

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

COMMISSIONERS:

Gregory B. Jaczko, Chairman  
Kristine L. Svinicki  
George Apostolakis  
William D. Magwood, IV  
William C. Ostendorff

In the Matter of

SOUTH CAROLINA ELECTRIC & GAS CO.  
and SOUTH CAROLINA PUBLIC SERVICE  
AUTHORITY (ALSO REFERRED TO AS  
SANTEE COOPER)

(Virgil C. Summer Nuclear Station, Units 2 and 3)

Docket Nos. 52-027-COL & 52-028-COL

**CLI-12-09**

**MEMORANDUM AND ORDER**

On October 12-13, 2011, we held a hearing on the application of South Carolina Electric & Gas Company and South Carolina Public Service Authority (also known as Santee Cooper) (together, SCE&G or Applicants) for combined licenses (COLs) to build and operate two additional power reactors at the Virgil C. Summer Nuclear Station in Fairfield County, South Carolina (VCSNS).<sup>1</sup> The application has been under review by the NRC Staff since 2008.<sup>2</sup> The purpose of the evidentiary hearing was to consider the sufficiency of the Staff's review of the

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<sup>1</sup> See South Carolina Public Service Authority (also Referred to as Santee Cooper); Combined License for Virgil C. Summer Station, Units 2 and 3; Notice of Hearing, 76 Fed. Reg. 53,492 (Aug. 26, 2011) (Notice of Hearing).

<sup>2</sup> South Carolina Electric and Gas Company (SCE&G) and the South Carolina Public Service Authority (Santee Cooper); Notice of Receipt and Availability of Application for a Combined License, 73 Fed. Reg. 39,339 (July 9, 2008).

COL application.<sup>3</sup> As discussed below, we conclude that the Staff's review has been adequate to support the findings set forth in 10 C.F.R. §§ 52.97(a) and 51.107(a), and we authorize the issuance of the COLs.

## I. BACKGROUND

### A. Proposed Action

The Applicants seek to build two new units of the AP1000 reactor design, which is a design certified in our regulations as a standard design.<sup>4</sup> The AP1000 design is described in a design control document (DCD), to which referencing applications must conform. The VCSNS application therefore incorporated by reference the material in the AP1000 certified design. The Staff's evaluation of that material is found in its safety evaluation for the AP1000 design.<sup>5</sup> The COL application underwent five revisions during the review process, reflecting, in part, changes necessitated by Staff requests for additional information (RAIs) during the review process.<sup>6</sup> The AP1000 design was undergoing revisions while the VCSNS application was under review; therefore, the application also was updated several times to reflect the revisions to the AP1000 DCD.<sup>7</sup> The VCSNS application review could not be finalized, and the licenses granted, until the

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<sup>3</sup> See Notice of Hearing, 76 Fed. Reg. at 53,493.

<sup>4</sup> See 10 C.F.R. pt. 52, app. D.

<sup>5</sup> See "Final Safety Evaluation Report Related to Certification of the AP1000 Standard Design," NUREG-1793 (Sept. 2004) (ADAMS accession numbers ML043450344, ML043450354, ML043450284, ML043450290, ML043450274); NUREG-1793, Supp. 1 (Dec. 2005) (ML060330557).

<sup>6</sup> See *South Carolina Electric & Gas, V. C. Summer Nuclear Station, Units 2 & 3 COL Application (Rev. 5)*, (Exs. NRC00001A to NRC0001BH). The application includes a Final Safety Analysis Report (FSAR) and an Environmental Report (ER).

<sup>7</sup> See *generally* "Final Safety Evaluation Report Related to Certification of the AP1000 Standard Plant Design," NUREG-1793, Vol. 1, Supp. 2 (Sept. 2011), § 1.1 (ML11293A120).

amendment to the AP1000 certified design also was finalized. The amendment was affirmed on December 22, 2011; the rule became effective December 30, 2011.<sup>8</sup>

The Applicants did not pursue an early site permit for the VCSNS site.<sup>9</sup> Therefore, all relevant site characteristics, including site geology, hydrology, seismology, manmade hazards, and the characteristics of the local population were studied in the course of the COL application review.

The Office of New Reactors (NRO) led the review and provided much of the Staff expertise in the review. Other NRC offices supported the effort, with the Office of Nuclear Security and Incident Response, the Office of Nuclear Reactor Regulation, the Office of Nuclear Material Safety and Safeguards, the Office of Federal and State Materials and Environmental Management Programs, and Staff in Regions 1 and 2 all contributing expertise. In addition, other federal agencies—including the Department of Homeland Security, the Federal Emergency Management Agency (FEMA), and the U.S. Army Corps of Engineers (ACE)—also contributed to NRC evaluations.<sup>10</sup> State agencies, including the South Carolina Historic Preservation Office, and the South Carolina Department of Natural Resources, also were consulted.<sup>11</sup> The Staff utilized the Standard Review Plan,<sup>12</sup> the Environmental Standard Review

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<sup>8</sup> Final Rule, AP1000 Design Certification Amendment, 76 Fed. Reg. 82,079 (Dec. 30, 2011). The effectiveness date of the rule for those entities who receive actual notice of the rule is the date of receipt. *Id.*

<sup>9</sup> See 10 C.F.R. pt. 52, subpt. A.

<sup>10</sup> Tr. at 51-52 (Testimony of Michael Johnson). See also Ex. NRC000017, *Staff Responses to Commission Post-Hearing Questions* (Oct. 27, 2011), at 23 (Staff Post-Hearing Responses).

<sup>11</sup> See Tr. at 62 (Flanders), 49 (Rice).

<sup>12</sup> “Standard Review Plan for the Review of Safety Analyses Report for Nuclear Power Plants: LWR Edition,” NUREG-0800 (2007) (NUREG-0800) (see <http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr0800/cover/>).

Plan,<sup>13</sup> and applicable regulatory guides, interim staff guidance documents, and office instructions in reviewing the application.<sup>14</sup>

Shortly before our hearing on this matter, we held an uncontested hearing on the first COL application to receive complete Staff review, for the Vogtle Electric Generating Plant, Units 3 and 4.<sup>15</sup> Also referencing the AP1000 design, Vogtle was designated as the “reference combined license application” (“reference COLA” or “RCOLA”) by NuStart Energy Development, LLC (NuStart), a consortium of companies whose mission includes facilitating the licensing of advanced nuclear power reactors. Consistent with the design-centered review approach, the subsequent COL applications (or “SCOLAs”), such as the VCSNS application, were modeled after the RCOLA. RAI responses, and any subsequent application revisions, were coordinated between the reference COL applicant and subsequent COL applicants, so that each subsequent COL applicant could adopt those RAI responses and application changes, except where site-specific factors made such adoption inappropriate.<sup>16</sup> This approach allows the NRC Staff to review each issue a single time, and thus enhances efficiency and consistency.<sup>17</sup>

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<sup>13</sup> “Standard Review Plan for Environmental Reviews for Nuclear Power Plants: Environmental Review Plan,” NUREG-1555 (2007) (ML003701937).

<sup>14</sup> See Ex. NRC000003, “Staff Statement in Support of the Uncontested Hearing for Issuance of Combined Licenses for the Virgil C. Summer Nuclear Station, Units 2 and 3 (Docket Nos. 52-027 and 52-028),” Commission Paper SECY-11-0115 (Aug. 19, 2011) (Staff Testimony).

<sup>15</sup> See Southern Nuclear Operating Co. et al; Combined Licenses for Vogtle Electric Generating Plant, Units 3 and 4, and Limited Work Authorizations; Notice of Hearing, 76 Fed. Reg. 50,767 (Aug. 16, 2011).

<sup>16</sup> See Tr. at 28-29 (Monroe).

<sup>17</sup> Under the “design-centered review approach,” the NRC uses, to the maximum extent practical, a “one issue, one review, one position” strategy to promote effective use of resources for performing reviews, and to optimize application review schedules. In particular, “the [S]taff will conduct one technical review for each reactor design issue and use this one decision to support the decision on a [design certification] and on multiple COL applications.” NRC Regulatory Issue Summary 2006-06, “New Reactor Standardization Needed to Support the Design-Centered Licensing Review Approach” (May 31, 2006) (ML053540251). See *generally* (continued . . .)

## B. Review Standards

The requirement for a hearing at the construction permit phase of new reactor generation facilities is stated in § 189(a) of the Atomic Energy Act of 1954, as amended (AEA or Act).<sup>18</sup> Interested parties are given the opportunity to contest the sufficiency of the application. Even in the absence of a contested hearing, however, AEA § 189(a) requires the Commission to hold an “uncontested” or mandatory hearing. We consider environmental issues as required by § 102(2)(A), (C), and (E) of the National Environmental Policy Act of 1969, as amended (NEPA). The Notice of Hearing for this uncontested proceeding articulates the standards for our review.<sup>19</sup> The determination we must make “is whether the review of the application by the Commission’s [S]taff has been adequate to support the findings found in 10 C.F.R. [§] 52.97 and 10 C.F.R. [§] 51.107 for each of the COL’s to be issued.”<sup>20</sup> In particular, we must determine whether:

- (1) The applicable standards and requirements of the Act and the Commission’s regulations have been met;
- (2) Any required notifications to other agencies or bodies have been duly made;<sup>21</sup>

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“Semiannual Update of the Status of New Reactor Licensing Activities and Future Planning for New Reactors,” Commission Paper SECY–06–0019 (Jan. 31, 2006), at 5-6 (ML053530315).

<sup>18</sup> Section 189(a) provides: “The Commission shall hold a hearing after thirty days’ notice and publication once in the Federal Register, on each application under section 103 or 104b. for a construction permit for a [utilization or production] facility . . . .” 42 U.S.C. § 2239(a).

<sup>19</sup> See Notice of Hearing, 76 Fed. Reg. at 53,493.

<sup>20</sup> *Id.*

<sup>21</sup> AEA § 182(c) requires the publication of notice of the application in the *Federal Register* for four consecutive weeks. This requirement has been satisfied. See South Carolina Electric and Gas Company (SCE&G) and the South Carolina Public Service Authority (Santee Cooper), Notice of Availability of Application for a Combined License, 76 Fed. Reg. 11,522 (Mar. 2, 2011); South Carolina Electric and Gas Company (SCE&G) and the South Carolina Public Service Authority (Santee Cooper), Notice of Availability of Application for a Combined License, 76 Fed. Reg. 12,998 (Mar. 9, 2011); South Carolina Electric and Gas Company (SCE&G) and the South Carolina Public Service Authority (Santee Cooper), Notice of Availability of Application for a Combined License, 76 Fed. Reg. 14,436 (Mar. 16, 2011); South Carolina (continued . . .)

- (3) There is reasonable assurance that the facility will be constructed and will operate in conformity with the license, the provisions of the Act, and the Commission's regulations;
- (4) The applicant is technically and financially qualified to engage in the activities authorized; and
- (5) Issuance of the license will not be inimical to the common defense and security or to the health and safety of the public.<sup>22</sup>

Also as described in the Notice of Hearing, our regulations implementing NEPA require us, in an uncontested hearing, to:

- (1) Determine whether the requirements of Section 102(2)(A), (C), and (E) of NEPA and the applicable regulations in 10 C.F.R. Part 51 have been met;
- (2) Independently consider the final balance among conflicting factors contained in the record of the proceeding with a view to determining the appropriate action to be taken;
- (3) Determine, after weighing the environmental, economic, technical, and other benefits against environmental and other costs, and considering reasonable alternatives, whether the combined license should be issued, denied, or appropriately conditioned to protect environmental values; and
- (4) Determine whether the NEPA review conducted by the NRC staff has been adequate.<sup>23</sup>

We do not review SCE&G's application *de novo*; rather, we consider the sufficiency of the Staff's review of that application.<sup>24</sup>

### **C. Contested COL Proceeding**

The "contested" portion of this proceeding was resolved without reaching an evidentiary hearing. The NRC published in the *Federal Register* a notice of opportunity for hearing in

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Electric and Gas Company (SCE&G) and the South Carolina Public Service Authority (Santee Cooper), Notice of Availability of Application for a Combined License, 76 Fed. Reg. 16,456 (Mar. 23, 2011). See also 10 C.F.R. § 50.43(a)(3).

<sup>22</sup> 10 C.F.R. § 52.97(a)(1).

<sup>23</sup> Notice of Hearing, 76 Fed. Reg. at 53,493. See also 10 C.F.R. § 51.107(a).

<sup>24</sup> See generally *Exelon Generation Co.* (Early Site Permit for Clinton ESP Site), CLI-05-17, 62 NRC 5, 39 (2005); *Clinton ESP*, CLI-06-20, 64 NRC 15, 21-22 (2006).

October 2008.<sup>25</sup> In response, two organizational petitioners, the Sierra Club and Friends of the Earth (filing jointly), and one individual, Mr. Joseph Wojcicki, requested a hearing before the Atomic Safety and Licensing Board. The Board found that only the Sierra Club had demonstrated standing. The Board found, however, that none of the proposed contentions offered by any petitioner was admissible, and therefore denied the hearing requests in February 2009.<sup>26</sup>

Both the joint petitioners and Mr. Wojcicki appealed. On appeal, we affirmed the Board's decision in all respects save one: we reversed the Board's ruling with respect to the admissibility of one proposed contention offered by the Sierra Club regarding alternatives to the proposed action.<sup>27</sup> The joint petitioners' proposed "energy alternatives" contention had argued that "demand-side management" was an alternative to the proposed project that should have been considered in the application. We held that the Board had read too narrowly a prior Commission decision relating to a differently-situated applicant, and we therefore remanded that issue to the Board for further consideration in light of our ruling.<sup>28</sup> We found that for a public utility such as Santee Cooper, who is proposing to produce power for state-designated service territories in which customers have no choice of alternative electric service providers, promoting energy efficiency by the end users may be a viable alternative. In contrast, the *Clinton* early site permit case involved a merchant power producer proposing to sell power on the open market;

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<sup>25</sup> South Carolina Electric and Gas Company, Acting for Itself and as Agent for the South Carolina Public Service Authority (Also Referred to as Santee Cooper); Application for the Virgil C. Summer Nuclear Station Units 2 and 3; Notice of Order, Hearing, and Opportunity to Petition for Leave to Intervene, 73 Fed. Reg. 60,362 (Oct. 10, 2008).

<sup>26</sup> LBP-09-2, 69 NRC 87 (2009). See also Order (Denying Motion for Reconsideration) (Mar. 12, 2009) (unpublished).

<sup>27</sup> CLI-10-1, 71 NRC 1, 20-21 (2010).

<sup>28</sup> *Id.* at 20 (contrasting the VCSNS application with that in *Exelon Generation Co., LLC* (Early Site Permit for Clinton ESP Site), CLI-05-29, 62 NRC 801 (2005), *aff'd*, *Env'tl. Law & Policy Center v. NRC*, 470 F.3d 676 (7th Cir. 2006)).

such an applicant had “neither the mission nor the ability to implement ‘energy efficiency’ alternatives.”<sup>29</sup>

In the same decision, we affirmed the Board’s rejection of the joint petitioners’ other two proposed contentions. This included one contention that argued that the COL application necessarily was incomplete because it referenced a version of the design (at that time, DCD Revision 17) that was still undergoing review.<sup>30</sup> In rejecting this contention, we explained that an applicant may reference an as-yet-uncertified design “at its own risk.”<sup>31</sup> We also affirmed the Board’s rejection of a contention concerning both safety and environmental aspects of potential hazards from aircraft impacts. The proposed contention had failed to challenge the Applicants’ probabilistic risk calculation of the likelihood of such a crash, and, moreover, was mooted by the publication of the final rule on consideration of aircraft impacts at new nuclear power plants.<sup>32</sup>

On remand of the “energy alternatives” contention, the Board concluded that the joint petitioners had not submitted an otherwise admissible contention on the subject of whether energy efficiency is a viable alternative to the proposed project.<sup>33</sup> We subsequently affirmed the Board’s decision on appeal, ending the contested portion of the proceeding.<sup>34</sup>

In April 2011, Friends of the Earth and the South Carolina Chapter of the Sierra Club joined in a petition, filed on multiple dockets, to (among other things) suspend licensing

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<sup>29</sup> *Id.*

<sup>30</sup> *See id.* at 8-10.

<sup>31</sup> *See id.* (citing *Progress Energy Carolinas, Inc.* (Shearon Harris Nuclear Power Plant, Units 2 and 3), CLI-08-15, 68 NRC 1, 3-4 (2008) (in turn citing 10 C.F.R. § 52.55(c) and 10 C.F.R. § 2.335(a))).

<sup>32</sup> *Id.* at 12-13 (citing Final Rule, Consideration of Aircraft Impacts for New Nuclear Power Plants, 74 Fed. Reg. 28,112 (June 12, 2009)).

<sup>33</sup> LBP-10-6, 71 NRC 350 (2010).

<sup>34</sup> CLI-10-21, 72 NRC 197 (2010).



decisions while the Commission considered the impacts of the accident at the Fukushima Dai-ichi plant in Japan.<sup>35</sup> We granted the petition in part, and denied it in part.<sup>36</sup>

#### **D. Uncontested Proceeding**

##### **1. Prehearing Activities**

As part of its COL review, the Staff and the ACE, as a cooperating agency, prepared an environmental impact statement. The Staff's environmental review was conducted in cooperation with the ACE under a memorandum of understanding. The Applicants also must obtain permits from the ACE under Section 404 of the Clean Water Act<sup>37</sup> and Section 10 of the Rivers and Harbors Act of 1899<sup>38</sup> in order to complete construction activities that may potentially affect wetlands.

The Final Environmental Impact Statement was released in April 2011.<sup>39</sup> It concluded, among other things, that unavoidable adverse environmental impacts during operation would be small, and that unavoidable adverse environmental impacts during construction for NRC-

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<sup>35</sup> See generally *Emergency Petition to Suspend All Pending Reactor Licensing Decisions and Related Rulemaking Decisions Pending Investigation of Lessons Learned from Fukushima Daiichi Nuclear Power Station Accident* (Apr. 18, 2011). See also *Supplemental Comments by Friends of the Earth and the South Carolina Chapter of the Sierra Club in Support of Emergency Petition Regarding NEPA Requirement to Address Safety and Environmental Implications of the Fukushima Task Force Report* (Aug. 10, 2011).

<sup>36</sup> *Union Electric Co. d/b/a Ameren Missouri* (Callaway Plant, Unit 2), CLI-11-5, 74 NRC \_\_\_ (Sept. 9, 2011) (slip op.).

<sup>37</sup> 33 U.S.C. § 1344.

<sup>38</sup> 33 U.S.C. § 403.

<sup>39</sup> Exs. NRC00006A & NRC00006B, "Final Environmental Impact Statement for Combined Licenses for Virgil C. Summer Nuclear Station, Units 2 and 3," NUREG-1939 (Apr. 2011) (FEIS). See *South Carolina Electric and Gas; Notice of Availability of the Final Environmental Impact Statement for Virgil C. Summer Nuclear Station, Units 2 and 3, Combined Licenses Application Review*, 76 Fed. Reg. 22,734 (Apr. 22, 2011).

authorized construction activities would be small.<sup>40</sup> The Staff concluded that construction and operation of the proposed units would have accrued benefits that most likely would outweigh the economic, environmental, and other societal costs.<sup>41</sup> The Staff's recommendation to the Commission related to the environmental aspects was that the COLs be issued, based on: the COL applications; consultation with other federal, state, tribal, and local agencies; the Staff's independent review; the Staff's consideration of comments during the scoping process and on the draft EIS; and the assessments and mitigation measures in the ER and FEIS.<sup>42</sup>

The Staff completed its safety review with the issuance of the Final Safety Evaluation Report in August, 2011.<sup>43</sup> The Staff concluded that the COL application complied with applicable safety regulations and recommended that the Commission make the findings necessary for issuance of the COLs.<sup>44</sup>

Consistent with 10 C.F.R. § 52.87, the Advisory Committee on Reactor Safeguards (ACRS) reviewed those portions of the application that concern safety. The ACRS reviewed the Staff's Advanced Safety Evaluation Report, and the full committee reviewed its concerns with the Staff at a meeting in February 2011.<sup>45</sup> The ACRS concluded that there was "reasonable

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<sup>40</sup> NRC00006A, FEIS, Table 10-1 at 10-5 to 10-8. For some ACE-authorized construction and pre-construction activities, such as land use impacts from building transmission lines, the unavoidable adverse environmental impacts were rated "moderate." *Id.*

<sup>41</sup> *Id.* at 10-27.

<sup>42</sup> *Id.* at xxxiii and 10-27.

<sup>43</sup> Ex. NRC000004, Final Safety Evaluation Report for Combined Licenses for Virgil C. Summer Nuclear Station Units 2 and 3 (Aug. 2011) (FSER).

<sup>44</sup> *Id.* at ii-iii.

<sup>45</sup> See Abdel-Khalik, Said, Chairman, ACRS, letter to Gregory B. Jaczko, Chairman, NRC "Report of the Safety Aspects of the South Carolina Electric and Gas Company Combined License Application for V.C. Summer Nuclear Station, Units 2 and 3" (Feb. 17, 2011) (ML110450490) (ACRS Report).

assurance that VCSNS, Units 2 and 3, can be built and operated without undue risk to the health and safety of the public.”<sup>46</sup>

Following completion of its safety review and issuance of the FSER, the Staff filed a statement in support of the uncontested hearing, which constituted its prehearing testimony, as is consistent with the Internal Commission Procedures.<sup>47</sup> SCE&G (representing both applicants) filed as hearing exhibits prehearing testimony and the curriculum vitae of principal witnesses who were to serve as panelists. Both parties also filed answers to the Commissioners’ pre-hearing questions, as well as their exhibit lists for the October 12-13, 2011, hearing.<sup>48</sup>

In the Notice of Hearing, State and local government bodies, as well as any affected federally-recognized Indian Tribes, were given the opportunity to file a statement including their position on any issues associated with the application or any questions they would like us to pose at the hearing.<sup>49</sup> We received no responses to this notice.

Prior to the hearing, the Secretary issued a scheduling order detailing matters such as the identification and swearing-in of witnesses, the process that would be used for formally

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<sup>46</sup> *Id.* at 5. The Staff subsequently responded to the ACRS Report, describing specific changes to the application and the final safety evaluation report, together with an explanation for actions taken. See Borchardt, R.W., Executive Director for Operations, NRC, letter to Said Abdel-Khalik, Chairman, ACRS, “Report on the Safety Aspects of the South Carolina Electric and Gas Company Combined License Application for Virgil C. Summer Nuclear Station, Units 2 and 3” (Mar. 26, 2011) (ML110560591).

<sup>47</sup> See generally Ex. NRC000003, Staff Testimony.

<sup>48</sup> Ex. NRC000007, *NRC Staff Responses to Commission Pre-Hearing Questions* (Sept. 28, 2011) (Staff Pre-Hearing Responses); Ex. SCE000001, *South Carolina Electric & Gas Company’s Answers to the Commission Questions for the V.C. Summer Units 2 and 3 Mandatory Hearing* (SCE&G Pre-Hearing Responses). See generally Order (Transmitting Pre-Hearing Questions) (Sept. 15, 2011) (unpublished) (Pre-Hearing Order).

<sup>49</sup> Notice of Hearing, 76 Fed. Reg. at 53,493.

admitting evidence, and the format of presentations.<sup>50</sup> This was followed by a Scheduling Note prescribing the content and time allotment of the presentations to be provided at the hearing by SCE&G and by the Staff.<sup>51</sup>

## **2. Hearing**

At the hearing, small witness panels for SCE&G and for the Staff gave presentations on topics we previously had determined to be of interest, followed by a question and answer period. During the question and answer period, witnesses for both the Staff and SCE&G (some of whom did not serve on the presentation panels) answered questions related to their particular areas of expertise. These witnesses all had been involved in either the development or review of the COL application.

### *a. Witnesses for the Overview Panel and Safety Panels*

The Staff provided fifty-nine witnesses to be sworn in by the Chairman.<sup>52</sup> Eighteen of these sworn witnesses were scheduled panelists, as described below. The remainder stood by to answer our questions concerning topics of their expertise; about thirteen of these “standby” witnesses had the opportunity to testify. SCE&G provided sixteen witnesses, including several who were not panelists, but were available to answer our questions.<sup>53</sup>

Michael Johnson, Director, NRO; Scott Flanders, Director, Division of Site and Environmental Reviews, NRO; and Frank Akstulewicz, Deputy Director, Division of New Reactor Licensing, NRO, gave an overview of the COL application review, including the topic of the

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<sup>50</sup> Scheduling Order (Sept. 28, 2011) (unpublished).

<sup>51</sup> Vietti-Cook, Annette, Secretary of the Commission, Memorandum to Counsel for Applicant and Staff (Enclosure: Scheduling Note) (Sept. 30, 2011); Scheduling Note (Revised) (Oct. 6, 2011) (Revised Scheduling Note).

<sup>52</sup> See *Revised Staff Witness List* (Oct. 5, 2011). See also Tr. at 16-18, 167, 277.

<sup>53</sup> Non-panelist SCE&G witnesses were Dave H. Carroll, Ronald B. Clary, Julie M. Giles, Gerald A. Loignon, Mark E. Stella, and Allan D. Torres. See Tr. at 15-16.

design-centered review approach for the AP1000 COL applications and a summary of the regulatory findings.<sup>54</sup>

Testifying for the Applicants were Stephen A. Byrne, Executive Vice President, Generation & Transmission, and Chief Operating Officer of SCE&G, and Alfred M. Paglia, Jr., Manager, Nuclear Licensing, New Nuclear Deployment, for SCE&G. These witnesses offered pre-filed written testimony as well as live testimony at the hearing.<sup>55</sup> They provided background information and an overview of the VCSNS project, including a discussion of the COL application, incorporation by reference of the AP1000 DCD, and the relationship between the VCSNS COL application and the AP1000 Reference COL application.

The first safety panel addressed site characteristics of the VCSNS site and SCE&G's request for a site-specific regulatory exemption involving a departure from AP1000 site parameters. Testifying for the Staff were three Staff members from NRO: Joseph Sebrosky, Senior Project Manager and Lead Safety Project Manager for the Summer COL Review; Michelle Hayes, Reactor Systems Engineer; and John Segala, Chief, Balance of Plant Branch 1.<sup>56</sup>

Testifying for the Applicants on safety matters was Amy M. Monroe, SCE&G Licensing Engineer, New Nuclear Deployment, who provided pre-filed written and live testimony during all

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<sup>54</sup> See generally *id.* at 50-77.

<sup>55</sup> See Ex. SCE000002, Testimony of Stephen A. Byrne and Alfred M. Paglia, Jr. in Support of the Mandatory Hearing for V.C. Summer Units 2 and 3 Combined Licenses. Mr. Byrne has a Bachelor of Science degree in chemical engineering from Wayne State University in Michigan and has over twenty-seven years' experience in the nuclear industry. He also has chaired the industry's New Plant Working Group for the past three years, and is currently chair of the New Plant Oversight Committee. *Id.* at 1-2. See also Ex. SCE000005, Curriculum Vitae of Stephen A. Byrne. Mr. Paglia holds a Bachelor of Science degree in Mechanical Engineering from the University of South Carolina, and has thirty-one years' experience in the nuclear industry. See Ex. SCE000006, Curriculum Vitae of Alfred M. Paglia, Jr., P.E.

<sup>56</sup> See generally Tr. at 94-130.

three panels addressing safety issues.<sup>57</sup> During the first safety panel, addressing general site characteristics of the VCSNS site, Ms. Monroe was joined in testifying at the hearing by Stephen E. Summer, Supervisor, Environmental Services, SCANA Services, Inc.<sup>58</sup>

The second safety panel addressed site hydrology, geology, seismology, and geotechnical engineering. Testifying for the Staff were four Staff members from NRO: Kenneth See, Senior Hydrologist; Gerry Stirewalt, Senior Geologist; Sarah Tabatabai, Geophysicist; and Malcolm Patterson, Reliability and Risk Analyst.<sup>59</sup> For the Applicants, Robert B. Whorton, P.E., consulting engineer for SCE&G,<sup>60</sup> testified along with Ms. Monroe and Mr. Summer.

The third safety panel addressed emergency planning, including relocation of the technical support center and control room habitability, engineered safety features, and auxiliary systems including the raw water and wastewater systems, and offsite power. The Staff's testimony was presented by Donald Habib, Project Manager, NRO, and Daniel Barss, Team Leader, New Reactor Licensing Branch, Office of Nuclear Security and Incident Response.<sup>61</sup>

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<sup>57</sup> See Ex. SCE000003, Testimony of Amy M. Monroe in Support of the Mandatory Hearing for V.C. Summer Units 2 and 3 Combined Licenses. Ms. Monroe holds a Bachelor of Science degree in Mechanical Engineering from the University of South Carolina, has twenty-four years' experience in nuclear power plant engineering in the fields of licensing and system performance, and has worked at SCE&G for twenty-eight years. *Id.* at 1. See also Ex. SCE000007, Curriculum Vitae of Amy M. Monroe.

<sup>58</sup> See Ex. SCE000011, Curriculum Vitae of Stephen E. Summer. Mr. Summer holds a Master of Science in Wildlife Biology from Clemson University and a Bachelor of Science in Biology from University of South Carolina. He has over thirty-three years' experience in environmental licensing, permitting, monitoring and assessment relating to electric generating facilities. *Id.* at 1.

<sup>59</sup> See Tr. at 137-82.

<sup>60</sup> See Ex. SCE000009, Curriculum Vitae of Robert B. Whorton. Mr. Whorton holds a Bachelor of Science in Civil-Structural Engineering from the University of South Carolina and has over forty years' experience. He has worked on the VCSNS Units 2 and 3 project since 2005. He was involved in the initial site layout for the new units and participated in geological, geotechnical, and seismic investigations for the COL application. *Id.* at 2-3.

<sup>61</sup> See Tr. at 191-235.

For the Applicants, Ms. Monroe was joined on that panel by Robert E. Williamson, III, Manager, Emergency Planning, SCE&G;<sup>62</sup> Timothy Schmidt, Engineer, New Nuclear Deployment, SCE&G;<sup>63</sup> and James C. Laborde, Consulting Engineer, New Nuclear Deployment, SCE&G.<sup>64</sup>

*b. Witnesses for Environmental Panels*

The first environmental panel discussed the scoping process, consultations with other governmental agencies, public outreach, and environmental impacts. Testifying for the Staff were four Staff members from NRO: Scott Flanders; Ryan Whited, Chief of Environmental Projects, Branch 2; Patricia Vokoun, Project Manager for the Summer Environmental Review; and Jack Cushing, Senior Project Manager.<sup>65</sup> In addition, Nancy Kohn, Senior Research Scientist with contractor Pacific Northwest National Laboratory, and Deputy Team Leader for the VC Summer Environmental Review, spoke on the Staff's panel.<sup>66</sup> April R. Rice, Licensing Supervisor and Project Manager for the environmental review for the VCSNS project, provided SCE&G's principal testimony on environmental issues.<sup>67</sup> She was joined in testifying by

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<sup>62</sup> See Ex. SCE000010, Curriculum Vitae of Robert E. Williamson. Mr. Williamson holds a Bachelor of Science in Workforce Education from Southern Illinois University and started his career in the nuclear field at the U.S. Navy Nuclear Power Training Unit in 1990. He worked at Cooper Nuclear Station and Pilgrim Nuclear Power Station prior to starting at VCSNS in 2003. *Id.*

<sup>63</sup> See Ex. SCE000020, Curriculum Vitae of Timothy Schmidt. He holds a Bachelor of Science in Chemical Engineering from the University of South Carolina and is a registered professional engineer in South Carolina. He joined SCE&G's office for New Nuclear Deployment in 2006, and, prior to that, worked at Vogtle Electric Generating Plant for four years. *Id.*

<sup>64</sup> See Ex. SCE000019, Curriculum Vitae of James C. LaBorde. He holds a Bachelor of Science in Engineering from the University of South Carolina. He is a registered professional engineer in South Carolina and has worked for SCE&G since 1974. *Id.*

<sup>65</sup> See Tr. at 249-52, 257-64, 267-71, 274-89.

<sup>66</sup> See *id.* at 252-57.

<sup>67</sup> Ex. SCE000004, Testimony of April R. Rice in Support of the Mandatory Hearing for V.C. Summer Units 2 and 3 Combined Licenses. Ms. Rice has Bachelor of Science degree in Nuclear Engineering from N.C. State University and has thirty years' experience in the nuclear (continued . . .)

Stephen Summer and by Lisa A. Matis, Project Manager and Regulatory Specialist for Tetra Tech, an environmental contractor.<sup>68</sup>

The final environmental panel discussed the environmental justice review and the Staff's collaboration with the ACE to produce the FEIS.<sup>69</sup> Panelists included Scott Flanders; Ryan Whited; Patricia Vokoun; Daniel Mussatti, Economist, NRO; and David Anderson, Senior Research Economist, Pacific Northwest National Laboratory.

### **3. Post-Hearing Questions**

After the hearing, the Secretary issued orders setting deadlines for proposed transcript corrections, and for responses to additional questions.<sup>70</sup> The Staff and SCE&G filed a joint motion for proposed transcript corrections.<sup>71</sup> Following the hearing, the Staff and SCE&G provided additional responses to questions posed during and following the hearing.<sup>72</sup> The

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industry. She has worked as a supervisor at SCE&G for nine years. *Id.* at 1. *See also* Ex. SCE000008, Curriculum Vitae of April R. Rice.

<sup>68</sup> *See* Ex. SCE000018, Curriculum Vitae of Lisa Matis. She holds a Master of Science in Mechanical Engineering from Stevens Institute of Technology and a Bachelor of Science in Chemical Engineering from Stanford University, and has more than 26 years' experience in the field of environmental management services. *Id.*

<sup>69</sup> *See* Tr. at 296-309.

<sup>70</sup> *See* Order (Setting Deadline for Proposed Transcript Corrections) (Oct. 17, 2011); Order (Supplemental Responses and Post-Hearing Questions) (Oct. 20, 2011) (unpublished) (Post-Hearing Order).

<sup>71</sup> *Joint Motion for Transcript Corrections* (Oct. 24, 2011).

<sup>72</sup> Ex. NRC000017, Staff Post-Hearing Responses; *South Carolina Electric & Gas Company's Supplemental Responses to In-Hearing Questions and Responses to Post-Hearing Questions for the V.C. Summer Units 2 and 3 Mandatory Hearing* (Oct. 27, 2011) (Ex. SCE000027, SCE&G Post-Hearing Responses). In addition, the Staff filed a letter making revisions to the FSER and to the draft combined license. Martin, Jody C., Counsel for the NRC Staff, letter to Chairman and Commissioners, U.S. Nuclear Regulatory Commission (Nov. 1, 2011). The letter (with its enclosure) was assigned Exhibit number NRC000018.



Secretary subsequently issued an order admitting all additional exhibits into the record, adopting transcript corrections, and closing the evidentiary record.<sup>73</sup>

## II. DISCUSSION

### A. Site-Specific Issues Addressed at Hearing

We asked a series of pre-hearing questions to inform our consideration of the sufficiency of the Staff's review of the COL application.<sup>74</sup> The hearing itself focused on issues that are of particular concern due to their novelty or specificity to the VCSNS site. The presentation topics were selected to correspond to areas of the Staff's FSER or FEIS where we required additional information or clarifications as part of our evaluation. We asked detailed questions during the hearing and followed up in areas of concern with post-hearing questions. Although the hearing focused on particular issues and did not give equal weight to all subjects considered in the Staff's environmental and safety reviews, we base today's decision on the entire record of this proceeding.

#### 1. *Response to Japan Task Force Recommendations*<sup>75</sup>

##### a. *Near-Term Task Force Recommendations and Emergency Petitions*

As described above, we recently granted in part, and denied in part, a petition for emergency action in this, and a number of other licensing proceedings, relating to the events at the Fukushima Dai-ichi Nuclear Power Station, following the March 11, 2011, earthquake and tsunami.<sup>76</sup> We granted the petitioners' request for a safety analysis, to the extent that the

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<sup>73</sup> Order (Adopting Proposed Transcript Corrections, Admitting Post-Hearing Responses, and Closing the Record of the Proceeding) (Nov. 7, 2011) (unpublished).

<sup>74</sup> See Pre-Hearing Order.

<sup>75</sup> See Ex. NRC000003, Staff Testimony, at 9; Ex. NRC000007, Staff Pre-Hearing Responses, at 1-2; Ex. NRC000017, Staff Post-Hearing Responses at 1-3, 9-12; Ex. SCE000027, SCE&G Post-Hearing Responses, at 7; Tr. at 52-53, 67-69, 72, 76-78, 83, 331-32.

<sup>76</sup> *Callaway*, CLI-11-5, 74 NRC \_\_ (slip op.).

requested analyses had already been undertaken.<sup>77</sup> Specifically, the NRC's Near-Term Task Force already had completed a short-term analysis of the implications of that accident.<sup>78</sup> The Near-Term Task Force was established in the weeks following the accident, and it completed its report with recommendations for future agency actions by July 2011.<sup>79</sup> At the time of our ruling on the "emergency petitions," we already had directed the Staff to commence a longer-term review of the implications of the accident, and to recommend priorities for future regulatory actions.<sup>80</sup>

We denied, however, the petitioners' requests to suspend various licensing proceedings, pending completion of the long-term analyses and the issuance of any resulting regulatory changes.<sup>81</sup> We found that continuing the licensing processes in accordance with our current regulations would cause "no imminent risk to public health and safety," because our current regulations provide for incorporating new requirements into existing licenses as they are shown to be necessary:

We have well-established processes for imposing any new requirements necessary to protect public health and safety and the common defense and security. Moving forward with our decisions and proceedings will have no effect on the NRC's ability to implement necessary rule or policy changes that might come out of our review of the Fukushima [Dai-ichi] events.<sup>82</sup>

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<sup>77</sup> *Id.* at \_\_\_ (slip op. at 31-32, 41).

<sup>78</sup> *See id.* at \_\_\_ (slip op. at 4-6).

<sup>79</sup> *See also* "Recommendations for Enhancing Reactor Safety in the 21st Century, The Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident" (July 12, 2011) (Near-Term Report) (transmitted to the Commission via "Near-Term Report and Recommendations for Agency Actions Following the Events in Japan," Commission Paper SECY-11-0093 (July 12, 2011) (ML11186A950 (package))).

<sup>80</sup> *See* Staff Requirements—SECY-11-0093—Near-Term Report and Recommendations for Agency Actions Following the Events in Japan (Aug. 19, 2011) (ML112310021), for our direction to the Staff in response to the Near-Term Report.

<sup>81</sup> *Callaway*, CLI-11-5, 74 NRC at \_\_\_ (slip op. at 20-29).

<sup>82</sup> *Id.* at 29.

In its information paper supporting the issuance of the VCSNS COLs, the Staff noted that three of the Near-Term Task Force recommendations apply specifically to the COL application: (1) confirmation of station blackout and spent fuel capabilities of the AP1000 design, (2) enhancement of on-site emergency response capability by integrating emergency operating procedures, severe accident management guidelines, and extensive damage mitigation guidelines, and (3) enhancement of emergency planning to address prolonged station blackout and multi-unit accidents.<sup>83</sup> The Staff also discussed two options for implementing these recommendations: (1) to formulate license conditions implementing the recommendations; or (2) to issue the licenses without conditions relating specifically to the recommendations, and later use the applicable regulations at 10 C.F.R. § 52.98 and 10 C.F.R. § 50.109 to amend the licenses to add appropriate conditions (depending on whether the conditions are within the scope of the certified design).<sup>84</sup> At that time, the Staff did not articulate a preferred course of action.<sup>85</sup>

In response to our pre-hearing questions, the Staff indicated that there are generally fewer regulatory and administrative requirements to follow in imposing license conditions prior to issuing a license than in imposing similar requirements retrospectively.<sup>86</sup> But because the VCSNS COL application references a certified design, elements of the licensing basis already have been established. Thus, the NRC would have to establish a regulatory basis for any change to the established design regardless of whether the COLs have issued.<sup>87</sup> Therefore, the

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<sup>83</sup> Ex. NRC000003, Staff Testimony, at 9.

<sup>84</sup> *Id.*

<sup>85</sup> *See id.*

<sup>86</sup> Ex. NRC000007, Staff Pre-Hearing Responses, at 1.

<sup>87</sup> *Id.* *See also* 10 C.F.R. §§ 52.83, 52.63(a) (“ . . . the Commission may not modify, rescind or impose new requirements on the certification information . . . unless [it] determines in a rulemaking” that the change meets one of several conditions, such as that the change is (continued . . . )

Staff recommended that the NRC proceed with issuing the licenses, and use appropriate regulatory tools to impose new requirements in the event that new requirements are established.<sup>88</sup>

At the hearing, the NRC Staff witnesses recommended proceeding with issuance of the licenses without delay regardless of whether we decide to impose license conditions pertaining to the Near-Term Task Force recommendations.<sup>89</sup> As noted above, Mr. Johnson, NRO Director, indicated that if the COLs issue without including license conditions, our regulations relevant to the finality of decisions could result in some additional administrative requirements to satisfy in imposing new requirements on the licensee.<sup>90</sup> He also testified that, ultimately, the licensee would be subject to the same requirements regardless of the timing of license issuance.<sup>91</sup> In response to our post-hearing questions on this topic, the Staff clarified that some Near-Term Task Force recommendations are not appropriate for implementation in the short term because their specifics are not yet established.<sup>92</sup>

After completion of the evidentiary hearing, the Staff transmitted to us SECY-12-0025, in which it proposed, among other things, to issue orders on certain topics to the Vogtle COL holder, based on its determination that additional requirements were needed to provide

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“necessary to provide adequate protection to the public health and safety or the common defense and security,” or that it “[s]ubstantially increases overall safety, reliability, or security of facility design, construction, or operation and the direct and indirect costs of implementation of the rule change are justified in view of the increased safety.”).

<sup>88</sup> Ex. NRC000007, Staff Pre-Hearing Responses, at 1.

<sup>89</sup> Tr. at 71-72 (Johnson).

<sup>90</sup> *Id.* at 76 (citing 10 C.F.R. § 50.109) (Johnson)).

<sup>91</sup> *Id.* at 76, 77, 83 (Johnson).

<sup>92</sup> Ex. NRC000017, Staff Post-Hearing Responses, at 9-11 (citing “Prioritization of Recommended Actions to be Taken in Response to Fukushima Lessons Learned,” Commission Paper SECY-11-0137 (Oct. 3, 2011) (ML11269A204)).

adequate protection to public health and safety.<sup>93</sup> Contemporaneously, the Staff filed a notice of material new information relevant to this adjudication, noting the pendency of SECY-12-0025, and stating that, if we agreed that the orders proposed for the Vogtle COLs “are necessary to provide adequate protection of the public health and safety,” then the Staff was prepared to include the substance of those orders as license conditions in the VCSNS COLs.<sup>94</sup>

The first order relates to the development of strategies to address beyond-design basis external events resulting in the simultaneous loss of all alternating current (AC) power and loss of normal access to the ultimate heat sink.<sup>95</sup> For Part 50 licensees, the Staff proposed a “phased” approach for mitigating these events. The “initial” phase requires the use of installed equipment and resources to maintain core, containment, and spent fuel pool cooling capabilities. The “transition” phase requires providing portable onsite equipment to maintain or restore these functions until they can be accomplished with resources brought from off site. The third and “final” phase requires obtaining sufficient offsite resources to sustain those functions indefinitely.<sup>96</sup>

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<sup>93</sup> See “Proposed Orders and Requests for Information in Response to Lessons Learned from Japan’s March 11, 2011, Great Tohoku Earthquake and Tsunami,” Commission Paper SECY-12-0025 (Feb. 17, 2012) (ML12039A103) (package). The Staff also recommended issuance of orders requiring reliable hardened vents in BWR Mark I and Mark II containments—an issue not relevant to the AP1000 reactor design.

<sup>94</sup> See *Notice to Commission of Information Relevant to the V.C. Summer Uncontested Hearing* (Feb. 22, 2012). The Secretary of the Commission subsequently provided an opportunity for the Applicants to respond to the Staff’s notification. See Order (Feb. 24, 2012) (unpublished). In response, SCE&G indicated that, “if the Commission already has concluded that the Vogtle Orders or any other actions proposed in SECY-12-0025 are necessary for adequate protection, then SCE&G agrees to their inclusion as license conditions.” *South Carolina Electric & Gas Company’s Response to the Nuclear Regulatory Commission Staff’s February 22, 2012 Notice* (Feb. 27, 2012). We include these filings as part of the adjudicatory record of this proceeding.

<sup>95</sup> SECY-12-0025 at 7.

<sup>96</sup> *Id.*, Enclosure 4, Attachment 3, “Requirements for Mitigation Strategies for Beyond-Design-Basis External Events at COL Holder Reactor Sites (Vogtle Units 3 and 4).”

The Staff observed that the AP1000 standard design includes passive design features that provide core, containment, and spent fuel pool cooling capability for 72 hours, without reliance on AC power.<sup>97</sup> The Staff therefore proposed that the Vogtle COL holder address only those requirements relative to the “final” phase. We approved issuance of this order to the Vogtle COL holder, finding that issuance of the order was warranted “as necessary for ensuring adequate protection under . . . 10 C.F.R. § 50.109(a)(4)(ii).”<sup>98</sup> For the same reasons, we impose the following condition on the licenses for VCSNS Units 2 and 3:

Requirements for Mitigation Strategies for Beyond-Design-Basis External Events

The Licensees shall address the following requirements:

1. The Licensees shall develop, implement, and maintain guidance and strategies to maintain or restore core cooling, containment and spent fuel pool cooling capabilities following a beyond-design-basis external event.
2. These strategies must be capable of mitigating a simultaneous loss of all AC power and loss of normal access to the normal heat sink and have adequate capacity to address challenges to core cooling, containment, and spent fuel pool cooling capabilities at all units on the VCSNS site.
3. The Licensees must provide reasonable protection for the associated equipment from external events. Such protection must demonstrate that there is adequate capacity to address challenges to core cooling, containment, and spent fuel pool cooling capabilities at all units on the VCSNS site.
4. The Licensees must be capable of implementing the strategies in all modes.
5. Full compliance shall include procedures, guidance, training, and acquisition, staging, or installing of equipment needed for the strategies.

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<sup>97</sup> SECY-12-0025 at 11.

<sup>98</sup> Staff Requirements—SECY-12-0025—Proposed Orders and Requests for Information in Response to Lessons Learned from Japan’s March 11, 2011, Great Tohoku Earthquake and Tsunami (Mar. 9, 2012) (ML120690347), at 1 (Staff Requirements—SECY-12-0025). Section 50.109(a)(4)(ii) provides an exception to the “Backfit Rule” where the Commission determines “[t]hat regulatory action is necessary to ensure that the facility provides adequate protection to the health and safety of the public and is in accord with the common defense and security.” The order notes that additional guidance, discussing an acceptable approach for complying with the order will be contained in final Interim Staff Guidance (ISG) scheduled to be issued by the NRC in August 2012. SECY-12-0025, Enclosure 7, at 4.

6. The Licensees shall promptly start implementation of the requirements stated in this condition and shall complete full implementation prior to initial fuel load.

6.1 The Licensees shall, within twenty (20) days of issuance of this license, notify the Commission (1) if they are unable to comply with any of these requirements, (2) if compliance with any of the requirements is unnecessary in their specific circumstances, or (3) if implementation of any of the requirements would cause the Licensees to be in violation of the provisions of any Commission regulation or this license. The notification shall provide the Licensees' justification for seeking relief from or variation of any specific requirement.

6.2 If the Licensees consider that implementation of any of these requirements would adversely impact safe and secure operation of the facility, the Licensees must notify the Commission, within twenty (20) days of issuance of the license, of the adverse safety impact, the basis for their determination that the requirement has an adverse safety impact, and either a proposal for achieving the same objectives specified in this license condition, or a schedule for modifying the facility to address the adverse safety condition. If neither approach is appropriate, then the Licensees must supplement their response to Section 6.1 of this license condition to identify the condition as a requirement with which they cannot comply, with attendant justifications as required in Section 6.1.

6.3 The Licensees shall, within one (1) year after issuance of the NRC's final Interim Staff Guidance detailing an acceptable approach for complying with these requirements, submit to the Commission for review an overall integrated plan, including a description of how compliance with the requirements described in this license condition will be achieved.

6.4 The Licensees shall provide an initial status report sixty (60) days following issuance of the final Interim Staff Guidance and at six (6)-month intervals following submittal of the overall integrated plan, as required in Section 6.3 of this license condition, which delineates progress made in implementing the requirements of this license condition.

6.5 The Licensees shall report to the Commission when full compliance with the requirements described in this license condition is achieved.

6.6 Licensee responses to conditions 6.1, 6.2, 6.3, 6.4, and 6.5, above, shall be submitted in accordance with 10 C.F.R. § 52.3.

In SECY-12-0025, the Staff also proposed to issue orders to licensees requiring reliable indication of the water level in site spent fuel storage pools, capable of supporting identification, by trained personnel, of three pool water level conditions: (1) a water level adequate to support operation of the normal spent fuel pool cooling system, (2) a water level adequate to provide

substantial radiation shielding for a person standing on the spent fuel pool operating deck, and (3) a water level where fuel remains covered and actions to implement makeup water addition should no longer be deferred.<sup>99</sup>

The AP1000 design basis, as incorporated by reference in the VCSNS 2 and 3 COL application, addresses many of these attributes of spent fuel pool level instrumentation. The Staff reviewed these design features in conjunction with its review for the certification of the AP1000 design. The spent fuel pool instruments in the AP1000 certified design measure the water level from the top of the spent fuel pool to the top of the fuel racks to address the range requirements listed above. The safety-related classification provides for several additional design features: (1) seismic and environmental qualification of the instruments; (2) independent power supplies; (3) electrical isolation and physical separation between instrument channels; (4) display in the control room as part of the post-accident monitoring instrumentation; and (5) routine calibration and testing.<sup>100</sup>

In view of the above, we approved issuance of an order to the Vogtle COL holder to address spent fuel pool instrumentation requirements not specified in the certified design as enhanced protective measures that represent a substantial increase in the protection of public health and safety.<sup>101</sup> In contrast to the order regarding mitigation strategies, the provisions of this order are not being incorporated as a license condition for the COLs for VCSNS Units 2 and 3. The Commission did not issue the spent fuel pool instrumentation requirements as an action

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<sup>99</sup> See SECY-12-0025, Enclosure 6, Attachment 3, “Requirements for Reliable Spent Fuel Pool Level Instrumentation at COL Holder Reactor Sites.”

<sup>100</sup> *Id.*

<sup>101</sup> See Staff Requirements—SECY-12-0025 at 1. See also *id.*, Attachment 3, “Revisions to SECY-12-0025, Enclosure 6,” at 4, 6-8 (unnumbered). We decided to “administratively exempt” this order from the provisions of the Backfit Rule (10 C.F.R. § 50.109), and the issue finality requirements of 10 C.F.R. § 52.63 and 10 C.F.R. Part 52, Appendix D, Paragraph VIII. This determination was based on insights gained to date from the agency’s review of the accident, including its initiating cause and particular failure sequence, as well as extensive stakeholder engagement, and broad endorsement for timely action. *Id.* at 7 (unnumbered).



that was necessary to ensure adequate protection. We recognize that the timing of the VCSNS COL licensing review presented a unique circumstance relative to Vogtle in determining how to impose the two applicable Fukushima orders to VCSNS. Similar to the Vogtle COL review, these requirements were not embedded in the existing Staff licensing review before the Commission; however, future licensing reviews will take into account these requirements. Furthermore, we have the authority to take necessary regulatory action, either by directing issuance of an order modifying the license or by directing inclusion of a license condition in the license where appropriate, with respect to these lessons learned. The spent fuel pool instrumentation order represents a substantial increase in the protection of public health and safety, and therefore, we direct the Director of the Office of New Reactors to issue Order EA-12-051 to SCE&G, concurrent with the issuance of the COLs for VCSNS Units 2 and 3.

In addition, in SECY-12-0025, the Staff informed us of its intent to issue requests for information addressing seismic and flooding reevaluations (Task Force Recommendation 2.1), seismic and flooding hazard walkdowns (Task Force Recommendation 2.3), and a request for licensees to address their current communications system and equipment under conditions of onsite and offsite damage and prolonged station blackout, and to perform a staffing study to determine the number and qualifications of staff required to fill all necessary positions in response to a multi-unit event (Task Force Recommendation 9.3).<sup>102</sup> On March 12, 2012, the Staff sent the request for information to the sole existing COL holder (for the Vogtle site), and stated that it is not requesting responses from COL holders under 10 C.F.R. Part 52 with respect to Recommendations 2.1 and 2.3 because the issues related to the seismic and flooding reevaluations and walkdowns are resolved.<sup>103</sup> Promptly after the VCSNS COLs are

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<sup>102</sup> See *generally* SECY-12-0025 at 8; Enclosure 7, “Draft 50.54(f) Letter—External Hazards Reevaluation, Walkdown and Emergency Staffing.”

<sup>103</sup> Regarding Recommendation 2.1, the Staff states that, as part of its COL review, the Vogtle licensee used an NRC-endorsed seismic source characterization model that had recently been (continued . . .)

issued, the Staff shall pose the same request for information to the VCSNS licensees previously issued to the Vogtle COL holder.

Our review of the remaining recommended actions associated with lessons learned from the Fukushima events is ongoing. We approved and provided direction on certain near-term actions identified by the Near-Term Task Force to be initiated without delay and shortly thereafter approved the prioritization of all of the recommendations and supported the Staff's proposed actions on the top two tiers of recommendations.<sup>104</sup> SECY-12-0025, as discussed above, represents only the first of the Staff's substantive recommendations for action. We will act on the Staff's recommended actions to implement the remaining recommendations, including those that result from the Staff's review of the responses to our information requests. The Staff's review is proceeding expeditiously.

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updated, and that the use of a newer, recently-endorsed model would not result in differences in the seismic hazard characterizations that would affect the plant design for this site. The Staff stated that it intends to confirm this position by developing seismic hazard curves for each of the sites, using the new source model. SECY-12-0025 at 11. Regarding the flooding reevaluation in Recommendation 2.1, the Staff stated that, because of the experience gained by both the NRC and the industry in preparing and reviewing numerous ESPs and COLs, present-day methodologies associated with evaluating flooding hazards at plant sites are well documented. Leeds, E.J., and Michael R. Johnson, NRC, letter to All Power Reactor Licensees and Holders of Construction Permits in Active or Deferred Status, "Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3, of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident" (Mar. 12, 2012) at Enclosure 2 (ML12053A340). Recommendation 2.3 is not applicable to a facility that has not yet been constructed. SECY-12-0025 at 11.

<sup>104</sup> See Staff Requirements—SECY-11-0124—Recommended Actions to be Taken Without Delay from the Near-Term Task Force Report (Oct. 18, 2011) (ML112911571). Among other things, we directed that the agency "should strive to complete and implement the lessons learned from the Fukushima accident within five years—by 2016." *Id.* at 1. See also Staff Requirements—SECY-11-0137—Prioritization of Recommended Actions to be Taken in Response to Fukushima Lessons Learned (Dec. 15, 2011) (ML113490055); "Prioritization of Recommended Actions to be Taken in Response to Fukushima Lessons Learned," Commission Paper SECY-11-0137 (Oct. 3, 2011) (ML11272A111) (package).

As we stated in CLI-11-5, we have in place well-established regulatory processes by which to impose any new requirements or other enhancements that may be needed.<sup>105</sup> The applicability of any new requirement will be determined when the justification is fully developed and we evaluate the Staff's bases. While these processes are well under way, it takes time to complete the steps necessary to ensure that any new requirements are technically justified and implemented appropriately. We are confident that the Commission's approach—using rigorous, well-established processes rather than the Chairman's loosely-defined proposed license condition—will assure timely implementation of new requirements based on Fukushima lessons learned. Indeed, this is the same approach we took in *Vogtle*. As we stated there, departing from our stable, predictable licensing process may unintentionally impact the Staff's disciplined work.<sup>106</sup> Moreover, all affected licensees ultimately will be required to comply with NRC direction resulting from lessons learned from the Fukushima accident, regardless of the timing of issuance of the affected licenses.<sup>107</sup> We therefore expect that the new VCSNS units will comply with all applicable "post-Fukushima" requirements in a timely fashion as they are developed, and we impose no additional Fukushima-related license conditions today.

## **2. Maximum Safety Wet Bulb (Noncoincident) Temperature Departure**

### **a. Wet Bulb Noncoincident Temperature and Need for the Departure**

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<sup>105</sup> See generally *Callaway*, CLI-11-5, 74 NRC at \_\_ (slip op. at 24-25).

<sup>106</sup> *Southern Nuclear Operating Co.* (Vogtle Electric Generating Plant, Units 3 and 4), CLI-12-2, 75 NRC \_\_ (Feb. 9, 2012) (slip op.).

<sup>107</sup> As discussed above, we have the regulatory flexibility to choose the appropriate vehicle (including imposition of a specific order or license condition, or promulgation of a generally-applicable rule) to implement new requirements arising from our review of the Fukushima accident. The mechanisms used have no bearing on the underlying result—the imposition of identical, binding requirements upon the affected licensees.

The Staff found that the VCSNS site falls within the AP1000 site parameters, with only one exception.<sup>108</sup> The VCSNS COL application included a request for a departure from the wet bulb noncoincident temperature as described in the AP1000 DCD. Because the wet bulb noncoincident temperature is considered “Tier 1 information,” or, part of the AP1000 certified design, a regulatory exemption is required.<sup>109</sup> This is the only site-specific exemption request for the VCSNS COL application.<sup>110</sup>

Michelle Hayes, testifying for the Staff, explained this value:

The wet bulb temperature is a derived temperature. It represents the lowest dry bulb temperature that can be obtained by evaporating water into the air at constant pressure. A higher wet bulb temperature means the air is wetter, and can therefore absorb less water vapor than a lower wet bulb temperature. The wet bulb temperature is derived from observations of dry bulb temperature, dew point temperature and atmospheric pressure. It is directly related to the relative humidity of the air.<sup>111</sup>

Ms. Hayes also explained that a “coincident” wet bulb temperature is a wet bulb temperature that was recorded at the same time as the dry bulb temperature, whereas a “non-coincident” temperature was not.<sup>112</sup> The Applicants noted that the maximum safety wet bulb (noncoincident) air temperature is the highest such temperature at a site, excluding peaks of less than two hours duration, that is allowable by the DCD.<sup>113</sup>

SCE&G calculated the wet bulb temperature for the site, using individual daily maximum wet bulb temperatures recorded over thirty years at Columbia South Carolina National Weather

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<sup>108</sup> Tr. at 100 (Sebrosky). See also Ex. NRC000004, FSER, at 2-7.

<sup>109</sup> See 10 C.F.R. pt. 52, app. D, §§ IV A.2.d and VIII.A.4.

<sup>110</sup> *Id.* This is not the only site-specific departure, however. See, e.g., discussion *infra* regarding the relocation of the Technical Support Center.

<sup>111</sup> Tr. at 100-01 (Hayes).

<sup>112</sup> *Id.* (Hayes).

<sup>113</sup> *Id.* at 89 (Monroe).

Service Station, and performing a linear regression analysis to derive a 100-year return value.<sup>114</sup>

The DCD-specified site parameter of maximum safety wet bulb, noncoincident air temperature, 86.1 degrees Fahrenheit, is slightly lower than the value SCE&G derived for the VCSNS site—87.3 degrees Fahrenheit.<sup>115</sup>

Because the cooling towers use evaporation to cool process water, a higher wet bulb temperature would reduce their cooling efficiency.<sup>116</sup> Evaluations therefore were performed to determine how the change could affect various systems, including the service water system.<sup>117</sup> The service water system supplies water to the component cooling water system, which in turn supports twelve systems.<sup>118</sup> SCE&G calculated that with the slight decrease in evaporative cooling resulting from the change, the maximum component cooling water temperature would increase by about 0.3 degrees Fahrenheit, remaining within the AP1000 DCD design parameter of less than 100 degrees Fahrenheit.<sup>119</sup> SCE&G evaluated all twelve of the systems cooled by the component cooling system, and determined that the existing design could accommodate the higher temperatures.<sup>120</sup>

Another potentially affected system is the nuclear island non-radioactive ventilation system. This is considered a non-safety system, although it provides ventilation to two safety-

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<sup>114</sup> *Id.* (Monroe).

<sup>115</sup> *Id.* at 31-32 (Monroe).

<sup>116</sup> Ex. NRC000003, Staff Testimony, at 14-15.

<sup>117</sup> Tr. at 90 (Monroe). See Ex. NRC00001P, COL Application Part 7, at 859-61.

<sup>118</sup> See generally Ex. NRC000004, FSER, § 9.2.2.

<sup>119</sup> Tr. at 106 (Hayes). See generally Ex. NRC000004, FSER, § 9.2.2.

<sup>120</sup> Tr. at 106 (Hayes). See Ex. NRC00001P, COL Application, Part 7, at 859-60; Ex. NRC000004, FSER, § 9.2.2.

related areas: the control room and the battery rooms.<sup>121</sup> SCE&G determined that the existing chillers could accommodate the higher heat load.<sup>122</sup>

As a result of these analyses, SCE&G concluded that the departure would have no detrimental effect on safety- and non-safety-related systems. Moreover, SCE&G performed an additional review to ensure that these conclusions would remain valid after incorporating Revision 19 of the AP1000 DCD into its application.<sup>123</sup>

*b. The Staff's Review and Findings Related to Wet Bulb Temperature Departure*

The Staff first reviewed the Applicants' method for deriving the wet-bulb temperature, and also performed an independent analysis using thirty-two years of data from the Columbia weather station.<sup>124</sup> The Staff concluded that the Applicants' analysis was acceptable and conservative.<sup>125</sup>

The Staff then confirmed the Applicants' evaluations of the effects of the slightly higher temperature on a variety of systems.<sup>126</sup> Systems that could be affected by the change are systems that rely on evaporative cooling or systems used to maintain relative humidity.<sup>127</sup> "Systems of interest" included the passive containment cooling system, the service water system, and the nuclear island non-radioactive ventilation system.<sup>128</sup>

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<sup>121</sup> Tr. at 106 (Hayes).

<sup>122</sup> *Id.* (Hayes).

<sup>123</sup> *Id.* at 91 (Monroe).

<sup>124</sup> *Id.* at 103-04 (Hayes). See generally Ex. NRC000004, FSER, § 2.3.1.

<sup>125</sup> *Id.*

<sup>126</sup> Tr. at 104 (Hayes).

<sup>127</sup> *Id.* (Hayes).

<sup>128</sup> *Id.* The Staff's evaluations of the effects that the higher temperature has on the operation of the AP1000 design are found in Ex. NRC000004, FSER, §§ 2.3.1, 5.4 (reactor coolant systems), 6.2 (containment systems), 6.4 (habitability systems), 9.1.3 (spent fuel pool cooling (continued . . .))

The passive containment cooling system is a safety-related system designed to use evaporative cooling and air and water convection to cool the inside of the containment following an accident.<sup>129</sup> The Staff performed an independent analysis, utilizing the CONTAIN thermo-hydraulic model, which was developed during the review of the AP1000 DCD.<sup>130</sup> The Staff undertook a specific effort to independently evaluate this system—rather than simply “confirming” results of the Applicants’ analysis—because it is safety-related.

For non-safety related systems, the Staff reviewed the application and the Applicants’ RAI responses, and also audited the Applicants’ calculations to confirm their analyses.<sup>131</sup> The Staff found the calculations to be acceptable.<sup>132</sup>

The Staff evaluation found that the exemption associated with the wet-bulb temperature departure should be granted because it is authorized by law, will not present an undue risk to public health or safety, and is consistent with the common defense and security, and that special circumstances are present.<sup>133</sup> In addition, the Staff found that application of the regulation is not necessary to achieve the underlying purpose of the rule.<sup>134</sup> The Staff

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system), 9.2.2 (component cooling water system for reactor auxiliaries), and 9.2.7 (component cooling water system for reactor auxiliaries – HVAC system).

<sup>129</sup> Tr. at 104 (Hayes).

<sup>130</sup> *Id.* at 104-05, 117-18, 123-24, 128 (Hayes). *See generally* Ex. NRC000004, FSER, § 6.2.4.

<sup>131</sup> *Id.* at 106 (Hayes). *See id.* at 128-29 (Segala) (discussion of margins of conservatism in service water and component cooling water systems, and with ventilation system chillers).

<sup>132</sup> *Id.* at 106-07 (Hayes). *See generally* Ex. NRC000004, FSER, § 9.2.7.

<sup>133</sup> Tr. at 102-03 (Hayes). *See* Ex. NRC000004, FSER, § 2.0.4, at 2-6 to 2-7 (Staff finding on exemption). *See also* 10 C.F.R. § 50.12(a)(2)(ii) (standard for granting exemption); NRC000003, Staff Testimony, at 14-16.

<sup>134</sup> Tr. at 121-22 (Hayes, Sebrosky). The Commission will only grant an exemption from a regulation where “special circumstances” are shown. A demonstration that application of the regulation is not necessary to achieve its underlying purpose is listed as one such special circumstance. *See* 10 C.F.R. § 50.12(a)(2)(ii).

concluded that the exemption will not result in a decrease in the level of safety otherwise provided by the design.<sup>135</sup>

### **3. Site Characteristics: Demography, Geography, Hydrology and Manmade Hazards**<sup>136</sup>

Safety Panel One also addressed site characteristics of the VCSNS site that are covered in Chapter 2 of the FSER, including nearby populations and hazards associated with industrial, transportation, and military facilities.<sup>137</sup> Safety Panel Two discussed, among other things, flooding scenarios addressed in FSER section 2.4.<sup>138</sup>

#### **a. General Site Characteristics**

The VCSNS site is located in central South Carolina, in the Piedmont section of the State, approximately 140 miles east of the Atlantic Coast, and approximately ninety miles from the base of the Blue Ridge Mountains.<sup>139</sup> The site is in a sparsely populated rural area; the largest town located within a ten-mile radius of this site is Chapin, with a population of 628.<sup>140</sup> The largest nearby population center is Columbia, South Carolina, approximately fourteen miles southeast of VCSNS.<sup>141</sup>

The site is south of the Monticello Reservoir, and it is bounded on the west by the Parr Reservoir and the Broad River.<sup>142</sup> There is no commercial navigation on these water bodies.<sup>143</sup>

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<sup>135</sup> See *id.* at 118-20 (Hayes, Sebrosky).

<sup>136</sup> See Ex. NRC000007, Staff Pre-Hearing Responses, at 5; Ex. SCE000001, SCE&G Pre-Hearing Responses, at 1-2; Tr. at 134-35, 141-52, 155-56, 158-77.

<sup>137</sup> Revised Scheduling Note at 3 (unnumbered).

<sup>138</sup> *Id.*

<sup>139</sup> Tr. at 91 (Summer).

<sup>140</sup> *Id.* (citing 2000 Census data).

<sup>141</sup> See Ex. NRC000009, Safety Panel One, Staff Slide 21.

<sup>142</sup> Tr. at 91 (Summer); Ex. SCE000014, Safety Panel Two, SCE&G Slide 3.

<sup>143</sup> Tr. at 93 (Summer).



The site is situated on a ridge top at an elevation of 400 feet, approximately 135 feet above the Parr Reservoir. Accordingly, SCE&G found that flooding from the adjacent water bodies is not a concern at the site.<sup>144</sup>

The application analyzed military facilities, industrial facilities, and transportation facilities and found that they presented no potential hazard to the site. For example, several small airports are located within a 25-mile radius of the plant site, but due to their low activity level and distance from the site, they were found to present an insignificant risk.<sup>145</sup> In addition, of the few major industrial facilities located within a five-mile radius, all are located approximately one mile or more from the VCSNS site.<sup>146</sup> The Applicants found overall that accidents from marine, military, aeronautical, and industrial hazards are probabilistically insignificant.<sup>147</sup>

*b. Staff Analysis of Demography, Geography, Hydrology and Manmade Hazards*

The purpose of the geography and demography review in FSER section 2.1 is to determine whether the COL applicant has proposed an acceptable site, including acceptable site boundaries, with appropriate consideration of nearby populations and natural and man-made features. The Staff described the steps in its review, as follows:

- (1) The Staff verified that no publicly used transportation modes or public roads cross the proposed exclusion area boundary, confirming that it would not be necessary to arrange for traffic control in the event of an emergency.<sup>148</sup>
- (2) The Staff reviewed the Applicants' demography and population estimates and performed independent calculations using census data to estimate the future

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<sup>144</sup> *Id.* at 133 (Summer). See Ex. SCE000014, Safety Panel Two, SCE&G Slide 4 (map of site topography).

<sup>145</sup> Tr. at 93 (Summer), 110 (Sebrosky). See also Ex. NRC000004, FSER, § 2.2.1.4, at 2-25 to 2-26).

<sup>146</sup> Tr. at 92 (Summer).

<sup>147</sup> See Ex. SCE000013, Safety Panel One, SCE&G Slide 14 (overview of nearby industrial, transportation, and military facilities). "Probabilistically insignificant" is interpreted to mean a probability of  $1 \times 10^{-7}$ , or one in ten million. See Tr. at 136 (Monroe).

<sup>148</sup> Tr. at 108-09 (Sebrosky).

population in the area up to the year 2060. The Staff determined that the Applicants' specified low population zone is acceptable because appropriate protective measures could be taken in the event of an accident.<sup>149</sup>

The Staff also confirmed that various offsite and anthropogenic hazards presented little danger to operations at the site. As one example, the Staff performed independent probability calculations to verify SCE&G's analysis of aircraft hazards. SCE&G acknowledged that one of the acceptance criteria provided in the Standard Review Plan used to assess nearby hazards—that the plant is at least two miles beyond the nearest edge of a federal airway—was not met.<sup>150</sup> Therefore, SCE&G used an alternative methodology to demonstrate that the risk of an aircraft accident at the site was acceptably low. The Staff independently calculated the probability using the most conservative total flight data within five miles of the plant, obtained from the Federal Aviation Administration for the airway in question, and verified that the total aircraft accident probability is on the order of one in ten million.<sup>151</sup>

The Staff independently evaluated SCE&G's analyses concerning hazards from explosions at nearby industrial sites and transportation routes, and determined that any such explosion hazards are at safe distances from the VCSNS site.<sup>152</sup> Similarly, the Staff performed independent evaluations of toxic gas and hazards from chemicals that are transported on the rail line running beside the Broad River, that are stored at VCSNS Unit 1, and that are expected to be stored at Units 2 and 3. The Staff determined that these chemical hazards would not adversely affect control room habitability of the two new units.<sup>153</sup>

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<sup>149</sup> *Id.* at 109 (Sebrosky). See 10 C.F.R. § 100.21. See also Ex. NRC000004, FSER, § 2.1.

<sup>150</sup> Tr. at 110 (Sebrosky). NUREG-0800, § 3.5.1.6 provides three acceptance criteria for the probability of aircraft accidents to be less than  $10^{-7}$  per year. If all three criteria are met, then no further analysis is performed.

<sup>151</sup> Tr. at 110 (Sebrosky). See Ex. NRC000004, FSER, § 2.2.1.4, at 2-25 to 2-26.

<sup>152</sup> Tr. at 111 (Sebrosky). See generally Ex. NRC000004, FSER, § 2.2.

<sup>153</sup> *Id.*

The Staff looked at hydrology to confirm that flooding presents no danger to operations at the site and that operations at the site present no danger to surface and groundwater. The Staff performed confirmatory analyses on SCE&G's flood scenarios, such as the local site flooding caused by local intense precipitation, flooding on the Broad River and nearby reservoirs, and the hypothetical breaching of upstream dams.<sup>154</sup> Based on its review of various flooding scenarios, including local intense precipitation and dam breach scenarios, the Staff found that the VCSNS is a dry site and needs no flood protections.<sup>155</sup> The Staff also analyzed the potential impact of a postulated accidental effluent release on nearby water users.<sup>156</sup> The Staff confirmed SCE&G's calculations, using more conservative assumptions about groundwater flow velocity, contaminant decay, adsorption and dilution. These conservatisms resulted in larger concentrations of contaminants at receptor locations.<sup>157</sup> The Staff concluded that, even with the additional conservatisms, concentrations at potential receptor locations resulting from these bounding accidental effluent release scenarios remained within applicable regulatory limits.<sup>158</sup>

#### **4. Site Characteristics: Geology, Seismology, Geotechnical Engineering**

Safety Panel Two discussed geology of the VCSNS site, including ground motion response spectra (GMRS) and the seismic margin analysis.<sup>159</sup>

##### *a. Site Geology of VCSNS site*

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<sup>154</sup> Tr. at 137-38 (See).

<sup>155</sup> *Id.* at 138 (See).

<sup>156</sup> *Id.* (See).

<sup>157</sup> *Id.* at 139-40 (See).

<sup>158</sup> *Id.* See 10 C.F.R. pt. 20, app. D.

<sup>159</sup> Revised Scheduling Note at 3 (unnumbered).

The VCSNS site is underlain by hard bedrock.<sup>160</sup> Robert Whorton, testifying for the Applicants, explained that the AP1000 certified seismic design response spectrum (CSDRS) is based on NRC Regulatory Guide 1.60 recommendations and assumes a peak ground acceleration of 0.30g at high frequency.<sup>161</sup> The VCSNS GMRS, also known as the site-specific safe shutdown earthquake, was developed through the probabilistic seismic hazards analysis process, with a peak ground acceleration of 0.23g at 100 hertz (Hz).<sup>162</sup> Mr. Whorton testified that the VCSNS GMRS exceeds the CSDRS at frequencies of approximately 17 to 80 Hz in a horizontal direction.<sup>163</sup> Westinghouse, however, developed an AP1000 hard rock high frequency response spectra (HRHF), to bound the first three hard rock site COL applications and to address high frequency exceedences above the certified design.<sup>164</sup> These high frequency exceedences were evaluated and found to be acceptable to the Staff.<sup>165</sup>

*b. Staff Review of Geology and Seismology*

The Staff reviewed the application to ensure that there were no capable tectonic features at the site or surrounding area that could present a hazard at the site.<sup>166</sup> As explained by Staff witness Mr. Stirewalt, “capable tectonic features” are defined as tectonic features of quaternary age, that is, 2.6 million years of age to the present.<sup>167</sup>

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<sup>160</sup> Tr. at 133-34 (Whorton).

<sup>161</sup> *Id.* at 134 (Whorton). See Regulatory Guide 1.60, “Design Response Spectra for Seismic Design of Nuclear Power Plants” (Rev. 1) (1973) (ML003740207).

<sup>162</sup> Tr. at 168-69 (Whorton).

<sup>163</sup> *Id.* at 134 (Whorton). See Ex. SCE000014, Safety Panel Two, SCE&G Slide 7.

<sup>164</sup> *Id.* at 134 (Whorton).

<sup>165</sup> *Id.* at 134-35 (Whorton).

<sup>166</sup> *Id.* at 140 (Stirewalt).

<sup>167</sup> *Id.* at 140-41 (Stirewalt). It is assumed that tectonic features older than quaternary are unlikely to become active. *Id.* at 155-56 (Stirewalt).

The Staff visited the VCSNS site during the excavation performed for Unit 2 in August 2010 and April 2011 to directly examine the geologic features being mapped.<sup>168</sup> The Staff confirmed that no capable tectonic features were found. The Staff proposes a license condition for Unit 3 geologic mapping, which has yet to be performed.<sup>169</sup>

The Staff confirmed that the only capable tectonic features in the site region are associated with seismically-induced paleo-liquefaction along the South Carolina coast. These features were generated by seismic shaking of saturated sediments during the 1886 and the pre-1886 earthquakes, which occurred in the Charleston area.<sup>170</sup> Based on its detailed technical review of the application, independent review of references cited by the Applicants, and knowledge of regional and site-specific geology for the VCSNS site, the Staff concluded that there were no capable tectonic features requiring further investigation other than in the Charleston area.<sup>171</sup>

Geophysicist Sara Tabatabai discussed the Staff's review of FSAR section 2.5.2, which addresses vibratory ground motion.<sup>172</sup> The Staff focused on ensuring that SCE&G adequately had updated the seismic source model for its probabilistic seismic hazard analysis. According to Ms. Tabatabai, the most significant seismic source is the Charleston seismic source. SCE&G

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<sup>168</sup> *Id.* at 143-44 (Stirewalt).

<sup>169</sup> *Id.* According to the witness, geologic mapping for Unit 3 has not been performed because excavation at the site is not yet at foundation grade level, which is twenty to forty meters below the surface. *Id.* at 157 (Stirewalt). See *generally* Ex. NRC000004, FSER, § 2.5.1.

<sup>170</sup> Tr. at 141 (Stirewalt). See Ex. NRC000010, Safety Panel Two, Staff Slide 4 (map of geologic and seismic features in VCSNS region).

<sup>171</sup> Tr. at 141 (Stirewalt).

<sup>172</sup> *Id.* at 146-50. See Ex. NRC000011, COL Application Part 2, FSAR, § 2.5.2-i (Rev. 5), subsection 2.5.2–vibratory ground motion.

updated the 1986 Charleston seismic source model, prepared by the Electric Power Research Institute, with an entirely new model, which was based on paleoseismic data.<sup>173</sup>

With respect to the GMRS, the Staff reviewed the methodology by which Westinghouse derived the HRHF and found it consistent with Staff guidance.<sup>174</sup> It also performed confirmatory analysis to ensure that SCE&G had implemented properly the seismic modeling parameters.<sup>175</sup> After reviewing, auditing, and verifying the Applicants' seismic design analysis, the Staff concluded that the AP1000 standard design is acceptable for the VCSNS site.

## **5. Probabilistic Risk Assessment**

### *a. Probabilistic Risk Assessment at VCSNS*

Safety Panel Two discussed at length various hazards that contribute to overall risk.<sup>176</sup> Probabilistic risk assessment (PRA) is addressed in Chapter 19 of the FSER and includes internally initiated events and external events including seismic events.

The VCSNS COL application incorporated by reference the AP1000 DCD PRA for internally initiated events.<sup>177</sup> External events, such as the hazards addressed in Chapters 2 and 3 of the FSAR (which correspond to Chapters 2 and 3 of the FSER), including high winds, flooding, fire, transportation accidents and accidents at nearby facilities, also are addressed probabilistically to determine their contributions to total plant risk.<sup>178</sup> According to the

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<sup>173</sup> Tr. at 147-48 (Tabatabai). See Ex. NRC000010, Safety Panel Two, Staff Slide 10.

<sup>174</sup> Tr. at 149 (Tabatabai).

<sup>175</sup> *Id.* at 149-50 (Tabatabai).

<sup>176</sup> Revised Scheduling Note at 3 (unnumbered).

<sup>177</sup> See Ex. NRC000004, FSER, at 19-1 to 19-3 (listing AP1000 DCD sections relating to PRA that were incorporated by reference in the COL application).

<sup>178</sup> Tr. at 152 (Patterson).

Applicants' analyses, risk from high winds, floods, and other external events were calculated to be probabilistically insignificant, thus requiring no further analysis.<sup>179</sup>

*b. Staff PRA Review*

Testifying for the Staff, Malcolm Patterson explained that even though the external events evaluated in Chapters 2 and 3 of the FSER may have a very low probability of occurrence, they still may represent a "significant percentage" of the estimated "core damage frequency" because the risk from internally initiated events is considered to be even lower.<sup>180</sup>

Mr. Patterson also explained that the Staff requires a seismic margin analysis to identify the equipment needed to shut down the plant after a seismic event. Our regulations demand a safety margin—"a cushion beyond the design basis"—to account for "uncertainty about how much shaking a particular [earth]quake is going to cause on a given site," Mr. Patterson explained.<sup>181</sup> According to the witness, the AP1000 DCD established a "review level earthquake" with a peak ground acceleration of 0.5g, to be used in the seismic margin analysis, to demonstrate a margin of safety over the safe shutdown earthquake of 0.3g.<sup>182</sup> Because the VCSNS site falls within the AP1000 hard rock high frequency spectrum established by Westinghouse, the Staff found the DCD seismic margin analysis to be conservative and acceptable.<sup>183</sup>

**6. Use of HABIL Code**

Also discussed by Safety Panel Three was the Staff's use of the HABIL code to model the dispersion of hazardous gasses in the case of a release from an offsite rail, truck, or pipeline

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<sup>179</sup> See *id.* at 136 (Monroe) (citing Ex. NRC00001J, FSAR Table 19.58-201, at 500).

<sup>180</sup> *Id.* at 150 (Patterson).

<sup>181</sup> *Id.* at 150-51 (Patterson).

<sup>182</sup> *Id.* at 151 (Patterson). See generally Ex. NRC000004, FSER, § 19.55.4.

<sup>183</sup> Tr. at 151 (Patterson). See generally Ex. NRC000004, FSER, § 19.55.4.

accident or from chemicals stored at Unit 1.<sup>184</sup> General Design Criterion 19 requires an applicant to ensure that its control room remains habitable in case of accidental release of hazardous gasses.<sup>185</sup> Potential toxic hazards are reviewed in FSER section 2.2.3.

SCE&G first looked at the types of chemicals stored at or transported to nearby facilities, and then used the Areal Locations of Hazardous Atmospheres (ALOHA) air dispersion model to predict the dispersion of gasses released in a hypothetical accidents.<sup>186</sup> ALOHA determines the maximum distance a vapor cloud could travel before it disperses enough to fall below the concentrations “immediately dangerous to life and health.”<sup>187</sup>

The Staff used the HABIT code to confirm SCE&G’s calculations.<sup>188</sup> The HABIT code is an NRC-developed meteorological model and code used to determine control room habitability in case of an accident involving hazardous gasses. In reviewing the advanced safety evaluation report, the ACRS raised a concern with the Staff’s use of the HABIT code.<sup>189</sup> The ACRS observed that HABIT is valid for gasses of neutral weight but not for heavy gasses.<sup>190</sup> In response, the Staff agreed that the HABIT code does not include an explicit heavy gas dispersion model and that HABIT can and should be improved.<sup>191</sup>

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<sup>184</sup> Tr. at 198-200 (Habib). See “General Design Criteria for Nuclear Power Plants,” 10 C.F.R. pt. 50, app. A (Criterion 19–Control Room).

<sup>185</sup> *Id.* at 199 (Habib).

<sup>186</sup> *Id.* at 187 (Monroe). See also Ex. NRC00001C, FSAR, § 2.2.3.1.

<sup>187</sup> Tr. at 187 (Monroe).

<sup>188</sup> *Id.* at 199 (Habib).

<sup>189</sup> *Id.* See also ACRS Report at 3.

<sup>190</sup> See *id.*

<sup>191</sup> Tr. at 200 (Habib). According to Mr. Habib, NRO has requested assistance from the Office of Nuclear Regulatory Research in improving the HABIT code. *Id.* See also Ex. NRC000003, Staff Testimony, at 8 (Staff is taking steps to improve the HABIT code in response to ACRS recommendation).



Mr. Habib, speaking for the Staff, explained that the Staff and ACRS took the HABIT code's limitations into consideration when making the safety finding.<sup>192</sup> He stated that, as long as these limitations are recognized and understood, the model can continue to be used appropriately for evaluation of toxic gas threats to the control room.<sup>193</sup> In its statement in support of the uncontested hearing, the Staff affirmed its position that HABIT can be used appropriately to perform independent confirmatory analyses.<sup>194</sup>

In response to our questioning at the hearing, John McKirgan, speaking for the Staff, stated that SCE&G's analyses using the ALOHA code are the "[analyses] of record" and the analyses on which both the Staff and ACRS based their safety findings.<sup>195</sup> Mr. McKirgan explained that the Staff uses the HABIT code to look at concentrations at the intake to the control room, so that "if the concentrations at the intake to the control room are below the levels of concern no further analysis is needed."<sup>196</sup> He reasserted that the HABIT code was used only to confirm the Applicants' analyses.<sup>197</sup>

## **7. Emergency Planning**

The COL application provided an emergency plan for the site, in accordance with 10 C.F.R. § 52.79(a)(21).<sup>198</sup> SCE&G proposes to use a consolidated emergency plan for the

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<sup>192</sup> Tr. at 200 (Habib).

<sup>193</sup> *Id.* (Habib).

<sup>194</sup> See Ex. NRC000003, Staff Testimony, at 8.

<sup>195</sup> Tr. at 224 (McKirgan). See *also* "ALOHA Analysis for On-Site Chemicals Stored at Unit 1" (Oct. 28, 2009) (ML103140719), "ALOHA Railroad Calculation" (Dec. 29, 2009) (ML103140720).

<sup>196</sup> Tr. at 226 (McKirgan).

<sup>197</sup> *Id.* at 224 (McKirgan).

<sup>198</sup> See *also* "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants" (Rev. 1), NUREG-0654/FEMA-REP-1 (Nov. 1980) (ML040420012).

three units at VCSNS, with unit-specific “annexes” for each of the two new reactors and for the existing Unit 1.<sup>199</sup>

Onsite emergency plans are developed by the applicant and reviewed by the NRC. Offsite plans are developed by State and local emergency response authorities, and reviewed by FEMA. The NRC Staff considered FEMA’s findings in making its necessary finding of reasonable assurance that adequate protective measures can, and will, be taken in the event of a radiological emergency.<sup>200</sup>

FEMA has reviewed the emergency plans for the State of South Carolina and the local government plans for Lexington, Newberry, Richland, and Fairfield counties . . . . FEMA has determined that the plans are adequate, and there is reasonable assurance that the plans can be implemented with no corrections needed. The NRC staff has reviewed the FEMA report and based its overall reasonable assurance finding on the FEMA findings and determinations regarding offsite emergency planning.<sup>201</sup>

According to Staff witnesses, the NRC and FEMA periodically evaluate emergency preparedness.<sup>202</sup> The licensee holds drills and exercises throughout the year.<sup>203</sup> Every two years, the licensee stages full participation exercises, which are evaluated by both FEMA and NRC.<sup>204</sup>

At the hearing, the Staff and SCE&G discussed emergency planning issues of particular concern, including the use of a single, centrally-located technical support center (TSC) for all three units, the size of the emergency planning zone, and the emergency action levels to be developed for the emergency plan.

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<sup>199</sup> Tr. at 184 (Williamson).

<sup>200</sup> See *id.* at 192 (Barss). See generally Ex. NRC000004, FSER, § 13.3.1; 10 C.F.R. § 50.47(a)(2).

<sup>201</sup> Ex. NRC000004, FSER, § 13.3.4, at 13-17.

<sup>202</sup> Tr. at 225 (Barss).

<sup>203</sup> *Id.* (Barss).

<sup>204</sup> *Id.* (Barss). See also 10 C.F.R. pt. 50, app. E, § IV.F.2.

a. *Relocation of the Technical Support Center*<sup>205</sup>

The VCSNS COL application proposes to use a single TSC for existing Unit 1 and proposed Units 2 and 3, to be co-located in the basement of the new nuclear operations building, between the protected areas of the three units.<sup>206</sup> Relocation of the technical support centers to a central facility allows for the relocation of each of the new units' operational support centers to the TSC locations designated in the AP1000 DCD, adjacent to the control room.<sup>207</sup> Each unit will continue to have its own operational support center.<sup>208</sup> This rearrangement is a departure from the AP1000 DCD.<sup>209</sup>

The relocation of the TSCs also differs from current NRC guidance, implemented in 1981 after the Three Mile Island accident, which directs that the TSC be proximate to the control

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<sup>205</sup> See Ex. NRC000003, Staff Testimony, at 13; Ex. NRC000007, Staff Pre-Hearing Responses, at 8, 14; Tr. at 185-86, 227-28, 233 (Williamson), 228-31 (Barss).

<sup>206</sup> Tr. at 185-86 (Williamson). Relocation of Unit 1's TSC requires a separate NRC approval under 10 C.F.R. § 50.54(q). Ex. NRC000017, Staff Post-Hearing Responses, at 20. SCE&G submitted a proposed revision of the Unit 1 emergency plan in February 2012. See Gatlin, Thomas D., SCE&G, to USNRC Document Control Desk (Feb. 16, 2012) (ML12054A105) (transmitting licensee's 10 C.F.R. § 50.54(q) evaluation of the proposed changes and proposed changes to emergency plan). SCE&G expects to implement the multi-unit emergency plan eighteen months prior to fuel load of the new units. Ex. SCE000027, SCE&G Post-Hearing Responses, at 9.

<sup>207</sup> Tr. at 186 (Williamson).

<sup>208</sup> SCE&G explains the relationship between the two support centers as follows:

The TSC is the lead facility for onsite emergency response and is the evaluation and decisionmaking facility for the onsite mitigation strategies. The Operational Support Centers (OSCs), one for each Unit, are the investigative and implementation facilities for onsite actions and assessments being taken during the emergency. Each OSC has a facility manager, the OSC Manager, who reports to the TSC Emergency Director per the Emergency Plan. Although these managers report to the TSC, the operation of each OSC is independent of the other OSCs.

Ex. SCE000027, SCE&G Post-Hearing Responses, at 11.

<sup>209</sup> Tr. at 184 (Williamson). See *a/so* Ex. NRC000003, Staff Testimony, at 13.

room to facilitate communications in case of emergencies.<sup>210</sup> Daniel Barss, testifying for the Staff, stated that transit time between the TSC and the affected control rooms will be “approximately 10 to 15 minutes [including] processing time through the exclusionary and protected area security control points.”<sup>211</sup>

According to the Staff, however, improvements in communications since the 1970s will make it unnecessary for the TSC personnel to be physically present in or near the control room:

The TSC will have dedicated diverse communication capabilities between the affected control rooms, technical support center, the OSC, and the emergency operations facility or EOF. Use of the current technologies, such as updated computer equipment, telecommunication—teleconferencing, real time system monitoring of plant data, telephone and radio systems for primary and backup emergency communications—will bridge this physical separation.<sup>212</sup>

The Staff witness stated that relocation of the TSCs will have advantages in terms of efficiency, elimination of confusion, and avoidance of staffing multiple TSCs where an incident affects more than one unit.<sup>213</sup>

The Staff also looked at other factors to assess the appropriateness of the change. Relocation to a single TSC does not change any of the design parameters for external events that the TSCs would otherwise have to withstand.<sup>214</sup> In addition, the emergency planning Staff worked with the Staff reviewing human factors engineering to resolve a concern that, during an emergency, it could be unclear to the TSC staff which of the three units is giving information.<sup>215</sup>

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<sup>210</sup> See “Functional Criteria for Emergency Response Facilities – Final Report,” NUREG-0696 (Feb. 1981) at 9 (see <http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr0696>) (walking time between TSC and control room should not exceed two minutes).

<sup>211</sup> Tr. at 194 (Barss).

<sup>212</sup> *Id.* (Barss).

<sup>213</sup> *Id.* at 194-95, 228-31 (Barss).

<sup>214</sup> *Id.* at 233 (Williamson). See also Ex. NRC000017, Staff Post-Hearing Responses, at 20.

<sup>215</sup> Tr. at 221-22 (Sebrosky, Barss). This concern was first raised by the ACRS with respect to the Vogtle application, which also proposes a single TSC for both the two new units and the two (continued . . .)

To address this issue, SCE&G will be required to design the displays within the TSC to ensure that it is clear from which unit relevant information derives.<sup>216</sup> The Staff therefore found that the changed locations would meet regulatory requirements and were acceptable.

*b. Emergency Planning Zone*<sup>217</sup>

In accordance with applicable regulations, the existing emergency planning zone (EPZ) is approximately a 10-mile radius around Unit 1, as adjusted to reflect the road network and land use.<sup>218</sup> Therefore, the boundary for the EPZ may be a bit greater than ten miles on one side of this circle a little less than ten miles on another.<sup>219</sup>

The EPZ was developed in coordination with SCE&G, FEMA, and State and local officials.<sup>220</sup> In consultation between SCE&G, South Carolina emergency officials, and the

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existing reactors. See Armijo, J.S., Vice-Chairman, ACRS, to Gregory B. Jaczko, Chairman, NRC (Jan. 24, 2011), at 4 (ML110170006).

<sup>216</sup> Tr. at 221 (Sebrosky). The issue is addressed in the following ITAAC (Inspections, Tests, Analyses, and Acceptance Criteria):

ITAAC 1.1: An inspection of the Control Rooms, Technical Support Center (TSC), and Emergency Operations Facility (EOF) will be performed to verify that they have displays for retrieving facility system and effluent parameters that are specified in the Emergency Classification and EAL scheme and the displays are functional.

Ex. NRC00004, FSER, § 18.2.5.

<sup>217</sup> See Ex. NRC000004, FSER, § 13.3; Ex. SCE000027, SCE&G's Pre-Hearing Responses, at 5 & Attachment 1 (map of EPZ); Ex. NRC000017, Staff's Post-Hearing Responses, at 17-18.

<sup>218</sup> See Tr. 192-93 (Barss). See 10 C.F.R. §§ 50.33(g), 50.47(b) and 10 C.F.R. pt. 50, app. E, "Emergency Planning and Preparedness for Production and Utilization Facilities. See also Ex. NRC000003, Staff Testimony, at 13-14.

<sup>219</sup> See Ex. NRC000003, Staff Testimony, at 14.

<sup>220</sup> Once the EPZ is approved, the licensee is not required to update the EPZ boundaries to reflect changes in land use. Any such change would be made on the recommendation of State and local officials, and would not need prior NRC approval as long as the change does not reduce the effectiveness of the emergency plan. See Ex. NRC000007, Staff Pre-Hearing Responses, at 14-15.

affected county governments, it was decided that the existing EPZ would be used for all three VCSNS units.<sup>221</sup>

Because the new units are to be located approximately one mile southwest of the existing Unit 1, the new units are one mile closer to the southwest boundary.<sup>222</sup> FEMA therefore investigated whether the original EPZ would be appropriate for use with the new units. FEMA's investigation showed that the additional area that would be included in a 10-mile radius around the new units was a sparsely populated area primarily used for logging.<sup>223</sup> Based on this information, FEMA agreed that use of the original EPZ for all three VCSNS units was acceptable.<sup>224</sup>

In addition to reviewing the application and FEMA's findings, the NRC Staff conducted two site visits to the proposed location for the new units, including various areas within the 10-mile EPZ.<sup>225</sup> The Staff concluded, based on these reviews, that the EPZ for the new units is acceptable and satisfies the applicable regulatory requirements.<sup>226</sup>

*c. Emergency Action Levels*<sup>227</sup>

Emergency action levels (EALs)—pre-determined, site-specific, observable thresholds that determine the emergency classification level in a given event—are not yet available for

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<sup>221</sup> Tr. at 185 (Williamson). See also *id.* at 195-96 (Barss) (observing that South Carolina and all four affected counties provided letters certifying their approval of the emergency plan, their commitment to participating in exercises, their commitment to executing their responsibilities under the plan, and their assurance that the plans are practicable).

<sup>222</sup> See Ex. NRC000003, Staff Testimony, at 14.

<sup>223</sup> *Id.*

<sup>224</sup> *Id.*

<sup>225</sup> Tr. at 197-98 (Barss).

<sup>226</sup> *Id.* (Barss). See Ex. NRC000004, FSER, § 13.3B, at 13-29.

<sup>227</sup> See Ex. NRC000017, Staff Post-Hearing Responses, at 13-14; Tr. at 184, 210-15 (Williamson, Barss).

accidents involving the proposed new units.<sup>228</sup> To address this, SCE&G proposed a license condition, which would require it to submit a set of fully developed EALs to the NRC at least 180 days prior to fuel load.<sup>229</sup>

The licensee shall submit a fully developed set of plant-specific Emergency Action Levels (EALs) for VCSNS Units 2 and 3 to the NRC in accordance with NEI 07-01, Revision 0. These fully developed EALs shall be submitted to the NRC for confirmation at least 180 days prior to initial fuel load. The submitted EALs will be written with no deviations.<sup>230</sup>

The Staff accepted this proposed license condition with the addition of a provision that the EALs will have been reviewed and approved by State and local officials prior to submission to NRC.<sup>231</sup>

Testifying for SCE&G, Robert Williamson explained that Westinghouse has not completed the design of the radiation monitors that will be used at the VCSNS site (these monitors are not part of the certified design for the AP1000).<sup>232</sup> SCE&G therefore cannot complete the offsite dose calculations now.<sup>233</sup> Once those design details are known, SCE&G will develop the EALs in accordance with NEI 07-01.<sup>234</sup> The EALs then will be reviewed with, and agreed upon by, State and local officials prior to submission to the NRC.<sup>235</sup>

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<sup>228</sup> An EAL can be an instrument reading, an equipment status indicator, a measurable parameter, or an observable event (e.g., flooding, fire).

<sup>229</sup> Tr. at 184 (Williamson).

<sup>230</sup> Ex. NRC000004, FSER, § 13.3, at 13-15.

<sup>231</sup> See *id.* at 13-18.

<sup>232</sup> Tr. at 210-11 (Williamson).

<sup>233</sup> *Id.* (Williamson).

<sup>234</sup> *Id.* at 211 (Barss). See Nuclear Energy Institute, NEI 07-01, Methodology for Development of Emergency Action Levels Advanced Passive Light Water Reactors, Rev. 0 (Sept. 2007) (ML072710311). The NEI approach has been approved by the NRC Staff. See Miller, Christopher G., U.S. Nuclear Regulatory Commission, letter to Alan Nelson, Nuclear Energy Institute (Aug. 12, 2009) (ML092190035).

<sup>235</sup> Tr. at 184 (Williamson).

The NRC Staff found that SCE&G's commitment, in the license condition, to develop the EALs in accordance with the NEI guidance was sufficiently specific to satisfy the regulation.<sup>236</sup> In response to our post-hearing question, the Staff stated that SCE&G did not require an exemption from our regulations at Part 50, Appendix E, because there is sufficient information in the application *at this point* "to permit the Staff to make a finding of reasonable assurance that [SCE&G] will meet the applicable requirements when the COL is issued" because it "provided an overview of the EAL scheme, including defining its four emergency classification levels."<sup>237</sup>

### **8. Squib Valves**

During the mandatory hearing for the COL application associated with Vogtle Units 3 and 4, held two weeks before the VCSNS hearing, we discussed at length issues associated with the inservice testing and inspection program for squib valves.<sup>238</sup> Squib valves are explosively actuated valves used in the AP1000 automatic depressurization system to reduce reactor pressure in the event of a loss of coolant accident, and as part of the passive core cooling system in the event of a severe accident. The design and qualification of the squib valves is described in the AP1000 DCD and incorporated by reference into the COL application.<sup>239</sup> ITAAC specified in Tier 1 of the AP1000 DCD require squib valves to be tested to demonstrate operational capability under design conditions.

The ACRS questioned the adequacy of inservice testing and inspection program for squib valves during its review of the Vogtle COL application, because that testing program was contingent on an American Society of Mechanical Engineers code provision that is still under

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<sup>236</sup> *Id.* at 213-15 (Barss).

<sup>237</sup> Ex. NRC000017, Staff Post-Hearing Responses, at 13-14.

<sup>238</sup> See *Southern Nuclear Operating Co.* (Vogtle Electric Generating Plant, Units 3 and 4), Tr. at 144-47, 160-64, 166-67, 168-70, 174-78, 179-80.

<sup>239</sup> See generally NRC00001J, FSAR, § 3.9.



development.<sup>240</sup> Because the VCSNS COL application also references the AP1000 design, it presents a similar concern. Although we did not hear a presentation on this issue during the VCSNS hearing, we asked the Staff a post-hearing question on this topic.<sup>241</sup>

Although we find that the Staff's review of the squib valve issues was rigorous, we have a concern similar to that initially raised by the ACRS regarding the status of the inservice inspection/inservice testing program for this component. As such, we find that including a license condition directing the implementation of a surveillance program, with the requirements described below, prior to fuel load, is appropriate.<sup>242</sup>

We therefore impose the following condition on the licenses for VCSNS Units 2 and 3:

Before initial fuel load, the licensees shall implement a surveillance program for explosively actuated valves (squib valves) that includes the following provisions in addition to the requirements specified in the edition of the ASME *Code for Operation and Maintenance of Nuclear Power Plants* (OM Code) as incorporated by reference in 10 CFR 50.55a.

a. Preservice Testing

All explosively actuated valves shall be preservice tested by verifying the operational readiness of the actuation logic and associated electrical circuits for each explosively actuated valve with its pyrotechnic charge removed from the valve. This must include confirmation that sufficient electrical parameters (voltage, current, resistance) are available at the explosively actuated valve from each circuit that is relied upon to actuate the valve. In addition, a sample of at least 20% of the pyrotechnic charges in all explosively actuated valves shall be tested in the valve or a qualified test fixture to confirm the capability of each sampled pyrotechnic charge to provide the necessary motive force to operate the valve to perform its intended function without damage to the valve body or connected piping. The sampling must select at least one explosively actuated valve from each redundant safety train. Corrective action shall be taken to resolve any deficiencies identified in the operational readiness of the actuation logic or associated electrical circuits, or the capability of a pyrotechnic charge. If a charge fails to fire or its capability is not confirmed, all charges with the same batch number shall be removed, discarded, and replaced with charges from a different batch number that has demonstrated successful 20% sampling of the charges.

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<sup>240</sup> See Advisory Committee on Reactor Safeguards, 579th Meeting, Tr. at 44-52 (Jan. 13, 2011) (ML110310213).

<sup>241</sup> See NRC000017, Staff Post-Hearing Responses, at 15-16.

<sup>242</sup> Our action in formulating and imposing a license condition in an adjudicatory order has precedent. See *Private Fuel Storage, L.L.C.* (Independent Spent Fuel Storage Installation), CLI-00-13, 52 NRC 23, 29-31 (2000).

b. Operational Surveillance

Explosively actuated valves shall be subject to the following surveillance activities after commencing plant operation:

- (1) At least once every 2 years, each explosively actuated valve shall undergo visual external examination and remote internal examination (including evaluation and removal of fluids or contaminants that may interfere with operation of the valve) to verify the operational readiness of the valve and its actuator. This examination shall also verify the appropriate position of the internal actuating mechanism and proper operation of remote position indicators. Corrective action shall be taken to resolve any deficiencies identified during the examination with post-maintenance testing conducted that satisfies the preservice testing requirements.
- (2) At least once every 10 years, each explosively actuated valve shall be disassembled for internal examination of the valve and actuator to verify the operational readiness of the valve assembly and the integrity of individual components and to remove any foreign material, fluid, or corrosion. The examination schedule shall provide for both of the two valve designs used for explosively actuated valves at the facility to be included among the explosively actuated valves to be disassembled and examined every 2 years. Corrective action shall be taken to resolve any deficiencies identified during the examination with post-maintenance testing conducted that satisfies the preservice testing requirements.
- (3) For explosively actuated valves selected for test sampling every 2 years in accordance with the ASME OM Code, the operational readiness of the actuation logic and associated electrical circuits shall be verified for each sampled explosively actuated valve following removal of its charge. This must include confirmation that sufficient electrical parameters (voltage, current, resistance) are available for each valve actuation circuit. Corrective action shall be taken to resolve any deficiencies identified in the actuation logic or associated electrical circuits.
- (4) For explosively actuated valves selected for test sampling every 2 years in accordance with the ASME OM Code, the sampling must select at least one explosively actuated valve from each redundant safety train. Each sampled pyrotechnic charge shall be tested in the valve or a qualified test fixture to confirm the capability of the charge to provide the necessary motive force to operate the valve to perform its intended function without damage to the valve body or connected piping. Corrective action shall be taken to resolve any deficiencies identified in the capability of a pyrotechnic charge in accordance with the preservice testing requirements.

This license condition shall expire upon (1) incorporation of the above surveillance provisions for explosively actuated valves into the facility's inservice testing program, or (2) incorporation of inservice testing requirements for explosively actuated valves in new reactors (i.e., plants receiving a construction permit, or combined license for construction and operation, after January 1, 2000) to be specified in a future edition of the ASME OM Code as incorporated by reference in 10 CFR 50.55a, including any conditions imposed by the NRC, into the facility's inservice testing program.

This license condition supplements the current requirements in the ASME OM code for explosively actuated valves, and sets forth requirements for both pre-service testing and operational surveillance, as well as any necessary corrective action. The license condition will expire when either (1) the license condition is incorporated into the VCSNS IST program; or (2) the updated ASME OM Code requirements for squib valves in new reactors, as accepted by the NRC in 10 C.F.R. § 50.55a, are incorporated into the VCSNS IST program.<sup>243</sup> For the purpose of satisfying the license condition, the licensee retains the option of including in its IST program either the requirements stated in this condition, or including updated ASME Code requirements.

We note, however, that regardless of the option chosen to satisfy the license condition, the relevant provisions of the OM Code may be subject to further revision in the future, and IST requirements for the squib valve components may change. We do not expect the IST program for squib valves necessarily to be a static one. As with any facility, the VCSNS units will be subject to our rules providing for the application of future Code revisions to operating plants; SCE&G ultimately may be required to comply with a later version of the OM Code, as accepted by the NRC and incorporated by reference into 10 C.F.R. § 50.55a. In particular, section 50.55a(f)(4) requires that, throughout the service life of the plant, valves such as squib valves must, to the extent practical, meet the IST requirements set forth in the ASME OM Code and addenda that become effective during that time. Therefore, even if SCE&G chooses to satisfy the license condition by incorporating the condition into its IST program, it still must comply with section 50.55a(f)(4) throughout the life of the plant.

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<sup>243</sup> While the proposed condition is based on a revision to the ASME OM Code currently under consideration, the Code requirements ultimately might differ from the license condition when the full ASME review process is complete.

## 9. Environmental Impacts

The second day of the uncontested hearing focused on environmental issues, including overall environmental impacts, environmental justice, and the cooperation between the NRC and the ACE. Although the COL application includes the Applicants' own Environmental Report, the NRC review team, which included more than forty experts from the NRC and its contractor staff at Pacific Northwest National Laboratory, working with the ACE as a cooperating agency (collectively, the "environmental review team"),<sup>244</sup> conducted an independent review in fulfillment of their NEPA responsibilities. As discussed above, NRC regulations that implement NEPA are found in 10 C.F.R. Part 51.

The Staff initiated its review with a Notice of Intent to conduct scoping to identify environmental issues important to the stakeholders, and invited public participation.<sup>245</sup> The environmental review team issued a draft EIS,<sup>246</sup> conducted additional public meetings to solicit public comment on the draft EIS, and extended the comment period to ensure stakeholders had

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<sup>244</sup> See Ex. NRC00006A, FEIS, at 1-2 and 1-6. See *also* Tr. at 61 (Flanders) and 252 (Vokoun). Cooperating agencies have the responsibility to assist the lead agency, here the NRC, through early participation in the NEPA process, including scoping, by providing technical input to the EIS and by making staff support available as needed by the lead agency. Ex. NRC00006A, FEIS, at 1-6. More information regarding the role of the ACE in the EIS process can be found *infra* at § II.A.9.C, "Cooperation with the Army Corps of Engineers in the Environmental Review."

<sup>245</sup> See Tr. at 251 (Vokoun). See South Carolina Electric and Gas Company Acting for Itself and as Agent for the South Carolina Public Service Company (Also Referred to as Santee Cooper[,]) Virgil C. Summer Nuclear Station Units 2 and 3; Combined License Application; Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process, 74 Fed. Reg. 323 (Jan. 5, 2009).

<sup>246</sup> See South Carolina Electric and Gas Company Acting for Itself and as Agent for the South Carolina Public Service Authority (Also Referred to as Santee Cooper[,]) Notice of Availability of the Draft Environmental Impact Statement for the Combined Licenses for Virgil C. Summer Nuclear Station, Units 2 and 3, 75 Fed. Reg. 21,368 (Apr. 23, 2010).

an opportunity for meaningful comment.<sup>247</sup> These efforts are described in Appendix E of the FEIS.<sup>248</sup>

The environmental review for the COL application included an assessment of the impacts from construction and operation of the new units on the human environment and considered alternatives to the proposed project.<sup>249</sup> The review also included audits of the proposed and alternative sites, more than seventy requests for additional information to SCE&G, confirmatory modeling and analyses, stakeholder interviews, and the review of relevant databases and maps. The ACE also evaluated certain construction and maintenance activities (onsite dredge-and-fill activities and construction of related transmission lines) proposed in U.S. waters, including wetlands that would be affected by the proposed project under the requested ACE permit.<sup>250</sup> We review the FEIS and the record of the proceeding to see if the Staff's review is reasonably supported in logic and fact and sufficient to support the Staff's conclusions.<sup>251</sup> Under NEPA, we also independently "consider the final balance among the conflicting factors contained in the record" in determining whether the licenses should issue.<sup>252</sup>

The environmental review team found, for the most part, that the impacts from the operation and construction of the project would be small. This includes impacts on:

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<sup>247</sup> See South Carolina Electric and Gas Company Acting for Itself and as Agent for the South Carolina Public Service Company (Also Referred to as Santee Cooper)[,] Virgil C. Summer Nuclear Station, Units 2 and 3 Combined License Application; Notice of an Extension to the Environmental Scoping Period, 74 NRC Fed. Reg. 9112 (Mar. 2, 2009).

<sup>248</sup> Tr. at 251 (Vokoun).

<sup>249</sup> See Ex. NRC00006A, FEIS, at 1-3.

<sup>250</sup> *Id.* at 1-2 and 1-5. The ACE evaluates these activities to determine whether to issue permits pursuant to Section 404 of the Federal Water Pollution Control Act (33 U.S.C. § 1344), as amended by the Clean Water Act of 1977 (33 U.S.C. § 1251, et seq.) (Clean Water Act). Ex. NRC00006A, FEIS, at 1-1 and 1-6.

<sup>251</sup> The NRC alone makes the licensing decision under the Atomic Energy Act regarding whether the COLs should be issued. See, e.g., Ex. NRC00006A, FEIS, at 1-1 and 1-6.

<sup>252</sup> 10 C.F.R. § 51.107(a)(2).

groundwater and surface water resources; aquatic ecology; air quality; radiological health (including radiological exposures to plant workers, the public and wildlife); and non-radiological health effects on the public and workers.<sup>253</sup> The Staff also considered postulated accidents (from a risk perspective)<sup>254</sup> and the uranium fuel cycle (including waste disposal, transportation of radioactive material and decommissioning).<sup>255</sup> The environmental review team consulted with the U.S. Fish and Wildlife Service, which concurred in the finding that the project is unlikely to adversely affect any endangered species.<sup>256</sup> They also consulted with the State Historic Preservation Officer concerning possible adverse effects on cultural resources.<sup>257</sup> The environmental review team found moderate impacts for land use and terrestrial ecology during construction, due to construction of thirty-nine miles of new transmission lines.<sup>258</sup> While the NRC usually does not consider the impacts of building transmission lines, the ACE does, because construction of the lines may impact wetlands.<sup>259</sup>

The principal benefits of the project were found to be providing sixteen to eighteen million megawatt hours of reliable baseload power annually (depending on the capacity reached),<sup>260</sup> increased energy diversity, and the lack of carbon emissions from the units as

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<sup>253</sup> Tr. at 253 (Kohn).

<sup>254</sup> *Id.* at 269-71 (Flanders). See Ex. NRC000017, Staff Post-Hearing Responses, at 24-25.

<sup>255</sup> *Id.* at 253 (Kohn).

<sup>256</sup> *Id.* at 254 (Kohn).

<sup>257</sup> *Id.* at 275 (Cushing).

<sup>258</sup> *Id.* at 254-55 (Kohn) (stating that a total of 400 miles of transmission lines would be added, but mostly within existing corridors, leading to moderate impacts on land use). See Ex. NRC00006A, FEIS, §§ 4.1.2, 4.3.1.

<sup>259</sup> Tr. at 300 (Whited).

<sup>260</sup> Tr. at 262 (Cushing). See *also id.* at 247 (Matis).

opposed to the emissions that would come from a coal- or gas-powered alternative.<sup>261</sup> In addition, the project is expected to generate 3,600 jobs during construction, 800 direct jobs during operation, and an additional 1,700 indirect jobs during operation.<sup>262</sup> The environmental review team concluded that there would be a large positive economic impact in that the project is expected to generate approximately \$860 million in property tax revenue to Fairfield County over the forty-year license period.<sup>263</sup>

As part of its review, the environmental review team conducted a week-long audit of the proposed site, which involved over seventy-five people from the NRC Staff, SCE&G, cooperating government agencies, and contractors Bechtel and Tetra Tech.<sup>264</sup> The environmental review team also conducted a separate audit of alternative sites in March 2009.<sup>265</sup>

At the hearing, the Staff summarized its recommendation that we find in favor of the proposed project with respect to environmental impacts:

The basis for [NRC Staff's] recommendation includes [that] most of the environmental impacts would be small; none of the reasonable alternatives would be environmentally preferable; [and that] the short term use of the environment from the production of electricity enhances the long term productivity of the region and would not be equaled by any other use of the site.<sup>266</sup>

We addressed specific topics of interest at the hearing. In particular, we directed the Staff and SCE&G to summarize, in Environmental Panel One, the process for developing the

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<sup>261</sup> *Id.* at 247 (Matis).

<sup>262</sup> *See id.* at 262-63 (Cushing). *See also* Ex. NRC00006A, FEIS, §§ 4.4.3.1 (jobs created directly and indirectly, during construction), 5.4.3.1 (jobs created directly and indirectly, during operation of the new units).

<sup>263</sup> Tr. at 262 (Cushing). *See also* Ex. NRC00006A, FEIS, §§ 5.4.3.2 and 5.4.3.3.

<sup>264</sup> Tr. at 242 (Rice).

<sup>265</sup> *Id.* (Rice).

<sup>266</sup> *Id.* at 263 (Cushing).

EIS, the environmental impacts for eleven specified topics, the alternatives analysis (including energy alternatives and alternative sites), and the costs and benefits of the proposed action.<sup>267</sup>

Environmental Panel Two addressed the two novel issues identified in the Staff's information paper: the environmental justice review, and interactions with the ACE.<sup>268</sup>

*a. Environmental Justice*

The Staff's environmental justice review follows the guidance in the relevant sections of NUREG-1555, the environmental standard review plan, and our 2004 "Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions."<sup>269</sup>

Ms. Matis discussed how SCE&G used census data to identify minority and low-income populations in the region and vicinity of the VCSNS site.<sup>270</sup> SCE&G evaluated census data for a fifty-mile radius around the site. If a block group's minority or low income population exceeded fifty percent, or exceeded the state's overall percentage of minority or low-income people by more than twenty percent, then the block group was considered minority or low-income (as applicable).<sup>271</sup> Ms. Matis explained that, using this metric, much of Fairfield County was deemed a minority population area.<sup>272</sup> But SCE&G found no "low income" block groups within the immediate vicinity of the VCSNS site, using this method.<sup>273</sup>

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<sup>267</sup> Revised Scheduling Note at 4-5 (unnumbered).

<sup>268</sup> *Id.* at 5 (unnumbered).

<sup>269</sup> Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions, 69 Fed. Reg. 52,040 (Aug. 24, 2004). *See generally* Ex. NRC00006A, FEIS, § 2.6; Ex. NRC000003, Staff Testimony, at 16-19; Ex. NRC000007, Staff Pre-Hearing Responses, at 18-21; Ex. NRC000017, Staff Post-Hearing Responses, at 25; Ex. SCE000027, SCE&G Post-Hearing Responses, at 16.

<sup>270</sup> Tr. at 293-94 (Matis).

<sup>271</sup> *Id.* at 294 (Matis).

<sup>272</sup> *Id.* (Matis).

<sup>273</sup> *Id.* (Matis).



The Staff explained that census data is only a starting point for its review process for identifying minority or low-income populations relevant to the environmental justice analysis.<sup>274</sup> The Staff conducts its own investigation by visiting local communities to observe general socioeconomic conditions, speaking with public officials and visiting with other community leaders, including minority leaders, church officials and the managers of local philanthropic and charitable organizations.<sup>275</sup> The Staff conducted its own investigation, which involved “driving affected roadways, meeting with local stakeholders, visiting river and lake recreation sites used by the local communities and visiting the cities and towns in the region.”<sup>276</sup>

The Staff found that Fairfield County, particularly in the area immediately surrounding the plant, and Jenkinsville, the nearest town, have high concentrations of low-income residents. There is no scheduled public transportation, and many of the local residents walk as their primary means of transportation.<sup>277</sup>

The Staff’s initial investigation found that many of the low-income people in the area felt disenfranchised from the political system in Fairfield County and that they would reap no benefits from the project.<sup>278</sup> The Staff therefore expanded its scoping process to reach out to the community. For example, during the scoping process, the Staff personally would transcribe comments so that the speaker would not have to speak publicly or use Internet comment forms.<sup>279</sup>

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<sup>274</sup> See *id.* at 303-04 (Mussatti).

<sup>275</sup> *Id.* at 304 (Mussatti), 306 (Anderson).

<sup>276</sup> *Id.* at 305 (Anderson).

<sup>277</sup> *Id.* at 305-06 (Anderson).

<sup>278</sup> *Id.* at 322, 328 (Mussatti).

<sup>279</sup> *Id.* at 306 (Anderson).

The Staff found that the project's principal potential adverse impact, as it relates to environmental justice considerations, was transportation impacts from trucks during construction and commuters during operations.<sup>280</sup> In response, SCE&G is drafting a traffic mitigation plan to help mitigate these adverse impacts.<sup>281</sup> Some of the mitigation measures described in the Applicants' Environmental Report have been undertaken already.<sup>282</sup> The Staff found that SCE&G's commitment to implementing a traffic mitigation plan would serve to minimize these adverse effects.<sup>283</sup>

The Staff found that benefits to the local community would be small during construction, but potentially greater during operation due to tax revenue, and direct and indirect jobs, generated by the plant.<sup>284</sup> According to Staff and SCE&G witnesses, an effort is being made to coordinate with local community colleges to train workers for jobs both in construction and operation of the plant.<sup>285</sup>

We inquired during the hearing whether reported subsistence gardening, hunting, and fishing by the low-income population would affect the estimated radiation dose to those individuals. According to the Staff witnesses, many low-income residents in the area rely on subsistence gardening or fishing.<sup>286</sup> In response to our post-hearing question, the Staff explained that radiological doses from subsistence gardening, hunting, and fishing do not raise

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<sup>280</sup> *Id.* at 307 (Anderson).

<sup>281</sup> *See id.* at 273 (Rice), 294 (Matis).

<sup>282</sup> *Id.* at 273-74 (Rice).

<sup>283</sup> *Id.* at 307-08 (Anderson).

<sup>284</sup> *Id.* at 256 (Kohn).

<sup>285</sup> *Id.* at 328-29 (Anderson), 333 (Byrne).

<sup>286</sup> *Id.* at 306 (Anderson).

any environmental justice concerns.<sup>287</sup> The Staff stated that this is because the hypothetical “maximally exposed individual” already is conservatively assumed to subsist entirely on locally produced foodstuffs.<sup>288</sup> Impacts to the maximally exposed individual, and to the local population, were found to be small overall.<sup>289</sup> Therefore, the Staff concluded that minority or low-income individuals engaged in subsistence behaviors would not experience disproportionately high and adverse impacts from radiation exposures from the new units.<sup>290</sup>

*b. Environmental Alternatives Analysis*

The FEIS examines alternatives to the project, both in terms of using a different form of energy (or conservation), and of building the proposed reactors at alternative sites.<sup>291</sup> The application included SCE&G’s alternatives analysis, which serves as a starting point for the Staff’s review. Alternatives not requiring new generation capacity (purchased power, extending the service life of existing plants, etc.) were not reasonable alternatives because the Staff concluded that these alternatives were not useful to provide baseload power.<sup>292</sup>

SCE&G evaluated a number of energy alternatives, including wind, solar, hydropower, geothermal power, biomass, coal and gas, and alternatives that do not involve building new power sources, such as demand-side management.<sup>293</sup> It then performed a more detailed evaluation for those alternatives that were considered to be reasonable baseload power sources

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<sup>287</sup> See Ex. NRC000017, Staff Post-Hearing Responses, at 7-8.

<sup>288</sup> *Id.* See generally Ex. NRC00006A, FEIS, § 5.9.3.

<sup>289</sup> See Ex. NRC000017, Staff Post-Hearing Responses, at 7-8. See generally Ex. NRC00006A, FEIS, § 5.9.3.

<sup>290</sup> See Ex. NRC000017, Staff Post-Hearing Responses, at 8. See generally Ex. NRC00006A, FEIS, § 5.5.4.

<sup>291</sup> See generally Environmental Standard Review Plan, Ch. 9; Ex. NRC00006A, FEIS, Ch. 9.

<sup>292</sup> Ex. NRC00006A, FEIS, § 9.2.1, at 9-3 to 9-5.

<sup>293</sup> Tr. at 245 (Rice).

in the region of interest—coal-fired and gas-fired options.<sup>294</sup> The ER concluded that these would not be environmentally preferable to new nuclear as energy alternatives, due to air quality impacts.<sup>295</sup>

The Staff evaluated in detail the reasonable alternatives that could meet the project's purpose to supply baseload power within SCE&G's and Santee Cooper's service territories, by the time the new units are projected to go online.<sup>296</sup> An alternative was not considered reasonable if it could not supply baseload power.<sup>297</sup> The Staff agreed with SCE&G's conclusions that only coal or natural gas could, by themselves, provide sufficient baseload power.<sup>298</sup> The Staff also looked at combining alternative energies with natural gas to generate the necessary baseload power.<sup>299</sup>

After narrowing down the alternative energy sources to those considered reasonable—coal, natural gas, or a combination—the Staff compared their environmental effects.<sup>300</sup> Primarily due to air emissions, none of these was found to be environmentally preferable to the proposed new AP1000 units.<sup>301</sup>

After the hearing, the Staff supplied a more in-depth response to our hearing question asking for a comparison between the NRC's approach to energy alternatives and those of other

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<sup>294</sup> *Id.* (Rice).

<sup>295</sup> *Id.* at 245-46 (Rice).

<sup>296</sup> *Id.* at 258 (Cushing).

<sup>297</sup> *Id.* (Cushing).

<sup>298</sup> *Id.* at 261 (Cushing).

<sup>299</sup> *Id.* (Cushing).

<sup>300</sup> *Id.* (Cushing).

<sup>301</sup> *Id.* (Cushing).

federal agencies.<sup>302</sup> Based on a survey, the Staff responded that the NRC's alternatives analysis is broader in scope, which is likely due to the difference in the "purpose and need" of the proposed federal action.<sup>303</sup> That is, the purpose and need of the VCSNS project was defined broadly as "providing baseload power" to the Applicants' service area, whereas the EISs selected for comparison had a narrower focus (providing loan guarantees for a solar plant).<sup>304</sup>

Distinct from the energy alternatives evaluation is the evaluation of alternative sites. Testifying for SCE&G, Ms. Rice stated that SCE&G conducted several siting studies in the course of the project and evaluated twenty potential sites for suitability.<sup>305</sup> SCE&G then narrowed down the twenty sites using exclusionary criteria that would preclude the site for the location of a nuclear power plant, such as geotechnical issues or the potential for significant impacts to natural resources.<sup>306</sup> This process eliminated nine of the twenty sites.<sup>307</sup> SCE&G then ranked the remaining eleven sites using site suitability criteria established by the Electric Power Research Institute.<sup>308</sup> The five sites receiving the highest score (including VCSNS) were evaluated in the Environmental Report.<sup>309</sup> The four alternative sites identified included two

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<sup>302</sup> Ex. NRC000017, Staff Post-Hearing Responses, at 5-6. *See also* Tr. at 281-82 (Flanders).

<sup>303</sup> Ex. NRC000017, Staff Post-Hearing Responses, at 5-6.

<sup>304</sup> *Id.* at 5.

<sup>305</sup> Tr. at 246 (Rice). *See generally* Ex. NRC000010, Environmental Report, § 9.3.2.2.

<sup>306</sup> Tr. at 246 (Rice).

<sup>307</sup> *Id.* (Rice). *See generally* Ex. NRC000010, Environmental Report, § 9.3.2.3.

<sup>308</sup> Tr. at 246 (Rice). *See* Ex. NRC000010, Environmental Report, Table 9.3-7 (comparing results).

<sup>309</sup> Tr. at 246-47 (Rice). *See* Ex. NRC000010, Environmental Report, §§ 9.3.3.1 through 9.3.3.4 (evaluation of four site alternatives to VCSNS).

greenfield sites, one site currently used for a coal generating plant, and the Savannah River site owned by the Department of Energy.<sup>310</sup>

The Staff audited these alternative sites as well as the proposed site.<sup>311</sup> These alternative sites were then compared to the proposed action to determine if there was an “environmentally preferable” or “obviously superior” alternative site.<sup>312</sup> Speaking for the Staff, Andrew Kugler explained that the NRC uses the “obviously superior” standard both in recognition of the fact that the proposed site has been examined more thoroughly than the alternatives, and to avoid situations where one alternative is superior with respect to one resource but another is superior with respect to a different resource.<sup>313</sup> Based on its review of alternative sites, the Staff concluded that none of the alternatives analyzed was “obviously superior” to the VCSNS site.<sup>314</sup>

*c. Cooperation with Army Corps of Engineers in the Environmental Review*

On September 12, 2008, the NRC and the ACE signed an updated memorandum of understanding (MOU) for the review of nuclear power plant applications.<sup>315</sup> The MOU established a framework for coordination and participation of both agencies, anticipating that the NRC normally would serve as the lead agency and that the ACE would act as a cooperating agency.<sup>316</sup> Its overall goal was to develop a single EIS that supported both the NRC's licensing

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<sup>310</sup> Tr. at 260 (Cushing).

<sup>311</sup> *Id.* at 274 (Vokoun).

<sup>312</sup> *Id.* at 320-21 (Kugler). See *Dominion Nuclear North Anna, LLC* (Early Site Permit for North Anna ESP Site), CLI-07-27, 66 NRC 215, 222 (2007) (the ER must evaluate alternative sites to determine whether any is “obviously superior” to the proposed site).

<sup>313</sup> Tr. at 320-21 (Kugler).

<sup>314</sup> See Ex. NRC00006A, FEIS, § 9.3.7.3.

<sup>315</sup> Tr. at 297 (Whited).

<sup>316</sup> *Id.* at 297 (Whited).

process and the ACE's permitting process.<sup>317</sup> ACE staff participated in site audits, developed requests for additional information specific to its own informational needs, and also participated in writing the EIS and responding to public comments on the draft EIS.<sup>318</sup>

At the hearing, the Staff explained some differences in approach between the ACE and NRC in completing the EIS. The ACE's mission is to protect the nation's aquatic resources, including wetlands under § 10 of the Rivers and Harbors Act of 1899 and § 404 of the Clean Water Act.<sup>319</sup> Applicants for an ACE permit must demonstrate that they have taken "all appropriate and practicable steps to first avoid, then minimize and, finally, to mitigate unavoidable impacts to aquatic resources."<sup>320</sup> In making permit decisions, the ACE may only issue the permit if it determines that the proposed action is the "least environmentally damaging practicable alternative."<sup>321</sup>

In addition, the ACE must consider environmental impacts of construction and pre-construction activities, such as site clearing and grading.<sup>322</sup> The NRC, in contrast, limits the scope of environmental analysis of pre-construction activities to activities falling within the scope of its regulatory authority.<sup>323</sup>

At the time of the hearing, the Applicants had not received a Section 401 Water Quality Certification from the South Carolina Department of Health and Environmental Control.<sup>324</sup> The

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<sup>317</sup> *Id.* at 297-98 (Whited).

<sup>318</sup> *Id.* at 299-300 (Whited).

<sup>319</sup> *Id.* at 298 (Whited).

<sup>320</sup> *Id.* (Whited).

<sup>321</sup> *Id.* See generally Ex. NRC00006A, FEIS, § 1.1.1.2.

<sup>322</sup> Tr. at 299 (Whited). See Ex. NRC00006A, FEIS, at 4-1 to 4-4.

<sup>323</sup> Tr. at 299 (Whited). See Final Rule, Limited Work Authorizations for Nuclear Power Plants, 72 Fed. Reg. 57,416, 57,427-28 (Oct. 9, 2007); 10 C.F.R. § 51.45(c).

<sup>324</sup> Tr. at 302 (Whited). See also Ex. NRC000007, Staff Pre-Hearing Responses, at 24.

South Carolina Department of Health and Environmental Control granted the certification on December 16, 2011.<sup>325</sup>

## **B. Findings**

We have conducted an independent review of the sufficiency of the Staff's safety findings, with particular attention to the topics discussed above, and in the Staff and Applicants' panel presentations. We posed a number of questions challenging the Staff's experts, both in writing and at the hearing itself, and find no reason to question their conclusions. For each of the topics discussed in these presentations, we determine that the Staff's review was reasonably supported in logic and fact, and was sufficient to support its findings. We make the same determination for topics addressed in the FSER that were not expressly discussed at the hearing or in today's decision.

Based on the evidence presented in support of the uncontested hearing, including the Staff's review documents and the testimony presented, we find that the applicable standards and requirements of the Act and the Commission's regulations have been met. The required notifications to other agencies or bodies have been duly made.<sup>326</sup> The Applicants are technically and financially qualified to engage in the activities authorized.<sup>327</sup> We find that there is reasonable assurance that the facility will be constructed and operated in conformity with the license, the provisions of the Act, and the Commission's regulations; and that issuance of the license will not be inimical to the common defense and security or to the health and safety of the public.

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<sup>325</sup> See Clary, Ronald B., SCE&G, to USNRC Document Control Desk (Dec. 21, 2011) (ML12011A028) (transmitting the § 401 Water Quality Certification).

<sup>326</sup> See 10 C.F.R. § 50.43(a)(3); Notices, *supra* note 21. See *generally* Ex. NRC000004, FSER, § 1.5.3.2.

<sup>327</sup> See *generally* Ex. NRC000004, FSER, § 1.5.1.



We also conducted an independent review of the Staff's environmental analysis in the FEIS—including with respect to those topics not expressly addressed at the hearing—taking into account the particular requirements of NEPA, discussed briefly below. NEPA Section 102(2)(A) requires agencies to use “a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts” in decisionmaking that may impact the environment.<sup>328</sup> We find that the environmental review team used the systematic, interdisciplinary approach NEPA requires. The environmental review team consisted of more than sixty individuals with expertise in disciplines including ecology, geology, hydrology, radiological health, socioeconomics and cultural resources.<sup>329</sup> Further, we commend the team's scoping efforts and outreach to the community as described during the hearing and in the FEIS.<sup>330</sup>

NEPA section 102(2)(E) calls for agencies to study, develop, and describe appropriate alternatives. The alternatives analysis is the “heart of the environmental impact statement.”<sup>331</sup> Based on the Staff's testimony at hearing as described above, as well as the discussion in the FEIS, we find that the environmental review identified an appropriate range of alternatives with respect to both alternative power sources and alternative sites, and adequately described the environmental impacts of each alternative.<sup>332</sup> We find reasonable the FEIS conclusion that

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<sup>328</sup> NEPA § 102(2)(A), 42 U.S.C. § 4332(2)(A).

<sup>329</sup> See Ex. NRC00006B, FEIS, app. A (list of contributors).

<sup>330</sup> *Id.*, §1.1.1.1.

<sup>331</sup> 10 C.F.R. pt. 51, subpt. A, app. A, § 5. See also 40 C.F.R. § 1502.14 (parallel provision in Council on Environmental Quality regulations).

<sup>332</sup> Tr. 258-61 (Cushing). See generally Ex. NRC00006A, FEIS, ch. 9 (alternatives to the proposed action); 10 C.F.R. pt. 51, subpt. A, app. A, § 5.

none of the alternative power sources, and none of the alternative sites, is environmentally preferable to the proposed action.<sup>333</sup>

NEPA section 102(2)(C) requires us to assess the relationship between local short-term uses of the environment and the long-term productivity of the environment,<sup>334</sup> and to describe the unavoidable adverse environmental impacts<sup>335</sup> and the irreversible and irretrievable commitments of resources associated with the proposed action.<sup>336</sup> These impacts were considered in FEIS Chapter 10. The environmental review team found that the short-term use of the site for electrical generation would have a positive long-term result: “the enhancement of regional productivity resulting from the electrical energy produced by the plant is expected to result in a correspondingly large increase in regional long-term productivity that would not be equaled by any other long-term use of the site.”<sup>337</sup> With respect to unavoidable adverse environmental impacts, the environmental review team concluded that such impact from operation of the two new facilities would be small.<sup>338</sup> The environmental review team concluded that the unavoidable adverse impacts from NRC-authorized construction activities would be generally small, with the exception of the adverse impact on traffic, which would be moderate, temporary, and highly localized.<sup>339</sup> Finally, the environmental review team concluded that the irretrievable commitment of resources for construction would be “similar to that of any major

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<sup>333</sup> See Ex. NRC00006A, FEIS § 10.5 (conclusions).

<sup>334</sup> NEPA § 102(2)(C)(iv), 42 U.S.C. § 4332(2)(C)(iv).

<sup>335</sup> NEPA § 102(2)(C)(ii), 42 U.S.C. § 4332(2)(C)(ii).

<sup>336</sup> NEPA § 102(2)(C)(v), 42 U.S.C. § 4332(2)(C)(v).

<sup>337</sup> Ex. NRC00006A, FEIS, § 10.3.

<sup>338</sup> *Id.*, § 10.2.1, Table 10-1.

<sup>339</sup> *Id.*, Table 10-1.

construction project.”<sup>340</sup> During operation, the principal resource that would be irretrievably committed would be uranium. On this point, the FEIS concluded that the impacts on the availability of uranium would be negligible.<sup>341</sup>

We must weigh these unavoidable adverse environmental impacts and resource commitments—the environmental “costs” of the project—against its benefits.<sup>342</sup> As described in the FEIS, the Public Service Commission of South Carolina determined that there is a need for power in the region, which the proposed generating plants would meet.<sup>343</sup> We find that the benefits to the local and regional population from the needed electricity and the resulting increased productivity, jobs, and taxes, as described during the hearing and in the FEIS,<sup>344</sup> outweigh the costs described above.

In sum, for each of the topics discussed at hearing, we find that the Staff’s review was reasonably supported in logic and fact and sufficient to support the Staff’s conclusions. Based on our review of the FEIS, we make the same determination for topics not directly addressed at the hearing or in today’s decision. Finally, in carrying out our review, we have considered particularly each of the requirements of NEPA section 102(2)(C), and find nothing in the record that would lead us to disturb the FEIS conclusions on those requirements. Overall, nothing in the adjudicatory record of this proceeding (including the contested proceeding) leads us to believe that the environmental findings are unreasonable. We conclude that the NEPA review conducted by the NRC Staff has been adequate.

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<sup>340</sup> *Id.*, § 10.4.2.

<sup>341</sup> *Id.*

<sup>342</sup> See Notice of Hearing, 76 Fed. Reg. at 53,493.

<sup>343</sup> See NRC00006A, FEIS, § 8.4.

<sup>344</sup> See Tr. at 247-48, 262. See *generally* NRC00006A, FEIS, §§ 4.4.3, 5.4.3.

Therefore, as a result of our review of the FEIS environmental analysis, and in accordance with the notice of hearing for this uncontested proceeding, we find that the requirements of NEPA, § 102(2)(A), (C), and (E), and the applicable regulations in 10 C.F.R. Part 51, have been satisfied with respect to the combined license application. We independently considered the final balance among conflicting factors contained in the record of this proceeding and we find, after weighing the environmental, economic, technical, and other benefits against environmental and other costs, and considering reasonable alternatives, that the combined licenses should be issued.

### III. CONCLUSION

We find that the Staff's review of the safety and environmental issues related to SCE&G's COL applications was sufficient to support the findings, identified in 10 C.F.R. §§ 52.97 and 51.107(a), for each of the COLs to be issued. In addition, we direct the NRC Staff to include in the VCSNS COLs the conditions described in today's decision relative to the implementation of a surveillance program for squib valves, and the development of strategies to address beyond-design-basis external events. Concurrent with the issuance of the licenses, the Director of the Office of New Reactors shall issue Order EA-12-051, related to the enhancement of reliable spent fuel pool instrumentation, to SCE&G. In addition, the Staff shall issue a request for information relative to Task Force Recommendation 9.3. The Director of the Office of New Reactors is authorized to issue the appropriate licenses for the construction and operation of Virgil C. Summer Nuclear Stations, Units 2 and 3.

IT IS SO ORDERED.

For the Commission

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Andrew L. Bates  
Acting Secretary of the Commission

Dated at Rockville, Maryland,  
this 30<sup>th</sup> day of March, 2012

## **Chairman Gregory B. Jaczko, Dissenting**

This COL decision is the second one we reach in a matter of months. In February, we issued COLs for two new reactors at the Vogtle site using the same AP1000 reactor design as Summer. Soon after, on March 12, 2012, we issued orders requiring safety enhancements based on the unprecedented and catastrophic accident at Fukushima, two of which apply to a COL holder using the AP1000 design. By virtue of this timing, the Vogtle licenses did not require compliance with those new requirements. These Summer licenses, in contrast, will include a license condition requiring compliance with one of these orders, directing development of mitigation strategies to address loss of power and access to the ultimate heat sink.

I fully support the decision by my colleagues to include this license condition and I consider this important progress in incorporating the lessons from Fukushima. However, I continue to believe that we should require that all Fukushima-related safety enhancements are implemented before these new reactors begin operating. To that end, I proposed a license condition that would require implementation of all new requirements that are presently being developed by the Staff, at our direction, to incorporate the lessons from Fukushima. Unfortunately, I do not have the support of my colleagues for this license condition and, therefore, cannot join them in approving the issuance of these COLs. My rationale for concluding that we have sufficient information to form a concrete, well defined license condition has already been explained in my dissenting opinion on the decision authorizing issuance of the Vogtle licenses.<sup>1</sup>

This has not been the first COL we consider while our Fukushima review is ongoing, nor will it be the last. Going forward, I continue to believe the best way to ensure safety, inspire public confidence, and promote regulatory efficiency and stability is to impose a license condition in each COL that requires implementation of all Fukushima safety enhancements

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<sup>1</sup> *Vogtle*, CLI-12-2, 75 NRC \_\_\_ (slip op., Chairman Gregory B. Jaczko, Dissenting, at 1-13).

before operation. This would apply a simple, logical and consistent standard to all new COL holders.

We already see the inconsistency that will be inevitable under the majority approach. The Summer COLs contain a license condition for a Fukushima-related requirement that was not included in the Vogtle licenses issued only a few weeks ago. This type of happenstance cannot justify issuing COLs with differing safety standards. But this will be the outcome if we proceed with licensing without proactively imposing license conditions requiring compliance with all Fukushima recommendations.

My proposed license condition will have the additional benefit of ensuring that future licenses are not delayed by our Fukushima review activities. The recent orders imposing Fukushima-related requirements were issued to licensees (including a COL holder), not applicants. Likewise, the Staff's recent information requests were only issued to the COL holder, not COL applicants. The Staff intends to obtain the necessary information and ensure compliance with the recent orders and requests for information during the license review process for future applications. This may delay issuance of the final safety review for the next COL application we expect to consider, for new reactors at the Levy County site. We could expect similar delays for future COLs, causing unnecessary uncertainty into our licensing process. A simple license condition will serve our regulatory interest in ensuring the safe operation of new reactors while, at the same time, ensuring a predictable process.

Over time, the safety of the nation's nuclear reactors has improved with technological advances and better understanding of potential hazards. Events like the accidents at Three Mile Island and Chernobyl, the September 2001 attacks, and the accident at Fukushima provide real world experience that offer new insights into our regulatory requirements, programs and processes. In the aftermath of Fukushima, we must move expeditiously to implement the lessons learned and enhance the safety of our nuclear fleet. We should proceed deliberately and thoughtfully when licensing new reactors. Without a binding requirement in the license, we

know from past experience that licensees may be relieved from compliance based on cost considerations or delay compliance for extended periods of time. We have seen this time and again, most notably with fire protection, and should not allow that to happen here. We should exercise our regulatory authority when we license these COLs to proactively require compliance with all Fukushima safety enhancements before operation.