

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION  
ATOMIC SAFETY AND LICENSING BOARD

Before Administrative Judges:

Paul S. Ryerson, Chairman  
Dr. Gary S. Arnold  
Dr. Craig M. White

In the Matter of

PSEG POWER, LLC AND PSEG  
NUCLEAR, LLC

(Early Site Permit Application)

Docket No. 52-043-ESP

ASLBP No. 15-943-01-ESP-BD01

April 26, 2016

INITIAL DECISION

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Before the Atomic Safety and Licensing Board (the Board) is an application from PSEG Power, LLC and PSEG Nuclear, LLC (collectively PSEG) for a 10 C.F.R. Part 52, Subpart A Early Site Permit (ESP).<sup>1</sup> In its ESP application, PSEG proposes a site for a potential nuclear power facility adjacent to two existing facilities in Salem County, New Jersey (the PSEG site).<sup>2</sup> An ESP is a “partial construction permit.”<sup>3</sup> However, “an ESP is not an authorization to construct or operate a nuclear power plant. It relates only to site suitability.”<sup>4</sup>

Pursuant to Section 189a(1)(A) of the Atomic Energy Act (AEA), 42 U.S.C. § 2239(a)(1)(A), and 10 C.F.R. § 52.21, this Board was constituted to conduct a mandatory (uncontested) hearing concerning PSEG’s ESP application.<sup>5</sup> Licensing boards have an “important but limited role” in such proceedings, in which the only parties are the applicant and the NRC Staff.<sup>6</sup> The Commission expects “licensing boards conducting mandatory hearings on uncontested issues to take an independent ‘hard look’ at NRC Staff safety and environmental

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<sup>1</sup> See 75 Fed. Reg. 68,624, 68,624 (Nov. 8, 2010)

<sup>2</sup> The existing nuclear power facilities are Salem Generating Station Units 1 and 2 and Hope Creek Generating Station Unit 1. Ex. NRC003, at 1-1 (Safety Evaluation of the Early Site Permit Application in the Matter of PSEG Power, LLC and PSEG Nuclear, LLC for the PSEG Early Site Permit Site at 1-1 (Sept. 2015)).

<sup>3</sup> 10 C.F.R. § 52.1(a); Exelon Generation Co., LLC (Early Site Permit for Clinton ESP Site), CLI-07-12, 65 NRC 203, 205 (2007).

<sup>4</sup> See Clinton ESP Site, CLI-07-12, 65 NRC at 205. “If an applicant includes a satisfactory site redress plan, an ESP holder may conduct certain site preparation activities under a ‘limited work authorization’ granted under 10 C.F.R. § 50.10(e).” Va. Electric & Power Co. (N. Anna Power Station, Unit 3), LBP-08-15, 68 NRC 294, 307 n.58 (2008) (citing 10 C.F.R. § 52.27); see also 10 C.F.R. § 50.10(d)(3). PSEG’s ESP application did not request a limited work authorization.

<sup>5</sup> Establishment of Atomic Safety and Licensing Board (Sept. 25, 2015); see also 80 Fed. Reg. 58,793 (Sept. 30, 2015).

<sup>6</sup> Exelon Generation Co., LLC (Early Site Permit for Clinton ESP Site), CLI-05-17, 62 NRC 5, 41 (2005).

findings.”<sup>7</sup> However, licensing boards are “not to replicate NRC Staff work.”<sup>8</sup> The Commission has directed that licensing boards “should conduct a simple ‘sufficiency’ review of uncontested issues, not a de novo review.”<sup>9</sup>

After reviewing the Final Environmental Impact Statement (FEIS) and Safety Evaluation Report (SER) prepared by the NRC Staff (including the license conditions imposed by the Staff), the prefiled testimony and exhibits filed by the Staff and PSEG, the oral testimony heard over the course of a one-day evidentiary hearing, and the complete record of this proceeding, the Board finds that the application and record of this proceeding contain sufficient information to support issuance of PSEG’s requested ESP and that the Staff’s review of the application has been adequate to support its independent safety and environmental findings. We have also independently considered the final balance among conflicting environmental and other factors with a view to determining the appropriate action to be taken, and determined that an ESP should be issued.

#### I. BACKGROUND

On May 25, 2010, PSEG submitted its initial ESP application to the NRC.<sup>10</sup> PSEG’s proposed site is located on the southern part of Artificial Island in Lower Alloways Creek Township in New Jersey.<sup>11</sup> “Artificial Island was formed from dredge spoils produced as a result of maintenance dredging of the Delaware River navigation channel by the [U.S. Army Corps of

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<sup>7</sup> Clinton ESP Site, CLI-05-17, 62 NRC at 34.

<sup>8</sup> Id.

<sup>9</sup> Id. at 39; see also Nuclear Innovation N. Am. LLC (S. Texas Project Units 3 & 4), CLI-16-02, 82 NRC \_\_, \_\_ (slip op. at 7) (Feb. 9, 2016).

<sup>10</sup> See Letter from David P. Lewis, PSEG Nuclear Development Project Director, & Paul J. Davison, Vice President, PSEG Operations Support to NRC (May 25, 2010) (ADAMS Accession No. ML101480484).

<sup>11</sup> Ex. NRC004A, 1 Environmental Impact Statement for an Early Site Permit (ESP) at the PSEG Site at 2-1 (Nov. 2015) [hereinafter Ex. NRC004A].

Engineers (USACE)].”<sup>12</sup> The proposed site is also adjacent to three existing nuclear power units on Artificial Island—Salem Generating Station Units 1 and 2 and Hope Creek Generating Station Unit 1.<sup>13</sup>

Pursuant to 10 C.F.R. Part 52, PSEG was not required to select a specific unit design at the ESP stage.<sup>14</sup> Rather, PSEG’s application referred to a plant parameter envelope (PPE) “as a surrogate for a nuclear power plant and its associated facilities.”<sup>15</sup> As stated in the FEIS, “[a] PPE is a set of values of plant design parameters that an ESP applicant expects would bound the design characteristics of the reactor or reactors that might be constructed at a given site.”<sup>16</sup> Accordingly, the PPE approach allows PSEG to “defer the selection of a reactor design until the construction permit (CP) or combined construction permit and operating license (combined license or COL) stage.”<sup>17</sup>

The NRC Staff conducted a four-phase safety review of PSEG’s application.<sup>18</sup> First, the NRC Staff identified several areas of concern and submitted requests for additional information

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<sup>12</sup> Id.

<sup>13</sup> Id.

<sup>14</sup> See Ex. NRC004A, at 3-4 (“An applicant for an ESP need not provide a detailed design of a reactor or reactors and the associated facilities but should provide sufficient values for parameters for the reactor or reactors and the associated facilities so that an assessment of site suitability can be made.”); see also Exelon Generation Co., LLC (Early Site Permit for Clinton ESP Site), LBP-06-28, 64 NRC 460, 467-68 (2006), permit issuance authorized, CLI-07-12, 65 NRC 203 (2007).

<sup>15</sup> Ex. NRC004A, at 1-2, 3-5.

<sup>16</sup> Id. at 3-4 to 3-5.

<sup>17</sup> Id. at 3-5. PSEG utilized information from the following reactor designs in developing the PPE for its proposed site: (1) Single Unit U.S. Evolutionary Power Reactor; (2) Single Unit Advanced Boiling Water Reactor; (3) Single Unit U.S. Advanced Pressurized Water Reactor; and (4) Dual Unit Advanced Passive 1000. Ex. NRC003, at 1-3.

<sup>18</sup> Ex. NRC003, at xvii.

to PSEG.<sup>19</sup> Second, the NRC Staff reviewed PSEG's responses to these requests and issued chapter-specific Advanced Safety Evaluations (ASEs).<sup>20</sup> Having resolved any outstanding concerns, there were no open items when the Staff completed the ASEs.<sup>21</sup> Next, the NRC Staff submitted the ASEs to the NRC Advisory Committee on Reactor Safeguards (ACRS).<sup>22</sup> The ACRS is an independent committee of technical experts who, pursuant to the Atomic Energy Act, "advise the Commission with regard to the hazards of proposed or existing reactor facilities and the adequacy of proposed reactor safety standards."<sup>23</sup> At the conclusion of its independent review, the ACRS determined that the ESP should be issued.<sup>24</sup> Finally, on September 29, 2015, the NRC Staff issued the final SER on PSEG's application.

The SER concludes that "one or two reactors, having characteristics that fall within the parameters for the site, and which meet the terms and conditions proposed by the staff in this SER, can be constructed and operated without undue risk to the health and safety of the public."<sup>25</sup> The SER also specifies nine permit conditions.<sup>26</sup> For example, two of the permit conditions address geology, seismology, and geotechnical engineering.<sup>27</sup> One such condition requires that:

[a]n applicant for a COL or CP referencing this early site permit shall perform detailed geologic mapping of excavations for safety-related structures; examine

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<sup>19</sup> Id.

<sup>20</sup> Id.

<sup>21</sup> Id.

<sup>22</sup> Id.

<sup>23</sup> 42 U.S.C. § 2039; see also id. § 2232(b).

<sup>24</sup> Ex. NRC003, App. E, at E-2.

<sup>25</sup> Id. at 22-1.

<sup>26</sup> Id., App. A, at A-2 to A-6.

<sup>27</sup> Id. at A-3.

and evaluate geologic features discovered in those excavations; and notify the Director of the Office of New Reactors . . . once excavations for safety-related structures are open for examination by NRC staff.<sup>28</sup>

Another permit condition requires that “[a]n applicant for a COL or CP [r]eferring this early site permit shall remove and replace the soils directly above the Vincentown Formation for soils under or adjacent to Seismic Category I structures to minimize any liquefaction potential.”<sup>29</sup>

Two other permit conditions address several issues with control over the proposed location’s exclusion area<sup>30</sup> and planning regarding possible explosions associated with gasoline storage and delivery.<sup>31</sup> The remaining five permit conditions address emergency planning.<sup>32</sup>

The NRC Staff also performed an environmental review. On October 15, 2010, in accordance with 10 C.F.R. § 51.26, the NRC published a notice of intent to prepare an environmental impact statement.<sup>33</sup> Thereafter, the NRC Staff conducted two public meetings near the proposed site and considered fifty-one written and oral public comments submitted in response to these public meetings.<sup>34</sup> In conducting its environmental review, the NRC Staff also consulted with federal, state, and local authorities, including but not limited to the U.S. Fish and Wildlife Service, the New Jersey Department of Environmental Protection (NJDEP), and the

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<sup>28</sup> Id.

<sup>29</sup> Id.

<sup>30</sup> 10 C.F.R. § 100.3 defines exclusion area as the “area surrounding the reactor, in which the reactor licensee has the authority to determine all activities including exclusion or removal of personnel and property from the area.”

<sup>31</sup> Id., App. A, at A-2 to A-3.

<sup>32</sup> Id. at A-4 to A-6.

<sup>33</sup> 75 Fed. Reg. 63,521, 63,521 (Oct. 15, 2010).

<sup>34</sup> See NRC Environmental Impact Statement Scoping Process Summary Report, PSEG [ESP] Application (Sept. 2011) at 3 (ADAMS Accession No. ML112150127).

State of Delaware Office of Historical and Cultural Affairs.<sup>35</sup> Further, “in support of its proposed action of issuing a Department of the Army permit, the U.S. Army Corps of Engineers . . . participated in the preparation of the EIS as a cooperating agency and as a collaborative member of the review team.”<sup>36</sup>

In August of 2014 the Staff published a Draft Environmental Impact Statement (DEIS).<sup>37</sup> After the DEIS was published, the NRC Staff held two public meetings: one in Carneys Point, New Jersey on October 1, 2014, and one in Middletown, Delaware on October 23, 2014.<sup>38</sup> Approximately two hundred and fifteen people attended these public meetings.<sup>39</sup> In addition to oral comments at the two public meetings, the NRC received forty-five letters and e-mails containing written comments.<sup>40</sup> On November 13, 2015, the NRC Staff posted the Final Environmental Impact Statement (FEIS) on the NRC public website.<sup>41</sup>

The Commission published a Notice of Hearing in the Federal Register on November 8, 2010.<sup>42</sup> No petitions to intervene under 10 C.F.R. § 2.309 or petitions to participate as an interested governmental entity under 10 C.F.R. § 2.315(c) were submitted.

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<sup>35</sup> Ex. NRC004A at xxiii.

<sup>36</sup> Id.

<sup>37</sup> [DEIS] for an [ESP] at the PSEG Site (Aug. 2014) (ADAMS Accession No. ML14219A304).

<sup>38</sup> Ex. NRC004A, at xxiv.

<sup>39</sup> See id.

<sup>40</sup> Ex. NRC004C, 3 Environmental Impact Statement for an Early Site Permit (ESP) at the PSEG Site, App. E, at E-2 (Nov. 2015) [hereinafter Ex. NRC004C].

<sup>41</sup> Licensing Board Order (Initial Scheduling Order) (Nov. 16, 2015) at 4 (unpublished) [hereinafter Initial Scheduling Order].

<sup>42</sup> 75 Fed. Reg. at 68,625.



This Board was established on September 25, 2015.<sup>43</sup> On January 14, 2016, the parties responded to the Board's initial written questions regarding the SER.<sup>44</sup> On January 28, 2016, the parties responded to the Board's second set of written questions primarily concerning the FEIS.<sup>45</sup>

After reviewing the parties' answers to the Board's initial written questions, the Board concluded that many of the parties' answers resolved its concerns on a given issue and established an adequate record.<sup>46</sup> As contemplated by the Initial Scheduling Order,<sup>47</sup> the Board identified issues on which it still had questions and wished to review more detailed prefiled testimony and exhibits.<sup>48</sup> On February 25, 2016, the Staff and PSEG submitted their prefiled written testimony and exhibits as directed by the Board's orders.<sup>49</sup>

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<sup>43</sup> 80 Fed. Reg. at 58,793.

<sup>44</sup> PSEG Responses to Initial Board Questions (Jan. 14, 2016); NRC Staff Response to the Licensing Board's Initial Questions Issued December 15, 2015 (Jan. 14, 2016); see also Licensing Board Memorandum and Order (Initial Board Questions and Associated Administrative Directives) (Dec. 15, 2015) (unpublished) [hereinafter December 15, 2015 Questions Order].

<sup>45</sup> PSEG Responses to Second Set of Board Questions (Jan. 28, 2016); NRC Staff Response to the Licensing Board's Second Set of Questions Issued January 6, 2016 and Other Matters (Jan. 28, 2016); see also Licensing Board Memorandum and Order (Second Set of Board Questions and Associated Administrative Directives) (Jan. 6, 2016) (unpublished) [hereinafter January 6, 2016 Questions Order].

<sup>46</sup> Licensing Board Memorandum and Order (Identifying Areas for Prefiled Testimony) (Jan. 27, 2016) at 1-2 (unpublished) [hereinafter SER Prefiled Testimony Order]; Licensing Board Memorandum and Order (Identifying Additional Areas for Prefiled Testimony) (Feb. 8, 2016) at 1-2 (unpublished) [hereinafter FEIS Prefiled Testimony Order].

<sup>47</sup> Initial Scheduling Order at 3-4.

<sup>48</sup> SER Prefiled Testimony Order at 2-3; FEIS Prefiled Testimony Order at 2-3.

<sup>49</sup> See SER Prefiled Testimony Order at 3; FEIS Prefiled Testimony Order at 4.

The Board conducted an evidentiary hearing on March 24, 2016.<sup>50</sup> Except as specifically excused prior to the hearing,<sup>51</sup> all twenty-two witnesses who submitted prefiled testimony were present and available to answer the Board's questions. The Board admitted without objection all prefiled exhibits submitted by either party.<sup>52</sup> On April 11, 2016, the Board accepted the parties' proposed transcript corrections and closed the evidentiary record.<sup>53</sup>

## II. LEGAL STANDARDS

Pursuant to 42 U.S.C. § 2239, "[t]he Commission shall hold a hearing . . . on each application under section 2133 or 2134(b) of this title for a construction permit for a facility."<sup>54</sup> ESP applications, as partial construction permit applications, are subject to the AEA hearing requirement, as well as "all procedural requirements in 10 C.F.R. part 2."<sup>55</sup>

In a mandatory, uncontested hearing, this Board's review is a limited one. The NRC Staff and PSEG agree that this Board must determine whether seven requirements are satisfied.<sup>56</sup> Pursuant to 10 C.F.R. § 52.24(a), an ESP may issue if the Board finds, among other things, that:

- (1) An application for an early site permit meets the applicable standards and requirements of the Act and the Commission's regulations;

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<sup>50</sup> Tr. at 62-185. On February 8, 2016, the Board issued a Notice of Hearing pursuant to 10 C.F.R. § 2.104. Licensing Board Order (Notice of Hearing) (Feb. 8, 2016). The Notice of Hearing was published in the Federal Register on February 16, 2016. 81 Fed. Reg. 7835, 7835 (Feb. 16, 2016).

<sup>51</sup> Licensing Board Memorandum and Order (Identifying Resolved Topics) (Mar. 15, 2016) at 1 (unpublished).

<sup>52</sup> Tr. at 70-72.

<sup>53</sup> Licensing Board Order (Approving Joint Proposed Transcript Corrections) (Apr. 11, 2016) (unpublished).

<sup>54</sup> 42 U.S.C. § 2239(a)(1)(A).

<sup>55</sup> 10 C.F.R. § 52.21; see also Sys. Energy Res., Inc. (Early Site Permit for Grand Gulf ESP Site), LBP-07-1, 65 NRC 27, 35, permit issuance authorized, CLI-07-14, 65 NRC 216 (2007).

<sup>56</sup> See Initial Scheduling Order at 2, Attach. A; Tr. at 14-15.

(2) Notifications, if any, to other agencies or bodies have been duly made;

(3) There is reasonable assurance that the site is in conformity with the provisions of the Act, and the Commission's regulations;

(4) The applicant is technically qualified to engage in any activities authorized;

(5) The proposed inspections, tests, analyses and acceptance criteria, including any on emergency planning, are necessary and sufficient, within the scope of the early site permit, to provide reasonable assurance that the facility has been constructed and will be operated in conformity with the license, the provisions of the Act, and the Commission's regulations;

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

...

(8) The findings required by subpart A of 10 CFR part 51 have been made.<sup>57</sup>

Pursuant to § 52.24(a)(8), the provisions of 10 C.F.R. § 51.105(a) further require the

Board to:

(1) Determine whether the requirements of Sections 102(2) (A), (C), and (E) of [the National Environmental Policy Act (NEPA)] and the regulations in this subpart 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 construction permit or early site permit

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<sup>57</sup> 10 C.F.R. § 52.24(a)(1)-(6), (8). 10 C.F.R. § 52.24(a)(7) states that an ESP may issue if the Board finds that "[a]ny significant adverse environmental impact resulting from activities requested under § 52.17(c) can be redressed." 10 C.F.R. § 52.17(c) allows an applicant to request a limited work authorization in conjunction with an ESP. Because PSEG has not requested a limited work authorization, this section does not apply. Additionally, 10 C.F.R. § 52.24(b) states that, if the Commission decides to authorize issuance of the ESP, the issued ESP "must specify the site characteristics, design parameters, and terms and conditions of the [ESP] the Commission deems appropriate."

should be issued, denied, or appropriately conditioned to protect environmental values;<sup>58</sup> [and]

(4) Determine, in an uncontested proceeding, whether the NEPA review conducted by the NRC staff has been adequate . . . .<sup>59</sup>

When addressing these questions, licensing boards are not expected to conduct a de novo review of safety or environmental issues, but rather “a simple ‘sufficiency’ review of uncontested issues.”<sup>60</sup> Licensing boards must “take an independent ‘hard look’ at NRC Staff safety and environmental findings, but not . . . replicate NRC Staff work. Giving appropriate deference to NRC Staff technical expertise, boards are to probe the logic and evidence

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<sup>58</sup> Pursuant to 10 C.F.R. § 52.21, an applicant’s environmental report and the NRC Staff’s environmental impact statement for an ESP application are not required to address the benefits of constructing and operating the facility as distinct from the benefits of issuing an ESP. See 10 C.F.R. § 52.21 (“An early site permit is subject to all procedural requirements in 10 CFR part 2 . . . provided that the designated sections may not be construed to require that the environmental report, or draft or final environmental impact statement include an assessment of the benefits of construction and operation of the reactor or reactors, or an analysis of alternative energy sources.”); see also Licenses, Certifications, and Approvals for Nuclear Power Plants, 72 Fed. Reg. 49,352, 49,434 (Aug. 28, 2007). However, where, as here, the applicant’s environmental report and the NRC Staff’s FEIS do evaluate energy alternatives and the need for power, see FEIS at 8-1, the Board must consider these issues in weighing the costs and benefits of the application. See 72 Fed. Reg. at 49,434 (“If the applicant has addressed all of the costs and benefits associated with construction and operation of the facility in its environmental report, the final balancing between costs and benefits needs to occur at the early site permit stage.”). Prior to the most recent amendments to 10 C.F.R. § 52.21 in 2007, several Commission and Board decisions took a contrary view. See, e.g., Clinton ESP Site, CLI-05-17, 62 NRC at 47; Exelon Generation Co., LLC (Early Site Permit for Clinton ESP Site), LBP-06-28, 64 NRC 460, 487 (2006), permit issuance authorized, CLI-07-12, 65 NRC 203 (2007); Dominion Nuclear N. Anna, LLC (Early Site Permit for N. Anna ESP Site), LBP-07-9, 65 NRC 539, 615, permit issuance authorized, CLI-07-27, 66 NRC 215 (2007).

<sup>59</sup> 10 C.F.R. § 51.105(a)(1)-(4). Because this is an uncontested proceeding, 10 C.F.R. § 51.105(a)(5), which concerns only contested cases, does not apply.

<sup>60</sup> Clinton ESP Site, CLI-05-17, 62 NRC at 39. The Commission has directed that:

[Licensing boards] should inquire whether the NRC Staff performed an adequate review and made findings with reasonable support in logic and fact. “An analogy is to the function of an appellate court, applying the ‘substantial evidence’ test, although it is imperfect because the ASLB looks not only to the information in the record, but also to the thoroughness of the review that the Staff . . . has given it.”

Id. (footnotes omitted).

supporting NRC Staff findings and decide whether those findings are sufficient to support license issuance.”<sup>61</sup>

Regarding NEPA findings, however, licensing boards are instructed to make independent environmental judgments,<sup>62</sup> although they “need not rethink or redo every aspect of the NRC Staff’s environmental findings or undertake their own fact-finding activities.”<sup>63</sup> A licensing board’s role is to “carefully probe [NRC Staff] findings by asking appropriate questions and by requiring supplemental information when necessary,”<sup>64</sup> but “the NRC Staff’s underlying technical and factual findings are not open to board reconsideration unless, after a review of the record, the board finds the NRC Staff review inadequate or its findings insufficient.”<sup>65</sup> In reaching our independent judgment regarding NEPA issues, licensing boards walk a fine line—our role is not to “second-guess underlying technical or factual findings by the NRC Staff,”<sup>66</sup> but to ensure that the demands of NEPA and our regulations are met through “independent environmental judgments by NRC licensing boards.”<sup>67</sup> Even a licensing board’s NEPA review

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<sup>61</sup> Id. at 34 (footnote omitted).

<sup>62</sup> After a licensing board in an uncontested proceeding determines the NRC Staff’s NEPA review is adequate, it must then “independently consider the final balance among conflicting factors that is struck in the staff’s recommendation.” Calvert Cliffs’ Coordinating Comm., Inc. v. AEC, 449 F.2d 1109, 1118 (D.C. Cir. 1971). The Commission has directed “boards to follow the approach spelled out in the D.C. Circuit’s seminal Calvert Cliffs decision.” Clinton ESP Site, CLI-05-17, 62 NRC at 44.

<sup>63</sup> Clinton ESP Site, CLI-05-17, 62 NRC at 44; see also N. Anna ESP Site, LBP-07-9, 65 NRC at 559-60.

<sup>64</sup> Clinton ESP Site, CLI-05-17, 62 NRC at 40.

<sup>65</sup> Id.

<sup>66</sup> Id. at 45.

<sup>67</sup> Id. at 44 (quoting Consumers Power Co. (Midland Plant, Units 1 & 2), ALAB-123, 6 AEC 331, 335 (1973)).

“must not be so intrusive or detailed as to involve the board in ‘independent basic research’ or a ‘duplicat[ion of] the analysis previously performed by the staff.’”<sup>68</sup>

### III. APPROACH TO EVIDENTARY HEARING

To summarize the posture of this proceeding as it comes before this Licensing Board:

1. PSEG seeks merely an early site permit. If granted, the permit will resolve some important issues. However, PSEG has not yet even selected a reactor design or manufacturer.<sup>69</sup> To obtain permission to construct and operate a reactor on the site, PSEG would have to come back to the NRC and address additional issues.<sup>70</sup>

2. PSEG’s proposal fundamentally requires the NRC merely to decide whether Artificial Island—an uninhabited island created out of dredge spoils that is home to three existing nuclear power reactors—might be an appropriate site for one or two additional nuclear power reactors.<sup>71</sup>

3. After reviewing both the safety aspects and environmental impact of PSEG’s proposal, the NRC Staff recommended issuance of the permit subject to specified conditions.<sup>72</sup>

4. After being afforded the opportunity to seek a contested evidentiary hearing on PSEG’s application, no member of the public or state or local government elected to do so.<sup>73</sup>

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<sup>68</sup> Id. at 45 (footnote omitted).

<sup>69</sup> Ex. NRC004A, at 3-5.

<sup>70</sup> Id.

<sup>71</sup> See id. at 2-1.

<sup>72</sup> See Ex. NRC003, at 22-1, App. A, at A-2 to A-6; Ex. NRC004B, 2 Environmental Impact Statement for an Early Site Permit (ESP) at the PSEG Site at 10-33 (Nov. 2015) [hereinafter Ex. NRC004B].

<sup>73</sup> See Establishment of Atomic Safety and Licensing Board (Sept. 25, 2015); see also 80 Fed. Reg. 58,793 (Sept. 30, 2015).

5. After reviewing PSEG's application, the NRC's independent ACRS recommended that the requested permit be issued.<sup>74</sup>

In these circumstances, some might suggest that a further independent hearing by this Board is redundant and unnecessary. The Atomic Energy Act, as interpreted by the Commission, provides otherwise. A hearing on an application for an early site permit is required by statute regardless of whether the application is opposed.<sup>75</sup> The Board's challenge and responsibility, therefore, has been to conduct this mandatory, uncontested proceeding so as to make a meaningful but efficient contribution to what has already been a lengthy and thorough review of PSEG's application.

The Atomic Energy Act does not prescribe a specific structure for a mandatory hearing, and the Commission has allowed licensing boards flexibility to select the most appropriate approach in the circumstances of each individual case.<sup>76</sup> As the Commission has explained:

As for the actual procedure to be followed at mandatory hearings, licensing boards have considerable flexibility. The AEA's mandatory hearing requirements in sections 189a and 193(b)(1) are phrased generally. "[T]he Act itself nowhere prescribes the content of a hearing or prescribes the manner in which this 'hearing' is to be run." The word "hearing" can refer to any of a number of events, including trial-type evidentiary hearings, "paper hearings," paper hearings accompanied by oral arguments, hearings employing a mixture of procedural rules, and legislative hearings. The AEA's hearing requirement does not demand a "one size fits all" approach. Thus, we do not dictate any particular procedure in the current cases, but we would expect the boards to select the most appropriate and expeditious approach given the specific circumstances of a case.<sup>77</sup>

In determining what structure may best serve the needs of this hearing, the Board heeded the Commission's advice to sharpen our focus by narrowing it:

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<sup>74</sup> Ex. NRC003, App. E, at E-2.

<sup>75</sup> See Atomic Energy Act of 1954, §§ 185b, 189a, 42 U.S.C. §§ 2235(b), 2239(a); Clinton ESP Site, CLI-05-17, 62 NRC at 27-29 (explaining the history of the AEA's mandatory hearing requirement and its applicability to early site permit applications).

<sup>76</sup> See Clinton ESP Site, CLI-05-17, 62 NRC at 42-43.

<sup>77</sup> Id. (footnotes omitted).

A “mandatory hearing” board must narrow its inquiry to those topics or sections in Staff documents that it deems most important and should concentrate on portions of the documents that do not on their face adequately explain the logic, underlying facts, and applicable regulations and guidance. It serves no purpose for the Staff to produce volumes of documents and information supporting facts and conclusions that are of small importance and are beyond dispute. It likewise serves no purpose for the Staff to produce copies of every document used in its review when the Board cannot possibly read through every one, let alone scrutinize them.<sup>78</sup>

Therefore, rather than undertake a comparatively shallow analysis of all possible issues, the Board focused on a relatively thorough examination of selected issues of concern by instituting a multi-step process that narrowed as the Staff and Applicant responded to the questions and concerns of the Board.

First, the Board members reviewed the SER and the FEIS.

Second, on December 15, 2015, and January 6, 2016, the Board set forth a total of ninety detailed written questions arising from the SER and the FEIS, to which it directed the parties to respond.<sup>79</sup> More specifically, we directed that “[t]he parties’ written answers shall, for each question, identify the responding subject matter expert(s) or individuals(s), and shall be submitted in exhibit form, under oath, so that they are suitable for receipt into evidence without the necessity of the personal appearance of each expert or individual.”<sup>80</sup> In other words, we directed the parties to respond under oath to our initial written questions, so that the Board could accord the responses as much weight as we would give sworn testimony presented in person at an evidentiary hearing.

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<sup>78</sup> Exelon Generation Co., LLC (Early Site Permit for Clinton ESP Site), CLI-06-20, 64 NRC 15, 21-22 (2006).

<sup>79</sup> January 6, 2016 Questions Order, Attach. A; December 15, 2015 Questions Order, Attach. A.

<sup>80</sup> Initial Scheduling Order at 4; see also January 6, 2016 Questions Order at 1; December 15, 2015 Questions Order at 1.



The parties responded to the Board's initial written questions on January 15 and 28, 2016.<sup>81</sup> Collectively, the parties' sworn responses totaled some 92 pages, exclusive of the supporting affidavits and resumes of the 36 responding individuals.<sup>82</sup> Because the parties provided substantial and, for the most part, directly responsive answers to the Board's initial questions, the need for written or oral testimony at the evidentiary hearing was reduced to the extent that the parties' sworn answers resolved many of the Board's concerns.

The following illustrate a few of the areas in which the Board's preliminary concerns were adequately addressed by the parties' responses to the Board's initial written questions:<sup>83</sup>

1. The Board was concerned about the extent to which the NRC Staff had independently confirmed PSEG's calculations.<sup>84</sup> The Staff responded that independent calculations were generally performed in significant safety areas and where there appeared to be meaningful uncertainty.<sup>85</sup> It specifically identified five areas in which significant verification calculations were performed (including meteorology, radiation protection, hydrology, vibratory

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<sup>81</sup> PSEG Responses to Initial Board Questions (Jan. 14, 2016) [hereinafter PSEG Response to First Set of Board Questions]; NRC Staff Response to the Licensing Board's Initial Questions Issued December 15, 2015 (Jan. 14, 2016) [hereinafter NRC Staff Response to First Set of Board Questions].

<sup>82</sup> PSEG Response to First Set of Board Questions; NRC Staff Response to First Set of Board Questions; PSEG Response to Second Set of Board Questions (Jan. 28, 2016) [hereinafter PSEG Response to Second Set of Board Questions]; NRC Staff Response to the Licensing Board's Second Set of Questions Issued January 6, 2016 and Other Matters (Jan. 28, 2016) [hereinafter NRC Staff Response to Second Set of Board Questions].

<sup>83</sup> Additionally, as discussed in Section V infra, in other instances the parties' initial responses—while not necessarily fully satisfactory by themselves—were adequate when considered together with subsequent written and oral testimony.

<sup>84</sup> December 15, 2015 Questions Order, Attach. A, ¶ 2.

<sup>85</sup> NRC Staff Response to First Set of Board Questions, Attach. A, at 1.

ground motion, and external manmade hazards)<sup>86</sup> and established that responsible Staff members were appropriately qualified,<sup>87</sup> thereby satisfying our concerns.

2. Because the proposed PSEG site is adjacent to existing nuclear reactors, the Board was interested both in whether the NRC Staff was able to conserve resources during its review by relying on existing information regarding those facilities and in whether cumulative safety-related effects were adequately considered.<sup>88</sup> First, the NRC Staff clarified that it reviewed the ESP application to determine whether it independently contained adequate information to support the ultimate decision.<sup>89</sup> Second, the NRC Staff described specific areas (including meteorology, radiation protection, hydrology, external manmade hazards, and emergency planning) where cumulative effects from existing units might arise, thus requiring that they be considered.<sup>90</sup> Based on the NRC Staff's responses, the Board's concerns regarding these issues were resolved.

3. The Board identified other concerns—arising from the potential interplay between a new power facility at the PSEG site and existing reactors—with respect to meteorology, flooding hazards, geology, and emergency planning.<sup>91</sup> The NRC Staff explained that its review of meteorology at the PSEG site did not consider the meteorological descriptions in safety documents for existing reactors, but that the Staff did review historical meteorological data collected at an onsite tower associated with the existing reactors.<sup>92</sup> Similarly, the NRC Staff

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<sup>86</sup> Id. at 2-4.

<sup>87</sup> Id.

<sup>88</sup> December 15, 2015 Questions Order, Attach. A, ¶¶ 4-5.

<sup>89</sup> NRC Staff Response to First Set of Board Questions, Attach. A, at 4.

<sup>90</sup> Id. at 4-5.

<sup>91</sup> December 15, 2015 Questions Order, Attach. A, ¶¶ 13, 19, 42, 52.

<sup>92</sup> NRC Staff Response to First Set of Board Questions, Attach. A, at 8.

explained that consideration of flooding hazards made use of related meteorological conditions for all units.<sup>93</sup> The NRC Staff stated that it also examined geologic information from the existing reactors' safety-related documents and confirmed that there are no significant differences regarding the PSEG site.<sup>94</sup> Likewise, the NRC Staff confirmed that the PSEG site emergency plan does not significantly differ from the plans for the existing reactors, except as required to incorporate the future selection of a reactor design.<sup>95</sup> Based on the parties' responses, the Board was satisfied that the NRC Staff had adequately considered the relationship between the PSEG site and the existing reactors on Artificial Island.

4. The Board was concerned about aspects of atmospheric stability and dispersion of radioactive material if a release were to occur.<sup>96</sup> The NRC Staff explained that, based on design height release assumptions—for a flat terrain like the PSEG site—a ground level release is generally conservative, which is consistent with NRC guidance.<sup>97</sup> Because the atmosphere is less dispersive at lower levels, and because less dispersion results in greater exposure to those in the plume pathway, assuming a ground level release results in greater exposure and is therefore conservative.<sup>98</sup> Additionally, the Staff explained, it is conservative to disregard building wakes because they are dispersive in nature.<sup>99</sup> Regarding the possible rise of a hot plume from above ground level, the NRC Staff acknowledged this possibility, but noted that the

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<sup>93</sup> Id. at 11.

<sup>94</sup> Id. at 25.

<sup>95</sup> Id. at 30.

<sup>96</sup> December 15, 2015 Questions Order, Attach. A, ¶¶ 14-16.

<sup>97</sup> NRC Staff Response to First Set of Board Questions, Attach. A, at 8-9.

<sup>98</sup> See id. at 9.

<sup>99</sup> See id.

higher altitude of the rise would result in greater dispersion and lower exposures.<sup>100</sup> Hence, not accounting for this possibility represented a conservative approach.<sup>101</sup> Lastly, the NRC Staff explained that assessing dispersion of airborne radioactive material in the reactor control room was not a necessary future action item, because this issue will necessarily be reviewed if and when PSEG applies for a COL.<sup>102</sup> Based on these responses, the Board was satisfied that the dispersion of radioactive material was adequately reviewed and subject to conservative assumptions.

5. The Board identified several concerns regarding the NRC Staff's review of PSEG's evaluation of the probable maximum surge and seiche flooding at the PSEG site.<sup>103</sup> The Board questioned the sensitivity of surface water elevation to the radius of maximum winds (radius value) for a hurricane, and why the assumption of 28 nautical miles for that radius value is conservative.<sup>104</sup> The NRC Staff responded that "[i]n general, keeping all other storm surge parameters constant, hurricane central pressure and resultant storm intensity decreases as [radius value] (storm size) increases."<sup>105</sup> As a result, a lower radius value yields a higher storm surge.<sup>106</sup> Furthermore, the NRC Staff stated that the largest storm surge recorded in the United States resulted from Hurricane Katrina, which had a radius value of 30 nautical miles.<sup>107</sup>

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<sup>100</sup> See id.

<sup>101</sup> See id.; see also PSEG Response to First Set of Board Questions, Attach. A, at 9.

<sup>102</sup> NRC Staff Response to First Set of Board Questions, Attach. A, at 10.

<sup>103</sup> December 15, 2015 Questions Order, Attach. A, ¶¶ 21-25.

<sup>104</sup> Id. ¶ 21.

<sup>105</sup> NRC Staff Response to First Set of Board Questions, Attach. A, at 12.

<sup>106</sup> See id.

<sup>107</sup> Id.

Therefore, the NRC Staff considered a radius value of 28 nautical miles to be conservative.<sup>108</sup> The Board also raised concerns regarding PSEG's evaluation of the maximum surge and seiche flooding using the SLOSH and ADCIRC+SWAN models.<sup>109</sup> The NRC Staff explained that, in one instance, PSEG had misapplied the SLOSH model in a context outside of its range of applicability.<sup>110</sup> After re-performing the analysis using the ADCIRC+SWAN model, the NRC Staff relied on those figures in making its safety findings.<sup>111</sup> Based on the NRC Staff's responses (together with the Board's own analysis of information in the SER), the Board's concerns regarding maximum surge and seiche flooding were resolved.

6. The Board raised concerns regarding several aspects of the NRC Staff's tsunami evaluation.<sup>112</sup> For example, the Board directed the Staff to support the conservatism of the probable maximum tsunami by considering historical information regarding a landslide in the Grand Banks resulting in a large tsunami along the coast of Newfoundland.<sup>113</sup> The NRC Staff replied that events similar to those in the Newfoundland example could occur; however, the landslide used for the safety evaluation was larger than that in Newfoundland and resulted in a tsunami of essentially the same height.<sup>114</sup> Moreover, the modeled event would not pose a hazard to the PSEG site because the height of the tsunami would be substantially reduced as it traveled up the Delaware Bay—unlike conditions along the coast of Newfoundland.<sup>115</sup>

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<sup>108</sup> Id.

<sup>109</sup> December 15, 2015 Questions Order, Attach. A, ¶ 22.

<sup>110</sup> NRC Staff Response to First Set of Board Questions, Attach. A, at 13.

<sup>111</sup> Id.

<sup>112</sup> December 15, 2015 Questions Order, Attach. A, ¶¶ 26-33, 41.

<sup>113</sup> Id. ¶ 27.

<sup>114</sup> See NRC Staff Response to First Set of Board Questions, Attach. A, at 16.

<sup>115</sup> See id.

The Board also directed the NRC Staff to consider an “earthquake located along a northeast trending seismic zone off the eastern coast of the United States” as a tsunami source.<sup>116</sup> The Staff explained that, because of the small motion in the vertical direction, such a source could not result in a large tsunami.<sup>117</sup> The Board further inquired as to whether the detailed geologic mapping to be performed in response to Permit Condition Number 3 would be used for further identification of paleotsunami deposits.<sup>118</sup> The NRC Staff replied that, due to the location and depth of future geologic mapping, if such deposits are present “these deposits would represent paleo-geologic and paleo-hydrologic conditions from so long ago they would not be informative relative to the characteristics of potential future tsunamis at the PSEG site.”<sup>119</sup> Lastly, the Board requested further information regarding inclusive boring logs;<sup>120</sup> more recent models for landslide-sourced tsunami waves along the east coast of the United States;<sup>121</sup> the conservatisms of the tsunami evaluation;<sup>122</sup> and the large attenuation of tsunami wave height within bays.<sup>123</sup> In each instance, the NRC Staff responded by providing recent publications and studies regarding these issues.<sup>124</sup> Based on the NRC Staff’s responses and identification of additional publications and studies, the Board’s concerns regarding tsunami issues were resolved.

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<sup>116</sup> December 15, 2015 Questions Order, Attach. A, ¶ 28.

<sup>117</sup> NRC Staff Response to First Set of Board Questions, Attach. A, at 17.

<sup>118</sup> December 15, 2015 Questions Order, Attach. A, ¶ 41.

<sup>119</sup> NRC Staff Response to First Set of Board Questions, Attach. A, at 25.

<sup>120</sup> December 15, 2015 Questions Order, Attach. A, ¶ 29.

<sup>121</sup> Id. ¶ 31.

<sup>122</sup> Id. ¶ 32.

<sup>123</sup> Id. ¶ 33.

<sup>124</sup> See NRC Staff Response to First Set of Board Questions, Attach. A, at 19-20.

7. The Board also identified various concerns associated with geology and seismology in the PSEG site area.<sup>125</sup> For example, the Board identified a situation in which PSEG defined the region surrounding the proposed site by applying regulatory guidance rather than a specific regulation addressing seismic requirements.<sup>126</sup> In response, both the NRC Staff and PSEG described why compliance with the regulatory guidance was an acceptable approach to satisfying analogous regulatory requirements.<sup>127</sup> In another example, the Board required the NRC Staff to identify those portions of the seismic evaluation that would eventually become design basis information should a COL or CP application be submitted.<sup>128</sup> The NRC Staff responded that, for a plant that does not have a design certification, the ground motion response spectrum (GMRS) developed for the ESP would be used to develop the safe shutdown earthquake spectra.<sup>129</sup> By contrast, for a certified unit, the certified seismic design response spectra (CSDRS) would be compared to the GMRS and either the CSDRS or a modified form of it would be a part of the design basis.<sup>130</sup> Lastly, the Board sought clarification regarding the methods used to identify liquefaction features in the marshland around the PSEG site.<sup>131</sup> The NRC Staff responded that PSEG had performed aerial and field reconnaissance in areas other than the tidal marsh area and identified no evidence of Quaternary seismic

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<sup>125</sup> December 15, 2015 Questions Order, Attach. A, ¶¶ 37-40.

<sup>126</sup> Id. ¶ 37.

<sup>127</sup> See NRC Staff Response to First Set of Board Questions, Attach. A, at 21-22; PSEG Response to First Set of Board Questions, Attach. A, at 18.

<sup>128</sup> December 15, 2015 Questions Order, Attach. A, ¶ 38.

<sup>129</sup> NRC Staff Response to First Set of Board Questions, Attach. A, at 22-23.

<sup>130</sup> Id.

<sup>131</sup> December 15, 2015 Questions Order, Attach. A, ¶ 40.

deformation.<sup>132</sup> Because the NRC Staff found PSEG's evaluation of surface tectonic deformation adequate, the Staff did not find it necessary for PSEG to conduct any additional tests in the tidal marsh area.<sup>133</sup> Based in part on these responses, the Board was satisfied that the geology and seismology of the PSEG site were adequately reviewed.

8. The Board questioned whether the risks from aircraft hazards should be considered on an airport-by-airport basis or in the aggregate.<sup>134</sup> The NRC Staff responded that, for the PSEG site, each nearby airport had been screened out for further consideration because each posed a risk less than  $10^{-7}$ /yr of a crash at the site.<sup>135</sup> However, even if the airports were considered in the aggregate, the sum of risks for all airports in the area would be less than  $10^{-6}$ /yr, which is the upper limit provided under NRC guidance.<sup>136</sup> The NRC Staff's response resolved the Board's concerns regarding this issue.

9. The Board questioned why the calculated radiation doses to the nearest resident (due to normal operations) approached the allowable limit.<sup>137</sup> The NRC Staff responded that it conservatively disregarded the decay during radionuclide transport, which resulted in the calculated dose being conservatively high.<sup>138</sup> The NRC Staff's response resolved the Board's concerns regarding this issue.

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<sup>132</sup> NRC Staff Response to First Set of Board Questions, Attach. A, at 24.

<sup>133</sup> Id.

<sup>134</sup> December 15, 2015 Questions Order, Attach. A, ¶ 45.

<sup>135</sup> NRC Staff Response to First Set of Board Questions, Attach. A, at 26-27.

<sup>136</sup> Id. at 27.

<sup>137</sup> December 15, 2015 Questions Order, Attach. A, ¶ 50.

<sup>138</sup> See NRC Staff Response to First Set of Board Questions, Attach. A, at 29.



10. To provide additional access road capacity to the site, PSEG proposes a three-lane, elevated causeway through coastal wetlands.<sup>139</sup> The Board therefore questioned whether the parties had evaluated whether improvements to an existing access road might provide additional capacity with fewer adverse environmental impacts.<sup>140</sup> In response, PSEG and the NRC Staff explained that, for operational and security reasons, two distinct traffic paths were needed for existing operations and construction activities.<sup>141</sup> Additionally, PSEG stated that eight alternative routes were considered, including widening the existing access road.<sup>142</sup> Because widening the access road would require wetland and floodplain fill, its adverse environmental impacts were greater than the proposed causeway.<sup>143</sup> On this basis, the Board was satisfied that this issue had been adequately reviewed.

11. The most recent unemployment data evaluated in the FEIS were from 2011.<sup>144</sup> Concerned that 2011 data might represent relatively depressed economic conditions, the Board asked whether consideration was given to updating an FEIS table that relies on this information.<sup>145</sup> The NRC Staff stated that the most recent economic data available at the time the FEIS was prepared were published by the Bureau of Labor Statistics in 2014, and represented data from 2012—only a year after that referenced in the FEIS.<sup>146</sup> The NRC Staff

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<sup>139</sup> Ex. NRC004A, at 2-18.

<sup>140</sup> January 6, 2016 Questions Order, Attach. A, ¶ 6.

<sup>141</sup> NRC Staff Response to Second Set of Board Questions, Attach. A, at 6; PSEG Response to Second Set of Board Questions, Attach. A, at 3.

<sup>142</sup> PSEG Response to Second Set of Board Questions, Attach. A, at 3.

<sup>143</sup> Id.

<sup>144</sup> Ex. NRC004A, Tbl. 2-21, at 2-125.

<sup>145</sup> January 6, 2016 Questions Order, Attach. A, ¶ 11.

<sup>146</sup> NRC Staff Response to Second Set of Board Questions, Attach. A, at 8.

explained that it compared the 2011 and 2012 data and identified only marginal differences, which did not affect the conclusions reached in the FEIS.<sup>147</sup> The Staff also gave assurances that, if a COL or construction permit application is later submitted, this issue will be reevaluated when preparing a supplement to the FEIS.<sup>148</sup> Therefore, the Board's concerns in this area were resolved.

12. Construction on the proposed site would occur mostly within areas dominated by common reed (*Phragmites australis*), an invasive, non-native plant species.<sup>149</sup> The Board questioned whether construction activities in these areas could facilitate the spread of this species to nearby wetlands, displacing more desirable plant species.<sup>150</sup> PSEG explained that many wetland impacts would occur within existing self-contained areas operated by the USACE and PSEG, thereby eliminating any potential increase in the spread of this species, in part because this species primarily depends on rhizome disruption and displacement for expansion.<sup>151</sup> PSEG stated that elevations within the route for the proposed causeway are sufficient to counter invasion of this species through tidal flooding effects.<sup>152</sup> Furthermore, PSEG assured the Board that the spread of this species would be monitored during construction and, if necessary, managed.<sup>153</sup> On the basis of PSEG's response, the Board was satisfied that the spread of this species would not increase to any appreciable degree as a result of potential construction activities.

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<sup>147</sup> Id. at 8.

<sup>148</sup> Id. at 8-9.

<sup>149</sup> Ex. NRC004A at 4-28.

<sup>150</sup> January 6, 2016 Questions Order, Attach. A, ¶ 14.

<sup>151</sup> PSEG Response to Second Set of Board Questions, Attach. A, at 7.

<sup>152</sup> Id. at 8.

<sup>153</sup> Id. at 8.

13. The Board had various other wetland resources concerns related to post-construction recovery of these areas and the USACE's role in permitting and identifying mitigation requirements for activities impacting wetlands resources.<sup>154</sup> Both the NRC Staff and PSEG indicated that any construction activities in wetland areas would be subject to planning, permitting, and mitigation requirements imposed by appropriate federal, state, and local agencies, including the USACE and NJDEP.<sup>155</sup> For example, PSEG will likely be subject to mitigation requirements to address unavoidable impacts, and any failure to comply with permit conditions could result in enforcement actions and/or suspension or revocation of any permits.<sup>156</sup> Furthermore, as noted by the NRC Staff, the NRC's regulatory authority is limited to NRC-regulated construction activities, thus limiting the NRC's review to NEPA and verification of the PSEG's compliance with the requirements of other agencies.<sup>157</sup> For these reasons, the Board was satisfied that a regulatory framework exists to ensure that wetlands are restored to pre-disturbance conditions or enhanced beyond existing conditions.<sup>158</sup>

14. The Board was concerned about elevated nighttime noise levels at two on-site monitoring locations that were higher than daytime levels observed at the same locations.<sup>159</sup> The NRC Staff responded that in one location higher noise levels were associated with an

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<sup>154</sup> January 6, 2016 Questions Order, Attach. A, ¶¶ 15, 17-19.

<sup>155</sup> See NRC Staff Response to Second Set of Board Questions, Attach. A, at 10; PSEG Response to Second Set of Board Questions, Attach. A, at 8.

<sup>156</sup> NRC Staff FEIS Responses, Attach. A, at 10-11.

<sup>157</sup> See id. at 12.

<sup>158</sup> See PSEG Response to Second Set of Board Questions, Attach. A, at 8 (“Any restoration of temporary fill areas will be monitored by regulatory agencies, including the USACE and the NJDEP. PSEG expects that permits issued by both agencies will have strict compliance and monitoring requirements for restoration of temporarily disturbed wetlands to assure they are restored to pre-disturbance conditions or enhanced beyond existing conditions.”).

<sup>159</sup> January 6, 2016 Questions Order, Attach. A, ¶ 24.

employee shift change during pre-dawn hours.<sup>160</sup> In the second location, the NRC Staff concluded that any building or operation noise levels would dissipate to ambient levels within a short distance.<sup>161</sup> The NRC Staff's response resolved the Board's concern regarding this issue.

15. The Board was also concerned about an apparent inconsistency in dose rate calculations regarding radiation exposure during the transport of new fuel.<sup>162</sup> The NRC Staff clarified that different computer codes, with different assumptions, were used to model doses for two distinct groups: (1) populations and transportation workers, such as inspectors, during routine operations; and (2) potentially maximally exposed individuals (e.g., persons stuck in traffic) and to the population during routine transportation.<sup>163</sup> The NRC Staff's response satisfied the Board's concerns.

Third, after reviewing the parties' responses to its initial questions, the Board nonetheless determined that it still wished to receive more detailed and integrated sworn prefiled testimony and exhibits concerning certain topics. Specifically, on January 27, 2016, the Board requested prefiled written testimony and exhibits concerning six matters pertaining to the SER,<sup>164</sup> which are set forth in section IV infra. Thereafter, on February 8, 2016, the Board requested prefiled written testimony and exhibits concerning eight matters pertaining to the FEIS,<sup>165</sup> which are set forth in section IV infra.

Again, we directed the parties to provide written testimony under oath, so that the Board could accord sworn prefiled testimony as much weight as we would give sworn testimony

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<sup>160</sup> NRC Staff Response to Second Set of Board Questions, Attach. A, at 15.

<sup>161</sup> Id.

<sup>162</sup> January 6, 2016 Questions Order, Attach. A, ¶ 28.

<sup>163</sup> NRC Staff Response to Second Set of Board Questions, Attach. A, at 17.

<sup>164</sup> SER Prefiled Testimony Order at 2-3.

<sup>165</sup> FEIS Prefiled Testimony Order at 2-3.

presented in person at the evidentiary hearing, without having to engage in the formality of asking witnesses at the hearing to “adopt” their prior written testimony.<sup>166</sup> In accordance with the Board’s suggestion that the parties coordinate their testimony as to avoid repetition,<sup>167</sup> PSEG did not submit prefiled testimony on every topic. Collectively, however, PSEG and the NRC Staff submitted approximately two hundred pages of prefiled written testimony from twenty-two witnesses, as well as associated exhibits.<sup>168</sup>

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<sup>166</sup> SER Prefiled Testimony Order at 3; FEIS Prefiled Testimony Order at 4.

<sup>167</sup> See SER Prefiled Testimony Order at 3; FEIS Prefiled Testimony Order at 4.

<sup>168</sup> Ex. PSEG001, Testimony of James Mallon and David Robillard on SER Topic 1 [hereinafter PSEG SER Topic 1 Testimony]; Ex. PSEG007, Testimony of James Mallon and David Robillard on SER Topic 2 [hereinafter PSEG SER Topic 2 Testimony]; Ex. PSEG011, Testimony of James Mallon on SER Topic 3 [hereinafter PSEG SER Topic 3 Testimony]; Ex. PSEG012, Testimony of James Mallon on SER Topic 6 [hereinafter PSEG SER Topic 6 Testimony]; Ex. PSEG013, Testimony of James Mallon on FEIS Topic 3 [hereinafter PSEG FEIS Topic 3 Testimony]; Ex. PSEG016, Testimony of James Mallon on FEIS Topic 6 [hereinafter PSEG FEIS Topic 6 Testimony]; Ex. NRC001-R, Testimony of Prosanta Chowdhury, Allen Fetter, and Bruce J. Musico on SER Topic 1 [hereinafter NRC SER Topic 1 Testimony]; Ex. NRC006-R, Testimony of Prosanta Chowdhury, Seshagiri Tammara, Gerry Lewis Stirewalt, Frankie G. Vega, and Bruce J. Musico on SER Topic 2 [hereinafter NRC SER Topic 2 Testimony]; Ex. NRC008-R, Testimony of Joseph F. Giacinto and Henry Jones on SER Topic 3 [hereinafter NRC SER Topic 3 Testimony]; Ex. NRC009, Testimony of Kevin R. Quinlan and Henry Jones on SER Topic 4 [hereinafter NRC SER Topic 4 Testimony]; Ex. NRC010-R, Testimony of Prosanta Chowdhury, Joseph F. Giacinto, Henry Jones, Dogan Seber, Stephanie Devlin-Gill, Donald Palmrose, and Bruce J. Musico on SER Topic 5 [hereinafter NRC SER Topic 5 Testimony]; Ex. NRC011, Testimony of Kevin R. Quinlan and Stephen E. Williams on SER Topic 6 [hereinafter NRC SER Topic 6 Testimony]; Ex. NRC012, Testimony of Michael Willingham and Neil Giffen on FEIS Topic 1 [hereinafter NRC FEIS Topic 1 Testimony]; Ex. NRC013, Testimony of Michael Willingham and Neil Giffen on FEIS Topic 2 [hereinafter NRC FEIS Topic 2 Testimony]; Ex. NRC014, Testimony of Philip Meyer and Mohammad Haque on FEIS Topic 3 [hereinafter NRC FEIS Topic 3 Testimony]; Ex. NRC015, Testimony of Michael Willingham and Neil Giffen on FEIS Topic 4 [hereinafter NRC FEIS Topic 4 Testimony]; Ex. NRC017, Testimony of Michael Willingham and Neil Giffen on FEIS Topic 5 [hereinafter NRC FEIS Topic 5 Testimony]; Ex. NRC018, Testimony of Allen Fetter, Jack Cushing, Jennifer Davis, and Andrew Kugler on FEIS Topic 6 [hereinafter NRC FEIS Topic 6 Testimony]; Ex. NRC019, Testimony of Allen Fetter, Jack Cushing, Jennifer Davis, and Andrew Kugler on FEIS Topic 7 [hereinafter NRC FEIS Topic 7 Testimony].

Fourth, at a one-day evidentiary hearing, the Board members had the opportunity to question in person specific witnesses who submitted prefiled written testimony.<sup>169</sup> All prefiled testimony and exhibits were admitted into evidence without objection.<sup>170</sup>

In other words, the Board's process was a continuing one, which allowed consideration of various kinds of information at various times. The sworn oral testimony at the evidentiary hearing constituted only a portion of the sworn testimony available to the Board—which included both prefiled testimony and responses under oath to the Board's initial written questions—and addressed only a portion of all the information (including the application itself) that we began to examine as soon as the Board was constituted. Also, absent objection in an uncontested case such as this, the Board saw no reason to exclude opinion testimony or other evidence that might be objectionable in a jury trial in a court of law.<sup>171</sup> Rather, in addressing the issues before it, the

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<sup>169</sup> Mindful of the policies underlying Rule 615 of the Federal Rules of Evidence, the Board considered whether to exclude witnesses from the hearing room during the testimony of other witnesses testifying on the same issues, but ultimately determined that would not be necessary in this particular case. Rule 615 provides (subject to limited exceptions) that at the request of any party a court “must” order witnesses excluded so that they cannot hear other witnesses’ testimony. Fed. R. Evid. 615. Alternatively, Rule 615 provides, “the court may do so on its own.” Id. In contrast to the practice followed by many licensing boards, courts therefore routinely exclude witnesses prior to their testimony. They do so, as the Supreme Court has recognized, not only to discourage or expose outright fabrication, but also to exercise a restraint on the natural tendency of witnesses to “tailor” their testimony to that of earlier witnesses. Geders v. United States, 425 U.S. 80, 87 (1976); see also GE-Hitachi Global Laser Enrichment LLC (GLE Commercial Facility), LBP-12-21, 76 NRC 218, 249-50 (2012).

<sup>170</sup> Tr. at 70-72.

<sup>171</sup> NRC regulations provide that “strict rules of evidence do not apply to written submissions,” 10 C.F.R. § 2.319(d), and rarely is it productive for licensing boards to devote time and resources to trying to separate “inadmissible” evidence from the merely unpersuasive. The bedrock principle underlying much of the law of evidence is set forth in Fed. R. Evid. 403: “The court may exclude relevant evidence if its probative value is substantially outweighed by a danger of one or more of the following: unfair prejudice, confusing the issues, misleading the jury, undue delay, wasting time, or needlessly presenting cumulative evidence.” In NRC licensing cases, however, excluding evidence will seldom achieve these objectives. Written prefiled testimony and exhibits are typically submitted well in advance of the evidentiary hearing, and, in our most common types of hearings, the licensing boards themselves—not the parties—orally examine the witnesses. 10 C.F.R. § 2.1207. Therefore, rulings excluding evidence have, as a practical matter, little effect in eliminating delay, waste of time, or the needless presentation of cumulative evidence in the record. If a licensing board deems prefiled evidence to be of little

Board considered all available facts—recognizing that some sources of information may be more reliable than others.<sup>172</sup>

#### IV. SUMMARY OF TESTIMONY

##### A. SER Topic 1

SER Topic 1 stated:

Pursuant to 10 C.F.R. § 52.24(a), in order to authorize issuance of an ESP the Licensing Board must make the following safety findings:

- (1) An application for an early site permit meets the applicable standards and requirements of the [AEA] and the Commission's regulations;
- (2) Notifications, if any, to other agencies or bodies have been duly made;
- (3) There is reasonable assurance that the site is in conformity with the provisions of the Act, and the Commission's regulations;
- (4) The applicant is technically qualified to engage in any activities authorized;
- (5) The proposed inspections, tests, analyses and acceptance criteria, including any on emergency planning, are necessary and sufficient, within the scope of the early site permit, to provide reasonable assurance that the facility has been constructed and will be operated in conformity with the license, the provisions of the Act, and the Commission's regulations; [and]
- (6) Issuance of the permit will not be inimical to the common defense and security or to the health and safety of the public . . . .

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or no value, it simply need not ask about it at the evidentiary hearing, and is free to accord such evidence little or no weight. Likewise, because the members of the licensing boards themselves must read challenged testimony to determine whether its probative value is substantially outweighed by the danger of unfair prejudice or confusion of the issues, excluding evidence on this ground also seems to have little practical effect. See GLE Commercial Facility, LBP-12-21, 76 NRC at 248 n.171.

<sup>172</sup> The Board also received written limited appearance statements from interested members of the public. In accordance with 10 C.F.R. § 2.315(a), however, such statements were not considered as evidence.

Staff shall briefly summarize those portions of its review that support each of these findings.<sup>173</sup>

Five witnesses testified on SER Topic 1:

1. PSEG Witnesses

James Mallon. Mr. Mallon is the Nuclear Development Manager for the Nuclear Development Department at PSEG.<sup>174</sup> He has a B.A. in physics from Franklin and Marshall College and has completed graduate business courses toward an M.B.A. at the University of Southern Maine.<sup>175</sup> He also holds a Senior Reactor Operator certification.<sup>176</sup>

Mr. Mallon has 34 years of experience in the nuclear industry.<sup>177</sup> At PSEG, he was the Early Site Permit Manager during the initial phases of the proposed project.<sup>178</sup> In 2011, he became the Manager of Nuclear Development, in which capacity he oversees both the ESP project and other activities related to small modular reactors and advanced nuclear technology.<sup>179</sup>

In his written testimony on SER Topic 1, Mr. Mallon testified as follows:

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<sup>173</sup> December 15, 2015 Questions Order, Attach. A, at 1. SER Topic 1 originated as SER Question No. 1 in the Board's Order of December 15, 2015. As allowed by the Board, the NRC Staff elected to defer its response until it submitted prefiled written testimony. Although SER Question No. 1 was specifically addressed to the NRC Staff, PSEG also responded, both in its answers to our December 15, 2015 Order and in its prefiled written testimony and exhibits. PSEG Response to First Set of Board Questions, Attach. A, at 1-5; PSEG SER Topic 1 Testimony.

<sup>174</sup> PSEG SER Topic 1 Testimony at 1.

<sup>175</sup> Id.

<sup>176</sup> Id.

<sup>177</sup> Id.

<sup>178</sup> Id. at 2.

<sup>179</sup> Id.



Although SER Topic 1 was primarily addressed to the NRC Staff, PSEG has also considered the findings that must be made to issue the ESP.<sup>180</sup> PSEG concludes that its application, the NRC's review, and the NRC's documentation all support making these findings.<sup>181</sup>

PSEG has not yet selected a particular reactor design to be constructed at the site.<sup>182</sup> However, to provide sufficient information to enable the NRC to determine whether the site is suitable for a new plant, PSEG's application sets forth a surrogate design with a set of bounding parameters.<sup>183</sup>

PSEG's application contains the information required by 10 C.F.R. § 52.17.<sup>184</sup> The structure and content of the application are based on relevant NRC guidance, including NUREG-0800, Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition; RS-002, Processing Applications for Early Site Permits; NRC Regulatory Guide 1.70, Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants; NRC Regulatory Guide 1.206, Combined License Applications for Nuclear Power Plants (LWR Edition); and NUREG-1555, Standard Review Plans for Environmental Reviews for Nuclear Power Plants.<sup>185</sup>

The NRC Staff appropriately reviewed PSEG's application, concluded all applicable standards for issuance of the ESP had been met, and determined that an ESP should be

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<sup>180</sup> Id. at 4.

<sup>181</sup> Id.

<sup>182</sup> Id. at 5.

<sup>183</sup> Id.

<sup>184</sup> Id. at 6.

<sup>185</sup> Id.

issued.<sup>186</sup> The NRC's independent ACRS reviewed both PSEG's application and the Staff's analysis, determined that "[t]he staff has done a thorough review of the early site permit application," and likewise concluded that the early site permit should be issued.<sup>187</sup>

The Board did not require oral testimony from Mr. Mallon on SER Topic 1.

David Robillard. Mr. Robillard is the Licensing Lead and Quality Assurance Specialist for the ESP project.<sup>188</sup> In this role, he has been responsible for the quality and accuracy of all submittals to the NRC.<sup>189</sup> Mr. Robillard has both an A.S. degree in Nuclear Technology and a B.S. degree in Business Administration from Excelsior College.<sup>190</sup> He has 46 years of experience working on a variety of nuclear activities.<sup>191</sup>

Mr. Robillard's written testimony on SER Topic 1 was substantively identical to portions of the written testimony of Mr. Mallon. In his oral testimony on SER Topic 1, Mr. Robillard testified as follows:

PSEG considered all of the applicable safety and environmental standards in the NRC regulations by reviewing the NRC's standard review plans.<sup>192</sup> PSEG considered the NRC Staff's environmental and safety reviews to be thorough given that the NRC Staff conducted a number of site audits, reached out to local members of the surrounding community, conducted

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<sup>186</sup> Id. at 8

<sup>187</sup> Id. (quoting Ex. NRC003, App. E, at E-2).

<sup>188</sup> Id. at 2.

<sup>189</sup> Id.

<sup>190</sup> Id.

<sup>191</sup> Id.

<sup>192</sup> Tr. at 104-05.

an independent need-for-power analysis, and made several requests for additional information regarding PSEG's safety and environmental analyses.<sup>193</sup>

## 2. NRC Staff Witnesses

Prosanta Chowdhury. Mr. Chowdhury is a Project Manager in the NRC's Division of New Reactor Licensing.<sup>194</sup> He has an M.S. in Nuclear Engineering from Louisiana State University and an M.S. in Electrical Engineering from Moscow Power Engineering Institute.<sup>195</sup> Mr. Chowdhury has about eight years of experience as a project manager at the NRC.<sup>196</sup> He coordinated all aspects of the NRC staff's review of PSEG's ESP application.<sup>197</sup>

In his written testimony on SER Topic 1, Mr. Chowdhury testified as follows:

The NRC Staff conducted the safety review of PSEG's ESP application against the applicable regulations in Title 10 of the Code of Federal Regulations, Parts 20, 50, 52, 73, and 100.<sup>198</sup> The Staff performed its safety review and evaluation using applicable portions of the Standard Review Plan (NUREG-0800), Interim Staff Guidance documents, Regulatory Guides, bulletins, generic letters, and other applicable NUREGs.<sup>199</sup> On the basis of its evaluation and its

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<sup>193</sup> Tr. at 106-07.

<sup>194</sup> NRC SER Topic 1 Testimony at 1.

<sup>195</sup> Ex. NRC002, Statements of Professional Qualifications for NRC Staff Witnesses, at 1 [hereinafter NRC Staff Statements of Professional Qualifications].

<sup>196</sup> Id.

<sup>197</sup> Id.

<sup>198</sup> NRC SER Topic 1 Testimony at 2.

<sup>199</sup> Id.

independent analyses as discussed in the SER,<sup>200</sup> the NRC Staff concluded that PSEG's ESP application satisfies all applicable statutory and regulatory standards and requirements.<sup>201</sup>

No notifications to other agencies or bodies were required within the scope of the ESP safety review.<sup>202</sup> As described by other NRC Staff witnesses, the NRC did publish the required availability, docketing, and hearing notices for the ESP application.<sup>203</sup>

When necessary after reviewing the application, the NRC Staff issued requests for additional information, conducted audits of PSEG's records, and performed its own confirmatory calculations.<sup>204</sup> The Staff also proposed certain permit conditions.<sup>205</sup> On this basis, the Staff was able to find reasonable assurance that the proposed PSEG site is in conformity with the provisions of the Atomic Energy Act and NRC regulations.<sup>206</sup>

Because PSEG did not request a limited work authorization, no technical qualifications to undertake construction activities had to be demonstrated at the ESP stage; rather, PSEG's technical qualifications to engage in NRC authorized activities would be evaluated at later stages of the licensing process.<sup>207</sup> PSEG has extensive experience as a nuclear plant owner and operator, including the existing facilities on Artificial Island, and is technically qualified to receive an ESP.<sup>208</sup>

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<sup>200</sup> See generally Ex. NRC003.

<sup>201</sup> NRC SER Topic 1 Testimony at 2.

<sup>202</sup> Id.

<sup>203</sup> Id.

<sup>204</sup> Id. at 3-4.

<sup>205</sup> Id. at 4.

<sup>206</sup> Id.

<sup>207</sup> Id.

<sup>208</sup> Id.

In the case of an ESP application that does not seek a limited work authorization, the only inspections, tests, analyses, and acceptance criteria (ITAAC) are those that pertain to emergency planning.<sup>209</sup> PSEG submitted a complete and integrated emergency plan and associated ITAAC,<sup>210</sup> which the Staff found necessary and sufficient to provide reasonable assurance that the facility that references the ESP will be constructed and operated in conformity with the license, the Atomic Energy Act, and NRC regulations.<sup>211</sup>

Based on its overall review of PSEG's application, the NRC Staff concluded that PSEG complied with all applicable regulatory requirements and that issuance of an ESP for the PSEG site will not be inimical to public health and safety or the common defense and security.<sup>212</sup>

In his oral testimony on SER Topic 1, Mr. Chowdhury testified as follows:

PSEG did not select a specific reactor design and instead utilized a PPE.<sup>213</sup> If PSEG selected a design outside these parameters at the COL stage, its application would be a deviation from the ESP.<sup>214</sup> However, in such circumstances, PSEG could request a variance, whereupon the NRC Staff would evaluate the significance of the differences between the ESP and the requested COL.<sup>215</sup>

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<sup>209</sup> Id.

<sup>210</sup> See Ex. PSEG004AC, PSEG Site ESP Application, Part 5 Emergency Plan, Rev. 4 (Apr. 15, 2015).

<sup>211</sup> NRC SER Topic 1 Testimony at 4-5.

<sup>212</sup> Id. at 5.

<sup>213</sup> Tr. at 93.

<sup>214</sup> Id.

<sup>215</sup> Tr. at 94.

The NRC Staff followed the NRC Standard Review Plan, NUREG-0800, to ensure that PSEG met all the applicable regulatory requirements and standards.<sup>216</sup> PSEG's compliance with these regulatory requirements allowed the NRC Staff to conclude that issuance of the ESP would not be inimical to the common defense, as defined by the Atomic Energy Act.<sup>217</sup>

Allen Fetter. Dr. Fetter is a Senior Project Manager in the Environmental Projects Branch of the NRC's Division of New Reactor Licensing.<sup>218</sup> He has a Ph.D. in Geology from the University of Kansas, an M.S. in Geology from the University of North Carolina, and a B.A. in Geology from Guilford College.<sup>219</sup> Dr. Fetter has about seven years of experience as a project manager at the NRC.<sup>220</sup> He planned and coordinated most aspects of the NRC Staff's environmental review of PSEG's ESP application.<sup>221</sup>

In his written testimony on SER Topic 1, Dr. Fetter testified that adequate announcement, notification and distribution of the FEIS had occurred.<sup>222</sup> In his oral testimony on SER Topic 1, Dr. Fetter testified that the NRC Staff was able to ensure that all of the required notifications were made to members of the public and other federal, state, and local regulatory bodies through federal register notices, site audits, press releases regarding public meetings, and meetings with local agencies.<sup>223</sup>

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<sup>216</sup> Tr. at 95, 98.

<sup>217</sup> Tr. at 99-100.

<sup>218</sup> NRC Staff Statements of Professional Qualifications at 3.

<sup>219</sup> Id.

<sup>220</sup> Id.

<sup>221</sup> Id.

<sup>222</sup> NRC SER Topic 1 Testimony at 3, 5-6.

<sup>223</sup> Tr. at 96-97.

Bruce J. Musico. Mr. Musico is a Senior Emergency Preparedness Specialist in the New Reactor Licensing Branch within the NRC's Office of Nuclear Security and Incident Response.<sup>224</sup> He has a J.D. from Franklin Pierce Law Center and a B.S. in Nuclear Engineering from the University of Michigan.<sup>225</sup> He has over 30 years of experience in commercial nuclear power and related industries, including approximately 25 years relating to nuclear reactor emergency planning.<sup>226</sup>

Mr. Musico's written testimony on SER Topic 1 was substantively identical to portions of the written testimony of Mr. Chowdhury. The Board did not require oral testimony from Mr. Musico on SER Topic 1.

#### B. SER Topic 2

SER Topic 2 stated:

The Staff's response to SER Question No. 9 acknowledges that each of the nine permit conditions the Staff proposes in the SER (at pp. A-2 through A-6) must be "precisely drawn so that the verification of compliance becomes a largely ministerial . . . act." Yet some of the proposed permit conditions arguably include subjective requirements, such as the direction that a future applicant must examine and adequately "evaluate" geologic features (No. 3) and develop emergency action plans that contain "few or no deviations or differences" from NRC-endorsed standards (No. 9). The Staff shall address in detail how verification of compliance with each proposed permit condition can be accomplished by "largely ministerial" action and, if and where appropriate, propose alternative language that might set forth a more objective standard.<sup>227</sup>

Seven witnesses testified on SER Topic 2:

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<sup>224</sup> NRC SER Topic 1 Testimony at 1.

<sup>225</sup> NRC Staff Statements of Professional Qualifications at 5.

<sup>226</sup> Id.

<sup>227</sup> SER Prefiled Testimony Order at 2.

## 1. PSEG Witnesses

James Mallon. Mr. Mallon's background and qualifications have been previously summarized in relation to his testimony on SER Topic 1. In his written testimony on SER Topic 2, Mr. Mallon testified as follows:

The Commission has ruled that, when the NRC imposes license conditions, the conditions must be precisely drawn so that verification becomes largely ministerial.<sup>228</sup> Verification should not require overly complex judgments or be subject to meaningful debate.<sup>229</sup>

At the same time, the Commission has clarified, "[t]his is not to say that the Staff is allowed no room to exercise professional judgment in conducting post-licensing verification activities."<sup>230</sup> Verification of compliance need only be a "largely" ministerial act and possible without having to make "overly" complex judgments.<sup>231</sup>

All nine proposed permit conditions meet this standard.<sup>232</sup> Moreover, seven of the nine proposed permit conditions are nearly identical to those that have been approved by the Commission in other proceedings.<sup>233</sup>

The Board did not require oral testimony from Mr. Mallon on SER Topic 2.

David Robillard. Mr. Robillard's background and qualifications have been previously summarized in relation to his testimony on SER Topic 1.

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<sup>228</sup> PSEG SER Topic 2 Testimony at 6.

<sup>229</sup> Id.

<sup>230</sup> Id. at 5 (quoting Private Fuel Storage, L.L.C. (Indep. Spent Fuel Storage Installation), CLI-00-13, 52 NRC 23, 34 (2000)).

<sup>231</sup> Id.

<sup>232</sup> Id. at 3-4.

<sup>233</sup> See id. at 9-21.



Mr. Robillard's written testimony on SER Topic 2 was substantively identical to the written testimony of Mr. Mallon. In his oral testimony on SER Topic 2, Mr. Robillard testified as follows:

PSEG did not find analogous Commission decisions approving permit conditions similar to PSEG Permit Conditions 1 and Permit Condition 2 because those conditions are very site specific.<sup>234</sup> For example, Permit Condition 1 requires PSEG to obtain a land exchange with the USACE for approximately 85 acres north of the existing Hope Creek reactor site.<sup>235</sup> By contrast, other past ESP applicants had larger sites and already had control over their exclusionary boundary.<sup>236</sup> Thus, these past applications did not need a land exchange.<sup>237</sup>

## 2. NRC Staff Witnesses

Prosanta Chowdhury. Mr. Chowdhury's background and qualifications have been previously summarized in relation to his testimony on SER Topic 1.

In his written testimony on SER Topic 2, Mr. Chowdhury testified as follows:

The NRC Staff included sufficiently prescriptive detail in its proposed permit conditions to ensure that its post-permitting compliance review will not require complex factual or legal judgments going beyond ministerial verification that the required actions have been completed.<sup>238</sup> For example, the Staff used widely-accepted industry standards and terminology, the interpretation of which would not be subject to reasonable dispute; incorporated as requirements prescriptive methodologies and standards from particular guidance documents;

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<sup>234</sup> Tr. at 110.

<sup>235</sup> Tr. at 109.

<sup>236</sup> Id.

<sup>237</sup> Id.

<sup>238</sup> NRC SER Topic 2 Testimony at 2.

and established prescriptive compliance steps to the extent those steps were not already incorporated from other sources referenced in the conditions.<sup>239</sup>

The Board did not require oral testimony from Mr. Chowdhury on SER Topic 2.

Seshagiri Tammara. Mr. Tammara is a Physical Scientist in the Radiation Protection and Accident Branch of the NRC's Division of Site Safety and Environmental Analysis.<sup>240</sup> He has an M.S. in Chemical Engineering from Osmania University, an M.S. in Chemical Engineering and Nuclear Engineering from the University of Maryland, and an M.S. in Environmental Engineering from the University of Maryland.<sup>241</sup> He has over 40 years of experience as a technical analyst and physical scientist.<sup>242</sup>

In his written testimony on SER Topic 2, Mr. Tammara addressed the process the NRC Staff anticipates it will use to verify compliance with Permit Conditions 1 and 2.<sup>243</sup> In his oral testimony on SER Topic 2, Mr. Tammara testified as follows:

Permit Condition 2 requires PSEG to perform certain calculations to ensure that the overpressure due to an explosion at a relocated gasoline storage tank will not exceed 1 psi.<sup>244</sup> PSEG complies with this permit condition by performing the requisite calculations, as prescribed in Regulatory Guide 1.19 and 1.78.<sup>245</sup> Whether PSEG performed these calculations correctly would be addressed in the NRC's review of any COL application.<sup>246</sup>

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<sup>239</sup> Id.

<sup>240</sup> Id. at 1

<sup>241</sup> NRC Staff Statements of Professional Qualifications at 7.

<sup>242</sup> Id.

<sup>243</sup> NRC SER Topic 2 Testimony at 3-5.

<sup>244</sup> See Tr. at 111-12; see also Ex. NRC003, App. A, at A-3.

<sup>245</sup> Tr. at 113-114.

<sup>246</sup> Tr. at 114.

Gerry Lewis Stirewalt. Dr. Stirewalt is a Senior Geologist in the Geoscience and Geotechnical Engineering Branch of the NRC's Division of Site Safety and Environmental Analysis.<sup>247</sup> He has a Ph.D. in Structural Geology from the University of North Carolina and a B.A. in Geology and Mathematics from Catawba College.<sup>248</sup> Dr. Stirewalt has more than 43 years of national and international experience in geoscience, including both practical experience and university teaching.<sup>249</sup>

In his written testimony on SER Topic 2, Dr. Stirewalt addressed the process the NRC Staff anticipates it will use to verify compliance with Permit Condition 3.<sup>250</sup> In his oral testimony on SER Topic 2, Dr. Stirewalt testified as follows:

Permit Condition 3 requires PSEG to perform detailed geologic mapping of its planned excavation for safety-related structures.<sup>251</sup> Although Dr. Stirewalt's written testimony referenced Regulatory Guide 1.132, Regulatory Guide 1.208 provides greater detail as to how the excavations should be mapped.<sup>252</sup> The NRC Staff did not explicitly reference these Regulatory Guides in the permit condition in the event that the guidance documents change at a future date.<sup>253</sup>

In addition, if PSEG were to find some kind of tectonic structure in the Vincentown formation in conducting its excavations, such a discovery would trigger a more extensive NRC

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<sup>247</sup> NRC SER Topic 2 Testimony at 1.

<sup>248</sup> NRC Staff Statements of Professional Qualifications at 8.

<sup>249</sup> Id.

<sup>250</sup> NRC SER Topic 2 Testimony, at 5-7.

<sup>251</sup> See Tr. at 116-17; see also NRC003, App. A, at A-3.

<sup>252</sup> Tr. at 116-17.

<sup>253</sup> Tr. at 117-18.

Staff reevaluation of the PSEG site's geologic structure.<sup>254</sup> However, any review of PSEG's excavations would be undertaken as part of the NRC Staff's construction inspections rather than through satisfaction of Permit Condition 3.<sup>255</sup> This distinction is to ensure that the requirements of Permit Conditions 3 remain ministerial.<sup>256</sup> Accordingly, Permit Condition 3 would be satisfied when PSEG notifies the NRC Staff that the excavations are ready for the NRC Staff's examination.<sup>257</sup>

Frankie G. Vega. Mr. Vega is a Project Manager in the Hazard Management Branch of the Japan Lessons Learned Division within the NRC's Office of Nuclear Reactor Regulation.<sup>258</sup> He has an M.E. in Civil Engineering from the University of Maryland and a B.S. in Civil Engineering from the University of Puerto Rico, and possesses nine years of experience as an engineer and project manager.<sup>259</sup>

In his written testimony on SER Topic 2, Mr. Vega addressed the process the NRC Staff anticipates it will use to verify compliance with Permit Condition 4.<sup>260</sup> The Board did not require oral testimony from Mr. Vega on SER Topic 2.

Bruce J. Musico. Mr. Musico's background and qualifications have been previously summarized in relation to his testimony on SER Topic 1.

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<sup>254</sup> Tr. at 121-22.

<sup>255</sup> Tr. at 122.

<sup>256</sup> Id.; see also Private Fuel Storage, CLI-00-13, 52 NRC at 34 (“[W]e must insist that the condition be precisely drawn so that the verification of compliance becomes a largely ministerial rather than an adjudicatory act.”).

<sup>257</sup> Tr. at 122.

<sup>258</sup> NRC SER Topic 2 Testimony at 1.

<sup>259</sup> NRC Staff Statements of Professional Qualifications at 10.

<sup>260</sup> NRC SER Topic 2 Testimony at 7-8.

In his written testimony on SER Topic 2, Mr. Musico addressed the process the NRC Staff anticipates it will use to verify compliance with Permit Conditions 5-9.<sup>261</sup> The Board did not require oral testimony from Mr. Musico on SER Topic 2.

### C. SER Topic 3

SER Topic 3 stated:

In response to SER Question No. 20 the Staff stated as follows:

While the Staff recognizes that increasing the resolution of the overall watershed basin model could improve the precision of the Applicant's river flooding model results, the Staff determined on the basis of experience with hydraulic modeling that such improvements could not change the conclusion that storm surge is the bounding flood hazard for the PSEG ESP site and additional analyses were not necessary.

To what extent is the "experience with hydraulic modeling" upon which this decision was based documented? If experience based knowledge is used in the Staff's decision-making process generally, how is this experience documented?<sup>262</sup>

Three witnesses testified on SER Topic 3:

#### 1. PSEG Witness

James Mallon. Mr. Mallon's background and qualifications have been previously summarized with regard to his testimony on SER Topic 1.

In his written testimony on SER Topic 3, Mr. Mallon testified as follows:

The SER correctly concluded that the probable maximum hurricane is the bounding flood hazard for the PSEG site.<sup>263</sup> The potential causes of flooding at the PSEG site include: (1) the probable maximum flood (PMF) on rivers and streams, (2) dam failures, (3) a storm surge

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<sup>261</sup> Id. at 8-13.

<sup>262</sup> SER Prefiled Testimony Order at 2.

<sup>263</sup> PSEG SER Topic 3 Testimony at 2.

due to the probable maximum hurricane (PMH), (4) tsunamis, and (5) ice effects.<sup>264</sup> Each is summarized in the following chart:<sup>265</sup>

Event		Primary Flood Causing Mechanism	Combined Effects			Total (ft.)	SSAR Reference
SSAR	Description	Flood Height (ft. NAVD)	Tide (ft.)	Waves (ft.)	Other <sup>(a)</sup> (ft.)		
2.4.3	PMF	2.1	4.5	3.1	11.3	21.0	Table 2.4.3-4
2.4.4	Dam Break	0.3	4.5	2.6	2.0	9.4	Table 2.4.4-5
2.4.5	PMH	20.2	4.5	7.4	N/A	32.1	Table 2.4.5-4, Run #2
2.4.6	Tsunami	1.15	4.5	N/A	N/A	5.65	Table 2.4.6-6
2.4.7	Ice Jam Flooding	0.1	4.5	2.8	0.7	8.1	Table 2.4.7-3

(a) PMF is combined with the worst regional hurricane flood level.  
 Dam Break is combined with the 500 year flood.  
 Ice Jam Flooding includes spring base flow effects on water level.

Because the PMH event resulted in the highest total water surface elevation (WSEL), it represents PSEG’s design basis flood.<sup>266</sup>

Although increasing the resolution of the overall watershed basin model could affect the primary flood causing mechanism for the PMF event, “increasing the resolution would not necessarily increase the resulting WSEL, but could result in a decrease in water level.”<sup>267</sup> Moreover, an increased resolution for the overall watershed basin model would only potentially impact the primary flood-cause mechanism for the PMF event, and “[a]side from the PMH event, the primary flood-causing mechanism associated with each flood hazard represents a small portion of the associated WSEL.”<sup>268</sup> Thus, even if the increased resolution did slightly increase the resulting WSEL for the PMF event, there was such a significant margin between the total

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<sup>264</sup> Id. at 4.

<sup>265</sup> Id. at 7.

<sup>266</sup> Id. at 7-10.

<sup>267</sup> Id. at 8.

<sup>268</sup> Id. at 9.

WSEL for the PMF event (21 feet North American Vertical Datum (NAVD)) and the PMH event (32.1 feet NAVD) that the PMH event would still serve as the design basis flood event.<sup>269</sup>

In his oral testimony on SER Topic 3, Mr. Mallon testified as follows:

Regulatory Guide 1.59 and American National Standards Institute Standard 2.8 set forth standards for performing a PMH analysis.<sup>270</sup> These standards require an applicant to conduct its analysis to approximate the roughly one in a million flood risk.<sup>271</sup> Both PSEG and the NRC Staff determined that Run No. 2 in Table 2.4.5-4 of PSEG's Site Safety Analysis Report, which represents PSEG's design basis flood of 32.1 feet NAVD,<sup>272</sup> also represents the water level expected in the requisite one in a million flood risk.<sup>273</sup>

## 2. NRC Staff Witnesses

Henry Jones. Dr. Jones is a Hydrologist in the Office of New Reactors, Division of Site and Environmental Analysis, Hydrology and Meteorology Branch.<sup>274</sup> He has a diploma in Strategic Studies from the Naval War College, a B.S. in Oceanography from the United States Naval Academy, an M.A. in International Relations from Salve Regina University, an M.S. in Systems Management (Information Systems) from the University of Southern California, an M.S. in Meteorology and Physical Oceanography from the Naval Postgraduate School, and a Ph.D., in Physical Oceanography from the Naval Postgraduate School.<sup>275</sup> Upon retiring from

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<sup>269</sup> Id. at 7, 9.

<sup>270</sup> Tr. at 124.

<sup>271</sup> Tr. at 125.

<sup>272</sup> See PSEG SER Topic 3 Testimony at 6; Ex. PSEG004B, PSEG Site ESP Application Part 2, Site Safety Analysis Report, Tbl. 2.4.5-4, at 2.4-93.

<sup>273</sup> Tr. at 125.

<sup>274</sup> NRC Staff Statements of Professional Qualifications at 12.

<sup>275</sup> Id.

the United States Navy in 2007, Dr. Jones joined the NRC, where he serves as the surge, seiche and tsunami hazard technical reviewer for all COL and ESP applications.<sup>276</sup>

In his written testimony on SER Topic 3, Dr. Jones testified as follows:

The NRC Staff has experience with the river flood model used by PSEG to calculate the probable maximum flood (PMF) event.<sup>277</sup> The following chart provides a summary of the component contributions to the maximum water level for the PMF event:<sup>278</sup>

Component	PMF Maximum Water Level Contribution (ft)
Riverine flooding	2.1
10 percent exceedance high tide	4.5
Historical Storm surge	11.3
Wave runup	3.1

Thus, as stated in PSEG's written testimony, the total PMF maximum water level is 21 feet.<sup>279</sup>

The river flood model used by PSEG employs a one-dimensional numerical method that results in river flood level estimates that are conservatively high.<sup>280</sup> The model's estimates are conservative because it includes limited lateral dispersal of energy when, "[i]n reality, river channels are rarely straight and flow energy disperses laterally traveling downstream which would tend to reduce the water level height resulting from [one-dimensional] model calculations."<sup>281</sup> Further, although the riverine flooding component is most likely conservatively high based on the one-dimensional model calculations, it remains a small portion of the PMF

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<sup>276</sup> Id. at 12-13.

<sup>277</sup> NRC SER Topic 3 Testimony at 1.

<sup>278</sup> Id. at 3.

<sup>279</sup> Id.; see also PSEG SER Topic 3 Testimony at 4.

<sup>280</sup> Id. at 3.

<sup>281</sup> Id.



maximum water level since it contributes only about 2.1 feet to the total maximum water level of 21 feet.<sup>282</sup>

As a general matter, the NRC Staff documents its experience based decision-making in NRC Staff guidance.<sup>283</sup> However, the NRC Staff's experience based knowledge as to the relevant river model is documented in SER Section 2.4 as well as in the NRC Staff's numerous requests for additional information.<sup>284</sup>

The Board did not require oral testimony from Dr. Jones on SER Topic 3.

Joseph F. Giacinto. Mr. Giacinto is a Hydrologist in the NRC's Office of New Reactors, Division of Site and Environmental Analysis, Hydrology Branch.<sup>285</sup> He received his B.S. in Geology (Geophysics) from San Diego State University, and his M.S. in Hydrology from the University of Arizona.<sup>286</sup> Mr. Giacinto has eight years of experience working as a hydrologist at the NRC.<sup>287</sup> During his time at the NRC, Mr. Giacinto has provided technical support in the areas of hydrology and geology for the NRC Staff's review of multiple COL and ESP applications.<sup>288</sup>

Mr. Giacinto's written testimony on SER Topic 3 was substantively identical to Dr. Jones' written testimony on this topic. In his oral testimony on SER Topic 3, Mr. Giacinto testified as follows:

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<sup>282</sup> Id.

<sup>283</sup> Id.

<sup>284</sup> Id. at 4.

<sup>285</sup> NRC Staff Statements of Professional Qualifications at 11.

<sup>286</sup> Id.

<sup>287</sup> Id.

<sup>288</sup> Id.

The Delaware River Basin is very large at approximately 14,000 square miles.<sup>289</sup> Due to the basin's size, the river basin model's "coarse" resolution was still sufficient.<sup>290</sup> A professional who routinely evaluates these types of river basin models would recognize that the nodalization was adequate.<sup>291</sup>

#### D. SER Topic 4

SER Topic 4 stated:

The [U.S. Global Change Research Program (USGCRP)] report cited in the FSER section 2.3.1.4.10 noted that the power and frequency of tropical storms has "increased substantially in recent decades," and many reports, including the USGCRP report, have predicted that this trend will continue in the coming decades. Expanding on their discussion in section 2.3.1.4.10, Staff shall explain how they addressed the issue of climate change induced increases in the power and frequency of hurricanes. In particular, Staff will explain how the models used to establish the PMH at the PSEG ESP site accommodate predicted increases in the power and frequency of storms.<sup>292</sup>

Two NRC Staff witnesses testified on SER Topic 4:

Kevin R. Quinlan. Mr. Quinlan is a Physical Scientist (Meteorologist) in the NRC's Office of New Reactors, Division of Site and Environmental Analysis, Hydrology and Meteorology Branch.<sup>293</sup> Mr. Quinlan has a B.S. in Meteorology from Millersville University of Pennsylvania and an M.S. in Atmospheric Science from the University of Alabama in Huntsville.<sup>294</sup> He has been employed with the Office of New Reactors since July 2008.<sup>295</sup> His work primarily includes

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<sup>289</sup> Tr. at 128.

<sup>290</sup> Tr. at 129-30.

<sup>291</sup> Tr. at 131.

<sup>292</sup> SER Prefiled Testimony Order at 2-3.

<sup>293</sup> NRC SER Topic 4 Testimony at 1.

<sup>294</sup> NRC Statements of Professional Qualifications at 14.

<sup>295</sup> Id.

the analysis of regional and local climatology to determine the most severe weather that may impact a potential reactor site or design.<sup>296</sup>

In his written testimony on SER Topic 4, Mr. Quinlan testified as follows:

The hurricane site characteristic wind speed at the PSEG site was reviewed pursuant to NRC Regulatory Guide 1.221, which provides the design-basis hurricane wind speeds with an exceedance frequency of  $10^{-7}$  per year.<sup>297</sup> This is a conservative exceedance frequency that represents a hurricane wind speed that is expected to occur once every 10 million years.<sup>298</sup>

Regulatory Guide 1.221 derived Design-Basis Hurricane Wind Speed values from NUREG/CR-7005, which uses a sensitivity analysis to assess the possible effects of increased hurricane frequency in the future.<sup>299</sup> NUREG/CR-7005 addresses a potential doubling in hurricane frequency on the exceedance frequency of  $10^{-7}$  per year.<sup>300</sup> The sensitivity analysis suggested that a factor of two increase in hurricane frequency would result in less than a two percent increase in wind speed.<sup>301</sup> A two percent increase in a wind speed of 159 mph (3-second gust), which Regulatory Guide 1.221 indicates is applicable to the PSEG site, results in a 3 mph increase to the site characteristic.<sup>302</sup> The NRC Staff found this to be appropriately conservative to account for potential climate change related increases in hurricane power and frequency, particularly given that climate change increases are still uncertain.<sup>303</sup> Moreover, if

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<sup>296</sup> Id.

<sup>297</sup> NRC SER Topic 4 Testimony at 2.

<sup>298</sup> Id.

<sup>299</sup> Id.

<sup>300</sup> Id.

<sup>301</sup> Id.

<sup>302</sup> Id. at 2-3.

<sup>303</sup> Id. at 3.

long-term climatic change becomes an issue, a COL holder has a continuing obligation to ensure that the plant stays within the licensing basis.<sup>304</sup>

In his oral testimony on SER Topic 4, Mr. Quinlan testified as follows:

To account for the variability associated with climate change, the NRC Staff analyzed hurricane wind speeds based on a doubling of the frequency of hurricanes in the Atlantic and Gulf Coasts.<sup>305</sup> The result was a two percent increase in maximum hurricane wind speeds.<sup>306</sup> At the ESP site this resulted in an approximately three mile per hour increase in wind speed.<sup>307</sup> Prospectively, the NRC Staff would be obligated to update regulatory guidance to address evolving site conditions associated with climate change and a license holder would be obligated to ensure that their site remained safe to operate.<sup>308</sup>

Henry Jones. Dr. Jones' background and qualifications were previously summarized with regard to his testimony on SER Topic 3. In his written testimony on SER Topic 4, Dr. Jones testified as follows:

The Probable Maximum Hurricane (PMH) models used to establish the PMH for the PSEG site are conservative in view of climate change predications.<sup>309</sup> The PMH includes meteorological factors such as radius of maximum winds, central pressure, latitude, forward speed, track direction, peripheral pressure, inflow angle, location of landfall, among others.<sup>310</sup>

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<sup>304</sup> Id.

<sup>305</sup> Tr. at 135.

<sup>306</sup> Id.

<sup>307</sup> Id.

<sup>308</sup> See Tr. at 144-45. Legal counsel for the NRC Staff stated at the hearing that regulations exist, including 10 C.F.R. § 50.54(f), to ensure that licensees maintain adequate protection as a condition of licensing. See Tr. at 145.

<sup>309</sup> NRC SER Topic 4 Testimony at 1.

<sup>310</sup> Id. at 3.

Hurricane intensity is influenced by all of these factors, but is mostly determined by the oceanographic parameter of sea surface temperature.<sup>311</sup> The PMH is used to calculate the probable maximum storm surge (PMSS).<sup>312</sup>

Basic climate change theory indicates that atmospheric warming will lead to warmer sea surface temperatures, which will fuel stronger storms.<sup>313</sup> However, studies exist that show that warming can lead to more El Nino events, which hinder hurricane development along the northern Atlantic seaboard.<sup>314</sup> Additional factors, including the divergence of the Gulfstream offshore north of Cape Hatteras, result in hurricanes losing energy as they approach the mid-Atlantic Coast, which includes the PSEG site location.<sup>315</sup> This feature of the Gulfstream is likely to be present irrespective of near-term climate change.<sup>316</sup>

Only three Category 3 storms have made landfall along the northern Atlantic seaboard since 1869, with no storms stronger than Category 3.<sup>317</sup> In the PMSS calculation, margin for climate change was provided at the PSEG site by using a Category 4 PMH.<sup>318</sup> Additional conservatism was built into the analysis by assuming steady-state winds, no decay in intensity prior to landfall, and no deviation in track speed or direction.<sup>319</sup> More generally, the influence of

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<sup>311</sup> Id.

<sup>312</sup> Id. at 3-4.

<sup>313</sup> Id. at 4.

<sup>314</sup> Id.

<sup>315</sup> Id.

<sup>316</sup> Id.

<sup>317</sup> Id.

<sup>318</sup> Id.

<sup>319</sup> Id.

land and associated frontal systems results in the environment near the PSEG site not being optimal for intense hurricanes.<sup>320</sup>

In his oral testimony on SER Topic 4, Dr. Jones testified as follows:

Sea level rise is the only factor that the NRC Staff requires to account for climate change, because the analysis contains so many conservatisms that the climate change factor is “swamp[ed]” after analyzing storm surge with a ten percent exceedance high tide.<sup>321</sup> More generally, if the intensity of a tropical storm increases, then central pressure lowers.<sup>322</sup> This results in an increased pressure gradient and higher wind velocities, which drive storm surge.<sup>323</sup> At the ESP site, however, an approaching tropical storm would be confronted with the ameliorating effect of traveling over colder water above Cape Hatteras and exposure to dry continental air.<sup>324</sup> The result would be a decrease in storm intensity and relatively lower storm surge.<sup>325</sup>

#### E. SER Topic 5

SER Topic 5 stated:

In what ways has the PSEG ESP application and review differed from previous ESPs due to events at Fukushima and subsequent evaluations and recommendations?<sup>326</sup>

Seven NRC Staff witnesses testified on SER Topic 5:

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<sup>320</sup> Id. at 5.

<sup>321</sup> Tr. at 134. Dr. Jones also stated that storm surge is subject to deterministic modeling; whereas, wind speed is subject to probabilistic modeling. Tr. at 133-34, 136.

<sup>322</sup> Tr. at 137.

<sup>323</sup> Id.

<sup>324</sup> Tr. at 139-141.

<sup>325</sup> See Tr. at 140-42.

<sup>326</sup> SER Prefiled Testimony Order at 3.

Prosanta Chowdhury. Mr. Chowdhury's background and qualifications have been previously summarized with regard to his testimony on SER Topic 1.

In his written testimony on SER Topic 5, Mr. Chowdhury testified as follows:

Following the events at Fukushima resulting from the March 11, 2011 Great Tohoku earthquake and tsunami in Japan, the NRC established the Fukushima Near-Term Task Force (NTTF) to review NRC regulations and make recommendations.<sup>327</sup> The NRC Staff then adopted specific actions to address NTTF's Recommendations as modified by input from the Commission.<sup>328</sup>

As part of its review of PSEG's ESP application, the NRC Staff considered whether the following Tier 1 recommendations from the NTTF were applicable:

- Recommendation 2.1: Seismic and Flood Hazard Reevaluations
- Recommendation 2.3: Seismic and Flood Walkdowns
- Recommendation 4.1: Station Blackout Regulatory Actions
- Recommendation 4.2: Equipment Covered under 10 C.F.R. 50.54(hh)(2)
- Recommendation 5.1: Reliable Hardened Vents for Mark I and Mark II Containments
- Recommendation 7.1: Spent Fuel Pool Instrumentation
- Recommendation 8: Strengthening and Integration of Emergency Operating Procedures, Severe Accidents Management Guidelines, and Extensive Damage Mitigation Guidelines

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<sup>327</sup> NRC SER Topic 5 Testimony at 2.

<sup>328</sup> Id. at 2-3; see SECY-12-0025, Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami, (Feb. 17, 2012 ) (ADAMS Accession No. ML12039A103); SECY-11-0137, Prioritization of Recommended Actions to be Taken in Response to Fukushima Lessons Learned (Oct. 3, 2011) (ADAMS Accession No. ML11269A204); SECY-11-0124, Recommended Actions to Be Taken Without Delay from the [NTTF] Report (Sept. 9, 2011) (ADAMS Accession No. ML11245A144); SECY-11-0093, Near-Term Report and Recommendations for Agency Actions Following the Events in Japan (July 12, 2011) (ADAMS Accession No. ML11186A950).

- Recommendation 9.3: Emergency Preparedness Regulatory Actions (staffing and communications)<sup>329</sup>

The NRC Staff ultimately determined that only Recommendations 2.1 and 9.3 are applicable to PSEG's ESP application.<sup>330</sup> The other recommendations are applicable to design certification and COL applications.<sup>331</sup> Although the NRC Staff applied these two NTTF Recommendations to the PSEG review, the NRC Staff's underlying review methodologies and guidance did not differ from previous ESP application reviews.<sup>332</sup>

In his oral testimony on SER Topic 5, Mr. Chowdhury testified as follows:

The NRC Staff considered NTTF Recommendation 9.3 to be applicable because PSEG submitted a complete and integrated emergency plan with its ESP application.<sup>333</sup> This integrated emergency plan is equivalent to what would be submitted with a COL application.<sup>334</sup> However, because PSEG did not select a reactor technology, PSEG could not submit all the required information for Recommendation 9.3.<sup>335</sup> Accordingly, the NRC Staff identified two permit conditions to ensure that the entirety of Recommendation 9.3 is addressed at the COL stage.<sup>336</sup>

Dogan Seber. Dr. Seber is a senior Geophysicist in the Office of Nuclear Reactor's Division of Site Safety & Environmental Analysis, Geosciences and Geotechnical Engineering

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<sup>329</sup> NRC SER Topic 5 Testimony at 3.

<sup>330</sup> Id.

<sup>331</sup> Id. at 4.

<sup>332</sup> Id. at 5-6.

<sup>333</sup> Tr. at 151.

<sup>334</sup> Id.

<sup>335</sup> Id.

<sup>336</sup> See id.



Branch.<sup>337</sup> He has a B.S. in Geophysical Engineering from Istanbul Technical University, an M.Sc. in Geophysics from St. Louis University, and a Ph.D. in Seismology from Cornell University.<sup>338</sup> Dr. Seber has 30 years of professional work experience in geophysics.<sup>339</sup> As a senior geophysicist at the NRC, Dr. Seber has worked on the re-assessment of seismic hazards of the operating nuclear power plants following the NTF Fukushima recommendations.<sup>340</sup>

In his written testimony on SER Topic 5, Dr. Seber testified that, with respect to Recommendation 2.1, “[t]he Staff determined that [PSEG’s] use of the most recent seismic source model, i.e., CEUS-SSC, for its site specific seismic hazard calculations fully and adequately addressed the reevaluation of seismic hazards aspect of NTF Recommendation 2.1.”<sup>341</sup> The Board did not require oral testimony from Dr. Seber on SER Topic 5.

Stephanie Devlin-Gill. Dr. Devlin-Gill is a Project Scientist in the Office of New Reactor’s Division of Site Safety & Environmental Analysis.<sup>342</sup> She received her B.A. in Physics with a Computer Science minor from Rutgers University, and her Ph.D. in Geophysics from Cornell University.<sup>343</sup> During her seven years at the NRC, Dr. Devlin-Gill has reviewed numerous existing reactor site seismic hazard reevaluations associated with the NTF seismic

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<sup>337</sup> NRC Staff Statements of Professional Qualifications at 15.

<sup>338</sup> Id.

<sup>339</sup> Id.

<sup>340</sup> Id.

<sup>341</sup> NRC SER Topic 5 Testimony at 4.

<sup>342</sup> NRC Staff Statements of Professional Qualifications at 17.

<sup>343</sup> Id.

Recommendation 2.1.<sup>344</sup> In addition, Dr. Devlin-Gill was the lead geophysicist on the 2014 update of two sections of the Standard Review Plans.<sup>345</sup>

Dr. Devlin-Gill's written testimony on SER Topic 5 was substantively similar to Dr. Seber's. The Board did not require oral testimony from Dr. Devlin-Gill on SER Topic 5.

Henry Jones. Dr. Jones' background and qualifications have been previously summarized with regard to his testimony on SER Topic 3.

In his written testimony on SER Topic 5, Dr. Jones testified as follows:

Another aspect of Recommendation 2.1 included a flooding hazard reevaluation and the NRC Staff determined that PSEG's use of Regulatory Guide 1.56 "fully and adequately addressed" this aspect of Recommendation 2.1.<sup>346</sup> The NRC Staff then concluded that there were "no additional requirements left to be addressed in Recommendation 2.1 for flooding reevaluations applicable to the PSEG Site ESP application review."<sup>347</sup> The Board did not require oral testimony from Dr. Jones on SER Topic 5.

Joseph F. Giacinto. Mr. Giacinto's background and qualifications have been previously summarized with regard to his testimony on SER Topic 3. His written testimony on SER Topic 5 was substantively identical to Dr. Jones' written testimony. The Board did not require oral testimony from Mr. Giacinto on SER Topic 5.

Bruce J. Musico. Mr. Musico's background and qualifications have been previously summarized with regard to his testimony on SER Topic 1.

In his written testimony on SER Topic 5, Mr. Musico testified as follows:

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<sup>344</sup> Id.

<sup>345</sup> Id.

<sup>346</sup> NRC SER Topic 5 Testimony at 4.

<sup>347</sup> Id.

Recommendation 9.3 “identifies the need for: (i) determining and implementing the required staffing for responding to a multi-unit event, and (ii) providing means to power communications equipment needed to communicate onsite and offsite during a prolonged station blackout.”<sup>348</sup> Because PSEG had not selected a reactor design, “detailed designs on onsite and offsite communication systems and emergency staffing plan are not yet complete.”<sup>349</sup> Consequently, the NRC Staff included Permit Conditions 5 and 6, which require PSEG to address the communication and staffing aspects of Recommendation 9.3 at the COL stage.<sup>350</sup>

The Board did not require oral testimony from Mr. Musico on SER Topic 5.

Donald Palmrose. Dr. Palmrose is a Senior Reactor Engineer in the Office of New Reactor’s Division of Site Safety and Environmental Analysis, Radiation Protection and Accident Consequences Branch.<sup>351</sup> He received his B.S. in Nuclear Engineering from Oregon State University, his M.S. in Nuclear Engineering from Texas A&M University, and his Ph.D. in Nuclear Engineering from Texas A&M University.<sup>352</sup> He has over 30 years of experience in the nuclear engineering profession.<sup>353</sup> As a Senior Reactor Engineer for the NRC, Dr. Palmrose performs and coordinates the environmental reviews for standard design certifications, COL, and ESP applications in the areas of environmental radiological dose analyses, nuclear power plant severe accident risks, and the evaluations of the transportation of radioactive materials.<sup>354</sup>

In his written testimony on SER Topic 5, Dr. Palmrose testified as follows:

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<sup>348</sup> Id.

<sup>349</sup> Id.

<sup>350</sup> Id.

<sup>351</sup> NRC Staff Statements of Professional Qualifications at 19.

<sup>352</sup> Id.

<sup>353</sup> Id.

<sup>354</sup> Id.

The NTTF Recommendations applicable to PSEG's application were addressed in the NRC Staff's safety review.<sup>355</sup> Therefore, although all previous ESPs were issued prior to the events at Fukushima, the NRC Staff determined that the PSEG environmental review "did not require application of different review methodologies, or guidance compared to those applied in previous ESP application reviews."<sup>356</sup>

The Board did not require oral testimony from Dr. Palmrose on SER Topic 5.

#### F. SER Topic 6

SER Topic 6 stated:

Explain, for the non-expert, how the Applicant calculated the long-term atmospheric dispersion for routine releases. What was the extent of Staff's review? Details of the calculations of the GASPARE code are not required.<sup>357</sup>

Three witnesses testified on SER Topic 6:

##### 1. PSEG Witness

James Mallon. Mr. Mallon's background and qualifications have been previously summarized with regard to his testimony on SER Topic 1.

In his written testimony on SER Topic 6, Mr. Mallon testified as follows concerning the first portion of Topic 6, namely how PSEG calculated the long-term atmospheric dispersion for routine releases:<sup>358</sup>

To confirm that a proposed nuclear power plant meets NRC's regulatory standards for radiation dose limits, applicants evaluate the short-term release of radionuclides following a design basis accident and the long-term release of radionuclides as part of routine releases.<sup>359</sup>

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<sup>355</sup> NRC SER Topic 5 Testimony at 5.

<sup>356</sup> Id.

<sup>357</sup> SER Prefiled Testimony Order at 3.

<sup>358</sup> PSEG SER Topic 6 Testimony at 3-6.

<sup>359</sup> Id.

Because the radionuclides that may be in the gaseous effluents at a plant are dispersed by wind after being released, applicants use atmospheric dispersion modeling to predict the extent of a release.<sup>360</sup>

The concentration of radionuclides in the air is represented by the long-term diffusion estimates expressed in  $\chi/Q$  values.<sup>361</sup> These values are determined at “receptors of interest,” such as a nearby residence, and at locations where an individual may receive the maximum allowable individual exposure outside of the plant site boundary.<sup>362</sup> These points of maximum individual exposure “are evaluated using a radial grid of sixteen 22½ degree sectors extending to 50 miles (mi.) from the new plant.”<sup>363</sup>

PSEG estimated the applicable  $\chi/Q$  values using NRC-sponsored XOQDOQ computer program.<sup>364</sup> This computer program incorporates assumptions outlined in Regulatory Guide 1.111, including that the effluents will travel in a straight-line trajectory from the release point to all receptors.<sup>365</sup> To calculate the  $\chi/Q$  values, the primary inputs in the XOQDOQ computer program are wind speed and wind direction.<sup>366</sup> For its calculations, PSEG used wind speed and wind direction inputs based on on-site meteorological data from January 1, 2006 through December 31, 2008.<sup>367</sup>

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<sup>360</sup> See id.

<sup>361</sup> Id. at 4.

<sup>362</sup> Id.

<sup>363</sup> Id.

<sup>364</sup> Id. at 5.

<sup>365</sup> Id.

<sup>366</sup> Id.

<sup>367</sup> Id.

The results of the XOQDOQ modeling are summarized in PSEG's Site Safety Analysis Report Table 2.3-24,<sup>368</sup> and the complete set of  $\chi/Q$  values for routine releases is provided in Table 2.3-37.<sup>369</sup> Ultimately, PSEG determined that the largest  $\chi/Q$  values for the site boundary is 1.6E-01 sec/m<sup>3</sup> in the South direction.<sup>370</sup> However, PSEG disregarded the limiting values for sectors SE to NW (clockwise direction) because in those sectors the site boundary borders the Delaware River.<sup>371</sup> "Therefore, the only sectors that are used to obtain the limiting  $\chi/Q$  value for the site boundary are between the NNW and ESE directions (clockwise direction)."<sup>372</sup>

In his oral testimony on SER Topic 6, Mr. Mallon testified as follows:

Differential heating rates of land versus water affect wind direction.<sup>373</sup> Thus the XOQDOQ computer model accounts for the different heating rates by using a joint frequency distribution of meteorological data.<sup>374</sup> In addition, PSEG's maximum  $\chi/Q$  values for routine releases adequately account for the range of half-lives of the nuclides in a release for purposes of calculating long-term, chronic exposure.<sup>375</sup> By contrast, "a short-lived code and accident-type analysis where you might have short-lived noble gases or iodine-131 would be different."<sup>376</sup>

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<sup>368</sup> Id.; see Ex. PSEG004B, Tbl. 2.3-34, at 2.3-96.

<sup>369</sup> PSEG SER Topic 6 Testimony at 6; see Ex. PSEG004B, Tbl. 2.3-34, at 2.3-109.

<sup>370</sup> PSEG SER Topic 6 Testimony at 6.

<sup>371</sup> Id. at 6-7.

<sup>372</sup> Id. at 7.

<sup>373</sup> Tr. at 159.

<sup>374</sup> Id.

<sup>375</sup> Tr. at 161; see also PSEG SER Topic 6 Testimony at 6.

<sup>376</sup> Tr. at 161.

## 2. NRC Staff Witnesses

Kevin R. Quinlan. Mr. Quinlan's background and qualifications have been previously summarized with regard to his testimony on SER Topic 4.

In his written testimony on SER Topic 6, Mr. Quinlan testified as follows:

Mr. Quinlan's testimony as to how PSEG calculated the long term atmospheric dispersion for routine releases was substantially similar to Mr. Mallon's testimony.<sup>377</sup> However, Mr. Quinlan added that, because PSEG disregarded the limiting values for sector SE to NW (clockwise direction), the NRC Staff included COL Action Item 2.3-1.<sup>378</sup> This action item requires an applicant at the COL stage to verify "receptors of interest" to ensure that the applicant identifies any receptor changes in sector SE to NW (clockwise direction) and, if necessary, to consider the  $\chi/Q$  values for that previously disregarded sector.<sup>379</sup>

As to the extent of the NRC Staff's review of the PSEG's calculations, the NRC Staff completed a quality assurance review of the three-year onsite meteorological data that PSEG used as the basis for its primary inputs in the XOQDOQ computer model.<sup>380</sup> The NRC Staff also independently created its own inputs of wind speed, wind direction, and atmospheric stability based on the same dataset.<sup>381</sup> After running this confirmatory analysis, the NRC Staff obtained results that were within approximately one percent of PSEG's values.<sup>382</sup> Thus, the NRC Staff concluded that PSEG's long-term atmospheric dispersion estimates were acceptable.<sup>383</sup>

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<sup>377</sup> See NRC SER Topic 6 Testimony at 2-3; see also PSEG SER Topic 6 Testimony at 3-6.

<sup>378</sup> NRC SER Topic 6 Testimony at 3.

<sup>379</sup> Id.

<sup>380</sup> Id. at 4.

<sup>381</sup> Id.

<sup>382</sup> Id.

<sup>383</sup> Id.

In his oral testimony on SER Topic 6, Mr. Quinlan testified as follows:

PSEG used a joint frequency distribution of wind speed, wind direction, and atmospheric stability as an input to the XOQDOQ computer model.<sup>384</sup> “A joint frequency distribution is a way of summarizing multiple years of meteorological data.”<sup>385</sup> PSEG’s data set for the joint frequency distribution was for a three-year period.<sup>386</sup> The NRC Staff conducted a rigorous quality assurance review of PSEG’s data set to ensure that each year within the three-year period was a reasonable representation of metrological conditions.<sup>387</sup> Further, while certain topographical features such as a nearby mountain range or large body of water could preclude the use of the XOQDOQ model, the PSEG site has no such topographical features.<sup>388</sup> More specifically, although some bodies of water are near the PSEG site, these are not large enough to preclude the use of the XOQDOQ model.<sup>389</sup>

Stephen E. Williams. Mr. Williams is a Health Physicist in the Office of New Reactors’ Division of Site and Environmental Analysis, Radiation Protection Accident Consequences Branch.<sup>390</sup> He received his B.S. in Radiological Health from Duquesne University and his M.S. in Environmental Pollution Control from Penn State University.<sup>391</sup> Mr. Williams has 40 years of experience in various disciplines in Health Physics, including eight years of experience at the

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<sup>384</sup> See Tr. at 153; see also NRC SER Topic 6 Testimony at 3.

<sup>385</sup> Tr. at 153.

<sup>386</sup> Id.

<sup>387</sup> Tr. at 154-55.

<sup>388</sup> Tr. at 155-56.

<sup>389</sup> Tr. at 156.

<sup>390</sup> NRC Staff Statements of Professional Qualifications at 20.

<sup>391</sup> Id.



NRC.<sup>392</sup> As a Health Physicist within the Office of New Reactors, Mr. Williams has participated in the technical review of three COL applications, four design certification documents, and three ESP applications.<sup>393</sup>

In his written testimony on SER Topic 6, Mr. Williams testified as follows:

To estimate the gaseous effluent doses and effluent concentrations to the public, PSEG combined its long-term atmospheric dispersion estimates with “routine gaseous effluent release parameters.”<sup>394</sup> These parameters “include volumes, flow rates, filtration factors, radiation monitor estimated readings, estimated duration of each release, and radiological sample results.”<sup>395</sup> PSEG’s methodology conformed to the NRC guidance in Regulatory Guide 1.112 and Regulatory Guide 1.109.<sup>396</sup> The NRC Staff also evaluated PSEG’s methodology by independently calculating the applicable doses and effluent concentrations.<sup>397</sup> The NRC Staff’s confirmatory calculations were within regulatory limits and similar to the values obtained by PSEG.<sup>398</sup>

The Board did not require oral testimony from Mr. Williams on SER Topic 6.

#### G. FEIS Topic 1

FEIS Topic 1 stated:

In its response to FEIS Question 8, PSEG implies that there was never evidence of the Bog Turtle on Artificial Island. Does the NRC Staff agree? If so, should FEIS subsection 2.4.1.3, which states that the Bog Turtle was recorded

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<sup>392</sup> Id.

<sup>393</sup> Id.

<sup>394</sup> NRC SER Topic 6 Testimony at 4.

<sup>395</sup> Id.

<sup>396</sup> Id.

<sup>397</sup> Id. at 5.

<sup>398</sup> Id.

historically “for Artificial Island and vicinity,” be revised to assert merely that there is historical evidence of the Bog Turtle in the “vicinity” of Artificial Island?<sup>399</sup>

Two NRC Staff witnesses submitted prefiled written testimony on FEIS Topic

1:<sup>400</sup>

Michael Willingham. Mr. Willingham is a Project Manager in the NRC’s Office of New Reactors, Division of Site Safety and Environmental Reviews, Hydrology and Meteorology Branch 2.<sup>401</sup> Mr. Willingham has a B.S. in Environmental Science from Texas A&M University Corpus Christi and an M.S. in Environmental Engineering and Science from Johns Hopkins University.<sup>402</sup> He has over nine years of experience managing and participating in multidisciplinary environmental and safety related projects for the NRC, including NEPA reviews, preparation of environmental impact statements, and pre-application activities related to environmental reviews of new reactors.<sup>403</sup>

In his written testimony on FEIS Topic 1, Mr. Willingham testified as follows:

Mr. Willingham is the technical reviewer for terrestrial ecology and land use for the environmental review associated with the ESP application submitted by PSEG.<sup>404</sup> As the ESP application reviewer for terrestrial ecology and land use, he was responsible for preparing the terrestrial and wetlands ecology portions of Sections 2.4, 4.3, 5.3, 7.3, and 9.3 of the FEIS.<sup>405</sup>

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<sup>399</sup> FEIS Prefiled Testimony Order at 2.

<sup>400</sup> The Board did not require oral testimony concerning FEIS Topic 1. See Licensing Board Order (Identifying Resolved Topics) (Mar. 15, 2016) at 1 (unpublished) [hereinafter Resolved Topics Order].

<sup>401</sup> NRC FEIS Topic 1 Testimony at 1.

<sup>402</sup> NRC Staff Statements of Professional Qualifications at 21.

<sup>403</sup> Id.

<sup>404</sup> NRC FEIS Topic 1 Testimony at 1.

<sup>405</sup> Id.

A 1980 study of the terrestrial ecology of Artificial Island and vicinity identified that the Bog Turtle was present within the study area, including Delaware.<sup>406</sup> The Bog Turtle, however, was not observed during a 2009-10 survey of the proposed ESP site and its vicinity.<sup>407</sup> The preferred habitat for the Bog Turtle does not exist in the quantity needed to support the species on Artificial Island.<sup>408</sup>

Furthermore, the FEIS was intended to reflect that the 1980 study merely “encompassed” both the Artificial Island and vicinity.<sup>409</sup> “[T]he historical evidence does not indicate direct observations of the bog turtle on Artificial Island.”<sup>410</sup> That the Bog Turtle was not historically present on the Artificial Island is a conclusion that is implicit in the FEIS.<sup>411</sup> A formal revision of the FEIS that “[t]he bog turtle was recorded historically for Artificial Island and vicinity” is therefore not required.<sup>412</sup>

Neil Giffen. Mr. Giffen is a Natural Resources Manager of the Facilities and Operations Directorate at the Oak Ridge National Laboratory (ORNL).<sup>413</sup> He is employed by UT-Battelle, LLC, a not-for-profit organization that manages and operates the ORNL for the U.S. Department of Energy.<sup>414</sup> Mr. Giffen has a B.A. in Environmental Science from State University of New York

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<sup>406</sup> Id. at 2.

<sup>407</sup> Id.

<sup>408</sup> Id. at 2-3.

<sup>409</sup> Id. at 3.

<sup>410</sup> Id.

<sup>411</sup> Id.

<sup>412</sup> See id.; see also Ex. NRC004A, at 2-6B.

<sup>413</sup> NRC FEIS Topic 1 Testimony at 1.

<sup>414</sup> Id.

and an M.S. in Wildlife Science from the University of Maryland.<sup>415</sup> He has over 25 years of experience conducting environmental assessments, including environmental impact analysis for proposed development projects and reviews of numerous environmental assessments and impact statements.<sup>416</sup>

Mr. Giffen assisted the NRC Staff in its environmental review of PSEG's ESP application associated with the areas of terrestrial and wetlands ecology.<sup>417</sup> In his written testimony on FEIS Topic 1, Mr. Giffen concurred with Mr. Willingham's statements regarding this issue.<sup>418</sup>

#### H. FEIS Topic 2

FEIS Topic 2 stated:

In its response to FEIS Question 9, PSEG implies that there was never evidence of the Eastern Tiger Salamander on Artificial Island. Does the NRC Staff agree? If so, should FEIS subsection 2.4.1.3, which asserts that the Eastern Tiger Salamander was recorded "during an ecological survey conducted on Artificial Island from 1972 through 1978," be revised to assert that the cited survey examined a study area within a 16 kilometer radius of southern Artificial Island and concluded merely that the Eastern Tiger Salamander was found in southern New Castle County, Delaware "just outside the study area and may occur within it"?<sup>419</sup>

Two NRC Staff witnesses submitted prefiled written testimony on FEIS Topic

2.<sup>420</sup>

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<sup>415</sup> NRC Staff Statements of Professional Qualifications at 23.

<sup>416</sup> Id.

<sup>417</sup> NRC FEIS Topic 1 Testimony at 1.

<sup>418</sup> Id. at 1-3.

<sup>419</sup> FEIS Prefiled Testimony Order at 2.

<sup>420</sup> The Board did not require oral testimony concerning FEIS Topic 2. Resolved Topics Order at 1.

Michael Willingham. Mr. Willingham's background and qualifications were previously summarized with regard to his testimony on FEIS Topic 1. In his written testimony on FEIS Topic 2, Mr. Willingham testified as follows:

A 1980 study of the terrestrial ecology of Artificial Island found that the Eastern Tiger Salamander was present just outside the study area, including a portion of Delaware, and may occur within the study area.<sup>421</sup> The Eastern Tiger Salamander was not observed during a 2009-10 survey of the proposed ESP site and its vicinity.<sup>422</sup> Artificial Island does not contain the habitat resources needed to support the Eastern Tiger Salamander.<sup>423</sup>

The Eastern Tiger Salamander was not recorded on Artificial Island during the 1972 to 1978 survey, but was reported in Salem County, New Jersey in the 1980 study.<sup>424</sup> The FEIS need not be revised to clarify that the 1980 study examined an area within a 16 kilometer radius of Artificial Island and concluded that the Eastern Tiger Salamander was found just outside of the study area and may occur within that area.<sup>425</sup> The FEIS was merely intended to reflect that the 1980 survey "encompassed" Artificial Island, but that the Eastern Tiger Salamander was not recorded on Artificial Island in that survey.<sup>426</sup>

Neil Giffen. Mr. Giffen's background and qualifications were previously summarized with regard to his testimony on FEIS Topic 1. In his written testimony on FEIS Topic 2, Mr. Giffen concurred with Mr. Willingham's statements regarding this issue.<sup>427</sup>

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<sup>421</sup> NRC FEIS Topic 2 Testimony at 2.

<sup>422</sup> Id.

<sup>423</sup> Id.

<sup>424</sup> Id. at 3.

<sup>425</sup> Id.

<sup>426</sup> Id.

<sup>427</sup> Id. at 1-3.

I. FEIS Topic 3

FEIS Topic 3 stated:

In its response to FEIS Question 21, PSEG clarifies that flow augmentation from Merrill Creek is not for the purposes of safety or non-safety cooling system operability. PSEG acknowledges, however, that such flow augmentation may be necessary to allow power generation to continue, in certain conditions, so as to avoid impacting the salt line in the Delaware River. Should PSEG apply for a construction permit or COL, will the NRC Staff examine at that time PSEG's ability to obtain adequate water supplies from the Merrill Creek Reservoir?<sup>428</sup>

Three witnesses testified on FEIS Topic 3:

1. PSEG Witness

James Mallon. Mr. Mallon's background and qualifications were previously summarized with regard to his testimony on SER Topic 1. In his written testimony on FEIS Topic 3, Mr. Mallon testified as follows:

The Merrill Creek Reservoir (MCR) would not be required for safety-related cooling in connection with a potential new plant at the PSEG site.<sup>429</sup> Furthermore, if additional water rights are required in the future, then PSEG considers it likely that it could transfer water rights from another PSEG-owned facility or it could obtain the water rights from a third party.<sup>430</sup> Finally, if PSEG proceeds with a COL application that references this ESP, then the MCR water rights issue would be subject to NRC Staff review.<sup>431</sup>

The MCR is used for low flow augmentation of the Delaware River during times of drought.<sup>432</sup> Specifically, the MCR allows certain power plants to continue to withdraw water from the Delaware River for power generation during declared drought warnings or

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<sup>428</sup> FEIS Prefiled Testimony Order at 2.

<sup>429</sup> PSEG FEIS Topic 3 Testimony at 3.

<sup>430</sup> Id.

<sup>431</sup> Id.

<sup>432</sup> Id. at 4.

emergencies.<sup>433</sup> The MCR is not required for any safety cooling purposes because the tidal flow in the Delaware River at the PSEG site is much greater than the flow required by an intake structure for a potential new plant.<sup>434</sup>

Flow augmentation from the MCR is initiated when flows in the Delaware River fall below 3,000 cubic feet per second at Trenton, New Jersey, which is 80 miles north of the PSEG site.<sup>435</sup> Flow augmentation occurs during declared drought conditions to protect the salt line in the Delaware River, so that Philadelphia-area freshwater intakes are not adversely effected.<sup>436</sup> Since the MCR was placed into service in 1988, it has been used for drought-related flow augmentation only four times.<sup>437</sup>

Storage allocation for the MCR is determined for each power plant or “designated unit” with ownership rights in the MCR.<sup>438</sup> Currently, thirty six generating stations are listed as designated units for purposes of the MCR.<sup>439</sup> Storage allocation in the MCR is based on the geographic location of a power plant along the Delaware River.<sup>440</sup> Power plants further north along the Delaware River have the highest allocations due to their higher freshwater consumptive uses relative to existing plants at the PSEG site that are located along a portion of the Delaware River that is considered brackish.<sup>441</sup>

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<sup>433</sup> Id.

<sup>434</sup> Id. at 5.

<sup>435</sup> Id. at 6.

<sup>436</sup> Id.

<sup>437</sup> Id. at 7.

<sup>438</sup> Id. at 4, 7.

<sup>439</sup> Id. at 8.

<sup>440</sup> Id. at 7.

<sup>441</sup> Id.

If PSEG required additional water allocation rights in the MCR at the PSEG site, then it could potentially transfer rights from other PSEG-owned facilities, like Mercer Generating Station, or enter into negotiations with a third-party designated unit.<sup>442</sup> If allocation rights were obtained from a third-party, then any agreement would be submitted to the Delaware River Basin Commission (DRBC) for approval.<sup>443</sup> Based on the existence of designated units with lengthy operation histories, it is likely that allocation rights would be available for acquisition as those plants ceased operations.<sup>444</sup>

Any new power plant at the PSEG site would require PSEG to submit an application to the DRBC, with specific plant values for water use.<sup>445</sup> The DRBC would then review the application, hold a public hearing, and issue a docket for surface water withdrawal with appropriate conditions.<sup>446</sup> As a part of this process, PSEG would be required to either hold the specific required MCR water allocation, or would be required to commit to an operating plan that would be in effect during declared droughts.<sup>447</sup> Regarding the latter, PSEG could commit to an operating plan that included power generation limits at the PSEG site or other PSEG-owned facilities.<sup>448</sup>

Finally, pursuant to 10 C.F.R. § 51.50(c)(1)(iii), an applicant for a COL that references an ESP must provide “[a]ny new and significant information for issues related to the impacts of construction and operation of the facility that were resolved in the early site permit

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<sup>442</sup> Id. at 8-9.

<sup>443</sup> Id. at 9.

<sup>444</sup> Id.

<sup>445</sup> Id.

<sup>446</sup> Id.

<sup>447</sup> Id.

<sup>448</sup> Id. at 9-10.



proceeding.”<sup>449</sup> Any identification and evaluation of new and significant information would include consideration of adequate water supplies from the MCR.<sup>450</sup> For this reason, PSEG anticipated that the NRC Staff will review the water allocation associated with any potential COL application associated with the PSEG site as a part of the process of preparing any supplement to the FEIS.<sup>451</sup>

In his oral testimony on FEIS Topic 3, Mr. Mallon testified as follows:

The purpose of the Merrill Creek Reservoir is to control the salt line of the Delaware River during a period of drought.<sup>452</sup> The PSEG site is south of the salt line and, therefore, any proposed plant at that site would be cooling with brackish water.<sup>453</sup> Nonetheless, the DRBC wanted PSEG to have a fresh water allocation so they assumed that eighteen percent of PSEG’s cooling water would be freshwater.<sup>454</sup> Downpowering the proposed new plant at the PSEG site would not have an impact on the salt line.<sup>455</sup> However, PSEG would downpower the plant if ordered to do so by the DRBC.<sup>456</sup>

## 2. NRC Staff Witnesses

Philip Meyer. Dr. Meyer is a Senior Research Engineer in the Hydrology Group of the Energy and Environment Directorate at the Pacific Northwest National Laboratory.<sup>457</sup> He has

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<sup>449</sup> Id. at 11; see also 10 C.F.R. § 51.50(c)(1)(iii).

<sup>450</sup> PSEG FEIS Topic 3 Testimony at 11.

<sup>451</sup> Id.

<sup>452</sup> Tr. at 163.

<sup>453</sup> Tr. at 167.

<sup>454</sup> Tr. at 164.

<sup>455</sup> Tr. at 166.

<sup>456</sup> Tr. at 164-65.

<sup>457</sup> NRC FEIS Topic 3 Testimony at 1.

supported the NRC Office of New Reactors since 2007, including serving as principal author and technical analyst for the groundwater sections of safety evaluations for the North Anna Unit 3 COL, Calvert Cliffs Unit 3 COL, and Vogtle Units 3 and 4 COL.<sup>458</sup> Dr. Meyer has a B.A. in Physics from Cornell University and an M.S. and a Ph.D in Civil Engineering from the University of Illinois.<sup>459</sup>

In his written testimony on FEIS Topic 3, Dr. Meyer testified as follows:

Dr. Meyer, along with Mohammad Haque, served as the NRC Staff technical reviewers for the water-related aspects of the ESP application.<sup>460</sup> They were responsible for the hydrology, water use, and water quality technical content of the FEIS, and for the preparation of Sections 2.3, 4.2, 5.2, and 7.2 of the FEIS.<sup>461</sup>

The NRC Staff would necessarily evaluate the adequacy of the MCR for low flow augmentation to the Delaware River as part of the environmental review of any CP or COL application that references an ESP for the proposed site.<sup>462</sup> In preparing a supplemental EIS for a CP or COL application that references the PSEG ESP, the NRC Staff would determine whether there is new and significant information related to the plant's water use.<sup>463</sup> More specifically, any supplemental ESP review would be in accordance with the NRC's regulations under 10 C.F.R. Part 51.<sup>464</sup>

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<sup>458</sup> NRC Staff Statements of Professional Qualifications at 27.

<sup>459</sup> Id.

<sup>460</sup> NRC FEIS Topic 3 Testimony at 1.

<sup>461</sup> Id.

<sup>462</sup> Id.

<sup>463</sup> Id. at 2

<sup>464</sup> Id.

The NRC Staff would look at changes to the list of designated units and changes in the allocation of MCR storage.<sup>465</sup> Additionally, the NRC Staff would consider, as appropriate, other related information including changes in the DRBC's requirements, new development that increases consumptive water use in the Delaware River basin, and changes in the climate of the region that could impact water resources.<sup>466</sup> In performing a review of any new or significant information associated with a CP or COL application, the NRC Staff would re-examine the potential environmental impacts associated with the MCR, which would inform the NRC's ultimate licensing decision.<sup>467</sup>

The Board did not require oral testimony from Dr. Meyer on FEIS Topic 3.

Mohammad Haque. Mr. Haque is a Senior Hydrologist in the NRC's Office of New Reactors, Division of Site Safety and Environmental Analysis, Environmental Technical Support Branch.<sup>468</sup> Mr. Haque has a B.S. in Civil Engineering and an M.S. in Civil Engineering from the University of Texas at Arlington.<sup>469</sup> He has over 40 years of experience in environmental and water resources engineering in the private and public sectors, including approximately 18 years at the NRC.<sup>470</sup> Mr. Haque's NRC experience includes approximately seven years in the Division of Site Safety and Environmental Analysis, including serving as a project manager and as a technical expert reviewing hydrologic aspects of safety analysis and environmental reports for various ESP and COL applications.<sup>471</sup>

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<sup>465</sup> Id.

<sup>466</sup> Id.

<sup>467</sup> Id.

<sup>468</sup> NRC FEIS Topic 3 Testimony at 1.

<sup>469</sup> NRC Staff Statements of Professional Qualifications at 26.

<sup>470</sup> Id.

<sup>471</sup> Id.

In his written testimony on FEIS Topic 3, Mr. Haque concurred with Dr. Meyer's statements regarding this issue.<sup>472</sup> In his oral testimony on FEIS Topic 3, Mr. Haque testified as follows:

In evaluating the potential environmental impacts that would be associated with release of the MCR water for low-flow augmentation, the NRC Staff would consider the equivalent freshwater consumptive water use of a new plant at the PSEG site.<sup>473</sup> Specifically, "[t]he DRBC requires that the consumptive use by a utility should be compensated for low flow augmentation and . . . they have an equivalent factor of 0.18 that has been established . . . to compute [the] equivalent amount for the brackish water."<sup>474</sup> This equivalency factor is the same for the Salem and Hope Creek power plants.<sup>475</sup>

#### J. FEIS Topic 4

FEIS Topic 4 stated:

Following the discussion in FEIS subsection 5.3.1.1 and the NRC Staff responses to FEIS Questions 22 and 23, the Staff shall provide additional detail about the potential impact of salt drift on freshwater wetlands in the vicinity of the ESP site. Specifically, the Staff noted in their response that "vegetation in the area has already adapted to naturally occurring levels of salt deposition" and that "cumulative impacts of salt deposition on the site and the vicinity would be minimal"; however, does this generalization apply to all of the potentially affected wetlands and could an incremental increase in salt drift adversely affect threatened or endangered plant or animal species?<sup>476</sup>

Two NRC Staff witnesses submitted prefiled written testimony on FEIS Topic 4:<sup>477</sup>

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<sup>472</sup> NRC FEIS Topic 3 Testimony at 1-2.

<sup>473</sup> See Tr. at 169; see also NRC FEIS Topic 3 Testimony at 2.

<sup>474</sup> Tr. at 169.

<sup>475</sup> Tr. at 170.

<sup>476</sup> FEIS Prefiled Testimony Order at 2-3.

<sup>477</sup> The Board did not require oral testimony concerning FEIS Topic 4. See Resolved Topics Order at 1.

Michael Willingham. Mr. Willingham's background and qualifications were previously summarized with regard to his testimony on FEIS Topic 1. In his written testimony on FEIS Topic 4, Mr. Willingham testified as follows:

Cumulative maximum salt deposition from the Hope Creek Generating Station natural draft cooling tower (NDCT), proposed linear mechanical draft cooling towers (LMDCTs), and natural salt deposition would result in a cumulative salt deposition rate of 3.74 kg/ha/mo.<sup>478</sup> The salt deposition rate for the proposed LMDCTs is 1.31 kg/ha/mo, and the rate for the existing NDCT is 1.13 kg/ha/mo.<sup>479</sup> The natural salt deposition rate for the area is 1.3 kg/ha/mo.<sup>480</sup> The salt deposition rates do not entirely overlap; therefore, the numerical values from the cooling towers are not directly additive.<sup>481</sup> Rather, the maximum salt drift deposition from the proposed LMDCTs would occur within 700 meters to the east, while the deposition from the existing NDCT occurs within 400 meters to the southeast.<sup>482</sup> As a result, the cumulative salt deposition rate of 3.74 kg/ha/mo is a conservative maximum bounding limit and actual rates are expected to be lower.<sup>483</sup>

Additionally, the dominant habitat type 700 meters to the east and southeast of the proposed location of the LMDCTs is *Phragmites*-dominated coastal wetlands.<sup>484</sup> Existing land use types that could potentially be affected by salt drift deposition from the proposed LMDCTs include disturbed wetlands, *Phragmites*-dominated interior wetlands, and developed land

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<sup>478</sup> NRC FEIS Topic 4 Testimony at 2.

<sup>479</sup> Id.

<sup>480</sup> Id.

<sup>481</sup> Id.

<sup>482</sup> Id.

<sup>483</sup> Id.

<sup>484</sup> Id.

uses.<sup>485</sup> Furthermore, all of the land uses and habitats within 400 meters of the east and northeast of the existing NDCT are urban/developed land uses and *Phragmites*-dominated coastal wetlands.<sup>486</sup>

155.6 acres of the existing PSEG site are *Phragmites*-dominated coastal wetlands, which is tidally influenced and can have salinity ranges from 1 to 9 ppt.<sup>487</sup> Therefore, the vegetation species in this habitat would be expected to have a higher level of salinity tolerance, resulting in minimal cumulative impacts of salt deposition on the site and vicinity.<sup>488</sup>

The extent of vegetation damaged by salt drift is related to the climatic conditions, stage of life cycle, and tolerance to salt.<sup>489</sup> For example, salt drift is more likely to damage (1) vegetation in more arid environments, (2) less salt tolerant species, and (3) plants during their growing season.<sup>490</sup> At the PSEG site, mean annual rainfall would be expected to prevent soil salinization that could damage vegetation, relative to more arid environments.<sup>491</sup> Additionally, the cumulative maximum salt deposition rate of 3.74 kg/ha/mo would occur during the winter.<sup>492</sup> This cumulative rate is less than that expected to cause acute injury to the most sensitive species list in NUREG-1437 and would not occur during the growing season of plants on and in the vicinity of the PSEG site.<sup>493</sup> Moreover, the coastal location of the site results in vegetation

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<sup>485</sup> Id.

<sup>486</sup> Id.

<sup>487</sup> Id.

<sup>488</sup> Id.

<sup>489</sup> See id. at 3

<sup>490</sup> Id.

<sup>491</sup> Id.

<sup>492</sup> Id.

<sup>493</sup> Id.

that is generally expected to have a high level of salinity tolerance; therefore, salt deposition is expected to have a minimal impact on plant species.<sup>494</sup>

Lastly, there are no known Federally-listed endangered or threatened vegetation or animal species that occur within the areas affected by salt drift.<sup>495</sup> In addition, although various state-listed species occur within wetlands affected by salt drift, including various wading birds and the northern harrier, these species commonly frequent coastal wetland habitats and are acclimated to saline environments.<sup>496</sup> As a result, the incremental increase in salt deposition rates resulting from a new cooling tower would not be expected to impact these bird species.<sup>497</sup>

Neil Giffen. Mr. Giffen's background and qualifications were previously summarized with regard to his testimony on FEIS Topic 1. In his written testimony on FEIS Topic 4, Mr. Giffen concurred with Mr. Willingham's statements regarding this issue.<sup>498</sup>

#### K. FEIS Topic 5

FEIS Topic 5 stated:

In its response to FEIS Question 29, the NRC Staff asserts that it does not expect that the potential new nuclear units "and associated infrastructure" would adversely affect either the Bog Turtle or the Eastern Tiger Salamander. Has the Staff confirmed that, in the most recent surveys, neither the Bog Turtle nor the Eastern Tiger Salamander were identified in the areas proposed for a new causeway, transmission lines, or related infrastructure?<sup>499</sup>

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<sup>494</sup> Id.

<sup>495</sup> Id.

<sup>496</sup> Id.

<sup>497</sup> Id.

<sup>498</sup> Id. at 1-4

<sup>499</sup> FEIS Prefiled Testimony Order at 3.

Two NRC Staff witnesses submitted prefiled written testimony on FEIS Topic

5.<sup>500</sup>

Michael Willingham. Mr. Willingham's background and qualifications were previously summarized with regard to his testimony on FEIS Topic 1. In his written testimony on FEIS Topic 5, Mr. Willingham testified as follows:

In preparing the FEIS, the NRC Staff reviewed relevant information and conducted site visits regarding the presence of the Bog Turtle and the Eastern Tiger Salamander in the areas proposed for a new causeway, transmission lines, or related infrastructure.<sup>501</sup> The 2009-10 survey—referenced in his testimony regarding FEIS Topics 1 and 2—included the proposed causeway, transmission lines, and related infrastructure.<sup>502</sup> As previously noted, the Bog Turtle and Eastern Tiger Salamander were not observed during the 2009-10 survey.<sup>503</sup> Reports by the Conserve Wildlife Foundation of New Jersey and the NJDEP indicate that Bog Turtles are primarily restricted to several counties in New Jersey, including northeastern portions of Salem County.<sup>504</sup> Eastern Tiger Salamanders are limited to the far eastern portions of Salem County, and Cumberland and Atlantic Counties in New Jersey.<sup>505</sup>

The NRC Staff also conducted several site visits to the proposed ESP site and vicinity and confirmed that the habitat observed was consistent with the information provided to the

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<sup>500</sup> The Board did not require oral testimony concerning FEIS Topic 5. See Resolved Topics Order at 1.

<sup>501</sup> NRC FEIS Topic 5 Testimony at 2.

<sup>502</sup> Id. at 3.

<sup>503</sup> Id.

<sup>504</sup> Id.

<sup>505</sup> Id.



NRC, which did not indicate the presence of the preferred habitat for either species.<sup>506</sup> Neither species was observed during NRC Staff site visits.<sup>507</sup>

Neil Giffen. Mr. Giffen's background and qualifications were previously summarized with regard to his testimony on FEIS Topic 1. In his written testimony on FEIS Topic 5, Mr. Giffen concurred with Mr. Willingham's statements regarding this issue.<sup>508</sup>

#### L. FEIS Topic 6

FEIS Topic 6 stated:

In its response to FEIS Question 33, the NRC Staff states that, "[w]ith the exception of the mitigation activities associated with the PSEG traffic study, all of the activities listed in Table 10-1 in the FEIS are associated with expected permit requirements of other Federal, State, and local agencies." For each of these expected permit requirements, the Staff shall either confirm that the expected permit requirement is essentially certain, or if not essentially certain, provide an estimate of the unavoidable impact if the respective requirement is not made. Likewise, in Table 10-2 of the FEIS, listing unavoidable impacts of operation, the Staff makes use of similar mitigation acts based upon expected permit requirements. The Staff shall make similar confirmations for this table as well.<sup>509</sup>

Five witnesses submitted prefiled written testimony on FEIS Topic 6:<sup>510</sup>

##### 1. PSEG Witness

James Mallon. Mr. Mallon's background and qualifications have been previously summarized with regard to his testimony on SER Topic 1.

In his written testimony on FEIS Topic 6, Mr. Mallon testified as follows:

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<sup>506</sup> Id.

<sup>507</sup> Id.

<sup>508</sup> Id. at 2-4.

<sup>509</sup> FEIS Prefiled Testimony Order at 3.

<sup>510</sup> The Board did not require oral testimony concerning FEIS Topic 6. Tr. at 72-73.

The mitigation activities listed in Table 10-1 of the FEIS will likely be included in the various permit requirements of other federal, state, and local agencies.<sup>511</sup> Specifically, Appendix H of the FEIS identifies the numerous authorizations, permits and certifications that may be required for the operation of a new nuclear power plant at the PSEG site.<sup>512</sup> Although PSEG has not yet received or applied for many of the necessary approvals, based on PSEG's 40 years of site experience and knowledge of the relevant agencies, it is likely that the required mitigation measures will be "comprehensive and complete."<sup>513</sup> Further, at the COL state, PSEG will be required to identify any new and significant information, including changes to the mitigation actions.<sup>514</sup>

For example, with respect to construction mitigation measures, the required land use approvals include, but are not limited to, a Federal USACE Section 10 and Section 404 Permit, a NJDEP Coastal Area Facility Review Act/Waterfront Development permit, as well as various zoning and construction approvals from the local Lower Alloways Creek Township.<sup>515</sup> "Based on PSEG's experience with other large construction projects, combined with the anticipated conditions of the NJDEP and USACE land use construction approvals, specific monitoring conditions and mitigation activities will be included."<sup>516</sup>

## 2. NRC Staff Witnesses

Allen Fetter. Mr. Fetter's background and qualifications have been previously summarized with regard to his testimony on SER Topic 1.

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<sup>511</sup> PSEG FEIS Topic 6 Testimony at 2-3.

<sup>512</sup> Id. at 4; see Ex. NRC004C, App. H, at H-1 to H-7.

<sup>513</sup> PSEG FEIS Topic 6 Testimony at 8-9.

<sup>514</sup> Id. at 7.

<sup>515</sup> Id. at 9.

<sup>516</sup> Id.

In his written testimony on FEIS Topic 6, Mr. Fetter testified as follows:

Under NEPA, the NRC Staff is required to consider mitigation measures that are reasonably foreseeable.<sup>517</sup> NRC Staff guidance regarding mitigation measures states that a mitigation measure is reasonably foreseeable if (1) it is required by the NRC as a license condition, (2) the mitigation measure is required or likely to be required by another regulatory agency or (3) the applicant stated in its communications with the NRC that it will perform the mitigation measure.<sup>518</sup> Mr. Fetter and the other NRC Staff witnesses on this topic included a chart in their written testimony that describes the NRC Staff's bases for concluding that the mitigation measures identified in Tables 10-1 and 10-2 of the FEIS are reasonably foreseeable.<sup>519</sup>

For example, in terms of impacts to aquatic resources, the NRC Staff concluded that its identified migration measures are reasonably foreseeable because PSEG will be required to acquire a Department of Army permit under Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act.<sup>520</sup> PSEG will also be required to obtain a Clean Water Act Section 401 water quality certification from NJDEP.<sup>521</sup> According to the NRC Staff, these permits will contain "special conditions, including [best management practices], to minimize impacts to aquatic resources and habitats."<sup>522</sup> In addition, prior to the issuance of the

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<sup>517</sup> NRC FEIS Topic 6 Testimony at 2.

<sup>518</sup> Id.; see Environmental Issues Associated with New Reactors, Interim Staff Guidance, (Aug. 2014) at 4 (ADAMS Accession No. ML14092A402).

<sup>519</sup> NRC FEIS Topic 6 Testimony, Tbl. 10-1, at 4-28.

<sup>520</sup> Id. at 8.

<sup>521</sup> Id.

<sup>522</sup> Id.

Department of Army permit, PSEG will be required to develop “a detailed compensatory mitigation plan to address unavoidable impacts to aquatic resources.”<sup>523</sup>

Jack Cushing. Mr. Cushing is a Senior Project Manager, in the Office of New Reactor’s Division of Site Safety & Environmental Analysis, Environmental Technical Support Branch.<sup>524</sup> He received his B.S. in Marine Engineering from the Massachusetts Maritime Academy.<sup>525</sup> Mr. Cushing has 33 years of experience in the nuclear power field, including 17 years with the NRC.<sup>526</sup> As part the NRC Staff’s review of PSEG’s ESP application, Mr. Cushing provided technical oversight for the historic and cultural resource review.<sup>527</sup>

Mr. Cushing’s written testimony on FEIS Topic 6 was substantively identical to Mr. Fetter’s written testimony on this topic.

Jennifer Davis. Ms. Davis is a Senior Project Manager, in the Office of New Reactor’s Division of Site Safety & Environmental Analysis, Environmental Technical Support Branch.<sup>528</sup> She received a B.A. in Historic Preservation/Classical Civilization from Mary Washington College.<sup>529</sup> Ms. Davis has approximately 14 years of experience managing environmental projects at the NRC.<sup>530</sup> During the PSEG review, Ms. Davis was the NRC’s technical lead for the NEPA evaluation of impacts to cultural and historic resources.<sup>531</sup>

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<sup>523</sup> Id.

<sup>524</sup> NRC Staff Statements of Professional Qualifications at 24.

<sup>525</sup> Id.

<sup>526</sup> Id.

<sup>527</sup> Id.

<sup>528</sup> Id. at 29.

<sup>529</sup> Id.

<sup>530</sup> Id.

<sup>531</sup> Id. at 30.

Ms. Davis' written testimony on FEIS Topic 6 was substantively identical to Mr. Fetter's written testimony on that topic.

Andrew Kugler. Mr. Kugler is a Senior Environmental Project Manager, in the Office of New Reactor's Division of Site Safety & Environmental Analysis, Environmental Technical Support Branch.<sup>532</sup> He received a B.S. in Mechanical Engineering from Cooper Union, and an M.S. in Technical Management from Johns Hopkins University.<sup>533</sup> Mr. Kugler has 15 years of experience managing environmental projects for the NRC.<sup>534</sup> During his time at the NRC, Mr. Kugler has managed or participated in review of over ten license renewal applications and several ESP applications.<sup>535</sup>

Mr. Kugler's written testimony on FEIS Topic 6 was substantively identical to Mr. Fetter's written testimony on this topic.

#### M. FEIS Topic 7

FEIS Topic 7 stated:

Related to the NRC Staff's response to FEIS Question 34, on page 10-5 of the FEIS, Table 10-1 lists the unavoidable adverse environmental impacts of construction on the PSEG site. The third column of this table lists the actions that can be taken to mitigate the impacts. However, FEIS section 10.2, Unavoidable Adverse Environmental Impacts, defines unavoidable adverse impacts as: "Unavoidable adverse environmental impacts are those potential impacts of the NRC action and the USACE action that cannot be avoided and for which no practical means of mitigation are available." The Staff shall confirm that the mitigation actions listed will not reduce impacts to less than the impacts listed in the second column of Table 10-1, but rather are actions required to limit impacts to those listed in the second column.<sup>536</sup>

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<sup>532</sup> Id. at 31.

<sup>533</sup> Id.

<sup>534</sup> Id.

<sup>535</sup> Id.

<sup>536</sup> FEIS Prefiled Testimony Order at 3.

Four NRC Staff witnesses submitted prefiled written testimony on FEIS Topic 7:<sup>537</sup>

Allen Fetter. Dr. Fetter's background and qualifications have been previously summarized with regard to his testimony on SER Topic 1. In his written testimony on FEIS Topic 7, Dr. Fetter testified as follows:

The NRC Staff classified unavoidable adverse impacts and mitigation actions in Table 10-1 of the FEIS.<sup>538</sup> Specifically, Table 10-1 lists the potential mitigation measures for various impacts in the third column.<sup>539</sup> In the fourth column, the table lists any remaining unavoidable adverse impacts after the mitigation measures are applied.<sup>540</sup> Thus, the mitigation measures identified in the third column of Table 10-1 will not alter the impact level on each resource area (i.e., whether the adverse impact will be small, moderate, or large).<sup>541</sup>

Jack Cushing. Mr. Cushing's background and qualifications have been previously summarized with regard to his testimony on FEIS Topic 6. Mr. Cushing's written testimony on FEIS Topic 7 was substantively identical to Mr. Fetter's testimony on this topic.

Jennifer Davis. Ms. Davis' background and qualifications have been previously summarized with regard to her testimony on FEIS Topic 6. Ms. Davis' written testimony on FEIS Topic 7 was substantively identical to Mr. Fetter's testimony on this topic.

Andrew Kugler. Mr. Kugler's background and qualifications have been previously summarized with regard to his testimony on FEIS Topic 6. Mr. Kugler's written testimony on FEIS Topic 7 was substantively identical to Mr. Fetter's testimony on this topic.

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<sup>537</sup> The Board did not require oral testimony concerning FEIS Topic 7. See Resolved Topics Order at 1.

<sup>538</sup> NRC FEIS Topic 7 Testimony at 2.

<sup>539</sup> Id.; see Ex. NRC004B, Tbl. 10-1, at 10-5 to 10-9.

<sup>540</sup> NRC FEIS Topic 7 Testimony at 2; see Ex. NRC004B, Tbl. 10-1, at 10-5 to 10-9.

<sup>541</sup> NRC FEIS Topic 7 Testimony at 2.

N. FEIS Topic 8

FEIS Topic 8 stated:

The NRC Staff shall ensure the presence at the evidentiary hearing of one or more witnesses capable of making brief presentations identifying the most significant parts of the cumulative impact assessment and assessment of alternative sites, and responding to the Board's questions thereon.<sup>542</sup>

Although the parties were not required to submit prefiled written testimony on FEIS Topic 8, two witnesses testified orally:

Andrew Kugler. Mr. Kugler's background and qualifications have been previously summarized with regard to his testimony on FEIS Topic 6. At the hearing, Mr. Kugler testified regarding the value of the alternative site analysis generally.<sup>543</sup> Although none of the alternative sites considered in the NRC Staff's environmental review of PSEG's application were obviously superior to the PSEG site, "there have been other application[s] in which a nearby existing nuclear power plant site has not been chosen over a different site that had other advantages."<sup>544</sup>

Jack Cushing. Mr. Cushing's background and qualifications have been previously summarized with regard to his testimony on FEIS Topic 6. At the hearing, Mr. Cushing testified that the cumulative impact assessment ensures that NRC Staff considers the full impact of action that may be minor in isolation, but collectively significant.<sup>545</sup> Therefore, the cumulative impact analysis examines the "tipping point on the resource" to analyze whether an individually minor action becomes the "straw [that] breaks the camel's back."<sup>546</sup>

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<sup>542</sup> FEIS Prefiled Testimony Order at 3.

<sup>543</sup> Tr. at 174-75.

<sup>544</sup> Tr. at 174.

<sup>545</sup> Tr. at 180.

<sup>546</sup> Id.

## V. DISCUSSION

In SER Topic 1, the Board asked the NRC Staff to summarize those portions of its review that supported each of the six safety-related findings necessary for issuance of an ESP.<sup>547</sup> The Staff confirmed that, based on its review of PSEG's application, PSEG complied with all applicable regulatory requirements.<sup>548</sup> The Staff also proposed certain permit conditions.<sup>549</sup>

Because PSEG did not request a limited work authorization, the scope of the Staff's review was limited. The Board is satisfied that the NRC will review PSEG's qualifications to engage in NRC authorized activities at later stages in the licensing process.<sup>550</sup> For example, even though PSEG has extensive experience as a nuclear power plant owner and operator, it was not actually required to demonstrate its technical qualifications to undertake construction activities at this stage.<sup>551</sup> For the same reason, the only applicable ITAAC at this stage are those that pertain to emergency planning, and the Staff correctly determined that PSEG had submitted a satisfactory emergency plan and associated ITAAC.<sup>552</sup>

Similarly, although PSEG has not yet selected a specific reactor design, its application utilized a plant parameter envelope.<sup>553</sup> The Board is satisfied that, if PSEG were to select a design outside these parameters at the COL stage, the NRC would have an appropriate

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<sup>547</sup> In fact, both the Staff and PSEG responded, and each went beyond the Board's request and addressed environmental findings as well. NRC SER Topic 1 Testimony at 5-7; PSEG SER Topic 1 Testimony at 18-29.

<sup>548</sup> NRC SER Topic 1 Testimony at 5.

<sup>549</sup> Id. at 4.

<sup>550</sup> Id.

<sup>551</sup> See id.

<sup>552</sup> Id. at 4-5.

<sup>553</sup> Tr. at 93.



opportunity to evaluate the significance of the differences in the context of the variance request that would be required in such circumstances.<sup>554</sup>

In SER Topic 2, the Board sought to determine whether each of the NRC Staff's nine proposed permit conditions was drawn with sufficient precision, such that verification of compliance would be largely a ministerial act. The NRC Staff explained how each permit condition included sufficiently prescriptive detail and used widely-accepted industry standards and terminology.<sup>555</sup> The Board also finds persuasive the fact that seven of the nine conditions are nearly identical to conditions the Commission has approved in other proceedings,<sup>556</sup> and that the other two are very site specific.<sup>557</sup>

In SER Topic 3, the Board specifically asked about the extent of the Staff's experience in hydraulic modeling and how it is documented. Both PSEG and the Staff provided considerably more detail concerning PSEG's flooding model and the Staff's review of it.<sup>558</sup> The Board is satisfied that the NRC Staff possesses appropriate experience, and that it is documented in SER Section 2.4.

In SER Topic 4, the Board asked the NRC Staff to explain how it had addressed the possible influence of climate change on the power and frequency of hurricanes. As the Staff explained, design-basis wind speeds were based on a doubling of the frequency of hurricanes in the Atlantic and Gulf Coasts and the PMH used to calculate maximum water elevation was sufficiently conservative to account for potential increases in power.<sup>559</sup> Overall, the Board

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<sup>554</sup> Tr. at 93-94.

<sup>555</sup> NRC SER Topic 2 Testimony at 3-13.

<sup>556</sup> PSEG SER Topic 2 Testimony at 9-21.

<sup>557</sup> Tr. at 110.

<sup>558</sup> See NRC SER Topic 3 Testimony at 2-3; PSEG SER Topic 3 Testimony at 4-7.

<sup>559</sup> NRC SER Topic 4 Testimony at 2-3.

agrees with the Staff's conclusion that its analysis is appropriately conservative, especially given uncertainties related to the ameliorating effect of colder water on tropical storms approaching the mid-Atlantic coast.<sup>560</sup> Additionally, the NRC Staff would be required to update regulatory guidance as necessary to address evolving site conditions, and PSEG would be obligated to ensure that its site remains safe to operate.<sup>561</sup>

In SER Topic 5, the Board asked what, if any, impact the Fukushima events in Japan had on the NRC Staff's review of PSEG's application. The Board is satisfied that, while the Staff considered numerous recommendations that arose out of the Fukushima incident,<sup>562</sup> the Staff properly concluded that only a few recommendations applied to the PSEG site at the ESP stage, and that none substantively altered the scope or nature of the Staff's review of PSEG's application.<sup>563</sup>

In SER Topic 6, the Board asked about PSEG's calculations of the long-term atmospheric dispersion of routine releases of radionuclides, and about the extent of the NRC Staff's review. The Board agrees with the Staff's conclusion that PSEG's long-term atmospheric dispersion estimates are acceptable.<sup>564</sup> Among other things, the NRC Staff undertook a quality assurance review of the onsite meteorological data that PSEG used as the basis for its primary inputs to the atmospheric dispersion model.<sup>565</sup> The Staff then created its own inputs, based on the same dataset, and ran a confirmatory analysis that produced results very similar to PSEG's

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<sup>560</sup> Id. at 3.

<sup>561</sup> See NRC SER Topic 5 Testimony at 4-5; Tr. at 144-45.

<sup>562</sup> NRC SER Topic 5 Testimony at 3.

<sup>563</sup> See id. at 4-5; Tr. at 151-52.

<sup>564</sup> NRC SER Topic 6 Testimony at 4.

<sup>565</sup> Id.

values.<sup>566</sup> Further, the Staff created COL Action Item 2.3-1, which will require PSEG at the COL stage to verify and, if necessary, adjust receptors of interest.<sup>567</sup>

In FEIS Topic 1, the Board sought and received confirmation that the preferred habitat for the Bog Turtle does not exist in the quantity needed to support the species on Artificial Island,<sup>568</sup> and that the historical evidence does not indicate direct observations of the Bog Turtle on Artificial Island at any time.<sup>569</sup>

In FEIS Topic 2, the Board sought and received confirmation that Artificial Island does not contain the habitat resources needed to support the Eastern Tiger Salamander,<sup>570</sup> and that the Eastern Tiger Salamander was not observed during a 2009-10 survey of the ESP Site and its vicinity.<sup>571</sup>

In FEIS Topic 3, the Board was concerned about PSEG's ability to obtain flow augmentation from the MCR if and when necessary. The Board is satisfied that (1) the MCR would not be required for safety-related cooling of a potential new plant at the PSEG site;<sup>572</sup> (2) if additional water rights are required in the future, PSEG considers it likely that it could transfer water rights from another PSEG-owned facility or could obtain them from a third party;<sup>573</sup> and (3)

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<sup>566</sup> Id.

<sup>567</sup> Id.

<sup>568</sup> NRC FEIS Topic 1 Testimony at 2-3.

<sup>569</sup> Id. at 3.

<sup>570</sup> NRC FEIS Topic 2 Testimony at 2.

<sup>571</sup> Id.

<sup>572</sup> PSEG FEIS Topic 3 Testimony at 3.

<sup>573</sup> Id.

if PSEG proceeds with a COL application, the MCR water rights issue would be subject to NRC Staff review at that time.<sup>574</sup>

In FEIS Topic 4, the Board was concerned whether an incremental increase in salt drift on freshwater wetlands in the vicinity of the ESP site could adversely affect threatened plant or animal species. The Board is persuaded that any such impact would be minimal, in part because (1) the coastal location of the site results in vegetation that is generally expected to have a high salinity tolerance;<sup>575</sup> and (2) no known federally-listed endangered or threatened vegetation or animal species occur within the areas affected by salt drift.<sup>576</sup> Additionally, although various wading birds and other state-listed species occur within wetlands affected by salt drift, these species commonly frequent coastal wetland habitats and are acclimated to saline environments.<sup>577</sup>

In FEIS Topic 5, the Board requested and received confirmation that neither the Bog Turtle nor the Eastern Tiger Salamander is present in the areas proposed for a new causeway, transmission lines, or related infrastructure.<sup>578</sup>

In FEIS Topic 6, the Board was concerned about the extent to which environmental mitigation activities over which the NRC does not exercise direct control will actually take place. The NRC Staff explained that, under NEPA, the NRC is required to consider mitigation measures that are reasonably foreseeable, even if some such measures arise from expected permits from other state and federal agencies that may not yet exist at the ESP stage.<sup>579</sup> NRC

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<sup>574</sup> Id.

<sup>575</sup> NRC FEIS Topic 4 Testimony at 3.

<sup>576</sup> Id.

<sup>577</sup> Id.

<sup>578</sup> NRC FEIS Topic 5 Testimony at 2-3.

<sup>579</sup> NRC FEIS Topic 6 Testimony at 2.

Staff guidance provides that a mitigation measure is reasonably foreseeable if (1) it is required by the NRC as a license condition, (2) it is required or likely to be required by another regulatory agency, or (3) an applicant has stated in communications with the NRC that it will perform the measure.<sup>580</sup> Several NRC Staff witnesses included a chart in their written testimony describing the Staff's grounds for concluding the mitigation measures identified in the FEIS are reasonably foreseeable.<sup>581</sup> On this basis, the Board's concerns are satisfied.

In FEIS Topic 7, the Board expressed concern about the relationship between mitigation measures and the Staff's characterization in the FEIS of the size of the anticipated impact level on each resource. The Board's concern has been addressed by the Staff's explanation that the mitigation measures would not alter the impact levels as set forth in the FEIS.<sup>582</sup>

In FEIS Topic 8, the Board did not express a specific concern, but directed the presence at the evidentiary hearing of NRC Staff witnesses capable of responding to the Board's questions regarding the cumulative impact assessment and assessment of alternative sites in the FEIS. The testimony of the Staff's witnesses<sup>583</sup> adequately addressed the Board's questions in these areas.

Based on the written and oral testimony, the Board's concerns regarding all fourteen issues identified for the evidentiary hearing were resolved. The Board sees no reason to impose permit conditions beyond the nine already proposed by the NRC Staff.<sup>584</sup>

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<sup>580</sup> Id.

<sup>581</sup> Id. at 4-28 Tbls.10-1 & 10-2.

<sup>582</sup> NRC FEIS Topic 7 Testimony at 2.

<sup>583</sup> Tr. at 173-81.

<sup>584</sup> Ex. NRC003, App. A, at A-2 to A-6.

## VI. FINDINGS

For the foregoing reasons, the Board makes the following determinations as required by 10 C.F.R. § 52.24(a) and 10 C.F.R. § 51.105(a):

1. In accordance with 10 C.F.R. § 52.24(a)(1), the applicable standards and requirements of the AEA and the NRC regulations have been met.
2. In accordance with 10 C.F.R. § 52.24(a)(2), all required notifications to other agencies or bodies have been made.
3. In accordance with 10 C.F.R. § 52.24(a)(3), 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.
4. In accordance with 10 C.F.R. § 52.24(a)(4), PSEG is technically qualified to engage in the activities authorized.
5. In accordance with 10 C.F.R. § 52.24(a)(5), the proposed inspections, tests, analyses and acceptance criteria, including any on emergency planning, are necessary and sufficient, within the scope of the ESP, to provide reasonable assurance that the facility will be constructed and will be operated in conformity with the license, the provisions of the Act, and the Commission's regulations.
6. In accordance with 10 C.F.R. § 52.24(a)(6), issuance of the licenses will not be inimical to the common defense and security or to the health and safety of the public.
7. In accordance with Subpart A of 10 C.F.R. Part 51, the requirements of Sections 102(2)(A), (C), and (E) of NEPA and Subpart A of 10 C.F.R. Part 51 have been complied with in the proceeding.
8. The Board determines, without conducting a de novo evaluation of the application, that the review conducted by the NRC Staff pursuant to 10 C.F.R. Part 51 has been adequate.

9. In accordance with Subpart A of 10 C.F.R. Part 51, the Board has independently considered the final balance among conflicting factors contained in the record of the proceeding with a view to determining the appropriate action to be taken.

10. In accordance with Subpart A of 10 C.F.R. Part 51, the Board determines, after weighing the environmental, economic, technical, and other benefits against the environmental and other costs, and considering reasonable alternatives, that an ESP should be issued.

#### VII. ORDER

The Director of the Office of New Reactors is authorized to issue to PSEG an ESP for the PSEG site for a duration of not more than twenty (20) years, consistent with the AEA, the Commission's regulations, and this Initial Decision. The ESP shall be subject to the nine permit conditions set forth in the SER.<sup>585</sup>

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<sup>585</sup> Ex. NRC003, App. A, at A-2 to A-6.

Pursuant to 10 C.F.R. § 2.341(a)(2), this Initial Decision will constitute a final decision of the Commission 120 days from the date of issuance, unless a petition for review is filed in accordance with 10 C.F.R. § 2.341(b) or the Commission directs otherwise. Any party wishing to file a petition for review on the grounds specified in § 2.341(b) must do so within twenty-five days after service of this Initial Decision.

It is so ORDERED.

THE ATOMIC SAFETY  
AND LICENSING BOARD

*/RA/*

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Paul S. Ryerson, Chairman  
ADMINISTRATIVE JUDGE

*/RA/*

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Dr. Gary S. Arnold  
ADMINISTRATIVE JUDGE

*/RA/*

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Dr. Craig M. White  
ADMINISTRATIVE JUDGE

Rockville, Maryland  
April 26, 2016



UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

In the Matter of )  
 )  
PSEG POWER, LLC ) Docket No. 52-043-ESP  
AND PSEG NUCLEAR, LLC )  
(Early Site Permit Application) )

CERTIFICATE OF SERVICE

I hereby certify that copies of the foregoing **INITIAL DECISION (LBP-16-04)** have been served upon the following persons by Electronic Information Exchange.

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PSEG POWER, LLC AND PSEG NUCLEAR, LLC - Docket No. 52-043-ESP  
**INITIAL DECISION (LBP-16-04)**

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

Dated at Rockville, Maryland,  
this 26<sup>th</sup> day of April, 2016