UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

COMMISSIONERS:

Stephen G. Burns, Chairman
Kristine L. Svinicki
Jeff Baran

In the Matter of DUKE ENERGY CAROLINAS, LLC (William States Lee III Nuclear Station, Units 1 and 2)	Docket Nos. 52-018-COL 52-019-COL

CLI-16-19

MEMORANDUM AND ORDER

On October 5, 2016, we held a hearing on the combined license (COL) application of Duke Energy Carolinas, LLC to construct and operate two new nuclear reactors in Cherokee County, South Carolina. In this uncontested proceeding, we consider whether the review of the application by the NRC Staff has been adequate to support the findings set forth in 10 C.F.R. §§ 52.97(a) and 51.107(a). As discussed below, we conclude that the Staff's review was sufficient to support the regulatory findings, and we authorize issuance of the combined licenses.

I. BACKGROUND

A. Proposed Action

In December 2007, Duke applied to build two Advanced Passive 1000 (AP1000) reactors on the William States Lee III Nuclear Station site in Cherokee County, South Carolina.

Consistent with 10 C.F.R. Part 52, Appendix D, Duke's application references the AP1000 certified design, as amended in design control document (DCD) Revision 19.[1] Issues resolved in the AP1000 design certification rulemaking are closed and will not be revisited here, unless they are the subject of a departure or exemption. The Staff accepted the application for review in February 2008.[2]

The Staff followed the design-centered review approach, under which the Staff performs one technical review for each standard issue outside the DCD. Under this approach, the first combined license application for a given design is designated the "reference COL" application (RCOLA) and later applications referencing the same design are designated "subsequent COL" applications (SCOLA). Where the Staff has already resolved an issue with respect to the RCOLA, the Staff's review of the same issue in an SCOLA consists of confirming that the information is identical in both applications. The application for Vogtle Electric Generating Plant, Units 3 and 4 was designated as the RCOLA for the AP1000 design; the Lee combined license application is therefore considered an SCOLA, with a correspondingly limited review.[3]

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[1] *See* Ex. NRC-011A, William States Lee III Nuclear Station Units 1 and 2, COL Application—Part 2, Final Safety Analysis Report, rev. 11 (Apr. 2016), at 1.1-1 (ADAMS accession no. ML16124A665 (package)) (FSAR); *see also* Westinghouse AP1000 Design Control Document, rev. 19 (June 13, 2011) (ML11171A287 (package)) (AP1000 DCD). The Revision 19 design was certified in 10 C.F.R. Part 52, Appendix D, "Design Certification Rule for the AP1000 Design."

[2] Duke Energy; Acceptance for Docketing of an Application for [Combined Licenses] for William States Lee III Units 1 and 2, 73 Fed. Reg. 11,156, 11,156 (Feb. 29, 2008).

[3] *See* Ex. NRC-001, "Staff Statement in Support of the Uncontested Hearing for Issuance of Combined Licenses for the William States Lee III Nuclear Station Units 1 and 2 (Docket Nos. 52-018 and 52-019)," Commission Paper SECY-16-0094 (Aug. 8, 2016), at 4 (ML16123A064) (Staff Information Paper).

Over the past eight years, the Staff has spent approximately 67,000 hours on the safety and environmental reviews of the application.[4] During this time, the Staff conducted several public meetings and teleconferences.[5] Duke responded to approximately 950 Staff requests for additional information, 700 of which were associated with the safety review and 250 of which were associated with the environmental review.[6]

The Office of New Reactors led the Staff's technical review, with support from across the agency.[7] Because building on the proposed site will require permits from the U.S. Army Corps of Engineers (Corps), the Corps participated in preparing the Final Environmental Impact Statement (Final EIS) as a cooperating agency.[8] In addition, the Staff consulted with federal, state, local, and tribal organizations and governments concerning a variety of issues, including those arising under the National Environmental Policy Act of 1969 (NEPA), the National Historic Preservation Act (NHPA), and the Endangered Species Act.[9] The Advisory Committee on Reactor Safeguards (ACRS), a committee of technical experts advising the Commission, provided an independent assessment of the safety aspects of Duke's application.[10]

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[4] Tr. at 51-52 (Ms. Ordaz).

[5] *See* Ex. NRC-001, Staff Information Paper, at 5; Tr. at 52 (Ms. Ordaz).

[6] Tr. at 52 (Ms. Ordaz).

[7] *Id.* at 52-53 (Ms. Ordaz).

[8] Ex. NRC-010, "Final Environmental Impact Statement for Combined Licenses (COLs) for William States Lee III Nuclear Station Units 1 and 2," NUREG-2111, vols. 1-3 (Dec. 2013), at xxxi to xxxii (ML16281A350) (Final EIS); Tr. at 59 (Mr. Lee).

[9] Tr. at 60 (Mr. Lee); Ex. NRC-001, Staff Information Paper, at 6.

[10] AEA § 182b., 42 U.S.C. § 2232(b); 10 C.F.R. §§ 1.13, 52.87; *see* Letter from John W. Stetkar, Chairman, ACRS, to Stephen G. Burns, Chairman, NRC (Dec. 14, 2015), at 5 (ML15348A196) (2015 ACRS Letter) (generally recommending approval of the combined license application); Letter from Dennis C. Bley, Chairman, ACRS, to Stephen G. Burns, Chairman, NRC (Apr. 18,

Duke's application does not reference an early site permit.[11] Therefore, all site characteristics, including site geology, hydrology, seismology, and man-made hazards, as well as the potential environmental impacts of the project, were considered during the review of the combined license application.

B. Review Standards

Section 189a. of the Atomic Energy Act of 1954, as amended (AEA), requires that we hold a hearing on each application to construct a nuclear power plant, regardless of whether an interested member of the public requests a hearing on the application.[12] With respect to safety matters, we must determine whether:

(1) the applicable standards and requirements of the AEA and the Commission's regulations have been met;

(2) any required notifications to other agencies or bodies have been duly made;

(3) there is reasonable assurance that the facility will be constructed and will operate in conformity with the licenses, the provisions of the AEA, and the Commission's regulations;

(4) the applicant is technically and financially qualified to engage in the activities authorized by the licenses; and

(5) issuance of the licenses will not be inimical to the common defense and security or to the health and safety of the public.[13]

With respect to environmental matters, we must:

2016) (ML16102A149) (2016 ACRS Letter). In 2016, the ACRS recommended the approval of five departures from the AP1000 design and associated exemption requests, which are discussed in more detail below. 2016 ACRS Letter at 1-2.

[11] *See* 10 C.F.R. pt. 52, subpt. A, "Early Site Permits" (describing the process for obtaining and the effect of early site permits).

[12] AEA § 189a., 42 U.S.C. § 2239(a).

[13] 10 C.F.R. § 52.97(a).

(1) determine whether the requirements of NEPA section 102(2)(A), (C), and (E), and the applicable regulations in 10 C.F.R. Part 51 (the NRC regulations implementing NEPA) 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 licenses 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.[14]

With the exception of one issue for which, as discussed in more detail below, we must provide our express approval, we do not review Duke's application *de novo*; rather, our inquiry is whether the Staff's review was sufficient to support these findings.[15]

C. Contested Proceeding

After the Staff accepted the application for review, it provided an opportunity to challenge the application in an adjudicatory hearing.[16] The Blue Ridge Environmental Defense League (BREDL) filed a petition to intervene with eleven proposed contentions.[17] The South Carolina

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[14] *Id.* § 51.107(a).

[15] *See, e.g.*, *DTE Electric Co*. (Fermi Nuclear Power Plant, Unit 3), CLI-15-13, 81 NRC 555, 560-61 (2015).

[16] Duke Energy; Notice of Hearing and Opportunity to Petition for Leave to Intervene and Order Imposing Procedures for Access to Sensitive Unclassified Non-Safeguards Information and Safeguards Information for Contention Preparation on [Combined Licenses] for the William States Lee III Units 1 and 2, 73 Fed. Reg. 22,978 (Apr. 28, 2008).

[17] *Petition for Intervention and Request for Hearing by the Blue Ridge Environmental Defense League* (June 27, 2008) (Petition). BREDL's proposed contentions were numbered 1-10, but one contention contained two separate parts.

Office of Regulatory Staff and the North Carolina Utilities Commission filed requests to participate as interested government entities.[18]

The Atomic Safety and Licensing Board, which was established to preside over the contested proceeding, found all of BREDL's contentions inadmissible, denied the hearing request, and therefore denied as moot the participation requests of the two government entities.[19] The Board, however, referred to us its dismissal of BREDL's Contention 2 in keeping with the Board's approach in the *Bellefonte* combined license proceeding, which had referred the dismissal of a substantively similar contention in that proceeding.[20] Contention 2 pertained to the consideration of greenhouse gas emissions from the construction and operation of the new units.[21]

We declined review of the referred rulings.[22] But in so doing, we observed that the Boards in this case and in *Bellefonte* had raised a general policy question concerning the consideration of greenhouse gas and carbon footprint impacts in environmental reviews for power plants.[23] We stated our expectation that environmental reviews for major licensing

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[18] *Request of the South Carolina Office of Regulatory Staff for an Opportunity to Participate in any Hearing and to Be Added to the Official Service List* (June 27, 2008); *Request of the North Carolina Utilities Commission for an Opportunity to Participate in any Hearing and to Be Added to the Official Service List* (July 28, 2008).

[19] LBP-08-17, 68 NRC 431, 458 (2008).

[20] *Id.* at 445 (citing *Tennessee Valley Authority* (Bellefonte Nuclear Power Plant, Units 3 and 4), LBP-08-16, 68 NRC 361, 419-20 (2008)).

[21] *See* Petition at 11-14.

[22] *Duke Energy Carolinas, LLC* (William States Lee III Nuclear Station, Units 1 and 2), CLI-09-21, 70 NRC 927, 930 (2009). BREDL did not appeal the Board's ruling denying its hearing request.

[23] *Id.*

actions would include the consideration of carbon dioxide and other greenhouse gas emissions and that reviews of reactor applications, like the combined license application at issue here, should encompass emissions from construction, operation, and the uranium fuel cycle.[24] The Staff's Final EIS discusses greenhouse gas emissions.[25]

During the pendency of the referred ruling on Contention 2, BREDL filed a new contention with the Board that challenged the agency's 2008 Proposed Waste Confidence Decision and Proposed Temporary Storage Rule.[26] The Board dismissed the contention and found that jurisdiction to review it did not rest with the Board.[27] BREDL did not seek our review; nor did BREDL refile the contention.

In April 2011, BREDL joined several petitioners across multiple dockets in the filing of a petition to suspend final reactor licensing and rulemaking decisions and for other relief in light of the March 2011 Fukushima Dai-ichi accident.[28] We declined to suspend the proceedings, but we granted the request for a safety analysis of the accident based on the agency's plans for a short-term and long-term lessons-learned review, and we referred portions of the petition

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[24] *Id.* at 930-31.

[25] *See* Ex. NRC-010, Final EIS at 4-113, 5-66 to 5-67, 6-10, 7-41 to 7-42, app. J.

[26] *New Contention Eleven* (Mar. 9, 2009; served Mar. 10, 2009). *See generally* Waste Confidence Decision Update, 73 Fed. Reg. 59,551 (Oct. 9, 2008); Proposed Rule, Consideration of Environmental Impacts of Temporary Storage of Spent Fuel after Cessation of Reactor Operation, 73 Fed. Reg. 59,547 (Oct. 9, 2008).

[27] Licensing Board Memorandum and Order (Regarding BREDL's New Contention Eleven) (Apr. 29, 2009), at 4-5 (unpublished). (The Board's jurisdiction ended when the Board denied BREDL's hearing request.)

[28] *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).

relating to pending certified design applications, including the AP1000 amendment, to the Staff as comments on the then-pending design certification rulemaking.[29]

Later that year, BREDL joined petitioners from other dockets to file a new contention asserting that the completed lessons-learned report of the Fukushima Near-Term Task Force had raised new and significant information that must be considered in the pending licensing proceedings.[30] A Board tasked specifically with ruling on these contentions found the filings premature and denied them on that basis.[31] BREDL appealed, but we found that BREDL had not raised a substantial question to warrant our review.[32]

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[29] *Union Electric Co. d/b/a Ameren Missouri* (Callaway Plant, Unit 2), CLI-11-5, 74 NRC 141, 175-76 (2011). The Staff responded to these comments in the Statement of Considerations for the final rule. *See* Final Rule, AP1000 Design Certification Amendment, 76 Fed. Reg. 82,079, 82,081 (Dec. 30, 2011); "NRC Responses to Public Comments, Final Rule: Amendment to AP1000 Design Certification Rule, 10 CFR Part 52, Appendix D" (Dec. 2011), at 9 n.1 (ML113480018).

[30] *Motion to Admit New Contention Regarding the Safety and Environmental Implications of the Nuclear Regulatory Commission Task Force Report on the Fukushima Dai-ichi Accident* (Aug. 11, 2011); *Contention Regarding NEPA Requirement to Address Safety and Environmental Implications of the Fukushima Task Force Report* (Aug. 11, 2011).

[31] *PPL Bell Bend, LLC* (Bell Bend Nuclear Power Plant), LBP-11-27, 74 NRC 591, 595, 603 (2011).

[32] *Luminant Generation Co., LLC* (Comanche Peak Nuclear Power Plant, Units 3 and 4), CLI-12-7, 75 NRC 379, 389, 392 (2012). A few months after the Board's dismissal of the new Fukushima-related contentions as premature, BREDL and a subset of the other petitioners filed motions to reinstate their contentions based on a Commission tasking memorandum that directed the Staff to implement some of the recommendations of the Near-Term Task Force. *Motion to Reinstate and Supplement the Basis for Fukushima Task Force Report Contention* (Oct. 28, 2011), at 1-2 (citing Staff Requirements—SECY-11-0124—Recommended Actions to Be Taken without Delay from the Near-Term Task Force Report (Oct. 18, 2011) (ML112911571)). The Board denied the motions for lack of jurisdiction: the Board found that the reinstatement motions were not included in the referral from the Secretary of the Commission or in the associated assignment from the Chief Administrative Judge. *Luminant Generation Co., LLC* (Comanche Peak Nuclear Power Plant, Units 3 and 4), LBP-11-36, 74 NRC 768, 772-73

A new round of litigation commenced in 2012 in response to the D.C. Circuit's vacatur and remand of the agency's Waste Confidence Decision Update and Temporary Storage Rule.[33] BREDL and several other petitioners sought to suspend pending licensing decisions, among other requested relief, until the agency completed action on the court's remand.[34] About a month later, BREDL filed a motion to reopen the proceeding to admit a contention challenging Duke's Environmental Report in light of the court's decision.[35] We granted the petitions in part—we suspended final licensing decisions until the court's remand was appropriately addressed and held any related contentions, including BREDL's proposed contention in this matter, in abeyance until further order.[36]

We lifted the suspension on final licensing decisions after we approved a generic environmental impact statement (GEIS) and final Continued Storage Rule that addressed the issues in the D.C. Circuit's remand.[37] We dismissed BREDL's proposed contention as a

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(2011). We acknowledged the Board's ruling when we denied the petition for review. CLI-12-7, 75 NRC at 386-87 n.23.

[33] *See generally New York v. NRC*, 681 F.3d 471 (D.C. Cir. 2012); Final Rule, Consideration of Environmental Impacts of Temporary Storage of Spent Fuel After Cessation of Reactor Operation, 75 Fed. Reg. 81,032 (Dec. 23, 2010); Waste Confidence Decision Update, 75 Fed. Reg. 81,037 (Dec. 23, 2010).

[34] *Petition to Suspend Final Decisions in all Pending Reactor Licensing Proceedings Pending Completion of Remanded Waste Confidence Proceedings* (June 18, 2012).

[35] *Motion to Reopen the Record for William States Lee III Units 1 and 2* (July 9, 2012); *Intervenors' Motion for Leave to File a New Contention Concerning Temporary Storage and Ultimate Disposal of Nuclear Waste at William States Lee III Units 1 and 2* (July 9, 2012).

[36] *Calvert Cliffs 3 Nuclear Project, LLC and UniStar Nuclear Operating Services, LLC* (Calvert Cliffs Nuclear Power Plant, Unit 3), CLI-12-16, 76 NRC 63, 67-69 (2012).

[37] *Calvert Cliffs 3 Nuclear Project, LLC and UniStar Nuclear Operating Services, LLC* (Calvert Cliffs Nuclear Power Plant, Unit 3), CLI-14-8, 80 NRC 71, 74-75 (2014). *See generally* Final Rule, Continued Storage of Spent Nuclear Fuel, 79 Fed. Reg. 56,238 (Sept. 19, 2014); Generic

challenge to the new rule.[38] BREDL thereafter joined another multi-docket suspension petition with a proposed new contention that challenged the Continued Storage Rule's lack of safety findings, later followed by a motion to supplement the Lee Final EIS to cross-reference the Continued Storage Rule and GEIS and a motion to lodge an associated "placeholder" contention.[39] We denied the petitions and motions.[40] All contested issues in this proceeding have now been resolved.

Environmental Impact Statement for Continued Storage of Spent Nuclear Fuel, 79 Fed. Reg. 56,263 (Sept. 19, 2014); Generic Environmental Impact Statement for Continued Storage of Spent Nuclear Fuel," NUREG-2157 (Aug. 2014) (ML14188B749).

[38] *Calvert Cliffs*, CLI-14-8, 80 NRC at 81.

[39] *Petition to Suspend Final Decisions in all Pending Reactor Licensing Proceedings Pending Issuance of Waste Confidence Safety Findings* (Sept. 29, 2014; errata filed Oct. 1, 2014); *Petitioner's Motion for Leave to File a New Contention Concerning the Absence of Required Waste Confidence Safety Findings in the Licensing Proceeding at William States Lee III Nuclear Power Plant* (Sept. 29, 2014); *Motion to Reopen the Record for William States Lee III Nuclear Power Plant* (Sept. 29, 2014); *Petition to Supplement Reactor-Specific Environmental Impact Statements to Incorporate by Reference the Generic Environmental Impact Statement for Continued Spent Fuel Storage* (Jan. 28, 2015); *Blue Ridge Environmental Defense League's Hearing Request and Petition to Intervene in Combined License Proceeding for W.S. Lee Nuclear Power Plant* (Apr. 22, 2015); *Blue Ridge Environmental Defense League's Motion to Reopen the Record of Combined License Proceeding for W.S. Lee Nuclear Power Plant* (Apr. 22, 2015).

[40] *Duke Energy Carolinas, LLC* (William States Lee III Nuclear Station, Units 1 and 2), CLI-15-15, 81 NRC 803, 804-05 (2015); *DTE Electric Co.* (Fermi Nuclear Power Plant, Unit 3), CLI-15-10, 81 NRC 535, 544 (2015); *DTE Electric Co.* (Fermi Nuclear Power Plant, Unit 3), CLI-15-4, 81 NRC 221, 242 (2015). Several petitioners sought review of the Continued Storage Rule and GEIS in the D.C. Circuit. The court denied the petitions for review, and a subset of petitioners, including BREDL, filed a petition for rehearing *en banc* that was also denied. *New York v. NRC*, 824 F.3d 1012 (D.C. Cir. 2016); Petition for Rehearing En Banc at 1 n.1, *New York v. NRC*, No. 14-1210 (D.C. Cir. July 18, 2016); *New York v. NRC*, No. 14-1210 (D.C. Cir. Aug. 8, 2016) (order denying petition for rehearing *en banc*).

D. Uncontested Proceeding

All safety and environmental matters relevant to the combined license application, except those resolved in the contested proceeding, are subject to our review in the uncontested proceeding.[41] The uncontested portion of the proceeding begins once the Staff has completed both its environmental and safety reviews. Here, the Final EIS was completed in 2013, therefore the release of the Final Safety Evaluation Report (FSER) on August 1, 2016, triggered the uncontested proceeding.[42] Shortly after the FSER was released, we received the Staff's statement in support of the uncontested hearing, which serves as the Staff's initial testimony and provides an overview of its safety and environmental review of the application.[43] Consistent with the design-centered review approach, the Staff's paper focused on "non-routine matters, such as unique features of the facility or novel issues that arose as part of the review process."[44]

1. Pre-Hearing Activities

We issued a Notice of Hearing on August 10, 2016, which set a schedule for pre-hearing filings.[45] We also invited interested states, local government bodies, and federally recognized

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[41] *See, e.g.*, *Fermi*, CLI-15-13, 81 NRC at 564-65.

[42] *See* Ex. NRC-009-R, "Final Safety Evaluation Report for Combined Licenses for William States Lee III Nuclear Station Units 1 and 2" (Aug. 2016) (ML16281A330) (FSER). A portion of the FSER is non-public and was admitted into the record as NRC-009A.

[43] Ex. NRC-001, Staff Information Paper.

[44] *Id.* at 2.

[45] Duke Energy Carolinas, LLC; William States Lee III Nuclear Station, Units 1 and 2, 81 Fed. Reg. 54,622, 54,623 (Aug. 16, 2016) (Notice of Hearing); *see also* DEC-001, *Applicant's Pre-Filed Testimony in Support of the Mandatory Hearing for the William States Lee III Nuclear Station, Units 1 and 2 Combined Licenses* (Sept. 28, 2016) (Duke Pre-Filed Testimony); Ex. DEC-002, *Curriculum Vitae of Robert H. Kitchen* (Sept. 28, 2016).

Indian tribes to provide a statement of issues for us to consider as part of the uncontested proceeding.[46] We received comments from the Attorney General of the State of South Carolina, the Secretary of Environmental Quality for the State of North Carolina, and the Tribal Historic Preservation Office for the Eastern Band of the Cherokee Indians.[47] The letter from South Carolina expressed support for the proposed Lee Nuclear Station.[48] The letter from North Carolina expressed support for nuclear power and suggested that a larger region of interest for the consideration of alternative sites "may identify a more suitable location with closer proximity to load centers."[49] The Eastern Band of the Cherokee Indians discussed the project in relation to consultation under the NHPA and indicated that the project "will not result in any ground disturbing activities which might adversely affect any cultural resources or archaeological sites significant to the Cherokee people."[50] The Tribe requested, however, that if plans change or if

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[46] Notice of Hearing, 81 Fed. Reg. at 54,623-24.

[47] Letter from Alan Wilson, Attorney General, State of South Carolina, to Annette L. Vietti-Cook, Secretary of the Commission (Aug. 26, 2016) (ML16245A223) (South Carolina); Letter from Donald R. van der Vaart, Secretary, North Carolina Department of Environmental Quality, to Annette L. Vietti-Cook, Secretary of the Commission, NRC (Aug. 25, 2016) (ML16245A222) (North Carolina); E-mail from Holly Austin, Federal Cultural Resource Law Liaison, Tribal Historic Preservation Office, Eastern Band of the Cherokee Indians, to Hearing Docket, NRC (Sept. 7, 2016 09:07 EDT) (ML16252A117) (Eastern Band of the Cherokee Indians). The South Carolina Public Service Commission sent a letter acknowledging the date of the hearing and our invitation to comment and indicated that information about the hearing had been shared with the Executive Director of the South Carolina Office of Regulatory Staff. Letter from Swain E. Whitfield, Chairman, South Carolina Public Service Commission, to Annette L. Vietti-Cook, Secretary of the Commission (Sept. 13, 2016) (ML16278A721).

[48] South Carolina at 1.

[49] North Carolina at 1; *see infra* notes 219-37 and accompanying text (discussing the consideration of alternative sites).

[50] Eastern Band of Cherokee Indians at 1.

cultural resources or human remains are discovered, work on the project should cease and consultation under the NHPA should continue with the Tribe.[51]

Also as part of our pre-hearing activities we issued questions to both the Staff and Duke and directed they file written responses before the hearing.[52] The questions ranged in topic from the safety-related issues of fire protection, emergency preparedness, and characteristics of the Lee site, to environmental issues that included the Staff's consideration of potentially new and significant information since issuance of the Final EIS, environmental impacts on terrestrial and aquatic resources, the Staff's interaction with other federal agencies, and the consideration of impacts from greenhouse gases.[53] The Secretary of the Commission transmitted a scheduling note to the Staff and Duke that provided the topics for, and the order of presentations at, the hearing.[54]

2. The Hearing

The hearing presentations were made by witness panels. The first panel of witnesses for Duke and the Staff gave an overview of the license application and the Staff's review,

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[51] *Id.*; *see infra* notes 245-47 and accompanying text (discussing Duke's obligations in the event cultural or historic resources are inadvertently discovered).

[52] Order of the Secretary (Transmitting Pre-Hearing Questions) (Sept. 1, 2016) (unpublished) (Pre-Hearing Questions Order); Ex. DEC-003, *Duke Energy Carolinas' Responses to Pre-Hearing Questions* (Sept. 28, 2016) (Duke Pre-Hearing Responses); Ex. NRC-007, *NRC Staff Responses to Commission Pre-Hearing Questions* (Sept. 28, 2016) (Staff Pre-Hearing Responses). We also issued two questions that contain sensitive unclassified non-safeguards information and that therefore were filed on the non-public docket for the proceeding. The parties' responses to those questions were likewise filed on the non-public docket.

[53] *See* Pre-Hearing Questions Order at 2-16.

[54] Scheduling Note, "Hearing on Combined Licenses for William States Lee III Nuclear Station, Units 1 and 2: Section 189a. of the Atomic Energy Act (Public Meeting)" (Sept. 21, 2016; revised Sept. 26, 2016) (ML16270A560).

respectively. The second panel focused on safety-related issues, and the third panel focused on environmental issues. Overall, the Staff made available seventy-six witnesses at the hearing, including scheduled panelists.[55] Five witnesses offered testimony on behalf of Duke at the hearing and in pre-filed written testimony.[56]

Among other things, Duke's overview panelists discussed the general qualifications of Duke; the selection of the Lee site; and Duke's Integrated Resource Plan, including factors that would influence a future decision whether to build the new units.[57] Additionally, the Duke panelists provided information regarding the Lee site, including the fact that it had served as the site of the former Cherokee Nuclear Station, a project that received NRC construction permits in 1977 but was ultimately cancelled prior to completion.[58] The Staff panelists provided background on the review of the combined license application and a summary of the Staff's safety and environmental findings under 10 C.F.R. § 52.97(a), NEPA sections 102(2)(A), (C), and (E), and 10 C.F.R. § 51.107(a).[59]

The safety panel focused on two novel issues in the Staff's review: (1) a departure from the AP1000 certified design involving the site foundation response spectra; and (2) Duke's

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[55] *See Revised NRC Staff Witness List* (Sept. 30, 2016). Fifteen of the listed witnesses did not appear at the hearing. *Compare id.*, attach. at 1-4, *with* Tr. at 14-16 (Ms. Wright).

[56] *See Duke Energy Carolinas' Witness List* (Sept. 14, 2016); Ex. DEC-001, Duke Pre-Filed Testimony; Tr. at 12 (Mr. Lewis).

[57] *See* Tr. at 19-37; Ex. DEC-005, Lee Nuclear Station—Overview (Sept. 28, 2016) (Duke Overview Presentation).

[58] *See* Tr. at 28-31 (Mr. Kitchen); Duke Power Co., Cherokee Nuclear Station, Units 1, 2 and 3, 43 Fed. Reg. 2022, 2022 (Jan. 13, 1978) (Notice of Issuance of Construction Permits).

[59] *See* Tr. at 50-65; NRC-012, Combined License Application Review William States Lee III Units 1 and 2, Overview Panel (Sept. 28, 2016) (Staff Overview Presentation).

request to consolidate the Lee Emergency Operations Facility (EOF) with its existing Charlotte, North Carolina EOF for the McGuire, Catawba, and Oconee Nuclear Stations.[60] The environmental panel discussed Duke's proposal to build an offsite reservoir, Make-Up Pond C, to provide supplemental cooling for the new units, as well as the environmental impacts, the consideration of alternatives, and the proposed mitigation measures associated with that proposal.[61] These issues are discussed further in section II.

3. Post-Hearing Activities

After the hearing, we posed three additional questions to the Staff and Duke.[62] The parties' written responses were admitted as exhibits, and after adopting corrections to the hearing transcript, we closed the evidentiary record.[63]

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[60] *See* Tr. at 84-96; Ex. DEC-006, Lee Nuclear Station—Safety Panel (Sept. 28, 2016) (Duke Safety Presentation); Ex. NRC-013, Combined License Application Review William States Lee III Units 1 and 2, Safety Panel (Sept. 28, 2016) (Staff Safety Presentation).

[61] *See* Tr. at 120-36; Ex. DEC-007, Lee Nuclear Station—Environmental (Sept. 28, 2016) (Duke Environmental Presentation); Ex. NRC-014-R, Combined License Application Review William States Lee III Units 1 and 2, Environmental Panel (Sept. 28, 2016) (Staff Environmental Presentation).

[62] Order of the Secretary (Transmitting Post-Hearing Questions) (Oct. 12, 2016), at 2-3 (unpublished).

[63] Order of the Secretary (Adopting Proposed Transcript Corrections, Admitting Post-Hearing Exhibits, and Closing the Record of the Proceeding) (Nov. 4, 2016) (unpublished). The Staff subsequently notified us of minor revisions to the license conditions in 2.D.(12), which we have taken into account. *Revisions to Draft Combined Licenses* (Dec. 7, 2016) (attaching table of revisions).

II. DISCUSSION

Although our review encompassed the entire application, we discuss here a brief selection of the safety and environmental topics addressed during the uncontested portion of the proceeding.

A. Safety-Related Issues

1. The Lee Nuclear Station Site

The Lee site sits near the border of North Carolina and South Carolina on the bank of the Broad River, approximately forty miles southwest of Charlotte, North Carolina and approximately twenty-five miles northeast of Spartanburg, South Carolina.[64] In the 1970s Duke Power Company selected the site to build the Cherokee Nuclear Station.[65] The NRC issued construction permits for the project, but it was cancelled a few years later.[66] Before the Cherokee project was terminated, however, considerable site preparation work had been done, including the installation of roads; the construction of reservoirs, including Make-Up Ponds A and B; and excavation of the power block and partial construction of Cherokee Unit 1.[67]

As part of its site investigation work for the Lee application, Duke removed several of the above-ground structures remaining from the Cherokee project and used a significant amount of

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[64] Tr. at 26 (Mr. Kitchen); Ex. DEC-005, Duke Overview Presentation, at 2.

[65] Tr. at 28 (Mr. Kitchen); Ex. NRC-011A, FSAR at 2.1-2; Ex. NRC-010, Final EIS at 2-5.

[66] *See* Notice of Issuance of Construction Permits, 43 Fed. Reg. at 2022; *Duke Power Co.* (Cherokee Nuclear Station, Units 1, 2, and 3), ALAB-745, 18 NRC 746, 747 & n.1 (1983).

[67] Tr. at 28-29 (Mr. Kitchen); Ex. DEC-005, Duke Overview Presentation, at 4; EX. NRC-011A, FSAR at 2.1-2 to 2.1-3.

this material for fill, as well as for stabilizing the banks of the existing reservoirs.[68] Additionally, Duke verified the geologic mapping and investigation that had been done for the Cherokee project to ensure its applicability to Lee.[69] Duke confirmed that the Cherokee geologic mapping had been correctly documented and "confirmed that the Cherokee foundation concrete meets the strength requirements for the AP1000 in the certified design."[70] Lee Unit 1 will be located on the foundation for what was to become Cherokee Unit 1.[71]

The Staff conducted a confirmatory analysis of Duke's site investigation activities.[72] At the hearing, the Staff explained that it looked "carefully at the rejuvenation of the original [mapping]" and that it had the opportunity to ask questions of the individual who had led the mapping effort for the Cherokee project.[73] The Staff also visited the site to observe the orientation of particular geologic features relative to the proposed units.[74] Based on Duke's site investigations and the Staff's confirmatory analysis, the Staff "conclude[d] that the applicant

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[68] Ex. DEC-005, Duke Overview Presentation, at 5-6; Tr. at 29-30 (Mr. Kitchen).

[69] Tr. at 30 (Mr. Kitchen); *see also, e.g.*, Ex. NRC-011A, FSAR § 2.5.1.2.5.5.

[70] Tr. at 30-31 (Mr. Kitchen).

[71] *Id.* at 30 (Mr. Kitchen); Ex. NRC-011A, FSAR at 2.5-206.

[72] *See* NRC-009-R, FSER § 2.5.1.4.

[73] Tr. at 106 (Dr. Stirewalt).

[74] *Id.* at 106-07 (Dr. Stirewalt); *see also* Ex. NRC-009-R, FSER at 2-238 (describing visits "between April 27 and May 2, 2008, [between] January 27 and 28, 2009, [between] July 12 to 14, 2011, and on February 10, 2014, to meet with the applicant regarding the geologic, seismic, geophysical, and geotechnical investigations conducted to characterize the site"). Technical experts from the U.S. Geological Survey accompanied the Staff on the January 2009 site visit. Ex. NRC-009-R, FSER at 2-238.

properly characterized regional and site lithology, stratigraphy, geologic and tectonic history, and structural geology, as well as subsurface soil materials and rock units at [the Lee site]."[75]

Additional work must be completed to remove former Cherokee legacy structures. For example, a proposed license condition would require Duke to confirm that a particular legacy stormwater drain line and its associated bedding material (if any) have been removed and the excavation backfilled with compacted native soils.[76] In the FSAR, Duke assumed the removal and backfill of this drain line to curb a potential preferential groundwater flow pathway for radionuclide transport from a postulated accident.[77] The Staff proposed the license condition because the line's removal was the basis for finding Duke's analysis acceptable.[78] Additionally, Duke has committed to removing or modifying other legacy structures to prepare the nuclear island foundation for Lee Unit 1.[79] Specifically, "the isolation joint material between the legacy Cherokee reactor and auxiliary building basemats within the Lee Unit 1 Nuclear Island

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[75] Ex. NRC-009-R, FSER at 2-265. A proposed license condition in the draft license for Unit 2 would require Duke to perform mapping for that unit and inform the NRC once excavations for its safety-related structures are open for examination. Ex. NRC-003, Combined License, William States Lee III Nuclear Station Unit 2 (Sept. 9, 2016), at 15 (ML16281A338) (Draft Combined License—Unit 2); Tr. at 104-05.

[76] Ex. NRC-002, Combined License, William States Lee III Nuclear Station Unit 1 (Sept. 9, 2016), at 14 (ML16281A336) (Draft Combined License—Unit 1); Ex. NRC-003, Draft Combined License—Unit 2, at 14.

[77] Ex. DEC-003, Duke Pre-Hearing Responses, at 16; Ex. NRC-011A, FSAR §§ 2.4.12.2.3, 2.4.13.

[78] Tr. at 103 (Mr. Hughes); Ex. NRC-007, Staff Pre-Hearing Responses, at 10. At the hearing, the Staff explained that the drain line removal was solely part of the hydrologic analysis; neither the removal of the drain line nor the removal of other legacy structures impacted the seismic analysis. Tr. at 104 (Mr. Hughes).

[79] *See* Ex. NRC-011A, FSAR § 2.5.4.5.2.1; Ex. DEC-003, Duke Pre-Hearing Responses, at 16-17.

foundation support zone will be removed"; "the legacy Cherokee groundwater drainage system will be sealed with fill concrete where exposed by excavation"; and "protective sheathing and waterproofing membranes associated with the legacy Cherokee pit/pump rooms will be removed."[80]

2. The Lee Nuclear Station Site Foundation Response Spectra

With regard to seismic considerations, Duke explained that the site spectra for the Lee site were developed using the 2012 Central Eastern United States Seismic Source Characterization for Nuclear Facilities and the Electric Power Research Institute's 2013 Ground Motion Model.[81] The seismic design basis for the AP1000 standard plant is a Certified Seismic Design Response Spectra (CSDRS).[82] The AP1000 standard plant design also has been qualified for the Hard Rock High Frequency Spectra (HRHF Spectra) to address high-frequency spectra exceedances for hard rock sites in the Central and Eastern United States.[83] The Lee site is a uniform hard rock site.[84] When compared to the CSDRS and HRHF Spectra, the Lee site-specific vertical and horizontal foundation response spectra exceed both the CSDRS and

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[80] Ex. DEC-003, Duke Pre-Hearing Responses, at 16-17 (citing Ex. NRC-011A, FSAR § 2.5.4.5.2.1, figs. 2.5.4-244a to 2.5.4-244e, 2.5.4-266).

[81] Tr. at 85 (Mr. Thrasher).

[82] *See* AP1000 DCD, Tier 2 Material, at 3.7-1; Tr. at 84 (Mr. Thrasher).

[83] Tr. at 84 (Mr. Thrasher); AP1000 DCD, Tier 2 Material, at 3I-1.

[84] Tr. at 85 (Mr. Thrasher).

the HRHF Spectra in the high frequency range.[85] Accordingly, Duke has requested a departure from the AP1000 DCD.[86]

To justify this departure, a site-specific seismic evaluation was performed to demonstrate that the exceedance in the high-frequency range is non-damaging and therefore acceptable.[87] The site-specific analysis used "the same general screening criteria documented in . . . Appendix 3I [of the AP1000 DCD] . . . to identify a representative sample of structures, components, supports, piping and equipment to evaluate . . . the acceptability of the AP1000 certified design for the Lee Nuclear Station [high frequency] motion."[88] The "site-specific analysis include[d] evaluations of building structures, reactor pressure vessel internals, primary component supports, primary loop nozzles, piping[,] and electro-mechanical equipment."[89] With regard to design forces and moments for structures and equipment, Duke stated that the analysis confirmed that the CSDRS bounds the Lee site-specific spectra results with significant margin.[90] Duke also stated that "CSDRS and HRHF piping stresses envelope the Lee site-specific spectra piping stresses," and that "[t]est [r]esponse [s]pectra used to qualify AP1000

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[85] Tr. at 85-86 (Mr. Thrasher); DEC-001, Duke Pre-Filed Testimony, at 10; NRC-013, Staff Safety Presentation, at 5-6; NRC-011E, William States Lee III Nuclear Station Units 1 and 2 COL Application—Part 7 Departures and Exemption Requests, rev. 11 (Apr. 2016), at 9-10 (ML16124A093) (Departures and Exemptions).

[86] *See* Ex. NRC-011E, Departures and Exemptions, at 10-13; Ex. NRC-001, Staff Information Paper, at 21-22.

[87] Tr. at 91 (Mr. Roche-Rivera); *see also id.* at 85-86 (Mr. Thrasher); Ex. NRC-011E, Departures and Exemptions, at 10.

[88] Ex. NRC-011E, Departures and Exemptions, at 10; *see* AP1000 DCD, Tier 2 Material, app. 3I.

[89] Ex. NRC-011E, Departures and Exemptions, at 11.

[90] Tr. at 86 (Mr. Thrasher); *see also* Ex. NRC-011E, Departures and Exemptions, at 11.

high-frequency sensitive equipment bound the required response spectra for the Lee site-specific equipment qualification."[91] Duke concluded that "the high frequency seismic input for the Lee site is non-damaging and the Lee site is qualified for deployment of the AP1000 standard plant."[92]

The Staff reviewed the site-specific analyses and Duke's responses to requests for additional information and concluded that the AP1000 design "is adequate for use at the Lee site."[93] The Staff thus found Duke's requested departure acceptable.[94] The ACRS reviewed the requested departure and determined that the "[s]ite seismic inputs . . . have been adequately addressed by [Duke] and the [S]taff."[95] The ACRS recommended that the departure be approved.[96]

Duke committed to ensure "that future equipment qualification testing for high frequency sensitive equipment envelopes the [Lee] site-specific [required response spectra], in addition to

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[91] Tr. at 86 (Mr. Thrasher). The required response spectra "defines the response spectra or seismic demand for which equipment must remain functional during a Safe Shutdown Earthquake." Ex. NRC-007, Staff Pre-Hearing Responses, at 9. Equipment qualification testing was performed in support of the entire fleet of AP1000s. *See* Ex. DEC-003, Duke Pre-Hearing Responses, at 15-16.

[92] Tr. at 86-87 (Mr. Thrasher).

[93] *Id.* at 93 (Mr. Roche-Rivera).

[94] *Id.* (Mr. Roche-Rivera); *see also* Ex. NRC-009-R, FSER § 3.7.2.4. With regard to the requirements in 10 C.F.R. Part 52 and Part 100 and siting issues more generally, the Staff "conclude[d] that the proposed . . . site is acceptable from the standpoint of geologic and seismic information and meets the requirements of 10 CFR 100.23 and 10 CFR 52.79(a)(1)(iii)." Ex. NRC-009-R, FSER at 2-265.

[95] 2015 ACRS Letter at 1.

[96] *Id.*

the CSDRS and HRHF [required response spectra]."[97] We asked whether Duke or the Staff had considered imposing a license condition (as opposed to accepting a commitment) given the need for a departure from the design.[98] In response, the Staff and Duke noted, as mentioned above, that the test response spectra used in the AP1000 equipment qualification testing bound the Lee site-specific required response spectra.[99] The Staff also noted that "[t]here are system-based ITAAC that require the seismic Category I high frequency sensitive equipment to withstand seismic design basis loads without loss of safety function."[100] According to the Staff, the ITAAC and the commitment together "provide reasonable assurance that the high frequency sensitive equipment will be qualified for the [Lee] site-specific [required response spectra]."[101] Additionally, the Staff pointed out that during operation, any replacement equipment must meet seismic suitability requirements in accordance with Duke's Quality Assurance Program.[102] The Staff therefore concluded that a license condition in lieu of the FSAR commitment was not necessary.[103] Similarly, Duke "believes that the . . . FSAR commitment is the appropriate measure to ensure long-term attention to this aspect of equipment qualification for [Lee] Units 1 and 2."[104]

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[97] Ex. DEC-003, Duke Pre-Hearing Responses, at 15 (citing Ex. NRC-011A, FSAR § 3.7.2.15, at 3.7-9).

[98] Pre-Hearing Questions Order at 5-6.

[99] Ex. DEC-003, Duke Pre-Hearing Responses, at 16; NRC-007, Staff Pre-Hearing Responses at 9.

[100] Ex. NRC-007, Staff Pre-Hearing Responses, at 9.

[101] *Id.*

[102] *Id.*

[103] *Id.*

[104] Ex. DEC-003, Duke Pre-Hearing Responses, at 16.

3. Exemptions and Departures from the AP1000 Certified Design

Duke requested seven exemptions and identified thirteen departures, including the departure regarding the Lee Nuclear Station site-specific foundation response spectra.[105] Duke explained at the hearing that its goal was to minimize the number of departures from the design while still recognizing that some changes were necessary to maintain standardization.[106]

Ten of Duke's identified departures are common to other combined license applications referencing the AP1000 certified design.[107] Five of these departures are identical to those proposed for the first time in the Levy Nuclear Plant combined license application, which also referenced the AP1000 certified design.[108] These departures concern the condensate return system and passive residual heat removal cooling; the main control room habitability dose analysis; heat load in the main control room; hydrogen control in containment; and the boron dilution block safety system bypass.[109] Because these departures require changes to AP1000

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[105] Ex. NRC-001, Staff Information Paper, at 13.

[106] Tr. at 44-45 (Mr. Kitchen).

[107] Ex. NRC-001, Staff Information Paper, at 13.

[108] *Id.*; *see* Ex. NRC-009-R, FSER, ch. 21; 2016 ACRS Letter. We recently authorized issuance of the combined licenses for Levy Nuclear Plant Units 1 and 2; the Staff issued the combined licenses on October 26, 2016. *Duke Energy Florida, LLC* (Levy Nuclear Plant, Units 1 and 2), CLI-16-16, 84 NRC __ (Oct. 20, 2016) (slip op.); Letter from Francis M. Akstulewicz, NRC, to Christopher M. Fallon, Duke Energy Florida (Oct. 26, 2016) (ML16176A200).

[109] *See* Ex. NRC-001, Staff Information Paper, at 15-17; Ex. NRC-011E, Departures and Exemptions, at 1; Ex. NRC-009-R, FSER § 1.2.3. The remaining five departures of the ten common to other AP1000 applications concern the organization and numbering of the FSAR; a regulatory citation in an interface description; revisions to the "Envir. Zone" numbers for spent fuel pool level instrumentation; quantification of the term "indefinitely" in the DCD for maintenance of safe shutdown conditions using the passive residual heat removal heat

Tier 1 information and technical specifications, exemptions also are required for their approval.[110] Thus, five of Duke's seven exemption requests pertain to these departures.[111]

Consistent with the design-centered review approach, the Staff designated the Levy combined license application as the "reference" application for the five common departures and exemptions; the Lee application is a "subsequent" application.[112] The Staff performed one review, then confirmed that the information was identical in the Lee application.[113] The ACRS reviewed and recommended approval of the requested departures and exemptions.[114] As discussed in further detail in our decision authorizing issuance of the combined licenses for the Levy Nuclear Plant, the Staff found each of the requested departures and their accompanying exemptions acceptable.[115]

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exchanger during a non-loss-of-coolant accident; and isolating current in Class 1E voltage regulating transformers. Ex. NRC-001, Staff Information Paper, at 18-19.

[110] Ex. NRC-001, Staff Information Paper, at 13-14.

[111] The remaining two exemption requests are similar to those previously granted to other combined license holders. The first relates to the organization and numbering of the combined license application. The second exempts the combined license holder from certain requirements pertaining to material control and accounting for special nuclear material, such that the same requirements apply to both Part 52 and Part 50 licensees. The Staff stated that its reasoning for finding the exemptions acceptable for the Lee application is the same as its reasoning for the previously approved exemption requests. *Id.* at 14-15; *see also Southern Nuclear Operating Co.* (Vogtle Electric Generating Plant, Units 3 and 4), CLI-12-2, 75 NRC 63, 82, 84 (2012).

[112] Ex. NRC-009-R, FSER at 21-1.

[113] *Id.*

[114] 2016 ACRS Letter at 1.

[115] *Levy*, CLI-16-16, 84 NRC at __ (slip op. at 17-21); *see also* Ex. NRC-001, Staff Information Paper, at 15.

Three departures are unique to the Lee combined license application.[116] One departure relates to the Lee site-specific foundation response spectra, discussed in section II.A.2 above.[117] The second Lee-specific departure addresses lateral earth pressure on below-grade nuclear island walls at the Lee site.[118] An evaluation of lateral earth pressures on below-grade nuclear island walls at the site was performed and compared to the corresponding pressures in the AP1000 DCD.[119] Duke determined that the lateral pressure of one of the evaluated load combinations slightly exceeds the corresponding load combination in the AP1000 DCD.[120] According to Duke, this exceedance is attributable to the groundwater level at the Lee site (eight feet below ground surface) compared to the groundwater level assumed in the AP1000 DCD (two feet below ground surface), resulting in "six additional feet of non-buoyant (heavier) soil than considered in the AP1000 standard evaluations, . . . [and] a corresponding higher passive earth pressure component" for that load combination.[121]

A site-specific analysis was performed to demonstrate that the site-specific lateral earth pressures are bounded by the AP1000 certified design.[122] Duke determined that "the site-specific nuclear island below-grade wall pressures resulting from the [nuclear island foundation input response spectra] will be less than those used in the standard AP1000 design for this load

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[116] Ex. NRC-001, Staff Information Paper, at 13.

[117] *Id.* at 18-19.

[118] *Id.*

[119] Ex. NRC-011E, Exemptions and Departures, at 16.

[120] *Id.*; *see also* Ex. NRC-009-R, FSER at 3-59.

[121] Ex. NRC-011E, Departures and Exemptions, at 16.

[122] *Id.*; Ex. NRC-001, Staff Information Paper, at 19.

combination."[123] Based on Duke's responses to requests for additional information and a review of the site-specific analysis, the Staff concluded that the departure is acceptable.[124]

The third Lee-specific departure relates to the location of the Technical Support Center (TSC) and the Operations Support Centers (OSC).[125] The TSC is "[t]he on-site facility that provides plant management and technical support to reactor operating personnel located in the [c]ontrol [r]oom during an emergency," and the OSCs are "on-site assembly area[s] separate from the [c]ontrol [r]oom and TSC where licensee operations support personnel report in an emergency."[126] Duke plans to move the TSC to a central location so that it can serve both units at the Lee site.[127] The TSC therefore would be located outside the control support area, which is a departure from the AP1000 DCD.[128] The OSCs would then occupy the space vacated by the TSC in the control support area for each unit.[129] Placement of the TSC in the centralized location would mean a slight increase in travel time to the TSC in an emergency—from two minutes to about five minutes.[130]

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[123] Ex. NRC-009-R, FSER at 3-60.

[124] *Id.*

[125] Ex. NRC-001, Staff Information Paper, at 19-20; Ex. NRC-011E, Departures and Exemptions, at 8.

[126] Ex. NRC-011D, William States Lee III Nuclear Station Units 1 and 2 COL Application—Part 5 Emergency Plan, rev. 7 (Nov. 2015), at ix (ML15336A127) (Emergency Plan).

[127] *See id.* at A10-2.

[128] Ex. NRC-001, Staff Information Paper, at 20; Ex. NRC-011E, Departures and Exemptions, at 8.

[129] Ex. NRC-011E, Departures and Exemptions, at 8; Ex. NRC-011D, Emergency Plan, at II-40.

[130] 2015 ACRS Letter at 4.

Duke reviewed the departure criteria for the AP1000 DCD in 10 C.F.R. Part 52, Appendix D, and determined that relocating the TSC and OSCs would not adversely affect their function, that the departure has no safety-significance, and that NRC approval is not required.[131] The Staff agreed that the departure does not require NRC approval.[132] Nonetheless, as part of its analysis of Duke's Emergency Plan, the Staff confirmed that the TSC and the OSCs would serve their intended emergency functions.[133] The Staff's finding with respect to the OSCs is subject to a demonstration of their adequacy during the full participation exercise that would be required before fuel load, as reflected in the inspections, tests, analyses, and acceptance criteria (ITAAC) in the draft combined licenses.[134] The ACRS reviewed Duke's proposal and found it acceptable "based on the communication and data links [that will be] provided, and based on the fact that it allows each unit's [OSC] to be located adjacent to the [c]ontrol [r]oom where the TSC would have been located."[135]

4. The Lee Nuclear Station Emergency Operations Facility

Also related to the issue of emergency preparedness, Duke has requested to consolidate the EOF for the Lee site with the EOF for its McGuire, Catawba, and Oconee plants

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[131] *See* Ex. NRC-011E, Departures and Exemptions, at 8-9; *see* 10 C.F.R. pt. 52, app. D, VIII.B.5.

[132] Ex. NRC-001, Staff Information Paper, at 20; Ex. NRC-009-R, FSER at 13-53, 13-58.

[133] Ex. NRC-009-R, FSER at 13-58 to 13-59.

[134] *Id.*; *see* Draft Combined License—Unit 1, at C-18 to C-19; Draft Combined License—Unit 2, at C-18 to C-19; Ex. NRC-011H, William States Lee III Nuclear Station Units 1 and 2 COL Application—Part 10 License Conditions and Inspections, Tests, Analyses, and Acceptance Criteria, rev. 11 (Apr. 2016), tbl. 3.8-1 (ML16124A672) (License Conditions and ITAAC); 10 C.F.R. pt. 50, app. E, IV.F.a(ii).

[135] 2015 ACRS Letter at 4.

at its corporate headquarters in Charlotte, North Carolina, which, according to Duke, "has proven to be an effective facility for implementation of [its] nuclear station emergency plans."[136] The Lee Nuclear Station therefore would benefit from the application of Duke's corporate emergency response structure and experience.[137] The Charlotte EOF is located approximately forty miles from the Lee Nuclear Station site.[138]

The EOF is the support facility responsible for "evaluating, coordinating, and directing the overall activities involved in coping with a radiological emergency."[139] Among other things, an applicant's emergency plan must make provisions for an EOF "from which effective direction can be given and effective control can be exercised during an emergency."[140] Section IV.E.8.b

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[136] Ex. NRC-011D, Emergency Plan, at A9-3.

[137] *Id.* at A9-2. The McGuire and Catawba stations have used a consolidated EOF since 1987; Duke obtained Commission approval to add the Oconee Nuclear Station in 2005. *See id.*; Staff Requirements—SECY-05-0172—Duke Power Company's Request to Incorporate the Oconee Emergency Operations Facility into the EOF Shared by Catawba and McGuire Nuclear Stations (Nov. 2, 2005) (ML053070025). The current EOF has been in use since 2005. Ex. NRC-011D, Emergency Plan, at A9-2. Duke has filed a license amendment request for approval to incorporate the EOFs for Brunswick Steam Electric Plant Units 1 and 2, Shearon Harris Nuclear Power Plant Unit 1, and H.B. Robinson Steam Electric Plant Unit 2 into the Charlotte EOF. *See* Ex. NRC-001, Staff Information Paper, at 21 n.1; Tr. at 35 (Mr. Kitchen); Ex. DEC-005, Duke Overview Presentation, at 15. Our decision today does not address the license amendment request, which will be considered separately.

[138] Tr. at 87 (Mr. Thrasher).

[139] Ex. NRC-009-R, FSER at 13-60; *see also* Ex. NRC-015, *NRC Staff Responses to Commission Post-Hearing Questions* (Oct. 20, 2016), at 2 (Staff Post-Hearing Responses); "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants," NUREG-0654/FEMA-REP-1, rev. 1 (Nov. 1980), at 52 (ML040420012).

[140] 10 C.F.R. pt. 50, app. E, IV.E.8.a(i); *see also id.* § 52.79(a)(21) (requiring combined license applicants to provide an emergency plan that complies with 10 C.F.R. § 50.47 and 10 C.F.R. pt. 50, app. E).

of 10 C.F.R. Part 50, Appendix E expressly permits an EOF to serve more than one nuclear power plant site.[141] But our express approval is required where—as here—an applicant or licensee proposes to locate the EOF more than twenty-five miles from the nuclear power plant site.[142] Additionally, for EOFs located more than twenty-five miles from a nuclear power plant site, "provisions must be made for locating NRC and offsite responders closer to the nuclear power [plant] site so that NRC and offsite responders can interact face-to-face with emergency response personnel entering and leaving the . . . site."[143] These provisions must include adequate space and supplies for NRC and offsite responders to function effectively during an emergency.[144]

Both parties discussed the EOF as part of the safety panel presentation at the hearing, and we asked pre- and post-hearing questions specific to this issue. As the Staff noted in its pre-filed testimony, this is the first time we have reviewed a consolidated EOF for a new facility as part of the final review in a combined license proceeding.[145]

With the EOF proposed to be located approximately forty miles from the Lee site, Duke also plans to establish a near-site assembly area at a Duke Energy facility in Kings Mountain,

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[141] 10 C.F.R. pt. 50, app. E, IV.E.8.b.

[142] *See id.*; *see also* Staff Requirements—SECY-10-0078—Centralized Emergency Operations Facilities and Combined License Applications (Sept. 7, 2010) (ML102500511) (approving the Staff's proposal to make the determination on the acceptability of consolidated EOFs as part of its review of combined license and early site permit applications).

[143] 10 C.F.R. pt. 50, app. E, IV.E.8.b.

[144] *See id.* (including requirements for "space for conducting briefings," "access to plant data and radiological information," and "access to copying equipment and office supplies").

[145] Ex. NRC-001, Staff Information Paper, at 21.

North Carolina, approximately fifteen miles from the Lee site.[146] According to Duke, the Kings Mountain facility provides space "sufficient for members of an NRC site team and Federal, State, and local responders" and it "includes an area for briefing emergency response personnel, communication capability with other licensee and offsite response facilities, access to plant data and radiological information[,] and access to copying equipment and supplies."[147]

As part of its review, the Staff verified that the consolidated EOF has the capability (1) "to obtain and display plant data and radiological information for each reactor at a nuclear power reactor site and for each nuclear power reactor site that the facility serves"; and (2) "to analyze plant technical information and provide technical briefings on event conditions and prognosis to licensee and offsite response organizations for each reactor at a nuclear power reactor site and for each nuclear power reactor site that the facility serves."[148] The Staff noted that "[p]lant and effluent data would be provided on as timely a basis at an EOF in Charlotte as it would be at a near-site location," that the data can be displayed at the Charlotte EOF, and that the data would be "sufficient to perform accident assessment and [to] evaluate potential onsite and offsite environmental consequences of an emergency at [the] Lee Nuclear Station."[149] The Staff also noted that use of the consolidated EOF enables "commonality of communication and interface

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[146] Ex. DEC-006, Duke Safety Presentation, at 5.

[147] Ex. NRC-011D, Emergency Plan, at A9-7.

[148] "Centralized Emergency Operations Facilities and Combined License Applications," Commission Paper SECY-10-0078 (June 16, 2010), at 3 (ML091970250); *see also* Ex. NRC-013, Staff Safety Presentation, at 15-16; Tr. at 95 (Mr. Thomas).

[149] Ex. NRC-009-R, FSER at 13-60 to 13-61.

with offsite officials and liaisons."[150] Regarding Duke's proposed near-site facility in Kings Mountain, North Carolina, the Staff testified that the facility has "everything that the staff would need"—including integrated communication systems and adequate space for the NRC and other emergency responders.[151]

A proposed license condition would require Duke to demonstrate, prior to fuel load, "the integrated capability and functionality of the EOF for activation and operation of the facility to respond to emergency events at both the [Lee Nuclear Station] and one additional nuclear facility that is supported by the EOF."[152] Additionally, the draft combined licenses include ITAAC that will require Duke to demonstrate the functionality of the EOF prior to fuel load.[153] The Staff concluded that the information that Duke provided for the consolidated EOF meets the NRC's emergency planning requirements, subject to completion of the ITAAC and satisfaction of the license condition, and the Staff recommends that we approve Duke's request.[154]

The ACRS reviewed Duke's request to consolidate the EOF for the Lee Nuclear Station and likewise recommends approval.[155] The ACRS reasoned that "[t]he distance from the Lee site to the common EOF is not excessive," and also noted Duke's proposed near-site facility in

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[150] *Id.* at 13-61.

[151] Tr. at 110 (Mr. Hughes).

[152] NRC-009-R, FSER at 13-63.

[153] *See* Ex. NRC-002, Draft Combined License—Unit 1, at C-18 to C-19; Ex. NRC-003, Draft Combined License—Unit 2, at C-18 to C-19; Ex. NRC-011H, License Conditions and ITAAC, tbl. 3.8-1; Tr. at 95-96 (Mr. Thomas).

[154] NRC-009-R, FSER at 13-63; Tr. at 95-96 (Mr. Thomas).

[155] *See* 2015 ACRS Letter at 1, 4.

Kings Mountain, North Carolina.[156] The ACRS based its recommendation "on the advantages provided by use of a common EOF . . . with the resources necessary to support more than a single site."[157]

Before the hearing, we asked Duke and the Staff to address several questions related to emergency preparedness, including the proposed consolidated EOF. Among other things, we asked the parties to discuss the capability of the EOF to handle a common event across multiple sites and the potential need for changes to the EOF to meet any AP1000-specific requirements for the Lee Nuclear Station.[158] We also asked about the potential need for additional training to accommodate the Lee site, whether it be related to addressing a common event at facilities with different reactor designs, or, more specifically, training related to the AP1000 design for members of the EOF staff.[159] We further explored this issue at the hearing; the parties discussed EOF staff training and the potential advantages and disadvantages of using the Charlotte EOF for the Lee Nuclear Station.[160]

Duke explained that "[k]ey positions of EOF staff that include the EOF Director, Assistant EOF Director, and Accident Assessment Manager are required to take training to cover multiple technologies,"[161] which will include the AP1000 and will be focused particularly on mitigating

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[156] *Id.* at 4.

[157] *Id.*

[158] Pre-Hearing Questions Order at 3-4.

[159] *Id.*

[160] *See, e.g.*, Tr. at 96-97 (Commissioner Baran); *id.* at 109-10 (Chairman Burns); *id.* at 112 (Commissioner Svinicki).

[161] Ex. DEC-003, Duke Pre-Hearing Responses, at 6.

beyond-design-basis events.[162] Duke also stated that it will expand its training program for multi-site event response to include the Lee site.[163] In addition, Duke explained that the only changes necessary to the Charlotte EOF would be to display site and plant parameters from the Lee units, and Duke listed relevant ITAAC that will ensure that AP1000 technology and data specific to the Lee Nuclear Station are addressed in the EOF.[164]

Duke represented that it is also possible that some of the other staff at its corporate office would be trained in AP1000 technology or have familiarity with the Lee Nuclear Station site and would be available to staff the EOF.[165] Duke stated, however, that it was less important for staff beyond key EOF positions to be trained in AP1000 technology because the EOF's function for accident mitigation is for coordination and other "bigger-picture aspects" of accident response, whereas staff at the nuclear power plant site in the OSCs, TSC, and the control room—individuals with experience at the site—would be directing the tactical response to the event.[166] The Staff explained that it found Duke's plan to provide AP1000-specific training to the EOF Director, Assistant EOF Director, and Accident Assessment Manager "adequate to fulfill the EOF mission and to ensure that supervisors are able to direct the [Emergency Response Organization] members in the performance of their duties."[167]

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[162] Tr. at 97-98 (Mr. Kitchen); Ex. DEC-003, Duke Pre-Hearing Responses, at 6.

[163] Ex. DEC-003, Duke Pre-Hearing Responses, at 6.

[164] *Id.* at 6-7.

[165] Ex. DEC-012, *Duke Energy Carolinas' Response to Post-Hearing Question* (Oct. 20, 2016), at 2 (Duke Post-Hearing Responses); Tr. at 97-98 (Mr. Kitchen).

[166] Tr. at 99-100 (Mr. Kitchen).

[167] Ex. NRC-015, Staff Post-Hearing Responses, at 2.

The Staff also noted that job and task analyses for staffing the Emergency Response Organization, once developed, will help determine whether additional AP1000-specific training is necessary.[168] The Staff stated that these job tasks and analyses are not required at this time; they will be completed in preparation for the full participation exercise that will be conducted at the Lee Nuclear Station prior to fuel load.[169] The Staff explained that it will verify the adequacy of Duke's training program by inspecting Duke's ability to adequately perform designated Emergency Response Organization functions during the required exercise described in the emergency preparedness ITAAC and subsequent biennial exercises if the NRC later makes the finding required by 10 C.F.R. § 52.103(g) allowing operation of the facility.[170] According to the Staff, its inspections "will verify, initially and continuously, whether key EOF positions, such as the EOF Director, Assistant Director, and Accident Assessment Manager, and any other EOF personnel identified based on job and task analyses, are receiving adequate AP1000-specific training to perform their designated emergency plan functions."[171]

We also asked whether an expansion of the Charlotte EOF might become necessary depending on the number of plants added to the facility.[172] Duke stated that a physical expansion of the facility was not planned for the addition of the Lee Nuclear Station.[173] Duke

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[168] *Id.*

[169] *Id.*; *see supra* note 134.

[170] Ex. NRC-015, Staff Post-Hearing Responses, at 2; *see* 10 C.F.R. § 52.103(g) (stating that operation of the facility is not permitted until the Commission finds that the acceptance criteria in the combined licenses are met).

[171] Ex. NRC-015, Staff Post-Hearing Responses, at 2.

[172] Tr. at 114-15 (Commissioner Svinicki).

[173] *Id.* at 115 (Mr. Kitchen).

further asserted that computer capability and the ability to display data, rather than strictly floor space, are the important considerations.[174] For its part, the Staff stated that the most important aspect of the issue is not the number of plants added to the Charlotte facility but rather the advantage afforded by the location of the EOF in relation to the plants in two states, South Carolina and North Carolina, where most of the emergency responders would be the same for Lee as for the existing units and would therefore be familiar with the Charlotte EOF.[175] But the Staff explained that any recommendation to the Commission on EOF consolidation is made on a case-by-case basis.[176]

B. Environmental Issues

1. Make-Up Pond C

When it filed its combined license application in 2007, Duke proposed to use Make-Up Ponds A and B for the Lee Nuclear Station's operational water requirements.[177] The two water impoundments were created during the construction phase of the cancelled Cherokee project.[178] Make-Up Pond A draws water from the Ninety-Nine Islands Reservoir—the water source for the Ninety-Nine Islands Hydroelectric Project; the Hydroelectric Project and the reservoir are under

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[174] *Id.* (Mr. Kitchen).

[175] *See id.* at 116-17 (Mr. Barss). South Carolina and North Carolina acknowledged their support for the Charlotte EOF location in their letters certifying their agreement with Duke's Emergency Plan for the Lee Nuclear Station. Ex. NRC-009-R, FSER at 13-60.

[176] *Id.* at 116-17 (Mr. Barss).

[177] Ex. NRC-001, Staff Information Paper, at 22; Ex. NRC-010, Final EIS at 2-6.

[178] Ex. NRC-001, Staff Information Paper, at 22.

the jurisdiction of the Federal Energy Regulatory Commission (FERC).[179] Make-Up Pond B was formed by an impoundment of McKowns Creek.[180] Make-Up Ponds A and B are now jurisdictional waters of the United States under the jurisdiction of the Corps.[181] Duke planned to use water from Make-Up Pond A more than ninety-five percent of the time and to use Make-Up Pond B during low flow conditions.[182]

In 2007 and 2008, the region surrounding the Lee site experienced a severe drought.[183] The Staff noted that water data from these drought years had not been included in Duke's combined license application.[184] The drought raised concerns that a severe, long-term drought could affect the reliability of the Lee Nuclear Station as a source of baseload power.[185] In addition, the Staff "determined that low water flows at certain times of the year would have resulted in adverse impacts to aquatic biota and downstream water users."[186]

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[179] *Id.*; Ex. NRC-010, Final EIS at 2-24. Duke operates the Ninety-Nine Islands Hydroelectric Project. Ex. NRC-010, Final EIS at 2-24.

[180] Ex. NRC-010, Final EIS at 2-6.

[181] *Id.* at 2-42.

[182] Ex. NRC-001, Staff Information Paper, at 23; Ex. NRC-014-R, Staff Environmental Presentation, at 3; Tr. at 125-26 (Ms. Vokoun).

[183] *See* Tr. at 121-22 (Mr. Snead).

[184] Ex. NRC-014-R, Staff Environmental Presentation, at 4; Tr. at 126 (Ms. Vokoun).

[185] Ex. NRC-010, Final EIS at 3-8 to 3-9; Tr. at 126 (Ms. Vokoun). Commenters at the scoping sessions and commenters on the Draft EIS expressed concern about water availability and potential droughts. *See* Tr. at 81 (Mr. Akstulewicz); Ex. NRC-010, Final EIS, apps. D-E.

[186] Tr. at 126 (Ms. Vokoun).

Duke revised its water balance calculations to include the 2007 and 2008 drought years.[187] Thereafter, Duke proposed to build Make-Up Pond C, an offsite reservoir that would be used for supplemental cooling water as a drought contingency to minimize the need to shut down the plant during low river flow conditions.[188] With Make-Up Ponds A, B, and C providing cooling water to the plant, Duke also plans to use a closed-cycle wet cooling system with mechanical draft cooling towers to transfer waste heat to the atmosphere.[189]

Duke filed a supplement to its application to include Make-Up Pond C in September 2009, and the Staff held additional public scoping meetings in the spring and summer of 2010.[190] As proposed, the "Make-Up Pond C site encompasses approximately 2110 ac[res] and is located northwest of the Lee Nuclear Station on the London Creek watershed."[191] Approximately 3.16 miles of London Creek would be dammed to create Make-Up Pond C.[192] Of the total proposed site acreage, approximately 643 acres would be used for "Make-Up Pond C itself, including the impoundment, dam footprint, saddle dikes, and spillway."[193] An additional 404 acres would be used "for other elements of Make-Up Pond C, including spoils placement areas, vegetation maintenance areas, and various roads, transmission lines, and ancillary

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[187] *Id.* (Ms. Vokoun).

[188] *Id.* at 122 (Mr. Snead).

[189] Ex. NRC-010, Final EIS at xxxiii, 3-50, 9-207. A portion of the water will be returned through a discharge structure on the Broad River upstream of the Ninety-Nine Islands Dam; the remaining water will be released to the atmosphere via evaporative cooling. *Id.* at xxxiii.

[190] Ex. DEC-007, Duke Environmental Presentation, at 4; Ex. NRC-010, Final EIS at 1-5.

[191] Ex. NRC-010, Final EIS at 2-9.

[192] *Id.* at 2-17.

[193] *Id.* at 2-11.

[support] facilities."[194] At the hearing, the Staff discussed its analysis of the environmental impacts of the construction and use of Make-Up Pond C, measures to mitigate these impacts, and the Staff's consideration of alternative technologies for plant cooling.[195] We asked a number of questions to evaluate the sufficiency of the Staff's review in this area.[196]

The Staff determined that creation of Make-Up Pond C would "inundate most of the London Creek stream network and forested valley," impacting approximately 12.5 miles of streams, 3.5 acres of wetlands, and 17.5 acres of open water, turning the existing creek system into a deep water lake habitat.[197] The Staff also found that the terrestrial impacts of the proposal would include loss of habitat and wildlife mortality that "would be substantial and mostly permanent in nature."[198] Additionally, the Staff determined that building "Make-Up Pond C would alter the functionality of the London Creek corridor as a wildlife travel corridor, particularly for some migrant songbirds, many of which are conservation priority in South Carolina."[199] For aquatic impacts, the Staff determined that there would be "a clearly noticeable and permanent change in aquatic resources to London Creek and its tributaries."[200] Accordingly, the Staff considered the impacts to aquatic and terrestrial resources to be "moderate," because "[t]he impacts would noticeably alter these resources, but the important

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[194] *Id.*

[195] *See* Tr. at 124-36; Ex. NRC-014-R, Staff Environmental Presentation, at 3-13.

[196] Pre-Hearing Questions Order at 7-11, 15; Tr. at 139-41, 143-49.

[197] Tr. at 130, 132 (Ms. Vokoun).

[198] *Id.* at 131 (Ms. Vokoun).

[199] *Id.* (Ms. Vokoun).

[200] *Id.* at 132 (Ms. Vokoun).

aspects of these attributes would not be destabilized as habitat and wildlife resources found in the London Creek watershed are also found in other areas of the surrounding upstate Piedmont Region."[201]

To determine whether these impacts could be minimized or avoided, the Staff considered alternative ways to address a potential water shortage.[202] The Staff "evaluated water storage options, other pond locations[,] and other cooling system designs," but focused on a hybrid-cooling-technology option because the Staff found that to be "the alternative with the best potential to eliminate entirely or reduce the size of Make-Up Pond C."[203] Hybrid cooling uses a combination of wet and dry cooling towers to reduce water use.[204] Although this design has never been used to cool nuclear or fossil fuel plants the size of the proposed Lee Nuclear Station and it "poses several significant technical challenges for its installation and operation," the Staff concluded that it would be feasible for the Lee Nuclear Station site.[205] Nevertheless, the Staff determined that the hybrid system "would not eliminate the need for Make-Up Pond C" and therefore concluded that it "would not be an environmentally preferable alternative."[206] After

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[201] *Id.* (Ms. Vokoun); *see* Ex. NRC-015, Staff Post-Hearing Responses, at 3 (clarifying that the Staff's "moderate" finding did not depend on the consideration of proposed mitigation measures).

[202] *See* Tr. at 127-28 (Mr. Vail).

[203] *Id.* at 128 (Mr. Vail).

[204] *Id.* (Mr. Vail).

[205] Ex. NRC-010, Final EIS at 9-210; *see also* Tr. at 128 (Mr. Vail).

[206] Tr. at 129-30 (Mr. Vail); *see also* Ex. NRC-010, Final EIS at 9-210; Ex. NRC-014-R, Staff Environmental Presentation, at 7.

its consideration of alternative water storage options, the Staff concluded that Make-Up Pond C would be necessary for supplemental cooling.[207]

The Staff also considered other measures to mitigate the environmental impacts of the project. The Final EIS includes a discussion of various mitigation approaches, such as implementation of best management practices for erosion control and implementation of a stormwater pollution prevention plan.[208] One approach developed as part of Duke's permit application with the Corps under section 404 of the Clean Water Act was a compensatory mitigation plan to offset the unavoidable impacts on jurisdictional waters of the United States from Make-Up Pond C, which Duke plans to pursue if it completes the project.[209] In addition to purchasing mitigation credits,[210] "Duke plans to accomplish a stream restoration and preservation effort at two separate locations, the privately owned Turkey Creek Tract and the Woods Ferry Study Area in the Sumter National Forest."[211] For the Woods Ferry Study Area, the goal will be to "reconnect streams to their respective flood plains, . . . reduce sedimentation and stabilize stream banks, . . . improve in-stream and adjacent habitats[,] and . . . improve

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[207] Ex. NRC-014-R, Staff Environmental Presentation, at 7.

[208] *See, e.g.*, Ex. NRC-010, Final EIS tbl.10-1.

[209] *See id.* at 4-54; Tr. at 132-33 (Ms. Vokoun).

[210] Ex. NRC-010, Final EIS at 4-56.

[211] Tr. at 133 (Ms. Vokoun). Duke selected these locations as part of an outreach effort with governmental and non-governmental stakeholder organizations. Ex. NRC-010, Final EIS at 4-55 to 4-56.

water quality."[212] Duke will provide preservation and buffer enhancement at the Turkey Creek Tract.[213]

The Woods Ferry project required a Special Use Permit from the United States Forest Service. In accordance with NEPA, the Forest Service prepared an Environmental Impact Statement to support the permit action.[214] The Forest Service has issued its record of decision, and the Staff anticipates that it will issue the Special Use Permit.[215] The Corps issued its record of decision and a Section 404 Permit for the Lee Nuclear Station in 2015.[216] The Staff stated that "[t]he mitigation measures and requirements ultimately [to be] imposed by the Forest Service and the Corps . . . are consistent with the analysis and conclusions in the . . . [Final] EIS."[217] Although the Staff found that restoration efforts under the compensatory mitigation plan "are expected to mitigate the environmental impacts of Make-Up Pond C," the Staff determined that "impacts to the resource[] areas would remain moderate, given that the stream ecosystem [at the Make-Up Pond C site] will be removed."[218]

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[212] Tr. at 133 (Ms. Vokoun); *see also* Ex. NRC-010, Final EIS at 4-56, 4-58.

[213] Ex. NRC-010, Final EIS at 4-58.

[214] Tr. at 134 (Ms. Vokoun).

[215] *Id.* (Ms. Vokoun).

[216] *Id.* (Ms. Vokoun); Ex. NRC-007, Staff Pre-Hearing Responses, at 23.

[217] Tr. at 134-35 (Ms. Vokoun).

[218] *Id.* at 133-34 (Ms. Vokoun).

2. Alternative Sites

As part of its environmental review, the Staff assessed Duke's process for selecting the Lee site.[219] Duke first established the region of interest, the "geographic area considered in searching for potential and candidate sites."[220] Duke defined its region of interest consistent with its franchised service area.[221] Within this area, Duke selected six candidate sites—"two in North Carolina, three in South Carolina, and one that extended across both States"—based on their "seismic [characteristics]/geology, population density, water availability, dedicated land use, regional ecological features, proximity to high-voltage transmission and load centers, and access to rail lines."[222] After additional screening of the candidate sites, Duke identified the Lee Nuclear Station site as the proposed site and identified three alternative sites: (1) the Perkins site in Davie County, North Carolina; (2) the Keowee site, adjacent to the Oconee Nuclear Station, in Oconee County, South Carolina; and (3) the Middleton Shoals site in Anderson County, South Carolina.[223] The three alternative sites are considered greenfield sites.[224]

The Staff performed an independent analysis of Duke's site selection process and concluded that it was reasonable.[225] In addition, the Staff reviewed each of the alternative sites

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[219] *See* Ex. NRC-010, Final EIS § 9.3.

[220] "Environmental Standard Review Plan," NUREG-1555 (July 2007) § 9.3, at 9.3-1 (ML071800223); *see* Ex. NRC-010, Final EIS § 9.3.1.

[221] Ex. NRC-010, Final EIS at 9-42.

[222] *Id.* at 9-43.

[223] *Id.* at 9-45.

[224] *Id.* The Lee site is considered previously disturbed by virtue of the construction activity associated with the cancelled Cherokee project. *See id.* at 2-5, 3-3.

[225] *Id.* at 9-42, 9-45.

to determine if any were environmentally preferable to the Lee site.[226] The Staff visited each of the three alternative sites and its analysis includes the information it collected from these visits, in addition to information from Duke and other federal and state agencies.[227]

The Perkins site is wholly owned by Duke and was previously characterized when the site was selected for the proposed Perkins Nuclear Station in the 1970s.[228] It is currently maintained as forested land by the North Carolina Wildlife Resources Commission and would "require extensive grading and cut-fill activities to support a two-unit nuclear power facility."[229] The Keowee site also is wholly owned by Duke and is maintained as forested land.[230] Because it is adjacent to the Oconee Nuclear Station, it "would share many of the same resources and services."[231] To support two new nuclear units, the Keowee site "would require extensive grading and the development of an offsite supplemental water reservoir."[232] The Middleton Shoals site is located on the eastern bank of the Savannah River, near Lake Russell.[233] Like the Perkins and Keowee sites, the Middleton Shoals site has been maintained as forested land,

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[226] *Id.* at 9-203.

[227] *Id.* at 9-45.

[228] *Id.* at 9-47, 9-54. The Perkins nuclear project was cancelled before a decision was made on the construction permit. *See Duke Power Co.* (Perkins Nuclear Station, Units 1, 2, and 3), ALAB-668, 15 NRC 450, 451-52 (1982).

[229] Ex. NRC-010, Final EIS at 9-54.

[230] *Id.* at 9-104.

[231] *Id.* at 9-95.

[232] *Id.* at 9-106.

[233] *Id.* at 9-159, 9-177.

and it "would require extensive grading and cut-fill activities to support a two-unit nuclear power facility."[234]

For each of these sites, the Staff evaluated impacts associated with land use, water use and quality, terrestrial and wetland resources, aquatic resources, socioeconomics, environmental justice, historic and cultural resources, air quality, non-radiological health impacts, radiological health impacts from normal operations, and postulated accidents.[235] Comparing its analysis of the three alternative sites with the proposed Lee site, the Staff found the environmental impacts "generally comparable."[236] Since no alternative site was environmentally preferable to the Lee site, the Staff concluded that none of the alternative sites would be "obviously superior" to the Lee site.[237]

3. Staff Non-Concurrence Associated with the General License to Construct an Independent Spent Fuel Storage Installation

During the Staff's environmental review, a non-concurrence was filed by members of the Staff working on the review.[238] The non-concurrence related to whether additional steps were warranted under NEPA, the NHPA, and the Endangered Species Act, in view of the possibility

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[234] *Id.* at 9-159.

[235] *See id.* §§ 9.3.3 to 9.3.5.

[236] *Id.* at 9-206.

[237] *Id.* at 9-203, 9-206.

[238] The non-concurrence, NCP-2016-007, which is not publicly available, was attached to the Staff's Information Paper. A substantively similar non-concurrence was filed during the review of the combined license application for the Levy Nuclear Plant and was addressed as part of that review. *See* Ex. NRC-001, Staff Information Paper, at 32; *Levy*, CLI-16-16, 84 NRC at __ (slip op. at 38-39).

that an independent spent fuel storage installation (ISFSI) could be constructed on the site at some future time.[239]

In response to a pre-hearing question, the Staff stated that it met the requirements for consultation under the NHPA because it consulted on the entirety of the Lee Nuclear Station site.[240] In January 2012, the South Carolina State Historic Preservation Officer (SHPO) informed the Staff that it had determined that the project, including the new units, "Make-Up Pond C, railroad spur, and transmission line corridors would cause no adverse effect on . . . identified historic properties if conditions were met" under the Cultural Resource Management Plan and Memorandum of Agreement between the SHPO, Duke, the Catawba Indian Nation, and the Corps.[241] The Staff explained that although it "did not explicitly discuss with the SHPO and Tribes the issuance of a general license," it referenced relevant information about the general license in the consultation record.[242] For example, the Staff noted that the Final EIS references an analysis in the Generic Environmental Impact Statement for License Renewal "that supports a conclusion that the impacts of building and operating an ISFSI on the site would be minor."[243] Nonetheless, the Staff notified the South Carolina SHPO in a follow-up phone call

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[239] NRC regulations grant a general license to construct and operate an ISFSI to certain licensees, including combined license holders. The non-concurrence centered on the concern that the consultations on the project did not include a specific discussion that an ISFSI potentially could be constructed onsite under the general license. Ex. NRC-001, Staff Information Paper, at 32; Ex. NRC-007, Staff Pre-Hearing Responses, at 27-28; *see* 10 C.F.R. § 72.210.

[240] Ex. NRC-007, Staff Pre-Hearing Responses, at 27.

[241] *Id.*; Ex. NRC-010, Final EIS at I-4 to I-5.

[242] Ex. NRC-007, Staff Pre-Hearing Responses, at 27.

[243] *Id.*

in July 2016 that issuance of a combined license includes authorization to construct and operate an ISFSI; the Staff represented that the SHPO expressed no concerns.[244]

According to the Staff, its conclusion that construction of the ISFSI would not contribute to adverse effects "is further reinforced by the provision in the [Cultural Resource Management Plan and Memorandum of Agreement] and Duke's corporate procedures," which require Duke "to stop work and coordinate with the SHPO if it inadvertently discovers cultural or historic objects on the site."[245] Additionally, the Staff explained that if Duke constructs an ISFSI at the Lee site, not only would historic and cultural resources be protected through the Memorandum of Agreement and the associated Cultural Resource Management Plan, but also through conditions in the Section 404 Permit from the Corps and the combined licenses.[246] The Staff also noted that the Section 401 Clean Water Act Certification from the State of South Carolina includes two permit conditions related to inadvertent discovery of archeological or paleontological resources.[247] The Staff advised that the non-concurring staff ultimately concurred in the Staff's review.[248]

C. Findings

With regard to Duke's request to consolidate the EOF for the Lee Nuclear Station with its existing EOF for the McGuire, Catawba, and Oconee plants in Charlotte, North Carolina, we find

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[244] *Id.*

[245] *Id.* (citing Ex. NRC-010, Final EIS at 4-111).

[246] *Id.* at 27-28.

[247] *Id.* at 28.

[248] Ex. NRC-001, Staff Information Paper, at 32.

that Duke has satisfied the requirements in 10 C.F.R. Part 50, Appendix E, section IV.E.8. Duke has shown that, from the Charlotte EOF, "effective direction can be given and effective control can be exercised during an emergency" at the Lee Nuclear Station.[249] Further, in accordance with section IV.E.8.b, Duke has made provision for a near-site facility—the Kings Mountain Facility—that will provide adequate space, supplies, and data and communications capability to support the NRC and other emergency responders so that they may "interact face-to-face with emergency response personnel entering and leaving the . . . [Lee] site."[250] We find that the proposed license condition and the ITAAC associated with the consolidated EOF are appropriately drawn to ensure the functionality of the EOF with respect to the Lee site.[251] Therefore, we approve Duke's request to consolidate the Lee EOF with its existing facility in Charlotte, North Carolina.

With regard to our findings for issuance of the combined licenses, we have conducted an independent review of the sufficiency of the Staff's safety findings, with particular attention to the topics discussed above. Our findings, however, are based on the entire record. Based on the evidence presented in the uncontested hearing, including the Staff's review documents and the testimony provided, we find that the applicable standards and requirements of the AEA and NRC regulations have been met. The required notifications to other agencies or bodies have been duly made.[252] We find that Duke is technically and financially qualified to engage in the

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[249] 10 C.F.R. pt. 50, app. E, IV.E.8.a(i); *see, e.g.*, Ex. NRC-011D, Emergency Plan, app. 9.

[250] 10 C.F.R. pt. 50, app. E, IV.E.8.b; *see, e.g.*, Ex. DEC-006, Duke Safety Presentation, at 5-6.

[251] *See, e.g.*, Ex. NRC-009-R, FSER at 13-60 to 13-63; Tr. at 95-96 (Mr. Thomas).

[252] The Staff notified the Public Service Commission of South Carolina, the North Carolina Utilities Commission, and FERC about the combined license application in December 2011. Ex. NRC-001, Staff Information Paper, at 25-26. The Staff published notices of the application in

activities authorized. We further find that there is reasonable assurance that the facility will be constructed and operated in conformity with the licenses, the provisions of the AEA, and the NRC's regulations and that issuance of the licenses will not be inimical to the common defense and security or to the health and safety of the public. In addition, we find that the proposed regulatory exemptions meet the standards in 10 C.F.R. § 50.12. And finally, we find that the proposed license conditions are appropriately drawn and sufficient to provide reasonable assurance of adequate protection of public health and safety.

We also conducted an independent review of the Staff's environmental analysis in the Final EIS, taking into account the particular requirements of NEPA. 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 decision-making that may impact the environment.[253] We find that the environmental review team used the systematic, interdisciplinary approach that NEPA requires.[254]

NEPA section 102(2)(C) requires us to assess the relationship between short-term uses and long-term productivity of the environment, to consider alternatives, and to describe the unavoidable adverse environmental impacts and the irreversible and irretrievable commitments

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the Federal Register on November 18, 2011, November 25, 2011, December 2, 2011, and December 9, 2011 (at 76 Fed. Reg. 71,608; 76 Fed. Reg. 72,725; 76 Fed. Reg. 75,566; and 76 Fed. Reg. 77,021, respectively). Ex. NRC-001, Staff Information Paper, at 26.

[253] 42 U.S.C. § 4332(2)(A).

[254] *See, e.g.*, Tr. at 58-62 (Mr. Lee) (providing an overview of the Staff's environmental review methodology); Ex. NRC-012, Staff Overview Presentation, at 9-13. The environmental review team consisted of individuals with expertise in disciplines including ecology, geology, hydrology, radiological health, socioeconomics, and cultural resources. Ex. NRC-010, Final EIS, app. A. The team consisted of individuals from the NRC and the Corps. *Id.*

of resources associated with the proposed action.[255] The discussion of alternatives is in Chapter 9 of the Final EIS; the other items are discussed in Chapter 10.[256] The review team found the principal short-term benefit of the project to be the production of electrical energy.[257] The review team also found that the economic productivity of the site would be much greater hosting the reactors than it would if used for agriculture, mining, or other probable uses for the site.[258] With regard to long-term productivity, the review team noted that there would be an impact if the plant were not immediately dismantled at the end of operation, but the team found that "the enhancement of regional productivity resulting from electrical-energy production by the plant is expected to result in a correspondingly large increase in regional long-term productivity that would not be equaled by other long-term uses of the site."[259]

NEPA section 102(2)(E) calls for agencies to study, develop, and describe appropriate alternatives.[260] The alternatives analysis is the "heart of the environmental impact statement."[261] Based on the discussion in the Final EIS, the Staff's testimony, and its responses to pre-hearing questions, we find that the Staff identified an appropriate range of alternatives with respect to alternative power sources, alternative sites, and alternative system designs and adequately

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[255] 42 U.S.C. § 4332(2)(C)(ii)-(v).

[256] Ex. NRC-010, Final EIS, chs. 9-10.

[257] *Id.* at 10-16.

[258] *Id.*

[259] *Id.* The review team also noted that "most long-term impacts resulting from land-use preemption by plant structures can be eliminated by removing these structures or by converting them to other productive uses." *Id.*

[260] 42 U.S.C. § 4332(2)(E).

[261] 10 C.F.R. pt. 51, app. A, § 5.

described the environmental impacts of each alternative.[262] We find reasonable the Staff's conclusion that none of the alternatives considered is environmentally preferable to the proposed action.[263]

Chapter 10 of the Final EIS includes tables listing the unavoidable adverse environmental impacts during preconstruction, construction, and operation, along with actions to mitigate those impacts.[264] The review team found that the unavoidable impacts during preconstruction and construction would be small for the following resource areas: water use, water quality, demography, economic impacts on the community, environmental justice, air quality, non-radiological health, radiological health, and nonradioactive waste.[265] The preconstruction and construction impacts for land use, terrestrial and aquatic ecology, physical resources, and historic and cultural resources would be moderate, but when considering NRC-authorized construction activities only, the impacts would be small.[266] The preconstruction and construction impacts to infrastructure and community services would be moderate for traffic impacts; all other infrastructure and community service impacts would be small.[267] For operation, the review team found that the unavoidable adverse impacts would be small for all resource areas.[268]

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[262] *See, e.g.*, Tr. at 150-51; Ex. NRC-010, Final EIS, ch. 9.

[263] *See, e.g.*, Ex. NRC-010, Final EIS at 10-20 to 10-21.

[264] *Id.* tbls.10-1 & 10-2.

[265] *Id.* tbl.10-1.

[266] *Id.*

[267] *Id.*

[268] *Id.* tbl.10-2.

Finally, with regard to irreversible and irretrievable commitments of resources, the review team concluded that disposal of radioactive and nonradioactive wastes would require an irreversible commitment of land and that over 24,600 gallons per minute of cooling water would be lost through evaporation during operation.[269] There would be some losses to terrestrial biota at the site—"[o]f particular note, the loss of habitat at Make-Up Pond C would permanently reduce wildlife populations in the London Creek watershed and the functionality of the watershed as a wildlife travel corridor."[270] With respect to aquatic biota, the review team found that preconstruction and construction activities "would result in a permanent change to an estimated 9.37 ac[res] of open water on the Lee Nuclear Station site" and that "[b]uilding Make-Up Pond C would result in permanent effects on an estimated 17.58 ac[res] of open water and 64,911 linear [feet] of stream offsite."[271] Additionally, the review team concluded that "[b]uilding Make-Up Pond C would fundamentally alter the physical and biological characteristics of London Creek, a tributary to the Broad River."[272] According to the review team, building Make-Up Pond C also will result in the permanent alteration of historic and cultural resources—specifically, "[t]he Service Family Cemetery would be relocated prior to impoundment of London Creek and inundation of the Make-Up Pond C area, permanently altering the cultural setting of

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[269] *Id.* at 10-17.

[270] *Id.* at 10-18.

[271] *Id.*

[272] *Id.*

this cultural resource and its relationship to regional history, settlement patterns, and the historical uses of the land."[273]

During construction of the plant, the review team concluded that the materials used, "while irretrievable, would be of small consequence with respect to the availability of such resources."[274] And with regard to operation of the proposed units, the review team determined that uranium would be irretrievably committed, but the amount would be negligible in comparison to the availability of uranium ore and existing stockpiles of highly enriched uranium in the United States and Russia that could be processed into fuel.[275]

We must weigh these unavoidable adverse environmental impacts and resource commitments—the environmental "costs" of the project—against the project's benefits.[276] Considering the need for power in the region and the expected increase in productivity, jobs, and tax revenue as described in the hearing and in the Final EIS, we find that the benefits of the project outweigh the costs described above. Moreover, we have considered each of the requirements of NEPA section 102(2)(C) and find nothing in the record that would contradict the Staff's conclusions on those requirements.

In sum, for each of the environmental topics discussed at the hearing and in this decision, 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, we also find that the

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[273] *Id.* at 10-19.

[274] *Id.*

[275] *Id.* at 10-19 to 10-20.

[276] 10 C.F.R. § 51.107(a).

remainder of the Final EIS was reasonably supported and sufficient to support the Staff's conclusions.

Therefore, as a result of our review of the Final EIS, and in accordance with the Notice of Hearing for this uncontested proceeding, we find that the requirements of NEPA section 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. 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 Duke's combined license application was sufficient to support the findings in 10 C.F.R. §§ 52.97(a) and 51.107(a). We *approve* Duke's request to consolidate the Lee EOF with the existing EOF at its corporate headquarters in Charlotte, North Carolina. We *authorize* the Director of the Office of New Reactors to issue the combined licenses for the construction and operation of William States Lee III Nuclear Station, Units 1 and 2. And finally, we *authorize* the Staff to issue the record of decision.

IT IS SO ORDERED.

For the Commission

NRC SEAL

/RA/

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Annette L. Vietti-Cook
Secretary of the Commission

Dated at Rockville, Maryland,
this 15th day of December 2016.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of	)	
	)	
DUKE ENERGY CAROLINAS, LLC	)	Docket Nos. 52-018-COL
	)	52-019-COL
(William States Lee III Nuclear Station Units 1 and 2)	)	
	)	
(Mandatory Hearing)	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of the foregoing **COMMISSION MEMORANDUM AND ORDER (CLI-16-19)** have been served upon the following persons by Electronic Information Exchange.

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[Original signed by Herald M. Speiser]
Office of the Secretary of the Commission

Dated at Rockville, Maryland,
this 15th day of December, 2016