data from these estimate the hydraulic conductivity. Tr.-M-1784; Exhibit SNC000073 at 12. The data was collected using standard methods that are widely used best practices in the industry. Tr.-M-1785.

20. SNC developed a two-dimensional groundwater model to integrate data interpretation and to predict future groundwater conditions. The single layer model of the water table aquifer indicates that the water table does not communicate with the underlying aquifer, and there is no vertical hydraulic gradient within the water table aquifer. The model was developed using the MODFLOW groundwater model, which is the standard model in the industry. Tr.-M-1786-88; Exhibit SNC000073 at 13-14.

21. The groundwater model developed by Dr. Findikakis and Bechtel depicts the flow of the water at the Vogtle site. The outcrop of the Blue Bluff Marl marks the edge of the water table aquifer. This area was treated using the support drain boundary condition, which allows

flow out of the model. The northwestern boundary along the water shed line works as the surface water divide, and acts as a no flow boundary because water on one side of the boundary flows in one direction, while water on the other side of the boundary flows in the other direction. Tr.-M-1790-91; Exhibit SNC000073 at 15.

22. The calibration statistics from SNC's groundwater model, which analyzed the hydraulic conductivity and groundwater recharge parameters, indicate that the direction of groundwater flow was not changing during the June 2005 to June 2007 time period. Tr.-M-1793-94.

23. SNC conducted modeling of future conditions at the site due to construction of the proposed new units. The primary changes are expected to be in the topography of the site due to future grading. There would be changes in subsurface materials because of the introduction of the structural backfill. There also would be changes in the distribution of the recharge due to grading and surface cover, including new buildings, paved areas, roads, gravel covered areas, and changes in vegetation cover. Tr.-M-1798-99; Exhibit SNC000073 at 18.

24. On behalf of SNC, Dr. Findikakis analyzed several plausible alternative combinations of groundwater recharges and hydraulic conductivity distribution. All of the analyses supported the conclusion that, after construction of the new units, all groundwater transport pathways from the power block area of Vogtle Units 3 and 4 would continue to flow to the north and eventually into Mallard Pond. Tr.-M-1800-01; Exhibit SNC000073 at 20-21.

25. SNC's modeling analyzed the effluent concentration limits at Mallard Pond before they reached the Savannah River. The model conservatively assumed that liquid effluents would instantaneously enter the water table and must travel through the backfill material and different native materials before discharging into Mallard Pond. Radionuclides in a liquid

release would enter the surface water system via Mallard Pond, but they would be diluted during transport to and while held in the pond. They would be further diluted in the stream running from the pond and before reaching the Savannah River. Tr.-1802; Exhibit SNC000073 at 21.

26. The concentrations of all of the nuclides at Mallard Pond were analyzed to be much smaller than the effluent concentration limits prescribed in 10 C.F.R. Part 20. The sum of the ratios of all nuclide concentrations in the Mallard Pond stream over the respective effluent concentration limits equals 0.058, compared to the regulatory limit of 1.0. Tr.-M-1805; Exhibit SNC000073 at 23.

27. NRC Staff reviewed land surface at the site and confirmed that the most current Light Detection and Ranging ("LiDAR") and Digital Elevation Model ("DEM") data sets were being employed in the model. LiDAR is a data set that is acquired by low-flying aircraft with laser instruments on board and has a relative accuracy of one foot horizontal and one foot vertical. DEM data sets are similar to maps that depict the topography of the site and are available from the United States Geological Survey. Tr.-M-1825-26; Exhibit NRC000060 (safety portion) at 5.

28. During its reviews to assure a plausible conceptual model, NRC Staff reviewed the aquifer base and the use of the top of the Blue Bluff Marl, drain boundary conditions, constant head boundary conditions, hydraulic conductivity distributions and magnitude (specifically the influence of the Utley limestone and engineered backfill), and recharge distributions and magnitude (influence of the surface, slope, structures, and its vegetation). In doing so, NRC Staff reviewed SNC's combination of hydraulic conductivity and recharge in space and magnitude and the selection of representative values. Exhibit NRC000060 (safety portion) at 5.

29. For the site characteristics important to groundwater transport, the on-site measured values of hydraulic conductivity indicate that the Barnwell Group sands, silts, and clays measured 0.3 to 0.8 feet per day during the Vogtle Units 1 and 2 site investigation; the Barnwell Group sands, silts and clays measured 0.12 to 2.65 feet per day during the Vogtle Units 3 and 4 site investigation; Utley limestone measured 0.3 to 343 feet per day during the VogtleUnits 1 and 2 investigation, and engineered backfill measured 1.3 to 3.3 feet per day after the Vogtle Units 1 and 2 construction. Exhibit NRC000060 (safety portion) at 6.

30. The NRC Staff's analysis of hydraulic conductivity applied in numerous zones and magnitudes in the models produced the following results: the Barnwell zone to the northwest and southeast of the ridge where the plants are located was assigned lower values, which tested between 12 and 34 feet per day; the Barnwell zone to the south of proposed Vogtle Units 3 and 4 was assigned the lowest values, which tested as low as 5 feet per day; the ridge top where the Utley limestone causes higher values tested up to 65 feet per day; the area south of Mallard Pond where the Utley limestone results in a cave tested up to 400 feet per day; and the engineered backfill at Vogtle Units 1, 2, 3, and 4 tested at ranges from 1.3 to 3.3 feet per day. Tr.-M-1828; Exhibit NRC000060 (safety portion) at 6.

31. The site proposed for the construction of Vogtle Units 3 and 4 was prepared for construction during the construction of Vogtle Units 1 and 2, so the site topography is flat. Tr.-M-1830.

32. The long-term average recharge rate in the region is 14.5 inches per year, and 6.8 inches per year when associated with the local aquifer. Tr.-M-1833; Exhibit NRC000060 (safety portion) at 11.

33. The NRC Staff determined that the recharge rates for zones and magnitudes are as follows: open areas with minimal vegetation and mild slopes range from 6 to 12 inches per year; forested areas with mild slopes range from 6 to 8 inches per year; open areas with minimal vegetation and steep slopes range from 5 to 8 inches per year; forested areas with steep slopes range from 2 to 5 inches per year; buildings and paved surfaces recharge zero inches per year; open areas with minimal slope and no vegetation recharge up to 14 inches per year; and ponds or infiltration areas reach 40 inches per year. Tr.-M-1834; Exhibit NRC000060 (safety portion) at 11.

34. NRC Staff's comparison of modeled values versus measured values for the pre-construction hydraulic head shows that the values were extremely similar. Exhibit NRC000060 (safety portion) at 13.

35. NRC Staff evaluated a matrix of recharge rates in its post-construction testing to determine how recharge rates might change in the future and influence the position of the hydraulic high point in the system, which determines what direction the groundwater will flow. Tr.-M-1838-39; Exhibit NRC000060 (safety portion) at 14-15.

36. When there is a high recharge rate for the power block and cooling towers, the effluent release points are located at the perimeter of the power block area. When the effluent release occurs, there is a tank rupture, floor drains that communicate liquid to other rooms in the building, and pumps are assumed to fail. The Mallard Pond drainage is the most plausible pathway. Daniels Branch is a plausible, but unlikely, pathway. Tr.-M-1841-42; Exhibit NRC000060 (safety portion) at 16.

37. The NRC Staff created a post-construction model that depicts the pathlines for high/high recharge rates. This model shows some pathways that go directly from the Vogtle

Units 3 and 4 power block towards the Savannah River, but this is due to higher infiltration rates having been placed on Vogtle Units 3 and 4. The results of the plausible model show that these are not plausible pathways and nothing flows towards the Savannah River. Tr.-M-1843; Exhibit NRC000060 (safety portion) at 16.

38. There is no data to suggest the presence of chelating agents in backfill sediments or aquifer sediments at the site. Tr.-M-1846.

39. The catchment area was estimated by using a standard 10-meter resolution USGS Digital Elevation Model, which evaluated flow direction. The catchment area is the land surface area contributing to surface water runoff, which is contributing to stream discharge at the discharge point of interest. Tr.-M-1847; Exhibit NRC000060 (safety portion) at 18.

40. A streamtube, plug-flow model approach neglecting dispersion in groundwater was used to analyze the Mallard Pond and Daniels Branch catchments. For the Mallard Pond catchment, NRC Staff found that for all radionuclides in the inventory, the sum of fractions is less than one (0.235). The tritium fraction was reviewed further because it was greater than one percent of its standard, but it fell well-below the Emergency Classification Level ("ECL"). The standard 10 C.F.R. Part 20 requirements can be met for the Mallard Pond catchment. For the Daniels Branch catchment, NRC Staff found that for all radionuclides in the inventory, the sum of fractions is less than one percent (0.336). The tritium and cesium-137 fractions were reviewed further because they were greater than one percent of their standard, but the fell well below the ECL. The standard 10 C.F.R. Part 20 requirements can be met for the Daniels Branch catchment. Tr.-M-1848-1849; Exhibit NRC000060 (safety portion) at 19; 10 C.F.R. Part 20, Appendix B, Table 2, Column 2.

41. The pre-construction model of the unconfined aquifer incorporated topography in the aquifer base; incorporated boundary conditions, and especially drains, in an appropriate manner; incorporated distributions of hydraulic conductivity and recharge; exhibited correspondence between measured and modeled parameters, and achieved correspondence with measured hydraulic head. Tr.-M-1850; Exhibit NRC000060 (safety portion) at 21.

42. NRC Staff's analysis of radiation exposures attributable to accidental releases of radioactive liquid effluent was conservative because it evaluated alternative conceptual models and multiple pathways, neglected dispersion in the groundwater environment, applied the lowest measured distribution coefficients, and applied low-discharge-year catchment flows. Exhibit SNC000060 (safety portion) at 21.

43. NRC Staff confirmed SNC's conclusion that the standard for 10 C.F.R. Part 20, Appendix B, Table 2, would be met. Exhibit NRC000060 (safety portion) at 21.

44. The groundwater transport analysis conducted by SNC is extremely conservative. The analysis assumes instantaneous release to groundwater, zero travel time through the unsaturated zone, and gives no credit for dispersion in groundwater. SNC's conservative analysis did not take credit for adsorption of radionuclides during transport, except for cobalt-60, strontrium-90, and cesium-134 and 137. For those three elements, the analysis used distribution coefficients that were determined from laboratory testing of several actual samples form both the backfill and native material. These samples were tested to determine the distribution coefficient that defines the rate of adsorption, and during those tests, the lowest value for each nuclide was used, which resulted in a very conservative analysis. NRC Staff also conservatively applied the lowest minimum values in its analysis of cobalt, strontium, and cesium. Tr.-M-1807-08, 1845, 1847; Exhibit SNC000073 at 24.

45. The water table aquifer is separated from the tertiary aquifer by a layer of non-permeable material, so it is highly unlikely that any nuclides would migrate to the tertiary aquifer. Nevertheless, for the tertiary aquifer pathway analysis, SNC conservatively assumed that eighty percent of the contents of the effluent tank instantaneously transferred into the tertiary aquifer, while taking zero credit for the thick, impermeable Blue Bluff Marl. In analyzing this pathway based upon hydraulic gradient, hydraulic conductivity, and porosity, the transport time to the Savannah River is on the order of 1,000 years. The distance between the entrance to the tertiary aquifer and the Savannah River is about one mile, and the transport velocity is less than five feet per year. Tr.-M-1812-14; Exhibit SNC000075 at 2.4.13-24 (Figure 2.4.13-2).

46. The transport analysis of accidental radioactive effluent releases in the water table aquifer demonstrates that the resulting concentrations of radionuclides are in compliance with 10 C.F.R. Part 20. The factors that are important to hydrological transport were obtained from site-specific measurements in accordance with 10 C.F.R. § 100.20(c)(3) and assigned conservatively. Exhibit SNC000073 at 30.

47. In its review of SNC's analysis of the effects of radiological contamination of groundwater, NRC Staff conducted a site audit, independently reviewed plausible alternative conceptual models, and performed sensitivity analyses that were based on post-construction recharge distributions. NRC Staff concluded that SNC has substantiated sufficient information pertaining to the identification and evaluation of the effects of accidental releases of radioactive liquid effluents in ground and surface waters on existing users and known and likely future users of ground and surface water resources in the vicinity of the proposed site. These conclusions are set forth in Chapter 2.4.13 of the FSER. Exhibit NRC000060 (safety portion) at 4; Exhibit NRC000056 at § 2.4.13.

b. Groundwater Impacts on Safety Related Structures

48. SNC presented testimony and documentary evidence regarding potential groundwater impacts on safety related structures resulting from the construction of Vogtle Units 3 and 4. The qualifications of SNC's witness, Dr. Angelos N. Findikakis, are described in paragraph 13.

49. The NRC Staff also presented expert witnesses, Dr. Charles T. Kincaid and Dr. Hosung Ahn. Dr. Kincaid has a degree in Civil Engineering and a Ph.D. in Engineering (Hydraulics). The qualifications of Drs. Kincaid and Ahn are described in paragraph 14.

50. Dr. Findikakis explained that the characteristics important to groundwater impacts were site configuration, the site grading and drainage, and the introduction of materials for construction (for example backfill). These characteristics were incorporated into the groundwater model employed as the primary tool for predicting future conditions. This is the same model Dr. Findikakis relied on during his discussion of radiological impacts.[74] The model is based on site specific data, using internal conservative parameters, and for the key groundwater impacts parameters, it employs a rate for the prefabricated vertical drains and rate of recharge. A sensitivity analysis addressed the impact of these parameters. Tr.-M-1888-89.

51. Surrounding Vogtle Units 3 and 4, the groundwater levels are between 150 and 160 feet above mean sea level. The site grade level is elevation 220, with the lowest structure's base at elevation 180, or just above 180. This indicates that below the lowest structure, groundwater depth is at least 20 feet. The water table is 60 to 70 feet below the ground surface. Tr.-M-1889-90; Exhibit SNC000073.

[74] *See* Findings 23-28 (describing SNC's Model and the Staff's evaluation of it); Tr.-M-1790-1801; Exhibit SNC0000073 at 15-18; Exhibit NRC0000060 (safety portion) at 5-6, 11-15.

52. Looking at post-construction conditions, the sensitivity analysis indicated that the change in the level of groundwater would be around two to five feet at most, with the variation being caused by the combination of parameters used. Considering the groundwater level, which will be at an elevation 155 to 160 feet below site grade level, the site grade level will be around 60 feet above the groundwater level. Tr.-M-1890.

53. Dr. Findikakis explained that this data shows the whole of the structure will be significantly above the water table, meaning there is no issue of hydrostatic loading on the safety buildings. The construction will not alter the groundwater level substantially. Tr.-M-1891; Exhibit SNC000073.

54. Dr. Kincaid, for the NRC Staff, then explained how the Staff analyzed whether the evaluation was conservative. NRC Staff also focused on pre-construction site hydrology parameters as compared to the measurements relied on and post-construction site hydrology. Tr.-M-1892.

55. The NRC Staff had previously issued an open item (2.4-2), requiring an improved and complete description of the current and future local hydrological conditions. This description had to include open site models and demonstrate that the design basis related to groundwater induced loadings on sub-surface portions of the safety related structures would not be exceeded. The groundwater model described by SNC's witness, Dr. Findikakis, was submitted in response to this open item. Based on this additional information and the NRC Staff's independent analysis, this open item is now closed. Tr.-M-1893; Exhibit NRC000056 at § 2.4.12.3; Exhibit NRC000061 at 4-5.

56. For analyzing the groundwater impact on safety related structures, the NRC Staff reviewed the model and developed alternate conceptual models that would also be acceptable for

the VEGP site, then selected and modified slightly a case which most closely represented the water table. The modifications the NRC Staff used to confirm SNC's analysis were in terms of drain elevations and conductivity. NRC Staff based its confirmatory analysis on sensitivity analyses of the post-construction recharge distributions' potential impact on the height of the water table and the vicinity of the reactors. Tr.-M-1893; Exhibit NRC000056 at § 2.4.12.3.

57. NRC Staff studied the site recharge extensively and relied in part on USGS data from the regional model. Considering load values in the Vogtle Units 1 and 2 area, for example around the primary structures (4 inches per year) and cooling towers (14 inches per year), the NRC Staff determined these values to be typical for an operating reactor area. In the pre-construction area of Vogtle Units 3 and 4, the rates are higher (16 inches per year) since the area was leveled during construction of Vogtle Units 1 and 2. Tr.-M-1895-97; Exhibit NRC000061 at 11.

58. The NRC Staff specifically considered the construction hydraulic heads, and compared the modeled results with the measured results. SNC's proposed model contained high predictions in the Vogtle Units 1 and 2 area with some lower values lateral to that to the north and to the south, and NRC Staff agreed with SNC that the proposed model was the best. Although the model is the best match, it over-predicts the hydraulic head in the Vogtle Units 1 and 2 area, which NRC Staff determined was likely caused by either the use of higher-than-needed recharge rates or by the conductivity applied, with conductivity being the more likely cause. NRC Staff's determination that the proposed model is the best match despite this over-prediction was based in part upon the model results achieved. SNC's and the NRC Staff's model results were virtually the same, with only a tenth of a foot difference in max values in the cooling tower and power block areas. Tr.-M-1897-98; Exhibit NRC000061 at 12.

59. NRC Staff also performed tests to determine the post-construction possibilities. The plausible case for the cooling tower area is 12 inches per year, which is one-quarter of the average annual precipitation. The technical literature regarding gravel recharge and infiltration indicate that, as the gravel is in-filled from wind-blown sediments, in the cooling tower area a high recharge rate would be half the average annual precipitation. A low recharge rate would be zero, and a plausible rate would be one-fourth the average annual precipitation. For the power block area, a high rate is one-half the average annual precipitation, a plausible rate is one-eighth, and a low rate is zero. NRC Staff employed the plausible rates of one fourth for the cooling tower area, or 12 inches per year, and one eighth for the power block area, or 6 inches per year. These were plausible, but conservative, figures. Further establishing the conservative nature of the recharge and infiltration analysis, the rates are applied across the entire distinguished areas, regardless of the presence of structures, pavement, parking lots, and other similar features. Tr.-M-1898-1900; Exhibit NRC000061 at 13.

60. When NRC Staff looked at post-construction hydraulic heads, it considered SNC's results for maximum groundwater level in the cooling tower area, 166.1 feet above mean sea level, and for maximum groundwater level in the power block area, 162.6 feet above mean sea level. The NRC Staff then performed its own simulation, getting results of 166.5 feet in the cooling tower area and 162.4 feet in the power block area. Tr.-M-1900. These results were very comparable. Tr.-M-1900; Exhibit NRC000056 at § 2.4.12.3; Exhibit NRC000061 at 15.

61. NRC Staff used various inputs to assure conservatism in the results. The prior analysis in the pre-construction mode, upon which NRC Staff based its confirmatory analysis, employed higher-than-observed elevations in the Vogtle Units 1 and 2 region, by three feet in one case and two in another. Further, the Vogtle Units 3 and 4 elevation will likely have the

same effect due to the placement of excavation backfill material in the model. Because both the SNC and NRC Staff pre-construction models yield high estimates of water table, the post-construction results are probably high, and conservative, as well. In its analysis of post-construction water levels, the NRC Staff chose to apply a recharge rate through the entire power block area and the entire cooling tower area with no zero recharge zones in those regions, rather than using the pre-construction recharge rates for Vogtle Units 1 and 2 as SNC did. Even given this difference, both SNC and NRC Staff analyses show a predicted post-construction water table of below 165 feet mean sea level. Tr.-M-1900-02; Exhibit NRC000061 at 16.

62. NRC Staff also analyzed the potential groundwater effects on the subsurface portion of safety related structures. The highest measured pre-construction water table elevation inside the proposed power block is 157.24 feet above mean sea level, making the model prediction of 162.9 feet conservative – adding the full range of four feet, the result of between 161 and 162 feet is still conservative (well below SNC's maximum groundwater level of 165 feet below mean sea level). Using the recharge rate as applied at the Vogtle Units 1 and 2, SNC's post-construction simulated water table inside the power block was 162.6 feet above mean sea level. NRC Staff's value, using its recharge rates based on the technical literature as detailed above, was 162.4 feet. Even as applied to the far south edge of the power block area, allowing for the full range of four feet, the value of 165 feet above mean sea level is appropriate, although of course the actual structures will be more interior within the power block region. Both the NRC Staff and SNC's simulations result in post-construction levels less than or equal to pre-construction levels, which is consistent with some observations at the existing Vogtle Units 1 and 2. Tr.-M-1902-04; Exhibit NRC000061 at 17.

63. NRC Staff concluded based on its analysis in accordance with RS-002 that SNC's site characteristic for highest groundwater level, 165 feet above mean sea level, is supported by both current observations and post-construction simulations. Also, because the bottom elevation for the subsurface portion of a safety related structure for a plant that fits within the bounding parameters in SNC's ESP Application is 180.5 feet above mean sea level, SNC's maximum groundwater level of 165 feet inside the power block presents no undue threat to any safety related structures located there. "[B]ased on its independent analysis, the NRC staff [found] the applicant's site characteristic value for the maximum groundwater elevation at the VEGP site to be acceptable" and that the elevation "will be far enough below the site grade so as to not represent a safety concern for the plant fitting within the bounding parameters proposed in the application." Exhibit NRC000056 at § 2.4.12.3; Tr.-M-1902-03; Exhibit NRC000061 at 17.

64. NRC Staff's analysis of the impact of groundwater on safety related structures was thorough, and its conclusion that groundwater poses no undue threat to safety related structures at the Vogtle ESP site is consistent with the facts.

c. Seismic and Geologic Characteristics

65. At the Mandatory Hearing, pursuant to the Board's December 5, 2008 Order, SNC and the NRC Staff provided presentations regarding the seismic and geologic characteristics of the Vogtle 3 and 4 site and the safety analysis of SNC's request for an LWA to perform foundation work at the site prior to issuance of the COL.

66. SNC presented testimony and documentary evidence regarding the seismic and geologic characteristics of the site and the safety analysis of the LWA request. SNC's witness on seismic and geologic issues was Mr. Donald P. Moore. Mr. Moore is a Consulting Engineer with SNC. Mr. Moore provided overall technical oversight of Section 2.5 of the Vogtle SSAR, which comprises geology, seismology, and geotechnical portions of the ESP and LWA

Applications. Mr. Moore has 40 years of experience in the commercial and nuclear power plant industry and in the areas of civil, structural, seismic analysis and design, soil dynamic behavior, and seismic qualification of structures, systems and components. He is a registered professional engineer and has a master's degree in engineering science relating mainly to structural engineering. His position of consulting engineer is the highest engineering technical classification with the Southern Company. Mr. Moore has been a member of various national standards and code committees on seismic analysis and design of nuclear facilities, and seismic qualification of electrical and mechanical equipment, including American Society of Civil Engineers Standard 43, which is the basis for the methodology used to develop the Vogtle site-specific ground motion response analysis. Tr.-M-2234-36.

67. NRC Staff presented the following panel of witnesses in support of its evaluation of the seismic and geologic characteristics of the Vogtle 3 and 4 site: Dr. Gerry Stirewalt, who is a Senior Geologist in the NRC Office of New Reactors; Sarah Gonzales, seismologist with the NRC in the Office of New Reactors; Laurel Bauer, a geologist with the Office of New Reactors; Brett Tegeler, a senior structural engineer with the NRC Office of New Reactors; and Dr. Carl Constantino, who is Professor Emeritus from the City University of New York. Dr. Constantino has served as a consultant to both NRC and the Department of Energy for the last 40 years on a variety of seismic issues and has been heavily involved in the development of criteria standards for both the generic nuclear industry as well as the Standard Review Plan for NRC. In addition, Mr. Tegeler, Dr. John Ma of the NRC Office of New Reactors, Dr. Constantino, and Mr. Christian Araguas, who is the NRC Project Manager for the Vogtle 3 and 4 ESP Application, presented evidence regarding the NRC Staff's evaluation of SNC's LWA request.

68. Witnesses for SNC and the NRC Staff were well-qualified and credible.

69. The proposed Vogtle Units 3 and 4 site is located near Waynesboro in Burke County, Georgia, southwest of the Savannah River. The site is directly across from the DOE's Savannah River Site ("SRS"). The Vogtle Unit 3 site is approximately 1700 feet west of Vogtle Unit 2. The geology and geotechnical soil conditions for proposed Vogtle Units 3 and 4 are identical in all material respects to the conditions for Vogtle Units 1 and 2. Since the licensing of Vogtle Units 1 and 2, there has been a significant amount of geological, seismological, and geotechnical studies performed at the SRS, including multiple deep borings, and fault identification studies. As part of the Vogtle ESP site investigation, the SRS shared much of its site information with SNC and that information proved to be very useful in supporting the Vogtle site investigation for the ESP. Tr.-M-2238-39.

70. Chapter 2.5, Geology and Seismology, of the Vogtle 3 and 4 SSAR addressed the following topics:

2.5.1 Site and Regional Geology

2.5.2 Seismic Evaluation

2.5.3 Surface Faulting

2.5.4 Stability of Subsurface Materials

2.5.5 Stability of Slopes

2.5.6 Embankments and Dams

Vogtle Site-Specific Evaluation Report at Appendix 2.5; Exhibit SNC000091-MA at 4; Exhibit SNC000080A-G-MA.

(i) 2.5.1 Site and Regional Geology

71. The SSAR evaluation of tectonic features in Chapter 2.5.1 included a literature review, contact with local researchers, air photo interpretation, aerial reconnaissance, review of

seismicity, seismic reflection profiles, and geomorphic analysis of river terraces. Exhibit SNC000091 at 8; Exhibit SNC000080 at § 2.5.1; Tr.-M-2240.

72. The NRC Staff's FSER for the Vogtle Site ESP, Exhibit NRC000056, evaluates SNC's ESP application relative to geologic, seismic and geotechnical engineering in Chapter 2.5 of the FSER and evaluates the safety analysis for the LWA request in the Site Safety Assessment in Chapters 2 and 3 of the FSER. Exhibit NRC000056.

73. The Vogtle 3 and 4 site is at an elevation of approximately 220 feet above mean sea level. The Barnwell Group or Upper Sands extends from the surface of the site to a depth of about 90 feet. The Upper Sands are variable in density, with some areas being very loose and others dense. The water table elevation is approximately 55 feet below the surface. At the bottom of the Barnwell Group, or Upper Sands, is a formation called Utley limestone, which is a very porous limestone. Below the Utley limestone is a formation called the Blue Bluff Marl, which begins at a depth of approximately 90 feet and extends for approximately 70 to 80 feet below the Barnwell Group to a depth of approximately 170 feet below the surface. Below the Blue Bluff Marl are coastal plain deposits consisting of extremely dense sands, about 900 feet thick. Below the coastal plains deposits directly below Vogtle Units 3 & 4 is Dunbarton Basin rock, which is a Triassic sandstone. The top of the Dunbarton Basin rock is approximately 1,000 feet below the surface. Tr.-M-2249-50; Exhibit SNC000091 at 12-14, 24; Exhibit SNC000080 at Figure 2.5.1-41.

(ii) 2.5.2 Seismic Evaluation

74. SNC evaluated all known faults in the vicinity of the site to determine whether they were capable tectonic sources. SNC concluded, and the NRC Staff concurred after a thorough review, that none of the faults evaluated was a capable tectonic source. Exhibit NRC000056 at § 2.5.1.3.2.

Pen Branch Fault

75. One of the primary areas upon which the evaluation of tectonic features focused was on the location and tectonic capability of the Pen Branch Fault. Tr.-M-2240, 2298.

76. The Pen Branch Fault exists at the interface of the Triassic basin rock and Paleozoic crystalline rock at a depth of about 1,000 feet. *See* Exhibit SNC000091 at 14; Tr.-M-2300.

77. The Pen Branch Fault runs in a southwest direction through the SRS across the Savannah River and across the Vogtle 3 and 4 site. SNC's analysis confirmed that the fault extends beneath the Vogtle site based on sub-surface geophysical data. Exhibit NRC000065 at 4; Exhibit SNC000091 at 10; Exhibit SNC000080 at Figure 2.5.1-42.

78. SNC conducted a seismic reflection survey at the Vogtle 3 and 4 site in order to locate the Pen Branch Fault. At the SRS, the Pen Branch fault has been identified using reflection surveys and deep borings. The Pen Branch Fault is neither exposed nor expressed at the surface of SRS. Previous studies have determined that the Pen Branch Fault is not a capable tectonic source, *i.e.*, it is not a source for earthquake motion at the site. Notwithstanding those previous investigations, however, the NRC Staff requested additional data regarding the fault and SNC performed additional studies to determine whether the Pen Branch Fault was a capable tectonic source. Tr.-M-2240, 2300.

79. In order to further evaluate the capability of the Pen Branch Fault, SNC conducted a study of Quatenary ("Qte") fluvial terraces overlaying the fault that established that the fault has not caused deformation since the Qte age. The Qte study included a survey of approximately 2600 elevation points on the surface of the Ellyton Terrace on the SRS, under which the fault is known to lie. The study demonstrated that the terrace, which is Qte in age, was not deformed. Based on the age of the terrace and its lack of deformation, the Pen Branch Fault is not a capable

tectonic source as defined by NRC Reg. Guide 1.165. *See* Tr.-M-2253-54; Tr.-M-2300-03; Exhibit SNC000065 at 11; Exhibit NRC000065 at 7-8; Exhibit NRC000056 at §§ 2.5.1.1, 2.5.1.3.

80. The NRC Staff carefully reviewed basic geologic and seismic information submitted by SNC in SSAR Section 2.5.1 and concurred with SNC that the data and analyses provide an adequate basis to conclude that no capable tectonic faults exist that have the potential to generate surface or near surface fault displacement. Based on the data from drill holes at SRS, NRC Staff concluded that most recent deformations of strata from the Pen Branch Fault in the vicinity of the Vogtle site occurred earlier than the Quaternary age. Consequently, the Fault is deemed to be non-capable. Exhibit NRC000056 at § 2.5.1.4; Tr.-M-2331-32.

Vibratory Ground Motion

81. SNC's analysis of vibratory ground motion in Section 2.5.2 of the SSAR included a probabilistic seismic hazard assessment ("PSHA") as an input to the determination of the Ground Motion Response Spectrum ("GMRS") for the site pursuant to 10 C.F.R. Part 100.2-3. Tr.-M-2264; Exhibit SNC000091 at 18.

82. In order to determine site-specific GMRS, SNC followed procedures agreed upon with NRC, which are now published in Reg. Guide 1.208, "A Performance Based Approach to Define Site-specific Earthquake Ground Motion." In order to determine the PSHA input to the GMRS, SNC followed NRC Reg. Guide 1.165, which identifies the Electric Power Research Institute ("EPRI"), PSHA, published in 1989, ("EPRI-SOG") as an acceptable starting point for analysis. Because NRC Reg. Guide 1.165 recommends that the EPRI model be updated to reflect seismic information discovered since the mid-to-late 1980s, SNC updated the EPRI-SOG Seismic Source Model, in consideration of significant new information concerning geometry,

maximum magnitude and the recurrence interval of the Charleston Source Zone. Tr.-M-2265-66, 2303-04; Exhibit NRC000065 at 9; Exhibit SNC000091 at 18.

83. The update of the EPRI-SOG Seismic Source Model was based primarily on liquefaction features from historic earthquakes that were discovered since the original EPRI study. The most significant new information is that the paleoliquefaction data that indicate that large Charleston-type earthquakes have reoccurrence intervals in the 500 to 1,000-year range instead of approximately 2,000 years, as reflected in the original EPRI-SOG Seismic Source Study. Based on this new information, SNC developed a new Charleston seismic source characterization model for the Vogtle PHSA. The update of the EPRI-SOG Seismic Source Model was peer reviewed by experts in seismic source characterizations and reviewed by NRC staff. Tr.-M-2267-68, 2307-11; Exhibit NRC000056 at § 2.5.2.2.2.

84. Using the updated EPRI-SOG Seismic Source Model, SNC developed site-specific PSHA results for the seismic hazard at hard rock and converted them to a soil PSHA, based on soil site amplification factors. SNC used a widely accepted computer model called SHAKE to develop the soil amplification factors. Using the soil PSHA, SNC determined the GMRS at the ground surface, which is equivalent to the safe shutdown earthquake ("SSE") for the site. This analysis assumed removal of the Upper Sands beneath Vogtle Units 3 and 4 and replacement of those sands with engineered structural backfill. The analysis assumed seismic properties for the engineered backfill, including a shear wave velocity profile validated from SNC's extensive testing conducted in connection with SNC's test pad program. Tr.-M-2260-61, 2267-76, 2323-24; Exhibit SNC000091 at 20; Exhibit NRC000056 at §§ 2.5.2.2.5-2.5.2.2.8, 2.5.4.1.2 (SSAR Table 2.5.4-10).

85. In reviewing SNC's site-specific PSHA, NRC Staff reviewed other EPRI seismic source zones that were part of its model to ensure that there were no seismic source zones other than Charleston that needed to be updated. The NRC Staff performed a sensitivity study on the Eastern Tennessee Seismic Zone and concluded that it did not result in a significant increase in the hazard at the Vogtle site. In addition, the NRC Staff reviewed SNC's demonstration that the Dames and Moore source zone modeling of the central and eastern United States seismic source zones was insignificant to the total seismic hazard at the Vogtle site. Tr.-M-2311-13; Exhibit NRC000065 (Seismic portion) at 14-18.

86. The analysis by NRC Staff in the FSER of SNC's vibration ground motion studies, as well as its testimony on these issues in the mandatory hearing, was extensive and persuasive. Based on that analysis, the NRC Staff concluded that SNC's characterization of the seismic sources surrounding the site was thorough and in conformance with 10 C.F.R. § 100.23. Further, the NRC Staff found that SNC's PSHA adequately addressed uncertainties inherent in the characterization of seismic sources through a PSHA that complied with applicable guidance in Reg. Guides 1.165 and 1.208 and that SNC's development of a site-specific GMRS adequately represents the regional and local seismic hazard. NRC Staff found the Vogtle site suitable with regard to vibratory ground motion criteria for nuclear power plants and that it meets the applicable requirement of 10 C.F.R. § 100.23. Exhibit NRC000056 at § 2.5.3; Tr.-M-2311-14, 2332; Exhibit NRC000065 (Seismic portion) at 20.

87. The NRC Staff's analysis of SNC's SSAR with respect to vibratory ground motion and the Vogtle site was thorough, consistent with regulatory requirements and guidance, and its findings are consistent with the evidence.

(iii) 2.5.3 Surface Faulting

88. Chapter 2.5.3 of SNC's SSAR and the NRC Staff FSER address surface faulting. As a result of the discovery of injected sand dikes in the Upper Sands of the Vogtle site, NRC Staff asked SNC to conduct an analysis to determine that the sand dykes were not tectonic in origin. Tr.-M-2318-19.

89. Based on a thorough analysis, SNC determined that the sand dikes were locally developed, *i.e.*, part of the Upper Sands that overlie the Blue Bluff Marl. SNC concluded, and the NRC Staff concurred, that the sand dikes were specially associated with dissolution depressions within the Utley limestone, which also overlies the Blue Bluff Marl. As a result, the NRC Staff concluded that the sand dikes were not tectonic features and posed no seismic hazard. In addition, the Upper Sands where the sand dikes were formed will be removed by SNC and replaced with engineered structural backfill. Tr.-M-2318-20, 2255-58; Exhibit NRC000065 at 21; Exhibit SNC000091 at 13, 26.

(iv) 2.5.4 Stability of Subsurface Materials

90. In order to adequately define the dynamic properties of the backfill to be installed at the Vogtle site, SNC constructed a "test pad." SNC excavated the side of a hill on the Vogtle site to a 20-foot depth and constructed a pad with structural engineered backfill using backfill placement procedures used during the construction of Vogtle Units 1 and 2. Based on that process, SNC performed static and dynamic field testing as well as laboratory tests of the engineered material. In addition, various backfill source materials at the site were tested. These studies were done to document the static and dynamic properties of the backfill. SNC was assisted in this activity by Dr. Ken Stokoe, Professor at the University of Texas, who is a well-known expert in soil dynamic testing. Tr.-M-2257-58.

91. Based on this analysis, SNC measured the shear wave velocity of the backfill using the standard techniques of Spectrum Analysis of Surface Waves ("SASW") and Seismic Crosshole Testing. Shear wave velocity is a measure of the stiffness of the soil and is an important input into seismic soil structure interaction ("SSI"), as well as the site-specific GMRS. Tr.-M-2259-60.

92. Based on the results of the studies at the "test pad," SNC concluded that the backfill design and properties were well-defined, that sufficient backfill material existed at the site and that the backfill met a minimum shear wave velocity of 1,000 feet per second at the foundation depth. Tr.-M-2260-61; Exhibit SNC000091 at 17.

93. As part of its preparation of its Combined Operating License ("COL") application and in order to respond to questions from the NRC Staff regarding the properties of the geologic material underneath the engineered backfill, SNC conducted 160 additional borings, 42 of which went down into and through the Blue Bluff Marl into the lower sands. These in situ layers, in addition to the engineered structural backfill, provide support to the foundation of the plant. Tr.-M-2324.

94. In reviewing the suitability of the backfill relative to the ESP, NRC Staff also had access to data submitted by SNC to support its LWA request. The data generated to support the LWA supplemented the data provided to support the ESP, such that the combination of the data from both programs provided reasonable assurance to define the shear wave velocity of the engineered structural backfill. Tr.-M-2325-26; Exhibit NRC000065 at 25.

95. NRC Staff requested additional information from SNC regarding soil degradation and damping ratio curves in order to obtain site specific data regarding non-linear behavior of backfill due to seismic events. SNC provided additional information in a revision to SSAR §

2.5.4 and demonstrated in SSAR § 2.5.2.9.3 that the new data had no impact on site response. Tr.-M-2328-29; Exhibit NRC000065 (Seismic portion) at 27; Exhibit NRC000056 at § 2.5.2.2.8.

96. NRC Staff questioned SNC's modeling approach for the seismic site response and seismic SSI response of the AP1000 Nuclear Island given the excavation and backfill geometry. SNC performed sensitivity analyses utilizing explicit two-dimensional dynamic models of the excavation and backfill geometry that demonstrated that SNC's modeling was adequate with respect to site response and SSI analysis.

97. NRC Staff agreed based on these sensitivity analyses that SNC's modeling approach was adequate. Tr.-M-2329-30; Exhibit NRC000056 at §§ 2.5.2.4.5, 3.7.2.3.1.2.

98. NRC Staff reviewed the test pad program conducted by SNC to demonstrate the dynamic properties of the engineered structural backfill. NRC Staff concluded that the test pad program was more extensive than usually performed. NRC Staff confirmed that approximately 3 million to 4 million cubic yards of engineered structural backfill will be installed as part of the foundation for Vogtle Units 3 and 4, that the placement of the backfill will be in accordance with the standard procedures used in the heavy construction industry, and that the installation of the backfill will result in a shear wave velocity necessary to ensure that significant large settlements or discontinuities which would impact the walls and the base mat of the structure would be avoided. Tr.-M-2323-24; Exhibit NRC000056 at §§ 2.5.2.2.2-2.5.2.2.4, 2.5.4.4.

99. NRC Staff concluded that with respect to the stability of subsurface material and foundations that are going to be used for the Vogtle site, that SNC provided sufficient information to adequately describe the site, characterize the site and use the data to generate seismic inputs into SSI analysis, specifically the site-specific GMRS, and also determined that SNC had provided sufficient information to judge that the stability for both static conditions and

sliding and overturing due to seismic are not issues of concern for the Vogtle 3 and 4 site. Tr.-M-2333; Exhibit NRC000056 at § 2.5.4.4; Exhibit NRC000065 (Seismic portion) at 29.

100. NRC Staff's conclusions regarding the stability of subsurface material for the Vogtle ESP site are based on a thorough evaluation and are consistent with the evidence. Tr.-M-2331-33.

101. NRC Staff included a permit condition in the FSER requiring "that the Applicant shall either remove and replace, or shall improve, the soil directly above the Blue Bluff marl for soil under or adjacent to seismic category 1 structures, to eliminate any liquefaction potential." SNC's LWA request encompasses activities that, when completed, will satisfy this permit condition. Satisfaction of the permit condition will eliminate liquefaction as a concern at the Vogtle site. Tr.-M-2277-78, 2328-29; Exhibit NRC000065 (Seismic portion) at 28; Exhibit SNC000091 at 25.

102. NRC Staff concluded that there were no safety-related permanent slopes near the location of the proposed Vogtle Units 3 and 4. Therefore no slope stability analysis was necessary. Exhibit NRC000065 (Seismic portion) at 31.

103. Although NRC Staff included twelve COL Action Items requiring additional information regarding the stability and bearing capacity of subsurface material and foundations in the FSER, each of those COL Actions Items have been resolved through the provision of additional information by SNC in connection with the LWA request or as part of a SSAR revision in this ESP proceeding. Accordingly, NRC Staff confirmed in the mandatory hearing that each of the seismic COL Action Items has been satisfied by SNC in this ESP proceeding. Exhibit NRC000065 at 30; Tr.-M-2331.

iii. Site Safety Assessment – FSER Chapter 3

104. Chapter 3 of the FSER provides NRC Staff's analysis of two distinct issues, aircraft hazards and the LWA analysis.

105. SNC provided information regarding aircraft hazards in its application and response to NRC Staff's RAI 3.5.1.6-1, including information regarding airports in the vicinity and projected aircraft operations and military aircraft activity near the Vogtle ESP site. Based on this data, SNC provided calculations regarding potential aircraft hazards. Exhibit NRC000056 at § 3.5.1.6.

106. The NRC Staff independently analyzed and verified SNC's information, data, and assumptions in its consideration of aircraft hazards in accordance with RS-002, finding that the VEGP site "is acceptable for planned nuclear units, and that the site meets the relevant requirements of 10 C.F.R. Part 52 and 10 C.F.R. Part 100." Exhibit NRC000056 at § 3.5.1.6.4.

a. Appendix 2.5E and Limited Work Authorization

107. The LWA analysis included Seismic Design Parameters, Seismic System Analysis, and Foundations. Exhibit NRC000056 § 3.7.1.1. SNC provided adequate information regarding all three LWA areas of consideration, including adequately developed seismic design parameters. Exhibit NRC000056 at §§ 3.7.1, 3.7.2, 3.8.5.

108. SNC's LWA activities encompass soil foundation work, the placement of a concrete mud map, a waterproofing membrane, a mechanically stabilized earth wall and temporary drains. Tr.-M-2277-78, 2335-36.

109. The engineered backfill will be installed first, followed by six inches of concrete, followed by a spray-on waterproof membrane and an additional six inches of concrete on top of the waterproof membrane to form the mud mat. The mud mat will be approximately 40 feet in depth, which corresponds to approximately the depth of the embedment of the nuclear island.

The footprint of the mud mat corresponds to the footprint of the nuclear island and is approximately 160 feet by approximately 260 feet, or approximately an acre in size. The mud mat to be placed will be 12 inches thick in total. It will be comprised of two 6-inch layers with waterproofing membrane sandwiched between the two layers, and the concrete should have a compressive strength of approximately 2500 psi. The waterproof membrane itself will be an elastic spray-on membrane, approximately 80-100 mils in thickness. It will be sandwiched between the two layers of concrete. The mud mat will provide the working surface for the reinforcing bar to be installed later. All this activity will occur within the mechanically stabilized earth ("MSE") retaining wall. The membrane will extend vertically up the MSE wall. The design of the foundation was reviewed by the NRC Staff pursuant to Standard Review Plan Sections 3.7.1, 3.7.2 and 3.8.5. Tr.-M-2278, 2342-44; Exhibit NRC000065 at 16; Exhibit SNC000091 at 25.

110. As a result of the LWA activities, the nuclear island of Vogtle Units 3 and 4 would be founded on approximately 50 feet of engineered structural backfill; a 70-80 foot layer of hard, slightly sandy clay (the Blue Bluff Marl), approximately 900 feet of dense sands beneath the Blue Bluff Marl; and the Triassic basin rock at approximately 1,049 of depth. Exhibit NRC000065 at 4; Exhibit SNC000091 at 24.

111. Because the GMRS for the Vogtle site exceeds the AP1000 certified seismic design response spectrum in both high and low frequency ranges, SNC performed a site-specific SSI analysis to demonstrate nuclear island stability for the LWA request. NRC Staff carefully reviewed SNC's site-specific analyses for foundation stability in their evaluatin of the LWA request. Exhibit NRC000065 at 18; Tr.-M-2285, 2347-48; Exhibit NRC000056 at § 3.7.1.4.

112. The NRC Staff reviewed the data generated by Applicant in support of the LWA request and the SSI modeling performed pursuant to Chapter 2.5 of the SSAR and FSER and concluded that the analyses of the subsurface stability are adequate to generate the information needed to compute the GMRS and the foundation input response spectrum ("FIRS") necessary for the approval of the LWA. Tr.-M-2327; Exhibit NRC000056 at §§ 3.7.1.3.2.1-3.7.1.4.

113. The shear wave velocity measurements taken in connection with the LWA test pad demonstrate that shear wave velocity of 1,000 per second is reached at a 20-foot depth, indicating that at the foundation depth of 40 feet, shear wave velocity should exceed 1,000 feet per second. Tr.-M-2261-62, 2341.

114. The NRC Staff conducted an evaluation of the input parameters to the site specific analysis, including FIRS and concluded the FIRS are free-field outcrop spectra (determined using the entire soil column from bedrock to the free surface) at the foundation basemat elevation (*i.e*. 40 feet below grade). The NRC Staff reviewed SNC's method for developing the FIRS and found that the method used to generate randomized shear wave velocity profiles and the mean uniform hazard spectra at the top of the backfill satisfied NRC regulatory requirements. NRC Staff also concluded that SNC's method for developing FIRS outcrop motions resulted in a conservative estimate of horizontal and vertical motion. Tr.-M-2272-74, 2326-27, 2338, 2347-48; Exhibit NRC000056 at §§ 3.7.1.3.1-3.7.1.3.2.1.

115. The NRC Staff also evaluated whether the FIRS satisfied the 10 C.F.R. Part 50 Appendix S requirement that the free field motion at the foundation elevation be a minimum peak ground acceleration ("PGA") value of 0.1 Gs. The NRC Staff reviewed SNC's site specific SSI and confirmed that the Vogtle FIRS PGA measurements at the bottom of the nuclear island foundation are approximately .26g in the horizontal direction and .23g in the vertical direction,

thus exceeding the minimum value for the horizontal component of SSE ground motion. Exhibit NRC000056 at § 3.7.1.4; Tr.-M-2348.

116. The NRC Staff concluded that the use by SNC of a 2-D site specific model for evaluating SSI for the purpose of determining maximum seismic demands meets applicable regulatory requirements. The NRC Staff will evaluate in-structure response as part of its review of SNC's COL Application. Tr.-M-2348-49; Exhibit NRC000065 (LWA) at 28; Exhibit NRC000056 at § 3.7.2.3.2.1.

117. SNC's site specific analysis demonstrated adequate margins of safety for seismic stability regarding sliding, overturning, static bearing, dynamic bearing and soil liquefaction. NRC Staff performed independent calculations to verify that seismic shear forces calculated by SNC's 2-D analysis were reasonable in range. The NRC Staff found that they were realistic values based on its calculations. Exhibit NRC000065 at 22-24; Tr.-M-2279-81, 2284-90, 2292-94, 2348-49; Exhibit SNC000091 at 31.

118. SNC has provided ITAAC for all LWA activities. The ITAAC for the LWA include requirements that the backfill material underneath seismic category 1 structures be installed to meet a minimum of 95% Modified Proctor Compaction, and that the shear wave velocity be greater than or equal to 1,000 per second at the depth of the nuclear island foundation and below. The ITAAC require testing to be performed during the placement of the backfill materials and that shear wave velocity measurements be performed when the backfill placement reaches the elevation at the bottom of the nuclear island foundation and at finished grade. The ITAAC acceptance criteria for backfill include documented confirmation that the backfill material supporting seismic category 1 structures meets the 95% modified proctor compaction

and that the as-built backfill shear wave velocity at nuclear island foundation depth and below be greater than or equal to 1,000 feet per second. Exhibit NRC000065 at 13; Tr.-M-2340-41.

119. NRC Staff does not believe that design changes from Rev. 15 of the AP1000 DCD to Rev. 17 of the AP1000 DCD will materially alter the dimensions of the footprint, weight or inertia of the nuclear island of the AP1000. Accordingly the design changes should not alter the seismic demand of the AP1000 and consequently those changes should not alter the conclusions reached in its review of the LWA. Tr.-M-2345.

120. SNC provided a thorough and detailed evaluation of the seismic characteristics of the Vogtle site, consistent with NRC regulations and guidelines. NRC Staff conducted a thorough review of the material submitted by SNC regarding the seismic characteristics of the Vogtle site and reasonably concluded, based upon the evidence, that SNC adequately developed seismic design parameters and has met the applicable regulatory requirements, that SNC adequately performed site specific two dimensional soil structure interaction analysis for the purpose of determining maximum seismic demands and has met the applicable regulatory requirements, and that SNC has demonstrated that the mud mat and waterproofing membrane are adequate, that the nuclear island foundation will be stable during a safe shutdown event, and that SNC's proposed mud mat and waterproofing membrane designs meet applicable regulatory requirements. Tr.-M-2331-33, 2341-42, 2344-46; Exhibit NRC000065 at 27-28, 31-35.

121. The ITAAC associated with the proposed LWA activities are adequate to ensure that the installation of the foundation for the nuclear island will be in accordance with NRC regulations and guidance and will provide adequate margins of safety. Tr.-M-2341-43, 2350-2358.

iv. Radiological – FSER Chapter 11

122. Chapter 11 of the FSER provides NRC Staff's analysis of radiological effluent release dose consequences from normal operations in SNC's Revision 2 of the ESP Application, which included Chapter 11 of the SSAR (Radioactive Waste Management). Exhibit NRC000056 at §§ 11.1, 11.4.

123. NRC Staff conducted its own analysis of SNC's information considering the regulatory requirements of 10 C.F.R. Parts 20, 52, and 100 to extent practicable in an ESP rather than a COL or CP proceeding. The Staff independently confirmed SNC's calculations and bounding parameters in its technical review. Exhibit NRC000056 at §§ 11.2-11.3.

124. NRC Staff's analysis of the safety issues regarding radiological impacts was thorough, consistent with regulatory requirements and guidance, and its findings are consistent with the evidence.

125. NRC Staff concluded there were reasonable assurances that SNC "will control and maintain radioactive gaseous and liquid effluents from the proposed facility within the regulatory limits" specified in 10 C.F.R. Part 20 and Appendix I to 10 C.F.R. Part 50. The NRC Staff further concluded in Chapter 11 of the FSER that "the postulated radiological doses to members of the public from radiological gaseous and liquid effluents resulting from the normal operation of one or more new nuclear power plants constructed on the proposed site would not pose an undue risk to the health and safety of the public." Finally, the NRC Staff concluded that the proposed site is acceptable with respect to radiological effluent release dose consequences from normal operations and "the application meets the relevant requirements of 10 C.F.R. 52.17 and 10 C.F.R. Part 100." Exhibit NRC000056 at § 11.4.

v. Conduct of Operations – FSER Chapter 13

126. Chapter 13, addressing the conduct of operations, states that SNC provided adequate and acceptable information regarding emergency planning, physical security, and the fitness for duty program. Exhibit NRC000056 at §§ 13.3, 13.6, 13.7.

127. In its independent review conducted in accordance with the guidance in RS-002 and 10 C.F.R. Parts 52 and 100, the NRC Staff consulted with the Federal Emergency Management Agency. In addition to reviewing SNC's onsite emergency plan, the NRC Staff reviewed the radiological emergency response plans for the States of South Carolina and Georgia and for the affected counties. The NRC Staff independently analyzed and confirmed SNC's data and conclusions. *Id.*

128. In accordance with the Board's December 5, 2008 Order, the NRC Staff and SNC presented testimony and documentary evidence regarding SNC's Emergency Plan for Vogtle Units 3 and 4.

129. SNC's witness regarding the Vogtle Units 3 and 4 Emergency Plan was Mr. Ted Amundson. Mr. Amundson has over 32 years of experience in the commercial nuclear industry, serving in a variety of roles, including system engineering and management positions in training, quality assurance, engineering and business support. While in the business support area, one of the functional areas he was responsible for included emergency preparedness. While serving in various positions, he was active in emergency preparedness serving as a drill or an exercise controller and evaluator, a scenario developer, and was qualified as an emergency director and emergency manager. In addition to the above, he was licensed as a Senior Reactor Operator and was a Shift Technical Advisor. He holds a Bachelor's degree in Mechanical Engineering with an aeronautical option and a Master's degree in Mechanical Engineering. Tr.-M-2077-78; Exhibit SNC000084.

130. NRC Staff also presented testimony and documentary evidence regarding SNC's Emergency Plan and the FSER. NRC Staff's witness in this regard was Mr. Bruce Musico. Mr. Musico is a Senior Emergency Preparedness Specialist with the NRC's Office of Nuclear Security and Incident Response. He is a nuclear engineer and has approximately 20 years of emergency planning experience. Tr.-M-2128; Exhibit NRC000080.

a. SNC's Emergency Plan

131. Pursuant to 10 C.F.R. § 52.17(b)(2)(ii), SNC submitted a complete and integrated Emergency Plan and a set of ITAAC to address those elements of the Plan that cannot be completed during the ESP application proceeding. The Emergency Plan was developed from the existing emergency plan for Vogtle Units 1 and 2 and revised to incorporate features that would accommodate the addition of Vogtle Units 3 and 4. Given the proximity of Vogtle Units 3 and 4 to the existing units, there are very few differences between the existing site and the ESP site for purposes of emergency planning. The Emergency Plan contains appendices that are applicable to all four units (*e.g.*, a description of the public notification system) and appendices that address the element features that are unique to Vogtle Units 1 and 2 and Units 3 and 4 (*e.g.*, detailed Emergency Action Levels for each design will be in the respective annexes). Tr.-M-2077-79; Exhibit SNC000083 at 3; Exhibit SNC000085.

132. Where an applicant for an ESP submits a complete and integrated emergency plan, 10 C.F.R. § 50.47(a)(1)(iii) requires a finding by the NRC prior to issuance of the ESP that such plan provides a reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency. The sixteen standards that a proposed emergency plan must satisfy in order to support such a finding are set forth in 10 C.F.R. § 50.47(b). *See* Exhibit NRC000064 at 6-7. As stated in the FSER, NRC Staff found that the information

provided by SNC in the EP was acceptable and met the requirements of 10 C.F.R. 50.47(b). Exhibit NRC000056.

133. In this regard, Mr. Amundson specifically testified regarding the Emergency Plan "Key Elements," which are those that are considered to be risk significant (as defined in NRC inspection manuals). These Key Elements are emergency classifications, notifications, accident assessment, and protective response. Mr. Amundson also testified regarding the elements of emergency communications and emergency facilities and equipment, which are of key importance to NRC and the public. Tr.-M-2086; Exhibit SNC000083 at 9.

(i) Emergency Classifications

134. Classification of emergencies within the Emergency Plan follows the industry standard definitions of notification of an unusual event, alert, site area emergency, and general emergency. An Emergency Action Level ("EAL") is a predetermined, site-specific, observable threshold for a plant initiating condition that places the plant in a given emergency classification level. An EAL can be an instrument reading; an equipment status indicator; a measurable parameter; a discrete, observable event; results of analyses; entry into specific emergency operating procedures; or other phenomena, which if it occurs, places it into a particular emergency classification level. Tr.-M-2086-88; Exhibit SNC000083 at 10; Exhibit SNC000085 at Annex V2, Section D and Annex V2-3.

135. EALs provide a variety of equipment-monitoring subpoints and other classification severity levels of which the emergency director must make the classification if an emergency condition exists. EALs are provided for a variety of initiating conditions for each of several recognition categories including: radiological releases, fission product barrier challenges, equipment malfunctions, and hazards including natural phenomenon and security issues. *Id.*

136. A new guideline for EALs, NEI 07-01, is currently under review by the NRC. NEI 07-01 contains EALs that are unique to the advanced passive reactor designs. The EALs approved in NEI 99-01 and the EALs proposed in NEI 07-01 are very similar. Mr. Amundson testified that any differences are primarily in the area of instrument and controls (*e.g.*, digital controlled rooms versus analog controlled rooms). In addition, there are certain aspects of the electrical design that are different in the sense that they are no longer required (*e.g.*, AC power is not required for safety parameters in the passive designs). The specific EALs, or modifications to EALs, have been proposed in NEI 07-01 to address such differences and these are currently under review by the NRC. Mr. Amundson stated that detailed EALs will be developed to conform with NEI 07-01 and will be submitted to the NRC for final confirmation approximately 18 months prior to fuel load. *Id.*

(ii) Notifications

137. With regard to Notifications, the SNC Emergency Plan provides that once an emergency condition exists, the emergency director will classify the event and initiate prompt notifications. Site personnel will hear a tone alert like a siren over the public address system, followed by an announcement regarding the nature of the event and action site personnel should take, if any. The Emergency Response Organization ("ERO") members would be directed to proceed to their assigned emergency facility. In addition, a message will be sent to all off-site ERO personnel via telephone using an auto-dialer system. This auto-dialer system will first send a message to all pagers held by ERO personnel and then it dials home phones and cell phones. State and local officials in the SRS would be notified within 15 minutes via the emergency notification network, which is a dedicated telephone system. The NRC would be notified as soon as possible, but no later than one hour after the classification via the emergency notification system. Tr.-M-2088-90; Exhibit SNC000083 at 11; Exhibit SNC000085 at Section E.

138. The public would be notified via sirens and tone alert radios, which are activated by county officials. Tone alert radios are provided by SNC to all residential, public, and commercial buildings within the 10-mile exposure pathway zone ("EPZ"), excluding the SRS which is responsible for notifying personnel on its site. *Id.*

(iii) Accident Assessment

139. The SNC Emergency Plan provides that initial accident assessment is performed by the shift manager or shift supervisor, whoever is performing the duties of the emergency director. This assessment is done using installed equipment and monitors. Once emergency response facilities are activated, accident assessment is performed from the Technical Support Center ("TSC"). Tr.-M-2090-93; Exhibit SNC000083 at 12; Exhibit SNC000085 at Section I.

140. All on-site conditions are monitored via radiological monitors and radio chemistry analysis may be performed on water and air samples in the on-site chemistry labs located in the respective power blocks. SNC can also utilize off-site laboratories of Georgia Power Company and AREVA, which is located in the Virginia area. Radiological monitors may be used to determine the release rates and computer systems may be used to estimate potential doses off-site. In addition, field monitoring teams may be placed in the field to monitor release plumes and may take samples of air, water, or soil for radiochemistry analysis. Computers are used extensively to process data and assist emergency directors in decision making. *Id.*

141. The primary system utilized for accident assessment is the Meteorological Information and Dose Assessment System ("MIDAS"), which is a computer program that has been utilized for this purpose for many years. The basic functions of MIDAS are the calculation of dispersion of the release material as it travels downwind and the estimation of the resulting concentrations of this material. Dispersion is modeled using the straight-line Gaussian dispersion model. Initial dose projections can be made within 15 minutes of a radiological

release using the MIDAS computer system. MIDAS may calculate doses from as many as four release points simultaneously and participation effects are considered in the analysis. Subsequent dose projections will be made approximately every 15 to 30 minutes depending on the variability of meteorological conditions and/or radioactive releases. *Id.*

(iv) Protective Response

142. With regard to protective response or protective actions recommendations ("PARs"), Mr. Amundson explained that PARs could include alerting, assembling, accountability, site dismissal, radiological monitoring, and decontamination. He also stated that the emergency director is responsible for providing corrective action recommendations to public officials as part of the initial notifications and follow-up communications. Public officials then issue the protective action orders to the public. The recommendations would be based upon the accident assessment described above. Specifically, using available information on plant conditions, projected dose estimates, and any available monitoring data, the emergency director would recommend whether the public should be advised to seek shelter or evacuate. The dismissal of non-involved station personnel and evacuation and/or sheltering of the general public is recommended for a general emergency, even though there may not have been a release of radioactivity from the plant. Tr.-M-2093-94; Exhibit SNC000083 at 13; Exhibit SNC000085 at Section J.

(v) Emergency Communications

143. The primary means of communicating with the NRC is via the Federal Telecommunications System ("FTS"). Communication with state and local officials is done through the Emergency Notification Network ("ENN"), but there are alternative means of communication including an administrative decision-making line, the Burke County Emergency Management Radio System, and/or commercial telephone systems. On-site communication

could be accomplished via dedicated telephone systems, cell telephone systems, standard PDX systems, Southern Link radio systems, and/or other radio systems. Tr.-M-2094-95; Exhibit SNC000083 at 14; Exhibit SNC000085 at Section F.

144. Dedicated circuits allow each control room to communicate directly with the TSC, Emergency Off-site Facility ("EOF"), and Operational Support Center. In addition, each control room contains ENN and ENS circuits. Following an event, the control rooms are not expected to communicate directly with each other, but could use the existing communication systems such as telephones and radios, if necessary. *Id.*

(vi) Emergency Support Facilities

145. Based on its analysis of methods to effectively implement the Emergency Plan at a multiple unit site, SNC has proposed a new TSC to support Vogtle Units 3 and 4 as well as the existing Vogtle Units 1 and 2. SNC proposes to locate the TSC between the Vogtle Unit 2 and Unit 3 power blocks in the Communication Support Center. SNC estimates that it will be approximately ten minutes walking time between the TSC and the Vogtle Unit 4 control room, which is the farthest control room from the TSC. SNC plans to have motorized vehicles to be available for personnel to travel between the TSC and the unit control rooms.

146. Mr. Amundson testified that while NRC guidance generally recommends that the TSC be located within two minutes "walking time" of the control room, industry experience over the past 25 years indicates that advances in communication technology have diminished the importance of close proximity of the TSC to the control room. Specifically, following the Three Mile Island ("TMI") incident, emergency planners anticipated that the decision makers would need frequent, face-to-face communication with the control room to facilitate technical and data exchanges. While this may have been the case following TMI, recent advances in communication systems that provide detailed voice and data information have made these face-

to-face communication sessions less important (as evidenced through drills and exercises). In this regard, the TSC will have many different communication tools including dedicated phone lines, fax machines, electronic mail, and two-way radios. Finally, the TSC will have teleconferencing equipment available, which would provide the ability to conduct face-to-face meetings. *Id.*

147. The TSC will be sized to accommodate an emergency on more than one unit at a time and will have communications equipment, data processing equipment, and support facilities to handle all on-site technologies in all four units. The entire control room of each unit could be electronically duplicated at the TSC, which would provide the ability to replicate information and data that is available to an operator in the control room and to decision makers in the TSC. The TSC will be activated approximately one year prior to fuel load on Vogtle Unit 3 to support the required full participation exercise. *Id.*

148. Mr. Amundson explained that a single TSC provides many benefits, including consistency in planning and execution of the response plan. It also provides a single reporting location, which would prevent any confusion on the part of the emergency team members, and provides a single point of contact for offsite agencies. *Id.*

149. The OSCs for Vogtle Units 3 and 4 will be located in the Control Support Area which is adjacent to the respective control rooms. Exhibit SNC000083 at 16; Exhibit SNC000089.

150. The existing EOF located in SNC corporate headquarters in Birmingham, Alabama will be modified to accommodate Vogtle Units 3 and 4. The EOF will continue to be located in SNC's headquarters in Birmingham, Alabama. The EOF is already designed to accommodate emergencies on all three SNC sites. The design will easily accommodate the

addition of the two new units at Vogtle. The primary function of the EOF is to provide technical assistance to the TSC, coordinate off-site assistance and response to state and local agencies, and to provide direction control and assessment of off-site radiological monitoring. The NRC approved the consolidation of the EOF for all SNC facilities and corporate headquarters in February 2005. Tr.-M-2095-06; Exhibit SNC000083 at 15-16; Exhibit SNC000086; Exhibit SNC000089; Exhibit SNC000090.

(vii) Evacuation Time Estimate

151. SNC performed a new evacuation time estimate ("ETE") study that confirms no significant impediments to emergency planning exists using the existing emergency planning zones. Moreover, twenty-one state and local agencies have certified their concurrence that the proposed plan is practicable and committed to the further development of the plans. Tr.-M-2085; Exhibit SNC000087.

b. NRC Staff's Review of SNC's Proposed Emergency Plan

152. NRC Staff expert, Mr. Bruce J. Musico, testified regarding the NRC Staff's review of the Emergency Plan. Mr. Musico stated that there are 16 planning standards that the NRC staff uses to evaluate the adequacy of an emergency plan (as set forth in 10 C.F.R. § 50.47(b) and NUREG 0654/FEMA-REP-1). Consistent with these standards, Mr. Musico stated that NRC Staff is required to determine whether the proposed emergency plan is adequate and whether there is reasonable assurance that it can be implemented. Tr.-M-2149; Exhibit NRC000064 at 3-4, 6.

153. The NRC Staff reviewed the information submitted by SNC and concluded that the there are no physical characteristics unique to the proposed site that could pose a significant

impediment to the development of emergency plans. Exhibit NRC000056 at Section 13; Exhibit NRC000064 at 3.

154. Mr. Musico explained that there is a distinction between the on-site plans and the off-site plans. NRC Staff reviews the on-site plans, the evacuation time estimate, and the related ITAAC while the Federal Emergency Management Agency ("FEMA") has the primary responsibility for the evaluation of the off-site emergency plans. NRC Staff then reviews FEMA's findings and determines whether there is reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency. The results of NRC Staff's review are set forth in Section 13.3 "Emergency Planning" of the FSER. Tr.-M-2130, 2150; Exhibit NRC000056 at § 13; Exhibit NRC000064 at 3-4, 8.

155. Mr. Musico testified that the basic concepts of emergency planning are based on the two emergency planning zones: the 10-mile plume exposure pathway ("10-mile EPZ") and the 50-mile ingestion-control pathway ("50-mile EPZ"). Within these zones, SNC is responsible for the on-site emergency plan and state and county agencies are responsible for the off-site emergency plans. Federal agencies coordinate their plans in support of these. Tr.-M-2145-46; Exhibit NRC000064 at 4, 8.

156. The portion of the 10-mile EPZ that is on the South Carolina side of the Savannah River is almost covered by the SRS. The DOE is responsible for the emergency response and protection of the individuals located at the SRS. There is a Memorandum of Agreement between DOE and SNC that provides for how emergency response would proceed in the event of an accident at either the Vogtle site or at SRS. Mr. Musico stated that NRC Staff did not review the emergency plans that DOE has for the SRS because such plans are not within the scope of this ESP application. Mr. Musico explained that where an applicant at an existing site incorporates

by reference and utilizes the existing features associated with an emergency plan into the application, there is a presumption of adequacy of those aspects of the incorporated emergency plan. Hence, NRC is not required to conduct a detailed analysis. This being said, NRC Staff did review the Memorandum of Agreement and were satisfied that it adequately represented the existing agreement between DOE and SNC. Tr.-M-2146-49; Exhibit SNC000064 at 8.

157. As described above, the Emergency Plan is based upon the existing plan for Vogtle Units 1 and 2 and will cover the existing units as well as Vogtle Units 3 and 4. Notwithstanding, Mr. Musico explained that the scope of the NRC Staff's review in this ESP proceeding was limited to the Emergency Plan for Vogtle Units 3 and 4. However, Mr. Musico stated that Staff did consider multi-unit events in its analysis. Tr.-M-2152-53; Exhibit NRC000064 at 10.

158. NRC's review of the SNC Emergency Plan for Vogtle Units 3 and 4 confirmed that there are no substantial changes to the off-site emergency planning associated with adding Vogtle Units 3 and 4 to the site and that minor modifications would be addressed in the implementing procedures and the EALs on notification. Mr. Musico added that the 10- and 50-mile EPZs are unchanged and the ETE associated with the 10-mile EPZ is also unchanged. Tr.-M-2153.

159. Mr. Musico also testified regarding NRC Staff's evaluation of the ETE submitted by SNC. Mr. Musico stated that the purpose of an ETE in emergency planning is to provide a representative time frame for evacuation so that emergency officials can incorporate input on evacuation characteristics and traffic flows at the time of an actual emergency and make well-informed, realistic decisions about protective action options. The ETE identifies whether there are impediments to evacuation, whether there are certain features offsite that would impact a

decision by the offsite authorities, and whether to seek shelter or evacuate. Mr. Musico testified that the NRC staff reviewed the ETE submitted by SNC and concluded that the there are no physical characteristics unique to the proposed site that could pose a significant impediment to the development of emergency plans. Tr.-M-2153-56; Exhibit NRC000056 at §§ 13.3.1, 13.3.3.2.10; Exhibit NRC000064 at 11.

160. With regard to the location of the TSC, Mr. Musico stated that NRC guidance and acceptance criteria 8.1.2 state that the TSC must be close to the control room and the walking distance from the TSC to the control room must not exceed two minutes. However, Mr. Musico testified that "advanced communication capabilities" may be used to satisfy the two-minute walking time requirement. In this regard, Mr. Musico stated that a number of other factors were considered by NRC Staff in the approval of the location. Tr.-M-2176-77; Exhibit NRC000064 at 13-23.

161. Mr. Musico explained that there are two key reasons for the location of the TSC near the control room: communications and data availability. Specifically, the methods of communications must enable the necessary management interaction and technical information exchange and data availability must be capable of providing TSC access to control room data. Mr. Musico further explained that the two-minute walking time guidance was the result of the TMI incident and has since been understood as an important part of emergency response in support of control rooms. Tr.-M-2176-77; Exhibit NRC000064 at 14.

162. There are various communication capabilities that have been proposed in support of Vogtle Units 3 and 4 Emergency Plan that provide the necessary communication and data availability and, thus, satisfy the requirement. In addition, the Protection and Monitoring System ("PMS"), Qualified Data Processing System ("QDPS"), Safety Parameter Display System

("SPDS"), and the Emergency Response Data Systems ("ERDS") would be available and are evidence of the multiple data capabilities that now exist. Mr. Musico testified that these capabilities are redundant, dedicated and diversified, and an upgrade from the communication capabilities that were available in 1979 and 1980 when the two-minute walking time requirement was established. Tr.-M-2181-82; Exhibit NRC000064 at 13-15, 18-21.

163. The pending revision to the AP1000 design specifies that the TSC be located within two minutes walking time from the unit control room. NRC Staff will review SNC's request for a departure from this requirement in the COL proceeding. Subject to final resolution of the AP1000 design rulemaking, NRC Staff found the proposed location of the common TSC to be appropriate based on the following factors: (a). advances in communication capabilities (since 1981); (b). increased efficiency of a common facility; (c). eliminates duplication of systems and equipment; (d). meets TSC habitability requirements; (e). located between Vogtle Unit 2 and 3 power blocks within the Vogtle site Protected Area and only a moderate distance from all control rooms; (f). Eliminates confusion regarding which TSC to staff; (g). eliminates need to staff multiple TSCs for multi-unit events; (h). coordinates response among all site units (*e.g.*, control rooms, onsite personnel); (i). provides centralized point of support for entire site; (j). provides single point of contact for offsite support; (k). addresses Security-related events (post-9/11); (l). backup TSC is available onsite (Vogtle Units 1 & 2); and (m) NRC has approved a TSC location ~15 minutes from the control room (*see* Clinton Power Station (March 12, 2007) (ADAMS ML070540270)) Tr.-M-2184; Exhibit NRC000064 at 22-23. Accordingly, as explained in the applicable permit condition detailed below, the location of the TSC will be subject to review and approval in the COL proceeding.

c. Final Safety Evaluation Report

164. NRC Staff reviewed the complete and integrated Emergency Plan submitted by SNC and concluded that, provided that the permit conditions identified below are adequately addressed and the ITAAC are met, the Emergency Plan establishes an adequate planning basis for an acceptable state of onsite emergency preparedness, and there is reasonable assurance that the plan can be implemented. Exhibit NRC000056 § at 13.3.4.

165. NRC Staff also concluded that the Emergency Plan provides an "adequate expression of the overall concept of operation and describe the essential elements of advanced planning and the provisions made to cope with emergency situations." Moreover, the ITAAC submitted by SNC are consistent with NRC's generic ITAAC and related guidance. NRC000056 at §§ 13.3.1, 13.3.3.

166. Finally, NRC Staff stated that, subject to the required conditions and satisfactory completion of the ITAAC, there is reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency at the Vogtle site. *Id.*

d. Emergency Plan Permit Conditions

167. NRC Staff identified seven permit conditions that are meant to address those aspects of the Emergency Plan that may be impacted by NRC's review of NEI 07-01 and ongoing licensing actions. Specifically, as Mr. Musico explained, because the EALs associated with the AP1000 are not yet complete from a generic standpoint as reflected in NEI 07-01, permit conditions are necessary to reflect this and to defer the review of these EALs to the COL application proceeding. Similarly, there are EALs that may be impacted by changes to the AP1000 design currently pending with Rev. 17 to the AP1000 DCD. Accordingly, permit conditions are necessary to require SNC to submit fully developed EAL schemes for Vogtle

Units 3 and 4 that reflect the approved version of NEI 07-01 and the final AP1000 design. Tr.-M-2164-70; Exhibit NRC000056 at § 13.3.3.2.2; Exhibit NRC000064 at 12.

168. NRC Staff also determined that a permit condition is necessary to resolve the issue regarding the location of the TSC. Specifically, this permit condition requires that SNC resolve the difference between the Vogtle Units 3 and 4 common TSC, and the TSC location specified in the AP1000 DCD. *Id.*

169. Finally, NRC Staff determined, subject to these permit conditions and ITAAC, that the on-site and off-site plans are adequate and that there is reasonable assurance that they can be implemented. Moreover, NRC Staff determined that there is reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency, subject to the permit conditions and ITAAC. *Id.*

e. Sufficiency of NRC Staff's Review

170. In its conclusions regarding the issues addressed in Chapter 13 of the FSER, the NRC Staff first concluded that "the VEGP onsite emergency plan establishes an adequate planning basis for an acceptable state of onsite emergency preparedness, and there is reasonable assurance that the plan can be implemented."[75] The NRC Staff also found that the site characteristics impacting physical security will allow a COL applicant "to develop adequate security plans and measures for a reactor(s) that it might construct and operate on the ESP site." The Fitness for Duty Program for LWA activities at the VEGP site is also acceptable. Exhibit NRC000056 at §§ 13.3.4, 13.6.4, 13.7.4.

[75] This finding is based upon the permit conditions identified in this section being adequately addressed and the enumerated ITAAC being met. Exhibit NRC000056 at § 13.3.4.

vi. Accident Analysis – FSER Chapter 15

171. Chapter 15 indicates that SNC provided the requisite information, including site-specific χ/Q values and AP1000 source-term values, for analysis of Radiological Consequences of Design Basis Accidents. Exhibit NRC000056 at § 15.0.3.

172. The NRC Staff independently considered the radiological consequences of design basis accidents in accordance with 10 C.F.R. Parts 50, 52, and 100 and NUREG-0800, including SNC's selection of design basis accidents, design- and site-specific short-term atmospheric dispersion factors, and source terms and radiological consequence evaluations. Exhibit NRC000056 at § 15.0.3.3.

173. The Staff concluded "the proposed site meets the radiological consequence evaluation factors identified in 10 C.F.R. 50.34(a)(1)" for the AP1000 design.[76] There is also "reasonable assurance that the radiological consequences of the postulated DBAs will be within the dose consequence evaluation factors set forth at 10 C.F.R. 50.34(a)(1);" the "site is suitable for power reactors with source term characteristics bounded by those of the AP1000[77] … without undue risk to the health and safety of the public;" and SNC thus complied with the requirements in 10 C.F.R. Parts 52 and 100. Exhibit NRC000056 at § 15.0.3.4.

vii. Quality Assurance Program – FSER Chapter 17

174. Chapter 17 addresses the Quality Assurance Program Description, submitted by SNC in its application, "Nuclear Development Quality Assurance Manual" ("QA Manual"). The QA Manual is properly organized, describes all aspects of work that are important to the safety of nuclear power, and commits SNC to comply with the requisite quality standards. The QA

[76] In this section, the Staff also proposed Permit Condition 9, which will be discussed below in the section on Permit Conditions Identified in the FSER. Exhibit NRC000056 at §15.0.3.4.

[77] These parameters are specified in Appendix A of the FSER, discussed below.

Manual also establishes specific program controls applied to nonsafety-related aspects of importance to plant safety and to which 10 C.F.R. Part 50, Appendix B does not apply. Exhibit NRC000056 at §§ 17.1, 17.3.2, 17.3.3, 17.3.19.

175. The Staff reviewed the QA Manual and the regulatory commitments it contains to independently determine whether it contains adequate guidance such that if it were properly implemented, it would ensure compliance with Appendix B of 10 C.F.R. Part 50. Exhibit NRC000056 at §§ 17.3, 17.4.

176. On the basis of its review, the Staff concluded that the QA Manual does provide adequate guidance to ensure compliance with Appendix B of 10 C.F.R. Part 50, and therefore it "can be used by the applicant for ESP and activities authorized by the limited work authorization." Exhibit NRC000056 at § 17.4.

viii. Review by ACRS – FSER Chapter 18

177. Chapter 18 details that the ACRS completed its review of SNC's ESP and LWA applications and the NRC Staff's FSER. The ACRS issued its final letter report to the NRC Chairman on December 22, 2008 (included as Appendix E to the FSER), and concluded that the application for an ESP and LWA and the NRC Staff's review of the application were adequate. "The ACRS concluded that the ESP and the LWA should be granted." Exhibit NRC000056 at § 18.0; Appendix E.

ix. Conclusions – FSER Chapter 19

178. Finally, the Staff concluded in Chapter 19 of the FSER that:

> the VEGP ESP site characteristics comply with the requirements of 10 C.F.R. Part 100, "Reactor Site Criteria," subject to limitations and conditions proposed … in [the] SER … Further, … the staff concludes that, taking into consideration the site criteria contained in 10 C.F.R. Part 100, two reactors, having characteristics that fall within the parameters for the site, and which meet the terms and

> conditions proposed … in [the] SER, can be constructed and operated without undue risk to the health and safety of the public.

Exhibit NRC000056 at § 19.0. The proposed emergency planning provides "reasonable assurance that the facility has been constructed and will be operated in conformity with the license, the provisions of the Atomic Energy Act, and the Commission's rules and regulations." Exhibit NRC000056 at § 19.0.

179. Based on a thorough and independent review of SNC's application, the NRC Staff concluded that issuance of the ESP and LWA would not be inimical to the common defense and security or the health and safety of the public. *Id.*

180. SNC's "LWA request meets the applicable standards and requirements of the Act and the Commission's regulations." *Id.*

x. Permit Conditions and COL Action Items – FSER Appendix A

a. Permit Conditions

181. Appendix A of the FSER describes the ESP Permit Conditions and COL Action Items proposed by NRC Staff for the Vogtle ESP.

182. The requirement for Permit Conditions ("PC") are set out in 10 C.F.R. § 52.24(b):

> The [ESP] must specify the … terms and conditions of the [ESP] the Commission deems appropriate. Before issuance of either a construction permit or combined license referencing an [ESP], the Commission shall find that any relevant terms and conditions of the early site permit have been met. Any terms or conditions of the [ESP] that could not be met by the time of issuance of the construction permit or combined license, must be set forth as terms or conditions of the construction permit or combined license.

Id.

183. PCs are warranted when "the staff's evaluation in the FSER rests on the assumption that is not currently supported and which is practicable to support only after ESP issuance" or when "a site physical-attribute is not acceptable for the design of systems,

structures, and components important to safety" or finally when "the staff's evaluation depends on a future act." PCs required by 10 C.F.R. § 52.24(b) are not necessary when an NRC regulation already requires regulatory review of the matter in the future. Tr.-M-2210-11.

184. PC 1 requires that "[t]he ESP holder shall either remove and replace, or shall improve, the soils directly above the Blue Bluff Marl for soils under or adjacent to Seismic Category 1 structures, to eliminate any liquefaction potential." Exhibit NRC000068. This permit condition is in place to ensure that SNC's future act of removing the soil directly above the Blue Bluff Marl in order to support no liquifaction potential as a site characteristic occurs. Exhibit NRC000068; Tr.-M-2212.

185. PC 2 and 3 require that "[a]n applicant for a [COL] referencing this [ESP] shall revise the [EALs] for both Vogtle Units 3 and 4 to reflect the final revision of NEI 07-01." NEI 07-01 is a generic revision addressing EALs, which SNC references in its application. However, because the NRC Staff has not completed its review of EALs associated with the AP1000, NEI 07-01 has not been finalized. This permit condition "reflect[s] the unfinished nature of [the NRC Staff's] review of those EALs and defer[s] the review of the EALs to the COL stage." Tr.-M-2165; Exhibit NRC000068.

186. PC 4 and 5 require that "[a]n applicant for a [COL] referencing this [ESP] shall submit a fully developed EAL scheme for both Vogtle Units 3 and 4 that reflects the completed AP1000 design details, subject to allowable ITAAC." The ESP does not provide for the generic design (AP1000) to be incorporated, but some of the physical characteristics associated with design are involved in analyzing the EAL scheme. This permit condition reflects this connection between the design and the EAL, considering that the AP1000 rulemaking is not complete. Tr.-M-2168-73; Exhibit NRC000068.

187. PC 6 and 7 require:

> An applicant for a [COL] referencing this [ESP] shall complete a fully developed set of EALs for both Units 3 and 4, which are based on in-plant conditions and instrumentation, including onsite and offsite monitoring, and which have been discussed and agreed on by the applicant or licensee and State and local governmental authorities, and shall include the full set of EALs in the COL application. If the EALs are not fully developed, the COL application shall contain appropriate ITAAC for the fully developed set of EALs for both Units 3 and 4.

Because the EAL cannot be disassociated from the design, this permit condition essentially encompasses the 10 C.F.R. Part 50 requirement that SNC eventually submit a fully-developed EAL scheme and facilitates the review of the same at the COL stage. Tr.-M-2171-72; Exhibit NRC000068.

188. PC 8 requires that "[a]n applicant for a [COL] referencing this [ESP] shall resolve the difference between the VEGP Units 3 and 4 common [TSC], and the TSC location specified in the AP1000 certified design." Because the AP1000 rulemaking is still in progress, and the ultimate requirements for the TSC are not yet finalized, this permit condition requires that, if SNC's TSC does not correspond to the requirements decided upon in the rulemaking, SNC will seek an exemption request or departure for that item. Tr.-M-2173; Exhibit NRC000068.

189. PC 9 requires: If a COL or CP application referencing this ESP also references a certified design, the COL or CP applicant may demonstrate compliance with the radiological consequence evaluation factors in 10 C.F.R. 52.79(a)(1) or 10 C.F.R. 50.34(a)(1), respectively, by demonstrating that the site-specific χ/Q values determined in the ESP fall within those evaluated in the approval of the referenced certified design. However, if a COL or CP referencing this ESP does not reference a certified design, the applicant would still need to demonstrate that its source term is bounded by the source term values included in the ESP. This

PC's purpose is to clarify that where the COL references this ESP and a certified design each of the individual source terms need not be compared with those imposed as part of the permit. In the event the COL applicant does not reference the certified design upon which the ESP is based, it must only demonstrate that the source term values for the design upon which the COLA is based are bounded by those included in the ESP." Tr.-M-2214-16; Exhibit NRC000068.

b. COL Action Items

190. COL action items are information requirements that the applicant for a COL referencing the Vogtle ESP will address in the FSAR (although the applicant may, after identifying and justifying the change, depart from or omit these items). The intent of a COL action item is to cover analysis that cannot be completed by the Applicant due to insufficient information at the ESP stage, but that will be available at the COL stage. Tr.-M-2198, 2203.

191. The first two COL action items, referenced by FSER § 2.2, involve control room habitability, which is a COL-stage issue because the design specifications for the control room are not yet available. Tr.-M-2101-04.

192. Because the AP1000 employs a passive containment cooling system, the COL Action Item 2.3-1 requires that, should a design change occur which would shift to the use of an ultimate heat sink cooling tower, that change in site characteristic should be addressed at the COL stage. A COL Action Item also ensures that a rail spur discovered on site but not mentioned in the application is incorporated into the security plan at the COL stage. Tr.-M-2204-05, 2208-09; Exhibit NRC000056 at §§ 2.3, 13.6.

B. Environmental

193. Section 102(2)(A) of NEPA requires federal agencies to "utilize a systematic and interdisciplinary approach which will insure the use of natural and social sciences and environmental design arts in planning and decision making which may have an impact on man's

environment." 42 U.S.C. § 4332(2)(A). The NRC Staff's FEIS satisfies this requirement, including discussions of the site (Chapter 2), the affected environment (Chapter 3), impacts from construction (Chapter 4) and impacts of operation (Chapter 5).

194. Section 102(2)(C) of NEPA requires federal agencies to include in an FEIS discussions of the following: (1) the environmental impact of the proposed action; (2) any adverse environmental effects which cannot be avoided; (3) alternatives to the proposed action; (4) the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity; and (§5) any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented. 42 U.S.C. §§ 4332(2)(C)(i) – (v).

195. The FEIS addresses each of these required discussions. Impacts of the proposed action are addressed in Chapter 4 (Construction Impacts), Chapter 5 (Operational Impacts), Chapter 6 (Fuel Cycle, Transportation and Decommissioning Impacts) and Chapter 7 (Cumulative Impacts). Adverse environmental effects which cannot be avoided are included in Section 11.2 (Unavoidable Adverse Environmental Impacts). Alternatives to the proposed action are discussed in Section 1.4 (Alternatives to the Proposed Action), Chapter 9 (Environmental Impacts of Alternatives) and Chapter 10 (Comparison of the Impacts of the Proposed Action and the Alternative Sites). Section 11.4 includes a discussion of the relationship between short-term uses and long-term productivity of the human environment. Section 11.5 includes a discussion of the irreversible and irretrievable commitments of resources. Exhibit NRC000001.

196. The FEIS satisfies the NRC Staff's obligation under Section 102(2)(C) and demonstrates the NRC Staff's "hard look" at the environmental impacts of the proposed action.

197. "The environmental review performed by the staff encompasses all subject matter areas necessary for the ESP application and no other required review has been deferred to the combined license stage." Tr.-M-2191.

i. Introduction – FEIS Chapter 1

198. Chapter 1 of the FEIS (Introduction) explains the ESP application and review process. SNC's ESP application included an ER. The NRC Staff reviewed the ESP application and accompanying ER in accordance with review standard RS-002, *Processing Applications for Early Site Permits* (NRC 2004). Chapter 1 also includes a description of the NRC Staff's three significance levels, SMALL, MODERATE, and LARGE, a description of the proposed action, a purpose and need statement and an outline of the EIS. Exhibit NRC000001 at §§ 1.1-1.6.

ii. Affected Environment – FEIS Chapter 2

199. In its ER, SNC provided information regarding the site location (ER § 2.1), as well as the land (ER § 2.2), water (ER § 2.3), ecology (ER § 2.4), socioeconomic (ER § 2.5), geology (ER § 2.6), meteorology, and air quality and noise (ER § 2.7) aspects of the site. The ER describes related Federal and other project activities (ER § 2.8) and existing plant site characteristics, design parameters and site interface values (ER § 2.9). Exhibit SNC000001 at §§ 2.1-2.9.

200. The NRC Staff considered the information provided by SNC in the ER and conducted its own, independent review of the "Affected Environment." Chapter 2 of the FEIS describes the site location for the proposed Vogtle Units 3 and 4. Chapter 2 also presents the land, meteorology and air quality, geology, radiological environment, water, ecology, socioeconomics, historic and cultural resources, and environmental justice aspects of the site. Finally, Chapter 2 contains a description of related federal projects and the NRC Staff's consultation requirements. Exhibit NRC000001 at Chapter 2.

201. The NRC's Environmental Standard Review Plan, NUREG 1555, does not contain guidance for environmental review of seismic issues. Instead, the ESRP in section 2.6 gudies the NRC staff to refer seismic evaluations and analyses to the SER. NRC Staff followed that guidance with respect to the Vogtle FEIS. NRC's Staff's compliance with NUREG 1555 was appropriate. Tr.-M-2363

iii. Site Layout and Plant Description – FEIS Chapter 3

202. In its ER, SNC provided information regarding the plant description (ER § 3.0), which included the external appearance and plant layout (ER § 3.1), the reactor power conversion system (ER § 3.2), plant water use (ER § 3.3), the cooling system (ER § 3.4), radioactive waste management system effluents (ER § 3.5), non-radioactive waste systems (ER § 3.6), the power transmission system (ER § 3.7), transportation of radioactive materials (ER § 3.8), pre-construction and construction activities (ER § 3.9), and a work force characterization (ER § 3.10). Exhibit SNC000001 at §§ 3.1-3.10.

203. The NRC Staff considered the information provided by SNC in the ER and conducted its own, independent review of the "Site Layout and Plant Description." Chapter 3 of the FEIS describes the key site characteristics needed to assess the environmental impacts of the proposed action. Chapter 3 discusses the external appearance and layout of the existing and new units, as well as the plant design and power transmission system. Exhibit NRC000001 at §§ 3.1-3.4.

iv. Construction Impacts – FEIS Chapter 4

204. In its ER, consistent with 10 C.F.R. §§ 51.45 and 51.50, SNC provided information regarding the environmental impacts of construction of Vogtle Units 3 and 4. These included land use impacts (ER § 4.1), water related impacts (ER § 4.2), ecological impacts (ER § 4.3), socioeconomic impacts (ER § 4.4), radiation exposure to construction workers (ER § 4.5),

measured and calculated dose rates (ER § 4.6), and non-radiological health impacts (ER § 4.7). Exhibit SNC000001 at §§ 4.1-4.7.

205. The NRC Staff considered the information provided by SNC in the ER and conducted its own, independent review of the "Site." Chapter 4 of the FEIS describes land use impacts (§ 4.1), meteorological and air-quality impacts (§ 4.2), water-related impacts (§ 4.3), ecological impacts (§ 4.4), socioeconomic impacts (§ 4.5), historic and cultural resources (§ 4.6), environmental justice impacts (§ 4.7), nonradiological health impacts (§ 4.8), and radiological health impacts (§ 4.9). Chapter 4 also includes an analysis of the measures and controls to limit adverse impacts during site-preparation activities and construction (§ 4.10) and a site redress plan (§ 4.11). Exhibit NRC000001 at §§ 4.1-4.11.

206. Using the three significance levels as a measure, the Staff concluded that impacts from construction would range from SMALL to MODERATE. Specific impact determinations are summarized in Table 4-7 of the FEIS. Exhibit NRC000001.

207. The methods used to analyze impacts from construction were proper and consistent with NEPA guidance. Chapter 4 of the FEIS demonstrates the NRC Staff's "hard look" at the environmental impacts associated with the construction of Vogtle Units 3 and 4.

208. The Board asked for additional information regarding construction impacts, specifically the prerequisite and actual activities that would be undertaken pursuant to the requested LWA, the anticipated impacts of those activities on the site and the specific activities that would be implemented under the Site Redress Plan to mitigate those impacts. At the Mandatory Hearing, SNC and the NRC Staff provided a presentation with such information. SNC's witness was Mr. Dale Fulton, who is an Environmental Project Manager for SNC with ten years of experience in environmental consulting. NRC's witness was Dr. Michael Sackshewsky,

Pacific Northwest National Laboratory's ("PNNL") team leader for the Vogtle ESP EIS. Both witnesses were well-qualified, knowledgeable, and credible regarding the subject matter.

209. SNC evaluated the environmental impacts of its LWA activities in its ER and proposed a site redress plan in connection with its LWA request in accordance with 10 C.F.R. § 52.17(c) and 10 C.F.R. § 50.10(d)(3). SNC concluded that the impacts from LWA activities were similar to those of construction and were SMALL to MODERATE. SNC proposes environmental controls to mitigate environmental impacts of construction. Exhibit SNC000077 at 11; Exhibit SNC000001 at §§ 1.3.2, 1.3.3, 3.9; Tr.-M-2033-34.

210. The ER evaluated the direct and cumulative impacts of pre-construction and construction of Vogtle Units 3 and 4, which included environmental impacts of the LWA activities and pre-construction activities associated with the LWA. Tr.-M-2033-34; Exhibit SNC000001 at §§ 1.3.2, 1.3.3, 3.9.

211. The FEIS considered construction and pre-construction impacts cumulatively, including the impacts of the LWA activities and pre-construction activities associated with the LWA. The NRC Staff concluded that the environmental impacts of the LWA activities are bounded by the overall construction impacts and that for many resource areas the environmental impact of actual construction is minimal. Exhibit NRC000063 at 13-14.

212. The NRC Staff concluded that the cumulative construction impacts are small, except for moderate impacts on historic and cultural resources and positive moderate impacts on several socioeconomic sub-areas. The LWA portion of the moderate impacts would likely be relatively small and of short duration. Exhibit NRC000063 at 14.

213. SNC's site redress plan describes how SNC would return the Vogtle Units 3 and 4 site to an unattended, environmentally stable and aesthetically acceptable condition in the event the Vogtle Units 3 and 4 are not constructed. Exhibit SNC000077 at 13, Exhibit SNC000082.

214. SNC's redress plan provides for the burial of engineered backfill and subsurface structures constructed as part of the LWA activities. *Id.*

215. None of the LWA activities require barging of materials to the Vogtle site. Tr.-M-2042-43.

216. The environmental impacts of performing site redress are similar to the impacts of pre-construction and the LWA construction impacts, including noise, traffic, erosion and sedimentation, air quality and potential pollution sources. SNC proposes to institute controls during pre-construction, construction and during redress activities to mitigate those impacts. Tr.-M-2041-42.

217. Prior to initiating site redress activities SNC would consult appropriate state and local officials regarding the acceptability of the burial of LWA structures in place as a landfill under the Georgia Solid Waste Management Rules, and would ensure that no significant amounts of degradable materials would remain below grade, and re-grade the area to conform to surrounding land surface and to mitigate erosion from storm water runoff. In the event Georgia State officials do not approve in-place disposal, SNC would demolish and remove LWA structures in accordance with Georgia requirements. Tr.-M-2041-42; Exhibit SNC000082; Exhibit SNC000077 at 13.

218. Prior to conducting LWA activities, SNC intends to conduct certain pre-construction activities that are outside the scope of the definition of "construction" under Part 51. Such pre-construction activities include excavation, underground pipe installation, docking and

unloading facilities installation, intake and discharge coffer dams and piling installation, road and railroad construction, security construction, clearing, grubbing and grading, and erosion and other environmental mitigation measures. Tr.-M-2028-29; SNC000077 at 5.

219. SNC proposes to implement fitness-for-duty, quality assurance and problem identification and resolution programs in connection with the LWA activities requested in connection with the ESP application. In addition, SNC will be required to obtain a variety of state and local permits in order to engage in the pre-construction and LWA activities. SNC000077 at 12.

220. SNC's LWA request includes a commitment to implement environmental controls or to mitigate the environmental impacts of the LWA activities, including groundwater monitoring, construction of debris basins and settling basins, preparation of site drainage and storm water management system, dust suppression controls, creation of solid waste storage areas, creation of borrow, spoils and soil storage areas, spill containment controls and silt screens. Tr.-M-2042; Exhibit SNC000077 at 11, 13.

221. NRC Staff concluded that SNC's proposed site redress plan would adequately redress the LWA impacts and would achieve an environmentally stable and aesthetically acceptable LWA site and that implementation of the site redress plan would not have any adverse environmental impacts.

222. The NRC Staff's conclusions regarding the environmental impacts of SNC's LWA activities and the acceptability of its site redress plan were based upon a thorough review by the NRC Staff of SNC's application for LWA and environmental report and are supported by the evidence.

223. The NRC Staff's review of the environmental impacts of the LWA activities and proposed site redress plan, together with the documentary and testimonial evidence presented by NRC Staff and SNC to the Board constitute a reasonable "hard look" at the environmental impacts of the LWA activities and regarding the SNC Site Redress Plan.

v. Operational Impacts – FEIS Chapter 5

224. In its ER, consistent with 10 C.F.R. §§ 51.45 and 51.50, SNC provided information regarding the environmental impacts of operation of Vogtle Units 3 and 4. These included land use impacts (ER § 5.1), water related impacts (ER § 5.2), cooling system impacts (ER § 5.3), radiological impacts of normal operation (ER § 5.4), environmental impact of waste (ER § 5.5), transmission system impacts (ER § 5.6), uranium fuel cycle impacts (ER § 5.7), socioeconomic impacts (ER § 5.8), decommissioning (ER § 5.9), measures and control to limit adverse impacts during operations (ER § 5.10), transportation of radioactive materials (ER § 5.11), and non-radiological health impacts (ER § 5.12). Exhibit SNC000001 at §§ 5.1-5.12.

225. The NRC Staff considered the information provided by SNC in its ER and conducted its own, independent review of the "Station Operational Impacts at the Proposed Site." Chapter 5 of the FEIS contains a description of the land use impacts (§ 5.1), meteorological and air-quality impacts (§ 5.2), water-related impacts (§ 5.3), ecological impacts (§ 5.4), socioeconomic impacts (§ 5.5), historic and cultural resource impacts from operations (§ 5.6), environmental justice (§ 5.7), nonradiological health impacts (§ 5.8), radiological impacts of normal operations (§ 5.9), environmental impacts of postulated accidents (§ 5.10), and measures and controls to limit adverse impacts during operation (§ 5.11). Exhibit NRC000001 at §§ 5.1-5.11.

226. In its ER, SNC provided information regarding environmental impacts of postulated accidents involving radioactive materials. This included information on design basis

accidents (ER § 7.1), severe accidents (ER § 7.2), and severe accident mitigation measures (ER § 7.3). Exhibit SNC000001 at §§ 7.1-7.3.

227. Design basis accidents are discussed in 5.10.1 of the FEIS and severe accidents are discussed in § 5.10.2.

228. The Board asked for additional information regarding Severe Accident Mitigation Alternatives ("SAMDAs") and such information was presented to the Board during the Mandatory Hearing. NRC presented evidence on this issue from Mr. James Van Ramsdell. Mr. Van Ramsdell has worked at the PNNL since 1967, and has 39 years of experience conducting environmental reviews. He was the program manager for updating the Environmental Standard Review Plans, and he conducted EIS Accident Analyses for the Clinton, Grand Gulf, and North Anna ESP Environmental Reviews. Exhibit NRC000075; Exhibit NRC000060 (environmental portion) at 27.

229. SAMDAs are changes in facility design to mitigate the consequences of severe accidents, (*i.e.* accidents that are beyond the design basis of a nuclear power plant). The Commission's Policy Statement "Nuclear Power Plant Accident Considerations Under the National Environmental Policy Act of 1969" and the Commission "Policy Statement on Severe Reactor Accidents Regarding Future Designs and Existing Plants," provide for the review of severe accidents in NRC NEPA documents on licensing actions. NRC Staff conducted a review of SAMDAs as part of its review of severe accidents for Vogtle Units 3 and 4. Exhibit NRC000066 at 3; Tr.-M-2368.

230. The AP1000 Design Certification Rule, 10 C.F.R. Part 52, Appendix D, certifies Rev. 15 of the AP1000 DCD as a standard design. The Vogtle SSAR is based on Rev. 15 of the AP1000 DCD. Rev. 15 includes an analysis of SAMDAs applicable to the AP1000 design. Many

SAMDAs that might be considered cost-beneficial in the context of the current generation of nuclear power plants are incorporated into the standard design of the AP1000. The core damage frequency of the AP1000 is also orders of magnitude lower than the current fleet. Consequently, the marginal benefit to the AP1000 from additional SAMDAs is less than the marginal cost of the alternative in each case. Accordingly, NRC's environmental assessment of Rev. 15 of the AP1000 DCD concluded that none of the potential SAMDAs evaluated was cost effective. Pursuant to 10 C.F.R. Part 52 Appendix D, SAMDA issues for plants referencing the design are resolved as long as the site parameters are bounded by the site parameters specified in the SAMDA evaluation in Rev. 15 of the DCD. Exhibit NRC000066 at 4-7; Tr.-M-2368-70, 2374.

231. The NRC Staff reviewed the relevant site parameter for the Vogtle site against the site parameters upon which the SAMDA analysis for the Rev. 15 of the AP1000 DCD was based. In all cases, the Vogtle site parameters are bounded by the generic site parameters upon which the DCD analysis is based. Exhibit NRC000066 at 8-9; Tr.-M-2371-72.

232. The NRC Staff's conclusions are consistent with the evidence and constitute a reasonable evaluation of SAMDA's for the Vogtle ESP site.

233. Using the three significance levels as a measure, the NRC Staff concluded that impacts from operation would range from SMALL to MODERATE. Specific impact determinations are summarized in Table 5-19 of the FEIS.

234. The methods used to analyze impacts of operation were proper and consistent with NRC NEPA guidance. Chapter 5 of the FEIS demonstrates the NRC Staff's "hard look" at the environmental impacts associated with the operation of Vogtle Units 3 and 4.

235. At the Mandatory Hearing, pursuant to the Board's Oct. 17, 2008 Order, SNC and the NRC Staff provided a presentation on the radiological sources, pathways and doses to the public from both routine operation and potential accidents for Vogtle Units 3 and 4.

236. SNC presented testimony and documentary evidence for the environmental review of the radiological impacts of Vogtle Units 3 and 4. SNC's witness was Mr. Philip L. Young. Mr. Young is a certified health physicist with Tetra Tech, Inc. He assisted with the preparation of the ER for Vogtle Units 3 and 4. Mr. Young has over seventeen years of experience assessing environmental impacts of nuclear facilities, managing the preparation of NEPA documents, and performing radiological human health and ecological risk assessments. He has been directly involved in the preparation of ERs for license renewal at eighteen nuclear power plants. Tr.-M-1751; Exhibit SNC000071.

237. NRC Staff presented the following panel of witnesses in support of its evaluation of the radiological impacts at the Vogtle site: Mr. Michael Smith and Mr. James Van Ramsdell. Mr. Smith has ten years of experience in the field of health physics related to performance assessment, safety analysis, dose assessment, computer modeling, environmental assessment, and the environmental impact for new nuclear power, high-level waste geologic repositories, spent fuel storage facilities, uranium reprocessing facilities, uranium in-situ leaching facilities, and various decommissioning projects. Mr. Van Ramsdell's qualifications are described in paragraph 228. Exhibit NRC000076; Exhibit NRC000060 (environmental portion) at 6.

238. SNC's environmental review of radiological impacts was an outward looking review, which analyzes the impact on the environment from the nuclear power plant. Tr.-M-1860-61.

239. In accordance with the requirement in 10 C.F.R. § 20.1302(b)(1), SNC evaluated the radiological impacts of the proposed units based on the radioactive exposure to "The Maximally Exposed Individual" ("MEI"). The MEI is a hypothetical individual who, because of proximity, activities, or living habits, could potentially receive the maximum possible dose of radiation. The dose for the MEI is calculated as if the individual resides at the site boundary. Exhibit SNC000070 at 4; NRC Reg. Guide 1.109, Appendix I, Revision 1.

240. The ER analyzes the potential exposure to members of the public through liquid effluent releases, gaseous effluent releases, and direct radiation from the facility. Tr.-M-1752; Exhibit SNC000070 at 6.

241. For liquid effluents, the potential exposure pathways include ingestion of aquatic food, ingestion of drinking water, and direct radiation exposure from shoreline activities. The LADTAP II computer program, which is specifically designed for calculating liquid effluent doses from power reactors, was used to calculate irradiation doses from liquid pathways at the Vogtle site. Tr.-M-1753-54.

242. Radiological contamination of drinking water was not evaluated in the SNC ER because the most recent land-use census showed no use of the Savannah River for drinking water purposes within 100 miles downstream of the Vogtle site. Tr.-M-1754-56; Exhibit SNC000070 at 8.

243. For gaseous effluents, the ER considered several exposure pathways, including immersion in the radioactive plume, direct exposure from deposited radioactivity, inhalation, ingestion of garden fruit and vegetables, and ingestion of beef. The dose from milk ingestion was not evaluated, because the most recent land-use census indicated that no milk cows existed within five miles of the Vogtle site. If milk cows are moved within the vicinity of the Vogtle site

at a later date, the annual land use census would identify them, and any necessary changes would be documented in a revision to the offsite dose calculation manual. The gaseous effluent doses were calculated by using the GASPAR II computer program, which is specifically designed for calculating effluent doses to members of the public. Exhibit SNC000070 at 11; Tr.-M-1758-59.

244. The liquid and gaseous effluent doses calculated by SNC for the MEI are less than the design objective standards set forth in 10 C.F.R. Part 50, Appendix I. The calculations are as follows: For liquid effluents, SNC's total body dose is 0.00017 mSv/year (adult), and the Appendix I standard is 0.03 mSv/year; SNC's maximum organ dose is 0.00021 mSv/year (child liver), and the Appendix I standard is 0.1 mSv/year. For gaseous effluents (Noble gases only), SNC's gamma air dose is 0.0068 mGy/year, and the Appendix I standard is 0.1 mGy/year; SNC's beta air dose is 0.0284 mGy/year, and the Appendix I standard is 0.2 mGy/year; SNC's total body dose is 0.0056 mSy/year, and the Appendix I standard is 0.05 mSv/year; SNC's skin dose is 0.0230 mSv/year, and the Appendix I standard is 0.15 mSv/year. For gaseous effluents (radioiodines and particulates), SNC's organ dose is 0.0591 mSv/year (child thyroid), and the Appendix I standard is 0.15 mSv/year. Tr.-M-1761; Exhibit SNC000070 at 15; Exhibit NRC000001 at Table 5-9.

245. To evaluate the direct radiation contribution from normal operations of Vogtle Units 3 and 4, SNC reviewed radiological doses from Vogtle Units 1 and 2. To estimate doses to the population within fifty miles of the site, Thermal Luminescent Dosimeter ("TLD") data from Units 1 and 2 was measured. SNC collected control data indicating the background radiation data at stations located at distances at least ten miles away from the plant so as not to include any contribution from doses from Vogtle. SNC also collected data at indicator stations located at the plant perimeter, which includes the background data plus the contributions from Plant Vogtle.

The total body dose calculated was 1.837 person-rem per year, while the natural background dose is 2430 person-rem per year, which indicates that there is no contribution from the Vogtle facilities. The range of average annual direct exposure from the control stations was 48.4 to 54.4 milliroentgens, while the exposure at the indicator stations was 48.0 to 54.4 milliroentgens, again indicating no contribution to background radiation from the existing Vogtle units. Tr.-M-1761-63; Exhibit SNC000070 at 16, 18; Exhibit SNC000001 at § 2.5.

246. Based on the data collected and calculations in accordance with NRC guidance in Reg. Guide 1.109, the cumulative impact of facilities in the vicinity of Plant Vogtle - Vogtle Units 1 and 2, Vogtle Units 3 and 4, SRS, and the proposed MOX facility – is estimated to be 2.9 millirem ("mrem") per year for the MEI and 30 person-rem per year for the population dose within a 50-mile radius of the Vogtle site. This calculated dose is far less than the maximum dose of 25 mrem per year for the whole body that is set forth in 40 C.F.R. § 190.10(a). Tr.-M-1766; Exhibit SNC000070 at 19.

247. SNC addressed the environmental impact of postulated accidents in its ER. For Design Basis Accidents ("DBA") for the Westinghouse AP1000 reactor, the consequences depend on the specific radionuclide released, the amount of each radionuclide released, and meteorological conditions. The methodology used for analyzing DBAs is contained in Reg. Guide 1.183, while the Chi over Q methodology is contained in Reg. Guide 1.145. Tr.-M-1768. The DBA dose at the Exclusion Area Boundary ("EAB") was calculated for the short term using a two hour dose and Chi over Q values. The DBA dose for the Low Population Zone ("LPZ") was calculated for the entire term of the accident, which is approximately 30 days. The doses were presented in terms of total effective dose equivalent ("TEDE") in rem with the site specific meteorological data, and in all cases, the site specific dose values were considerably smaller than

the NRC review criteria. For example, the dose for a pre-existing iodine spike during a main stream line break is 7.38 x 10^{-2} rem at the EAB and 2.58 x 10^{-2} rem at the LPZ. In comparison, the review criteria dose for that same accident is much higher at 2.5 x 10^{+1} rem. Accordingly, the doses calculated for a single AP1000 unit at the Vogtle site are well within the NRC review criteria. Tr.-M-1769; Exhibit SNC000070 at 21; Exhibit NRC000001 at § 5.10.1, Figures 5-13 and 5-14.

248. Severe accidents are accidents beyond the DBAs that might result in substantial damage to the reactor core or degradation of the containment. In order to assess the radiological impacts of such an accident, Westinghouse developed a probabilistic risk assessment ("PRA") model in Rev. 15 of the AP1000 DCD that was based on generic meteorology conditions and regional characteristics. SNC performed an updated PRA that includes site-specific characteristics for severe accident analysis. This analysis is included in Section 7.2 of the ER and discloses the full impacts of a severe accident at the Vogtle site. SNC considered air, surface water, and groundwater pathways when analyzing the consequences of severe accidents. The MACCS2 Code was used to model the environmental consequences of severe accidents. The MACCS2 Code focuses on atmospheric releases, including deposition of radioactivity, and includes the following pathways: direct exposure to the passing plume, exposure to material deposited on surfaces and on the skin, inhalation of plume or re-suspended material, and ingestion of contaminated food or water. The MACCS2 Code did not consider fishing, swimming, or groundwater pathways for these analyses. However, this information was incorporated into the analysis by gathering data from the Generic Environmental Impact Statement. The MACCS2 Code assessed the consequences of severe accidents in three different areas: human health, economic costs, and land area affected by contamination of human health.

The human health risks were determined to be SMALL for all risk categories considered for severe accidents. A comparison in FEIS Table 5-16 confirms that the environmental risks from a Westinghouse AP1000 reactor severe accident at the Vogtle site are well below the risks defined in NUREG-1150 and well below the NRC Safety Goal Policy values. The FEIS concludes that the environmental risks from probability-weighted consequences of a severe accident at Vogtle Units 3 and 4 are SMALL. Tr.-M-1770-73; Exhibit SNC000070 at 22-25; Exhibit SNC000001 at § 5.10.2, Table 5-16.

249. NRC Staff reviewed SNC's assessment of environmental impacts from radiological releases in Chapter 5.9 of the FEIS. For impacts from normal operations, NRC Staff conducted an independent review the following information: radiological monitoring that began at the Vogtle site in 1987 and 1989 for Vogtle Units 1 and 2; pre-operational monitoring from 1981 to 1987; results of the annual environmental operating reports, and the annual rate of active effluent release reports submitted annually by SNC. The assessment of direct radiation and doses from liquid and gaseous effluence on the construction workers who would be building Vogtle Units 3 and 4 was determined to be 26.3 mrem, which is less than the 100 mrem annual public dose limit set forth in 10 C.F.R. § 20.1301. Tr.-M-1862-63; Exhibit NRC000060 (environmental portion) at 9-10.

250. NRC Staff's analysis of dose from liquid effluents supported SNC's results. Both analyses met the regulatory standards, and the dose estimates were identical for total body, organ, and thyroid doses. The only difference was in the population dose (0.185 vs. 0.222), and this is due to SNC analyzing population estimates from the year 2000, while NRC Staff analyzed population estimates from the year 2013. NRC Staff followed guidance that instructed the use of a value for population from a year that is five years beyond the licensing action. The population

in 2013 is estimated to be twenty percent greater than it was in 2000, which accounts for the twenty percent difference in the population dose calculation. NRC Staff used the LADTAP II code to estimate radiation exposure from potable water, aquatic foods, shoreline deposits, swimming, boating, and irrigated foods. Tr.-M-1865-66; Exhibit NRC000060 (environmental portion) at 14.

251. The GASPAR II code, which was specifically written to estimate radiation exposure from releases of noble gasses and radioiodine, and particularly emissions from nuclear power plants, was used to analyze doses from gaseous effluents. NRC Staff's results were comparable to those of SNC, and both analyses met the regulatory standards. There were slight differences in the calculations for a few categories, but this was due to NRC Staff using a different source term and not rounding off values from the AP1000 DCD values. Tr.-M-1868-69; Exhibit NRC000060 (environmental portion) at 16-18.

252. A comparison of the MEI dose estimates for a single new reactor unit shows that the radiological impacts from normal operations of the proposed units are an order of magnitude lower than the design objectives. A comparison of the data calculated for SNC's ER to the design objectives set forth in 10 C.F.R. Part 50, Appendix I, indicates the following: the total body dose for liquid effluents calculated in the ER is 0.00017 millisieverts ("mSv") per year, while the Appendix I standard is a maximum of 0.03 mSv per year; the Gamma air dose for gaseous effluents in the ER is 0.0068 milligray ("mGy") per year, while the Appendix I standard is a maximum of 0.1 mGy per year; the Beta air dose for gaseous effluents in the ER is 0.0284 mGy per year, while the Appendix I standard is a maximum of 0.2 mGy per year. Accordingly, the radiation doses from the proposed units are less than the NRC maximum doses. Tr.-M-1870; Exhibit NRC000060 (environmental portion) at 21.

253. For public doses, the radiological impacts of normal operations of the plant were within the regulatory design objectives and dose standards set forth in 10 C.F.R. § 20.1301. For onsite workers, the occupational dose is anticipated to be less than the individual doses incurred at the current operating reactors, and the doses will be in compliance with 10 C.F.R. § 20.1201 and ALARA. The dose rate estimates to biota were less than The National Council on Radiation Protection and International Atomic Energy Agency recommendations and results. NRC Staff determined that the impact for each of these areas is SMALL. Tr.-M-1871-72; Exhibit NRC000060 (environmental portion) at 22.

254. To determine the cumulative radiological impacts, NRC Staff considered contributions from the existing and proposed Vogtle Units, historical and ongoing releases from the SRS, and other nearby nuclear facilities, and the proposed Mixed Oxide ("MOX") Fuel Fabrication Facility. The total dose to the maximally exposed individual is less than 3 mrem per year, which is far below the regulatory maximum of 25 mrem per year. The NRC Staff determined that the radiological health impacts during construction, the radiological health impacts of operation, the uranium fuel cycle impacts, and the cumulative impacts are SMALL. Tr.-M-1872, 1874; Exhibit NRC000060 (environmental portion) at 24-25.

255. The design basis accident review is guided by the Environmental Standard Review Plan 7.1, Chapter 15 of the Standard Review Plan, and NRC Reg. Guide 1.183. NRC Staff reviewed SNC's exclusion area and low population zone boundary definitions, calculation of atmospheric dispersion factors, accident selection, and dose estimates, and the calculations confirmed the accuracy of SNC's estimates. Tr.-M-1876; 10 C.F.R. § 100.21(c).

256. DBA dose estimates were generally less than ten percent of the safety criteria, and the Loss of Coolant Accident dose estimates were less than fifteen percent. Based upon NRC

Staff review of the SNC choice of DBAs and analysis of consequences of DBAs for an AP1000 reactor at the Vogtle site, as well as Staff's independent evaluation at the site, the Staff concluded that the Vogtle site is suitable for operation of two reactors with parameters falling within the parameters of the AP1000 Rev. 15 design. Tr.-M-1877-78; Exhibit NRC000060 (environmental portion) at 31-32.

257. The MACCS2 Code was developed specifically for assessing severe accident consequences, and the Standard Review Plan sanctions its use. The atmospheric transport and dispersion components of the MACCS2 Code have been evaluated by comparison with similar components of more elaborate models and found to give reasonable results. Further, using the MACCS2 Code facilitates comparison of the consequence assessment for postulated reactors at the Vogtle site with consequence assessments performed for existing reactors and for new reactor designs at other sites. The RASCAL and LODI codes were also run at Vogtle, and those codes provided comparable results. Tr.-M-1879; Exhibit NRC000060 (environmental portion) at 34.

258. The review basis for severe accidents was the AP1000, Rev. 15 source terms and the Vogtle site specific meteorology population land use and economic data. The risk estimates for population data were 2.8×10^{-4} person-sieverts per reactor year. Fatality estimates were 1.9×10^{-10} person-sieverts per reactor year. The economic cost was $48.00 per reactor year, and the farm land requiring decontamination was 3.6×10^{-4} hectares per year, the equivalent of four squares per year. Tr.-M-1882; Exhibit NRC000060 (environmental portion) at 36.

259. The severe accident population dose risk of a postulated new AP1000 reactor at the Vogtle site is less than ten percent of the severe accident risk for an existing unit. The proposed Vogtle Units 3 and 4 will contribute very little to the cumulative total risk of the plant.

The results of both SNC and NRC Staff's analysis indicate that the environmental risks associated with severe accidents for an AP1000 reactor at the Vogtle site are SMALL compared to the risks associated with operations of current reactors at the Vogtle site and other sites, as well as the Commission's safety goals. Tr.-M-1884-85; Exhibit NRC000060 (environmental portion) at 39.

260. NRC Staff concluded that the environmental impact of probability-weighted consequences of a severe accident at the Vogtle site would be of SMALL significance for an AP1000 reactor. Exhibit NRC000060 (environmental portion) at 39.

261. NRC Staff's analysis of the environmental issues regarding radiological impacts was thorough, consistent with regulatory requirements and guidance, and its findings are consistent with the evidence.

vi. Fuel Cycle, Transportation and Decommissioning – FEIS Chapter 6

262. In its ER, SNC provided information regarding environmental measurements and monitoring programs. This included descriptions of thermal monitoring (ER § 6.1), radiological monitoring (ER § 6.2), hydrological monitoring (ER § 6.3), meteorological monitoring (ER § 6.4), ecological monitoring (ER § 6.5) and chemical monitoring (ER § 6.6). Exhibit SNC000001 at §§ 6.1-6.6.

263. The Staff considered the information provided by SNC in its ER and conducted its own, independent review of the "Fuel Cycle, Transportation, and Decommissioning." Chapter 6 of the FEIS describes fuel cycle impacts and solid waste management (§ 6.1), transportation impacts (§ 6.2) and decommissioning impacts (§ 6.3). Exhibit NRC000001 at §§ 6.1-6.3.

264. The Staff concluded that impacts of the uranium fuel cycle would be SMALL (§ 6.1.9), impacts of transportation of construction materials, personnel, fuel, and radioactive

wastes to and from the site would be SMALL (§ 6.2.4), and impacts of decommissioning would be SMALL (§ 6.3). *Id.*

265. The methods used to analyze impacts of the fuel cycle, transportation of radioactive waste and decommissioning were proper and consistent with NRC NEPA guidance. Chapter 6 of the FEIS demonstrates the Staff's "hard look" at the environmental impacts associated with the fuel cycle, transportation and decommissioning.

266. In its ER, SNC provided information regarding environmental impacts of postulated accidents involving radioactive materials. This included information on transportation accidents (ER § 7.4). This information was reviewed and considered by the Staff. Transportation accidents are discussed in § 6.2.1 of the FEIS. *Id.*

vii. Cumulative Impacts – FEIS Chapter 7

267. Chapter 7 (Cumulative Impacts) of the FEIS addresses the impacts of the proposed action when combined with other past, present, and reasonably foreseeable future actions in the vicinity of the plant that would affect the same resources impacted by the proposed Vogtle Units 3 and 4. Consistent with 40 C.F.R. § 1508.7, the Staff analyzed the following cumulative impacts: land use (§ 7.1), air quality (§ 7.2), water use and quality (§ 7.3), terrestrial ecosystem (§ 7.4), aquatic ecosystem (§ 7.5), socioeconomics, historic and cultural resources and environmental justice (§ 7.6), non-radiological health (§ 7.7), radiological impacts of normal operation (§ 7.8), severe accidents (§ 7.9) and fuel cycle, transportation and decommissioning (§ 7.10). Exhibit NRC000001 at §§ 7.1-7.10.

268. Using proper and accepted methods, the Staff concluded that cumulative impacts of the construction and operation of Vogtle Units 3 and 4 would be SMALL. Chapter 7 demonstrates the Staff's "hard look" at the cumulative impacts associated with Vogtle Units 3 and 4. Exhibit NRC000001 at § 7.11.

269. The Board asked for additional information on the cumulative surface and groundwater impacts associated with the operation of Vogtle Units 1 through 4. At the mandatory hearing, Staff provided presentations providing such information.

270. NRC Staff presented testimony and exhibits regarding surface water use impacts. A panel composed of Mr. Lance Vail and Dr. Christopher Cook provided testimony and a written presentation on behalf of the Staff.

271. The Savannah River Basin begin just north of the southern border of North Carolina and extends along the Savannah River, which forms the Georgia-South Carolina border, to Savannah Georgia. In performing its analysis of water use impacts that NRC staff divided the basin into four domains: (1) the area north of Strom Thurmond Dam, (2) the area from Thurmond Dam south to the Vogtle site; (3) the Vogtle site itself, and (4) the area south of the Vogtle site to the Savannah Harbor. Tr.-M-1702; Exhibit NRC000059 at 4-5.

272. The Savannah River Basin covers an area roughly 60 miles wide, the drainage from which feed streams which feed the river. The Thurmond Dam north of the Vogtle site is the principal control source of inflow for the river. Tr.-M-1702-03, Exhibit NRC000059 at 4-5.

273. NRC Staff presented evidence from the Augusta Gauge for the period since 1925, demonstrating the range of river flows over that period of time, and the impact of projects such as the Thurmond Dam on the volatility of flows. NRC Staff evaluated the level of flows at the Thurmond Dam over time and could not determine a long term impact on river flows from climate change. Exhibit NRC000059 at 6; Tr.-M-1705.

274. NRC Staff also presented evidence of the flows at the gauge at Thurmond Dam as compared to the Waynesboro Gauge near the Vogtle site. The data indicate that the flows at the Waynesboro Gauge, and therefore at the Vogtle site, are typically higher than at the Thurmond

Dam gauge, owing to inflows from various streams between the Thurmond Dam and the Vogtle site. From time to time the flow will be higher at the Dam at the beginning of a large increase in the release rate at the Dam, until the time the increase in flow rate arrives at the Vogtle site. T.-M-1707-08, 1710, 1719, 1725; Exhibit NRC000059 at 7.

275. The Waynesboro Gauge has only been installed for approximately 5 years. The NRC Staff relied on the Thurmond and Augusta Gauges for its analysis of water use impacts, because longer term data was available from those sources. Nevertheless, the data from the Waynesboro Gauge indicates that flows are generally higher at the site and that reliance on the Thurmond Dam and Augusta gauge data is conservative. Tr.-M-1705-06.

276. The NRC Staff conducted its analysis of water use during a record drought in the Savannah River Basin. Its analysis evaluated water use in the context of the Army Corps of Engineers Drought Contingency Plan, which was in place during the entire period of NRC Staff's evaluation. Consequently, the river flows evaluated by the staff were lower than would be expected under normal circumstances and its evaluation yielded what should be conservative results regarding water use impacts. Tr.-M-1711, 1720-25; Exhibit NRC000059 at 14-15 .

277. The NRC Staff calculated the consumptive water use of other users of water from the Savannah to equate to a flow rate of 78.7 cfs and a withdrawal rate of 389.6 cfs. This consumptive use was calculated based on conservative assumptions about the quantity of water withdrawn and consumed by other users, including assumptions that a power plant with a once-through cooling systems would consume a quantity of water equivalent to a 650 MW plant with a wet cooling tower. These other users consumptive use is more than offset by groundflows and runoff into the Savannah River between the Thurmond Dam and the Vogtle Site. Tr.-M-1714, Exhibit NRC000059 at 8.

278. NRC Staff calculated the cumulative consumptive surface water use of Vogtle Units 1-4 at 2.4% of the river flow at the historic average rate of 8830 cfs, 5.5% at the Drought Level 3 Contingency rate of 3800 cfs, 6.9% at a very conservative rate of 3000 cfs, and 10.4% at 2000 cfs, a rate which has never been recorded at the Thurmond Dam or the vicinity of the Vogtle site. Even under the extreme and hypothetical drought conditions, the Vogtle Units consumptive use would be more than offset by the flows into the river between Thurmond Dam and the Vogtle site. Tr.-M-1715; Exhibit NRC000059 at 9, 14.

279. Based on its analysis the NRC Staff concluded that although the proposed units would increase the consumptive water use of the Savannah River and that continuation of the current drought would increase the fractional consumptive use of the proposed units, that the appropriate riverflow upon which to base its NEPA evaluation of cumulative impacts during low-flow conditions was 3800 cfs, which results in a consumptive use by Vogtle Units 3 and 4 of 3-4%. Based on those parameters the Staff's assessment of consumptive water use impacts was SMALL. The NRC Staff tested the sensitivity of its finding to even lower flow conditions, 3000 cfs, and 2000 cfs, and determined that those flows, which would be temporary and in the case of 2000, lower than ever recorded, would not alter the Staff's conclusion. Exhibit NRC000059 at 14-16, Tr.-M-1725-27.

280. The NRC Staff's evaluation of the impacts of surface water use was thorough, independent and based on reasonable assumptions and sources of data. The analysis constitutes a reasonable evaluation of surface water use impacts. Tr.-M-1715-16, 1726-27, Exhibit NRC000059.

281. NRC Staff presented evidence regarding groundwater impacts from Dr. Charles Kincaid. Dr. Kincaid is a scientist with PNNL and has 29 years of experience in soil physics and groundwater. Tr.-M-1727.

282. Dr. Kincaid calculated that the proposed Vogtle Units 3 and 4 would be approximately 1% of the groundwater resource in the vicinity of the site, and that the cumulative use of all 4 Vogtle Units would be approximately 2%. The cumulative groundwater use amounts to 2.13 million gallons per day or 3.3 cfs. That use is compared to the deep aquifer base flow of 119 million gallons per day or 184 cfs. The deep aquifer base flow numbers are relatively unaffected by drought. Tr.-M-1728-30.

283. Dr. Kincaid also calculated the drawdown impacts of the proposed units. The projected drawdown at the boundary of the site was estimated to be 4 meters, as compared to 120 meters of confining head in the aquifer. The drawdown from the proposed units would not substantially impact the groundwater resource of adjacent users. Tr.-M-1730-31.

284. Based on Dr. Kincaid's calculations, the NRC Staff concluded that the impacts of the proposed units from the consumptive use of groundwater would be SMALL. This conclusion is well-supported by the evidence and is a sufficient "hard look" at this impact. Tr.-M-1730-31; Exhibit NRC000001.

285. Dr. Kincaid also reviewed the data regarding the discovery of tritium in the water table aquifer in 1988 to determine its source. Factors such as the location of the tritium concentrations being upriver of the Vogtle Site and tritium concentrations in rainfall suggested that the source of the tritium was atmospheric releases to by SRS, which were then deposited by rainfall. Due to the fact that the Vogtle 1 and 2 units do not withdraw water from the water table aquifer or discharge effluents to it, and all other reasoning pointed to the SRS as the source of the

tritium, NRC concluded that Vogtle Units 1 and 2 were not the source of the tritium or that proposed Vogtle Units 3 and 4 would contribute to tritium in the aquifer. Exhibit NRC000059 at 19; Tr.-M-1733-34.

286. Dr. Kincaid also concluded from his studies that the impacts of the proposed units from migration of SRS contamination and Saltwater Intrusion would be SMALL. These conclusions are supported by the evidence and constitute a sufficient hard look at these impacts. Tr.-M-1734-36; Exhibit NRC000059 at 20-21.

287. Based on the SMALL impacts associated with consumptive groundwater use, contribution to tritium in the water table aquifer, migration of SRS groundwater plumes and saltwater intrusion, NRC Staff concluded that the cumulative impacts of groundwater use from Vogtle Units 3 and 4 would be SMALL. These conclusions are supported by the evidence and constitute a sufficient hard look at the cumulative impact of the proposed units. Exhibit NRC000059 at 22; Tr.-M-1736.

viii. Need for Power – FEIS Chapter 8

288. In its ER, SNC provided a need for power analysis. This section described SNC's approach (ER § 8.1), Integrated Resource Planning in Georgia (ER § 8.2), the Georgia Power Integrated Resource Plan (ER § 8.3), and other planning (ER § 8.4). Exhibit SNC000001 at §§ 8.1-8.4.

289. The Staff considered the information provided by SNC in its ER and conducted its own, independent "Need for Power" analysis. Chapter 8 of the FEIS includes a description of the power system (§ 8.1), power demand/integrated resource planning (§ 8.2), power

supply/integrated resource planning in the State of Georgia (§ 8.3), and an assessment of need for power/NRC Findings on GPC's IRP (§ 8.4).[78] Exhibit NRC000001 at §§ 8.1-8.4.

ix. Alternative Sites and Comparison of Impacts – FEIS Chapters 9 and 10

290. In its ER, SNC provided information regarding alternatives to the proposed action. This included a description of the no-action alternative (ER § 9.1), energy alternatives (ER § 9.2), alternative sites (ER § 9.3), and alternative plant and transmission systems (ER § 9.4). Exhibit SNC000001 at §§ 9.1-9.4.

291. The Staff considered the information provided by SNC in its ER and conducted its own, independent review of "Environmental Impacts of Alternatives." Chapter 9 of the FEIS contains a description of the no action alternative (§ 9.1), energy alternatives (§ 9.2), system design alternatives (§ 9.3), region of interest and alternative site selection process (§ 9.4), an evaluation of alternative sites (§ 9.5) and a description of issues among sites handled generically (9.6). Exhibit NRC000001 at §§ 9.1-9.6.

292. Chapter 10 of the FEIS contains a comparison of the proposed site with alternative sites. The Staff concluded that while the environmental impacts of construction and operation would be different at the alternative sites, none of those sites is environmentally preferable to the Vogtle site.

293. The Board asked for additional information on the SNC's evaluation alternatives to the proposed ESP. At the mandatory hearing, SNC and the Staff provided presentations on this topic.

[78] After the Mandatory Hearing, the Georgia Public Service Commission issued a written order certifying the construction of Vogtle Units 3 and 4. *See* http://www.psc.state.ga.us/facts/docftp.asp?txtdocname=119014.

294. SNC presented testimony on alternatives to the proposed action from Mr. Thomas Moorer. Mr. Moorer has over 31 years of experience in electric utility environmental management, including 18 years of experience in nuclear environmental management, water and wastewater, NEPA and environmental permitting. Mr. Moorer is currently employed as Manager for Nuclear Development – Environmental for SNC. Mr. Moorer has degrees in both environmental science and civil/environmental engineering. Tr.-M-1932-33.

295. NRC presented testimony regarding alternatives to the proposed action from a panel of witnesses, including Mr. Mark Notich, Mr. Lance Vail, Dr. Christopher Cook, and Mr. Paul Hendrickson. Mr. Notich is the NRC's Environmental Project Manager for the Vogtle ESP, and Mr. Vail evaluated hydrology issues for the NRC in connection with the Vogtle ESP application. Mr. Hendrickson is an NRC contractor employed by PNNL. Mr. Hendrickson has been employed with PNNL for 36 years and has supported NRC environmental impact statements for approximately 11 years, including environmental impact statements for license renewal. Mr. Hendrickson has both bachelor and graduate degrees from the University of Washington and a graduate degree from Purdue University. Tr.-M-1972-73.

296. Chapter 9 of SNC's Environmental Report reviewed and evaluated the No Action Alternative, energy alternatives, alternative sites and alternative cooling system technologies. The review is based on NRC guidance in NRC Reg. Guide 4.2, NRC Environmental Standard Review Plan, NUREG 1555, and NRC Reg. Guide 4.7 regarding siting criteria for nuclear power plants. Tr.-M-1933-34.

297. SNC's analysis of energy alternatives is divided into generation and non-generation alternatives. Tr.-M-1933.

298. SNC's alternatives evaluation is based upon its relevant service area, which includes the geographic area where the output of Vogtle Units 3 and 4 would be sold, and the "region of interest," which is the geographic area that Southern Company services, i.e., including Georgia, parts of Alabama, parts of Mississippi and part of the Florida panhandle. Tr.-M-1934.

299. SNC's analysis of the No Action Alternative included the assumption not only that the ESP would not be issued but also that the COL would not be issued and that, therefore, no nuclear plant would be constructed. While a failure to build the proposed units might have a small short-term impact in terms of Georgia Power's ability to meet electricity demand, the failure to construct the units would be to degrade Georgia Power's reserve margins over time and eventually diminish GPC's ability to serve its customers. Tr.-M-1935.

300. The No Action Alternative would ultimately result in shifting of environmental impacts from Vogtle Units 3 and 4 to other generation sources. Tr.-M-1935-36.

301. SNC has evaluated demand side conservation efforts and has concluded that while they are an appropriate part of the overall generation strategy there is insufficient demand side possibility to fill the need for the approximately 2400 megawatts of base load generation represented by Vogtle Units 3 and 4. Tr.-M-1936.

302. SNC evaluated demand side management as part of its non-generation energy alternatives analysis. In addition, SNC evaluated power purchase agreements from other generators, license renewal of its current fleet of nuclear plants, up-rates of its current fleet of nuclear plants, and combinations of these alternatives. Tr.-M-1936-37.

303. SNC's analysis demonstrated that the baseload generation represented by the proposed Vogtle Units 3 and 4 cannot be replaced by non-generation energy alternatives. Tr.-M-1937-38; Exhibit SNC000001 at § 9.2.

304. The NRC Staff conducted an independent evaluation of energy alternatives, which included four non-generating options. First, the Staff evaluated the option of supplying the needed generation through purchased power and concluded that that was not a reasonable option given GPC's need for new base load generation as described in its integrated resource plan, which was approved by the Georgia Public Service Commission in July of 2007. Tr.-M-1975.

305. NRC Staff also considered the reactivation of retired plants as an energy alternative requiring no new generation. The Staff concluded that option would be difficult and in some cases impractical because the current environmental requirements would be difficult for a retired plant to meet. Moreover, in most cases any retired plant would be considerably smaller than the type of capacity being proposed for Vogtle Units 3 and 4. Tr.-M-1975-76.

306. NRC Staff, like SNC, also considered an extension of life of existing baseload generation units. The only GPC generating units that are currently slated for retirement during the relevant time period are two old coal-fired units in the Atlanta area. NRC Staff concluded that the same problems associated with reactivating retired units would be problems with extending the life of these units. Tr.-M-1976.

307. NRC Staff also considered conservation and demand side programs, which are also taken into consideration in the need for power analysis in the FEIS. NRC Staff considered GPC's Integrated Resources Plan, which accounts for demand side management in its evaluation of base load generation needs. Based on its review of the relevant data, the NRC Staff concluded that although demand side management is important, it is not adequate to meet growing demand for electricity over time. That conclusion is consistent with the conclusion of the Georgia Public Service Commission. Tr.-M-1976-77.

308. Accordingly, based on its independent review of energy alternatives requiring generation, NRC Staff concluded that options not requiring new generation are not reasonable alternatives to a new baseload nuclear power plan. On March 17, 2009, the Georgia Public Service Commission confirmed its preference for the construction of Vogtle Units 3 and 4 in its order certifying the construction of the two nuclear units. Tr.-M-1977.

309. SNC evaluated a number of energy alternatives requiring new generation, including coal-fired generation, gas-fired generation, biomass, wind and solar generation. SNC also evaluated combinations of those alternatives. Based on this analysis SNC concluded that the most feasible generation alternative was a combination of combined cycle gas-fired generation and wind generation. SNC evaluated a combined cycle gas plant combined with 120 megawatts of electric wind power as a combination alternative. The alternative evaluated consisted of four 530 megawatt gas-fired combined cycle units plus 120 megawatts of wind energy. The combined cycle plant evaluated was slightly undersized, so it would need to be sized so that it could satisfy the entire 2,234 megawatts of generation during times when the wind power was unavailable. Tr.-M-1939-40; Exhibit NRC000001 at § 9.2.

310. The environmental impacts considered for the alternatives included air impacts, water impacts and land use impacts. The combination of all the impacts considered demonstrated that nuclear was a better choice from an environmental impact standpoint. SNC's analysis demonstrated that none of the energy alternatives standing alone, nor the combined cycle gas and wind combination, compared favorably with nuclear in terms of their comparative environmental impacts. Tr.-M-1940-41.

311. The NRC Staff also considered energy alternatives requiring new generating capacity. The principal options considered by the NRC Staff were new pulverized coal

generation, and natural gas combined cycle generation at the Vogtle site. The Staff also considered a variety of other energy options, including combinations of generation technologies and fuels. Exhibit NRC000062 at 8-9.

312. The NRC Staff's analysis concluded that the impacts on air quality from a coal-fired power plant would be moderate, as compared to the small impacts of a nuclear power plant on air quality. In addition, a coal-fired power plant would have significant waste management issues from ash and scrubber sludge, which the Staff characterized as moderate, as compared to the small waste impacts from a nuclear generating plant, which included a consideration of spent fuel storage. Tr.-M-1981-82.

313. The NRC Staff assessed the impacts on the ecology from a coal-fired plant as moderate, as compared to the small to moderate impacts of a nuclear power plant. Tr.-M-1982.

314. NRC Staff's evaluation of natural gas fired generation as an energy alternative also determined that air impacts from a natural gas facility would be larger than what would be expected from a nuclear plant, owing to a combined cycle gas plant's emission of sulfur oxide, nitrogen oxide, carbon monoxide and particulate matter. In addition, a combined cycle gas plant was deemed to be less favorable than a nuclear power plant in terms of the positive impacts on socioeconomics. A nuclear power plant would contribute more to property tax revenue and therefore be more beneficial to the local economy than a combined cycle plant. Tr.-M-1983.

315. NRC Staff also evaluated oil fired generation, which was determined to be prohibitively expensive. Tr.-M-1983-84.

316. NRC Staff also evaluated the following renewable energy sources: wind, solar, hydropower, geothermal, and biomass, as alternatives to nuclear power generation. Tr.-M-1984-89.

317. NRC Staff noted that most of the State of Georgia is in a Category 1 class for wind power as assessed by the Department of Energy, indicating that the State has a very small potential for wind energy. In addition, the Staff noted that wind has a very low capacity factor as compared to a nuclear power plant. Similarly, the Staff evaluated solar energy as not appropriate for baseload power generation because, like wind, it has a relatively low capacity factor in comparison to a nuclear power plant. Hydropower was determined to be inadequate both in terms of generation capacity and to have significant environmental impacts associated with the construction of dams. NRC Staff could not identify a suitable eastern resource for geothermal baseload generation and concluded that the capacity for wood, municipal solid waste and biomass was significantly smaller than the nuclear baseload units proposed by SNC. Accordingly, the Staff's conclusion regarding these generation alternatives is that individually they are not reasonable alternatives to a baseload nuclear plant. Tr.-M-1983-85.

318. The NRC Staff also performed its own analysis of a combination of energy sources. In according with Council of Environmental Quality guidance, the Staff chose one combination of energy sources to evaluate a combination of natural gas combined cycle, wind energy, biomass and municipal solid waste, hydropower and conservation. Tr.-M-1989-94.

319. Based on its analysis of a combination of generation sources as compared to the proposed nuclear units, NRC Staff concluded that the combination alternative had greater air impacts, waste management impacts and less positive socioeconomic impacts as compared to the proposed nuclear plants. Tr.-M-1989-90; Exhibit NRC000066 at 15-16.

320. Neither SNC nor NRC Staff considered solar to be a viable fuel source for the evaluation of a combination of energy alternatives. Tr.-M-1991-92.

321. Based on its analysis of energy alternatives, the NRC Staff concluded that none of the viable energy alternatives for generating approximately 2200 baseload megawatts was clearly preferable to the construction of a new two-unit nuclear power plant. Tr.-M-1993.

322. The comparative environmental impacts of the AP1000 versus other energy alternatives are applicable whether the comparison is to the 2,234 megawatts of generation provided by two AP1000 units or whether the comparison is to 1,117 megawatts of generation provided by one AP1000. For example, if SNC built one AP1000 unit in combination with other energy alternatives, SNC's analysis that supports its findings that the environmental impacts of replacing the single AP1000 unit with a combination of gas and wind would still be greater than constructing the single AP1000 unit. For example, the air impacts from two 530 megawatt combined cycle gas plants would still exceed the environmental impacts of a single AP1000 unit. In addition, SNC would lose significant economies of scale associated with constructing one AP1000 unit as opposed to dual AP1000 units. Elimination of one of the two AP1000 units would, nevertheless, be considered new information which would have to be evaluated for its significance on the alternatives analysis. Tr.-M-1941-42.

323. If demand for electricity were reduced significantly because of the economic recession, it is more probable that GPC would delay the construction schedule for the second AP1000 unit than to cancel the unit. Tr.-M-1944.

324. If the scope of the project changed to only one unit, the Staff would perform another alternatives analysis. *Id.*

325. In assessing the environmental impacts of alternative generation sources, neither SNC nor NRC Staff took credit for any cost associated with carbon dioxide, potential cap and trade legislation or other types of programs to value the carbon dioxide emissions associated with

fossil generation sources, because carbon dioxide is not currently required. Consideration of costs associated with carbon dioxide emissions would shift any assessment of comparative environmental impacts more in favor of nuclear generation versus alternative fossil generation. Tr.-M-1946-47.

326. SNC evaluated alternative sites to determine whether there was an "obviously superior" site to the Vogtle site. SNC based its analysis on NRC Environmental Standard Review Plan (ESRP), Section 9.3(iii)(8), NRC Reg. Guide 4.2 and NRC Reg. Guide 4.7. Tr.-M-1948.

327. SNC's alternative site selection process consisted of: (1) the identification of all potential sites within SNC's "region of interest" (ROI) as defined by ESRP, Section 9.3, that had existing generating units of 1000 megawatts or greater, adequate land availability, and available cooling water; and (2) review and evaluation of available green field and brown field sites. One of the green field sites, the Dallas County site near Selma, Alabama was not specifically mentioned in either the Environmental Report or in SNC's responses to requests for additional information because it was screened out very early in the process in favor of the Barton site. The Barton site was selected because SNC had substantially more relevant information on the site, because it had been the subject of a Preliminary Safety Analysis Report in the 1970's. Tr.-M-1948-50; Exhibit SNC000076 at 12.

328. The potential alternative sites within the ROI were screened based on alienability, consistent with NRC guidance and then evaluated according to the criteria of land availability (minimum of 2,000 acres), access to adequate quantities of cooling water, transmission access, site geology, and demographics. Exhibit SNC000076 at 13; Tr.-M-1951.

329. SNC did not evaluate sites outside of its ROI because it did not control any sites outside of its ROI. Limiting the review of sites within its ROI was consistent with the guidance in the ESRP. Tr.-M-1952.

330. The sites that were evaluated by SNC included sites where existing coal fired plants were located, as well as two nuclear sites in Georgia and Alabama—Plants Hatch and Farley. Tr.-M-1953-54; Exhibit SNC000076 at 14-16.

331. Based on its evaluation of all the possible alternative sites within its ROI, SNC identified three candidate sites—Plants Hatch and Farley, and the Chilton-Elmore or Barton site--in addition to the Vogtle site for evaluation. The selection of Plants Hatch and Farley as alternative sites for evaluation was based on the preference expressed in the NRC Environmental Standard Review Plan for other existing nuclear sites when available. Such sites provide a more direct comparison to the proposed site, but in addition have distinct advantages for the development of additional generation, including associated infrastructure and support facilities, awareness of environmental impacts, site physical characteristics, such as geology, knowledge of water availability and availability of transmission. Tr.-M-1954-55; Exhibit SNC000076 at 18-19.

332. The Barton site was included in order to provide at least one green field site in the analysis and because of the amount of relevant site information available to SNC regarding the site. Tr.-M-1956.

333. SNC utilized the guidance in NRC Reg. Guide 4.2 and the Environmental Standard Review Plan to develop criteria to compare the alternative candidate sites to the Vogtle site. SNC's criteria were consistent with the guidance in Reg. Guide 4.2 that provides that "reconnaissance-type investigations" are adequate for the alternative site review. The SNC

process evaluated the alternative sites based on the environmental impacts from both construction and operations at each site to determine a significance level of impact for each criteria or category. Accordingly, a single significance level of Small, Moderate or Large was assigned to each criterion consistent with 10 C.F.R. Part 50, Appendix B, Table B-1. Exhibit SNC000076 at 21; Tr.-M-1957-58.

334. Based on SNC's assessment of impacts for each of the alternative sites, as compared to the proposed Vogtle site, no "obviously superior site" to Vogtle was identified for the proposed units. Exhibit SNC000001 at Tables 9.7 and 9.8; Exhibit SNC000076 at 23; Tr.-M-1959.

335. SNC did not exclude any sites based solely on the lack of cooling water, and there were no obviously superior sites, assuming cooling water had not been a criterion. SNC did not make any presumptions about a particular cooling technology for the initial screening. Tr.-M-1960-61.

336. SNC excluded sites based on their failure to meet a minimum area of 2,000 acres. SNC did not screen sites based on a maximum number of acres. All the sites evaluated by SNC would have been adequate in size to provide for the installation of any cooling technology. Tr.-M-1968-70.

337. In reviewing SNC's alternative site analysis the Staff followed the guidance in NRC Environmental Standard Review Plan, Section 9.3. The Staff review SNC's analysis to see that SNC conducted a "reasonable process" to go from its region of interest to candidate area, to potential sites to candidate sites, to the proposed site. NRC Staff reviewed SNC's analysis to ensure that the process is a reasonable one that can be justified and supported. Tr.-M-2000.

338. After reviewing SNC's analysis, the NRC Staff concluded that SNC's process and reasoning was a "reasonable basis for screening the potential sites to the four candidate sites." Tr.-M-2000-01.

339. The NRC Staff conducted an independent review of the four candidate sites identified by SNC. The NRC Staff visited each of the candidate sites, reviewed scoping comments, comments on the draft EIS and performed its own review of relevant literature. The NRC Staff consulted with local agencies in deriving their characterizations and followed the guidance in NRC Environmental Standard Review Plan, Section 9.3. The NRC Staff developed impact characterizations for each site on a range of relevant environmental factors. Based on this analysis, the NRC Staff concluded that while there are some differences between NRC Staff's characterization of environmental impacts at each proposed site, and at the alternative ESP sites none of the differences are sufficient for the NRC Staff to conclude that any of the alternative sites would be environmentally preferable to the proposed Vogtle ESP site. Accordingly, none of the alternative sites would be alternatively superior to the proposed Vogtle site." Tr.-M-2004-06.

340. SNC's method for defining its region of interest and narrowing the region of interest to a candidate area than to potential sites then to candidate sites was in accordance with the process in ESRP, Section 9.3, and is the preferable way to perform a site alternatives analysis. Tr.-M-2007-08.

341. SNC also evaluated alternative cooling designs as part of its alternatives analysis. Exhibit SNC000001 at § 9.4; Exhibit SNC000076 at 24; Tr.-M-1962.

342. SNC evaluated once through cooling, mechanical draft wet towers, natural draft wet towers, dry towers, wet/dry hybrid towers, cooling ponds, and spray canals. Tr.-M-1962.

343. SNC's comparison of natural draft towers to mechanical draft towers was influenced by SNC's experience with natural draft towers with existing Vogtle Units 1 and 2, and their operators' preference for the simplicity of operation of natural draft towers. SNC also concluded that the natural draft towers had less impact in terms of aesthetics, given that two natural draft towers are already on the site. Tr.-M-1964.

344. SNC's analysis of wet/dry hybrid towers was influenced by the greater land requirements of hybrid cooling systems, the loss of efficiency from hybrid cooling systems and the significant parasitic load associated with such systems. These disadvantages of hybrid towers were deemed by SNC to outweigh the approximately one-third reduction in water use associated with hybrid cooling systems, given the abundant water available to Vogtle 3 and 4 in the Savannah River. Tr.-M-1964-66.

345. SNC concluded that its proposed closed-cycle wet cooling system with natural draft towers was preferable to a once-through cooling system based primarily on the amount of water used by a once-through system. Other technologies, such as cooling ponds, require large amounts of land, are not very efficient and were not deemed preferable to the proposed closed-cycle wet cooling system. Tr.-M-1966.

346. NRC Staff also reviewed alternative cooling technologies, including wet/dry hybrid towers. NRC Staff, as it described in the FEIS, found adverse impacts associated with hybrid towers in terms of "the performance of the system, the cost, and the parasitic loads." Accordingly, although hybrid wet/dry towers would reduce water related impacts because of the reduction in overall water withdrawal use, the NRC Staff concluded that any potential advantages of the wet/dry hybrid system were offset by the efficiency and environmental disadvantages of the cooling systems considered. Accordingly, the Staff concluded that there

was no environmentally preferable alternative to the proposed closed-cycle wet cooling system. Tr.-M-2011-12; Exhibit NRC000066 at 30.

347. The Board concludes that the Staff satisfied its requirement in Section 102(2)(E) of NEPA, to "study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources." 42 U.S.C. § 4332(2)(E).

348. The Staff provided a proper analysis of alternatives to the proposed action, as required by Section 102(2)(E) of NEPA. In Chapter 9 of the FEIS (Environmental Impacts of Alternatives) satisfies this requirement. The NRC Staff considered the no-action alternative, energy source alternatives, system design alternatives and site alternatives. Chapter 10 (Comparison of the Impacts of the Proposed Action and the Alternative Sites) compares impacts of alternatives with those of the proposed site.

x. Conclusions and Recommendations – FEIS Chapter 11

349. In its ER, SNC provided information regarding the environmental consequences of the proposed action. This section described unavoidable adverse environmental impacts (ER § 10.1), irreversible and irretrievable commitments of resources (ER § 10.2), relationship between short-term uses and long-term productivity of the human environment (ER § 10.3), a benefit-cost balance (ER § 10.4), and an analysis of the cumulative impacts (ER § 10.5). Exhibit SNC000001 at §§ 10.1-10.5.

350. The NRC Staff reviewed and independently considered the information submitted by SNC and included its analysis in Chapter 11 of the FEIS (Conclusions and Recommendations). Section 11.2 explains that unavoidable adverse environmental impacts are discussed in Chapters 4 and 5; Section 11.4 describes the relationship between short-term uses and long-term productivity on the human environment; Section 11.6 identifies the benefits and

costs of constructing and operating two additional units; and Section 11.5 describes the irreversible and irretrievable commitments of resources associated with the proposed action. Exhibit NRC000001 at § 11.

xi. General Findings

351. SNC's ER and NRC Staff's FEIS are based on Rev. 15 of the AP1000 DCD.

352. Westinghouse Electric Corporation has submitted proposed amendments to the AP1000 DCD, consisting of Revisions 16 and 17. SNC's Combined Operating License application, or COLA, references Rev. 16 of the DCD and SNC has indicated it will revise the COLA to reference Rev. 17.

353. In its comments on the Draft EIS in the ESP proceeding, SNC identified AP1000 design parameters that changed from Rev. 15 to Rev. 16. The NRC Staff evaluated the sensitivity of its findings in the FEIS against the new information in its responses to comments in Appendix E of the FEIS.

354. NRC Staff will issue a Supplement to the FEIS for the ESP in the Vogtle 3 and 4 COLA proceeding. As part of that process, NRC Staff will address new information, including new information from Revisions 16, 17 or any subsequent revision to the Westinghouse AP1000 DCD and evaluate it for significance. Any new information that is determined to be significant will be subject to a full NEPA review in the Supplement. Otherwise, the Supplement will adopt the review and findings of the ESP FEIS. Tr.-M-2386-89.

355. The NRC Staff has consulted with and obtained comments from other Federal agencies with jurisdiction by law or special expertise. As explained in section 1.5 (Compliance and Consultations) of the FEIS, SNC provided a list of consultations associated with the ESP application. The Staff reviewed the list and contacted appropriate Federal, State, Tribal and local agencies to identify issues of concern. Appendix B (Organizations Contacted) outlines the

Federal, State, Tribal and local organizations contacted during the Staff's review. Appendix H (Authorizations and Consultations) lists the potential authorizations and consultations relevant to the ESP application.

356. The NRC Staff's analysis demonstrates its "hard look" at alternatives to the proposed action.

IV. Conclusions of Law

A. Safety

1. The Board, as directed by the Commission's guidance,[79] conducted an independent, sufficiency review of the Staff's findings and probed those findings by seeking a detailed review of the analysis in four safety issues.

2. The information provided by SNC in the SSAR was adequate and acceptable under 10 C.F.R. Parts 50, 52, and 100. The Staff's independent technical analysis, detailed in its findings in the FSER, was adequate in accordance with NUREG-0800, RS-002, and 10 C.F.R. Parts 50, 52, and 100, and the Staff made its findings with reasonable support in logic and fact.

3. As required by 10 C.F.R. § 100.20(a), the NRC Staff's consideration in the FSER of population density and use characteristics of the site included in the exclusion area, population distribution, and site related characteristics. The NRC Staff adequately evaluated the individual and societal risk of potential plant accidents and whether physical characteristics unique to the Vogtle Units 3 and 4 site would pose a significant impediment to the development of emergency plans. The NRC Staff's conclusions that the risk of potential plant accidents was low and that the site characteristics posed no significant impediment to the development of emergency plans had a sound basis in logic and fact.

[79] *In re Exelon Generation Co., LLC et al.*, CLI 05-17, 62 NRC 5 (2005).

4. In the FSER, the NRC Staff employed its evaluation of man related hazards in establishing site parameters as required by 10 C.F.R. § 100.20(b), and sufficiently considered, to the extent applicable in an ESP proceeding, whether, with respect to the hazards associated with evaluated potential accidents, the proposed site is acceptable for the planned units. The NRC Staff's conclusion that, with respect to the hazards associated with evaluated potential accidents, the proposed site is acceptable for the planned units is supported by and consistent with the record of the proceeding.

5. In its consideration of the site detailed in the FSER, the NRC Staff followed the factors set out in 10 C.F.R. § 100.20(c), analyzing geologic and seismic siting factors, meteorological factors, and hydrological factors important to radionuclide transport as detailed in 10 C.F.R. §§ 100.21 and 100.23.

6. The NRC Staff's review and analysis regarding groundwater impact on safety related structures comported with 10 C.F.R. Part 100 and was sufficient. The NRC Staff's conclusion that there was no undue risk to safety related structures from groundwater had a sound basis in fact consistent with the record.

7. The NRC Staff's review and analysis regarding geologic, hydrologic, and seismic site characteristics comported with 10 C.F.R. Part 100. The NRC Staff thoroughly and independently analyzed and confirmed SNC's information, and its conclusions that SNC developed appropriate seismic design parameters and complied with the related application requirements were well-founded. The NRC Staff's analysis regarding seismic site characteristics was sufficient and its conclusion that the Vogtle ESP site satisfies the criteria in 10 C.F.R. Part 100 is supported by the record.

8. The NRC Staff's review and analysis regarding emergency planning complies with the requirements and standards set forth in 10 C.F.R. §§ 50.47 and 52.17, 10 C.F.R. Part 50 Appendix E, Reg. Guide 1.101, and the related guidance from the Commission. Moreover, NRC Staff's finding that, subject to the related permit conditions, SNC's emergency plan provides reasonable assurance that adequate protective measures will be taken in the event of a radiological emergency is supported by the record.

9. The NRC Staff's conclusions that the proposed Fitness for Duty program for LWA activities and the Quality Assurance Program description for ESP and LWA activities are acceptable and comply with the regulations set forth in 10 C.F.R. Parts 26 and 50, Appendix B, respectively, are supported by and well-founded in the record.

10. The NRC Staff's analysis of radiological consequences of design basis accidents complied with 10 C.F.R. § 52.17, 10 C.F.R. Part 100, Reg. Guide 1.145, Reg. Guide 1.183, and NUREG-0800. The NRC Staff's determination that the proposed site is suitable and does not cause undue risk to the health and safety of the public is reasonable and acceptable.

11. The NRC Staff's review and analysis regarding radiological impacts of normal operation complied with 10 C.F.R. Part 50 Appendix I, 10 C.F.R. Part 20, Reg. Guide 1.109, and Reg. Guide 1.111. The NRC Staff thoroughly and independently analyzed SNC's information, and its conclusion that SNC meets the applicable regulatory standards is well-founded and consistent with the evidence.

12. The ITAACs proposed for emergency planning and the LWA provide reasonable assurance that the Vogtle Units 3 and 4 site will be constructed and operated in conformity with the license, the Atomic Energy Act, 42 U.S.C. § 2011 *et seq.*, and NRC regulations.

13. This Board, having reviewed the basis for the Staff's central safety related conclusions, finds that the Staff's review is adequate to support the finding that the issuance of the Vogtle ESP will not be inimical to the common defense and security or to the health and safety of the public, in accordance with the Notice of Hearing, 71 Fed. Reg. at 60,195 and 10 C.F.R. § 52.24(a)(6).

14. Further, this Board finds that the Staff's review is adequate to support the finding that, taking into consideration the site criteria contained in 10 C.F.R. Part 100, a reactor, or reactors, having characteristics that fall within the parameters for the site, can be constructed and operated without undue risk to the health and safety of the public, in accordance with the Notice of Hearing, 71 Fed. Reg. at 60,195.

15. Finally, the Board finds that in accordance with 10 C.F.R. § 50.10(e), there are no unresolved safety issues relating to the activities to be conducted under the LWA that constitute good cause for withholding the LWA. As such, the Board finds the LWA should be issued.

B. Environmental

16. NEPA Baseline Issue 1 requires the Board to independently consider and decide whether the requirements of NEPA Sections 102(2)(A), (C), and (E) and the Commission's NEPA regulations at 10 C.F.R. Part 51 have been met.

17. The information provided by SNC in its ER is adequate and acceptable under 10 C.F.R Part 51 and NEPA. The Staff's independent technical analysis, detailed in the FEIS, utilizes a "systematic, inderdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decisionmaking which may have an impact on man's environment," and therefore comports with the NRC's requirements in Appendix A of 10 C.F.R. Part 51. The NRC Staff's findings in the FEIS

constitute the "hard look" required by NEPA. The NRC Staff's environmental findings have reasonable support in logic and fact.

18. The FEIS adequately addresses (i) the environmental impact of the proposed action, (ii) any unavoidable adverse environmental effects, (iii) alternatives to the proposed action, (iv) the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and (v) any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented in accordance with NEPA § 102(2)(c)(i)-(v), 42 U.S.C. § 4332(2)(c)(i)-(v). The Board concludes that the NRC Staff has satisfied the requirements of Section 102(2)(c) of NEPA by consulting with and obtaining comments from other Federal agencies with jurisdiction by law or special expertise. 42 U.S.C. § 4332(2)(C).

19. The FEIS adequately addresses alternatives to recommended courses of action to the proposed action to the extent that it involves unresolved conflicts concerning alternative uses of available resources. NEPA § 102(2)(E), 42 U.S.C. § 4332(2)(E). Compliance with NEPA Section 102(2)(E), which focuses on alternatives, is substantially equivalent to compliance with the NEPA Section 102(2)(C)(iii) alternatives analysis.[80] Accordingly, the NRC Staff's consideration of alternatives to the proposed action in the FEIS satisfies NEPA Section 102(2)(E). 42 U.S.C. § 4332(e).

20. This Board, having reviewed the basis for the Staff's central environmental related conclusions, finds that the Staff's review is adequate under 10. C.F.R. Part 51. All findings and analyses required by NEPA Section 102(2)(A),(C), and (E), 42 U.S.C. § 4332(2)(A),(C), and (E), have been satisfied.

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[80] *In re Dominion Nuclear North Anna, LLC* (Early Site Permit for North Anna ESP Site), LBP-07-09, 65 N.R.C. 539, 614 (2007).

21. NEPA Baseline Issue 2 requires the Board to independently consider the final balance among the conflicting factors contained in the record of the proceeding and to determine the appropriate action to be taken. In accordance with the Notice of Hearing, 72 Fed. Reg. 60,195, the Board has independently considered the final balance among the conflicting factors contained in the record of this proceeding (excluding examination of the costs and benefits of the proposed facility), and concludes that, overall, the balance supports issuance of the ESP and LWA.

22. Finally, NEPA Baseline Issue 3 requires the Board to determine, after considering reasonable alternatives, whether the ESP should be issue, denied, or appropriately conditioned to protect environmental values. In accordance with the Notice of Hearing, 72 Fed. Reg. 60,195, the Board has reviewed the evidence presented by the Parties to this proceeding, considered reasonable alternatives and concludes that the ESP and LWA should be issued, and no conditions on such are necessary or appropriate to protect environmental values.

C. Section 52.24 Findings

23. The Board finds that the requirements of 10 C.F.R. § 52.24(a)(1),(2), and (4) have been met, specifically finding that (1) SNC's application for an early site permit meets the applicable standards and requirements of the Act and the Commission's regulations; (2) required notifications to other agencies or bodies regarding the application for the Early Site Permit have been duly made; and (3) the applicant is technically qualified to engage in any activities authorized by the Early Site Permit and Limited Work Authorization that are the subject of this proceeding.

24. The Staff's review was sufficient to establish that there is reasonable assurance that the site is in conformity with the provisions of the Act, and the Commission's regulations as required by 10 C.F.R. § 52.24(a)(3).

25. The Board finds that, in accordance with 10 C.F.R. § 52.24(a)(5), the proposed ITAACs, including those on emergency planning, are necessary and sufficient, within the scope of the ESP, to provide reasonable assurance that Vogtle Units 3 and 4 will be constructed and operated in conformity with the license, the Atomic Energy Act, 42 U.S.C. § 2001 *et seq.*, and NRC regulations.

26. The Board concludes based on the record of the proceeding that issuance of the ESP and LWA will not be inimical to the common defense and security or to the health and safety of the public, as required by 10 C.F.R. § 52.24(a)(6).

27. The Board, per 10 C.F.R. § 52.24(a)(7), further concludes that any significant adverse environmental impact resulting from LWA activities can be redressed.

28. As required by 10 C.F.R. § 52.24(a)(8), and the Notice of Hearing, all findings required by subpart A of 10 C.F.R. Part 51 have been made.

29. Finally, per 10 C.F.R. § 52.24(b)-(c), the Board finds that the ESP specifies the site characteristics, design parameters, and term and conditions that are appropriate, and specifies the activities SNC is authorized to perform under 10 C.F.R. § 52.10.

Respectfully submitted,

(Original signed by M. Stanford Blanton)

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Dated this 22nd day of May, 2009.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

SOUTHERN NUCLEAR OPERATING COMPANY'S PROPOSED FINDINGS OF FACT AND CONCLUSIONS OF LAW REGARDING UNCONTESTED ISSUES

CERTIFICATE OF SERVICE

I hereby certify that copies of SOUTHERN NUCLEAR OPERATING COMPANY'S PROPOSED FINDINGS OF FACT AND CONCLUSIONS OF LAW REGARDING UNCONTESTED ISSUES in the above captioned proceeding have been served by electronic mail as shown below and/or by e-submittal this 22nd day of May, 2009.

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