

October 17, 2006

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of )  
 )  
EXELON GENERATION COMPANY, LLC. ) Docket No. 52-007-ESP  
 )  
(Early Site Permit for Clinton ESP Site) )

NRC STAFF'S PREFILED DIRECT TESTIMONY ON  
ENVIRONMENTAL ISSUES IN THE CLINTON ESP PROCEEDING

The questions and answers below constitute the NRC Staff's prefiled direct testimony on environmental issues in the Clinton ESP proceeding. Appended to the testimony are affidavits and statements of professional qualifications for the associated reviewers, whose initials are indicated for each portion of testimony for which they have technical responsibility in the context of this mandatory hearing. In most portions of the testimony, useful citations – for example, to applicable regulations or to relevant pages of the Staff's review documents – have been included for reference.

a. FEIS Chapter 1, "Introduction" & Project Manager's Overview

**Q1: Describe briefly the general scope and chronology of the Staff's environmental review.**

**A1:** 1. (EH, TK) With respect to environmental matters – that is, matters stemming from the agency's obligations under the National Environmental Policy Act (NEPA) – the Staff's Final Environmental Impact Statement ("FEIS") related to an Early Site Permit at the Exelon ESP Site, issued in July 2006, addresses (1) the results of the NRC Staff's analyses, which consider and weigh the environmental effects of the proposed action (issuance of the ESP) and of constructing and operating one or more new nuclear units at the ESP site, (2) mitigation measures for reducing or avoiding adverse effects, (3) the environmental impacts of

alternatives to the proposed action, and (4) the NRC Staff's recommendation regarding the proposed action based on its environmental review. FEIS at xxviii.

2. (EH, TK) On November 25, 2003, the NRC Staff published a notice in the *Federal Register* (68 FR 66130) stating its intent to prepare an Environmental Impact Statement ("EIS") regarding the application submitted by Exelon Generation Company, LLC for an ESP at the Exelon ESP site located at the Clinton Power Station, conduct scoping, and publish a draft EIS ("DEIS") for public comment as required by 10 C.F.R. § 51.26. FEIS at 1-1. A public scoping meeting was held on December 18, 2003, to obtain public input on the scope of the environmental review. FEIS at 1-5. The U.S. Environmental Protection Agency issued a notice on March 11, 2005 (70 FR 12211) announcing the availability of the DEIS, and a public meeting was held on April 19, 2005, to receive comments on the DEIS. FEIS at 1-5. The Staff considered these comments while developing its FEIS. FEIS at 1-5, App. E.

3. (EH, TK) Following requirements set forth in 10 C.F.R. Part 51 and the guidance in Review Standard (RS)-002, the NRC environmental staff (and its technical experts from the Pacific Northwest National Laboratory retained to assist the Staff) visited the Exelon ESP site located at the Clinton Power Station and alternative sites in March 2004 to gather information and to become familiar with the sites and their environs. FEIS at 1-5. During these site visits, the Staff and its contractor personnel met with the Applicant's staff, public officials, and the public. FEIS at 1-5. To guide its assessment of environmental impacts of a proposed action or alternative actions, the NRC established a standard for quantifying environmental impacts using the Council on Environmental Quality guidance (40 C.F.R. § 1508.27). FEIS at 1-6. Using this

approach, the NRC established three significance levels -- SMALL, MODERATE, or LARGE<sup>1</sup> -- that the Staff applied to its findings throughout the FEIS. FEIS at 1-6.

4. (EH, TK) In conducting its review, the Staff evaluated environmental impacts based on the bounding parameter values Exelon submitted as part of its application; as discussed elsewhere in connection with the Staff's health and safety review (as well as later in the Staff's environmental testimony), these values constitute a "plant parameter envelope" ("PPE") for the Exelon ESP site and represent the "footprint" for a future facility. A list of these values is reproduced in Appendix J to the FEIS. In any COL or CP application referencing an Exelon ESP, the Staff would review the actual design selected to determine whether the design fits within these bounding parameter values.

**Q2: Describe briefly the primary regulatory guidance applicable to the Staff's environmental review.**

**A2:** 5. (EH, TK) The NRC standards for review of an ESP application are outlined in 10 C.F.R. § 52.18. The NRC Staff conducts its reviews of ESP applications in accordance with guidance set forth in review standard RS-002. That review standard draws from the previously published NUREG-0800, *Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants*, as well as from NUREG-1555, *Environmental Standard Review Plan* (hereafter "ESRP"). FEIS at xxviii.

6. (EH, TK) The Staff's FEIS focused on the environmental effects of construction and operation of reactors with characteristics that fall within the PPE developed by Exelon and

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<sup>1</sup> (EH, TK) The NRC Staff's definitions of these significance levels are as follows:  
SMALL – Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.  
MODERATE – Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.  
LARGE – Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

included an evaluation of alternative sites to determine whether there is an obviously superior alternative to the proposed Exelon ESP site. FEIS at 1-3. An ESP environmental report is not required to include an assessment of the benefits (for example, the need for power) (10 C.F.R. § 52.17) or a discussion of energy alternatives; these may be deferred to the CP or COL application. FEIS at 1-3. However, the Exelon environmental report did address energy alternatives; therefore, the FEIS included an assessment of energy alternatives, but did not evaluate the need for power. FEIS at 1-3.

**Q3: Does the approach used by the Staff in its health and safety review differ from that used in the environmental review?**

**A3:** 7. (EH, TK) Yes. In general terms, there are some fundamental differences between the approaches used for the final safety evaluation report (“FSER”) and the FEIS. The sources of these differences are the statutory and regulatory requirements for each review. The Staff’s safety review is performed under the Atomic Energy Act and in accordance with the regulations in 10 C.F.R. Part 52. The environmental review is performed under NEPA as implemented in NRC regulations at 10 C.F.R. Part 51. Whereas the safety review is focused primarily on protecting the health and safety of the public, the environmental review considers a much broader range of impacts to the environment as a whole.

8. (EH, TK) Starting from NEPA and Part 51, for an environmental review the Staff evaluates the reasonably foreseeable impacts. In addition, the Staff has the latitude, if numerical data are not available, to qualitatively evaluate the impacts.<sup>2</sup> In contrast, the safety review generally focuses on the results of conservative analyses. As an example, in considering  $\chi/Q$  values the Staff used “typical” meteorological conditions in the FEIS

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<sup>2</sup> (EH, TK) As stated in 10 C.F.R. § 51.71(d), “The analysis for all draft environmental impact statements will, to the fullest extent practicable, quantify the various factors considered. To the extent that there are important qualitative considerations or factors that cannot be quantified, these considerations or factors will be discussed in qualitative terms.”

(see FEIS at 5-63). "Typical" is defined as those conditions that give atmospheric dispersion factors that are exceeded [i.e., dispersion is less] 50 percent of the time. In contrast, for the Chapter 15 analyses in the FSER, the Staff used values for  $\chi/Q$  associated with "adverse" meteorological conditions (defined as those conditions that give atmospheric dispersion factors that are exceeded no more than 5 percent of the time).

9. (LV) Another reason for differences in approach between the FEIS and the FSER is the matter of perspective. For example, both the FEIS and the FSER consider impacts related to hydrology. But in these two documents, the Staff is looking at hydrology for very different reasons. In the FEIS, the Staff is evaluating the impacts on the hydrology of the surrounding area of constructing and operating a nuclear plant (or plants). In the FSER, in contrast, the Staff is evaluating the potential impacts of local hydrology on the plant. Thus, in one case the Staff is looking from the inside out, and in the other case it is looking from the outside in. This difference in perspective leads to very different evaluations in relation to the same resource. Specifically, the analyses in the FSER address, for example, concerns related to the probable maximum flood, an issue unrelated to the environmental review. On the other hand, the analyses in the FEIS address concerns related to issues such as reduced streamflow downstream of the plant.

10. (EH, TK) In summary, because of the differences in the basic goals of the analyses in the FEIS and the FSER, there are differences in the data used and the approaches applied by the Staff in the analyses. Based upon the reasoning described above, these differences are to be expected between the FEIS and FSER reviews.

**Q4: More specifically, do differences in the two documents' analysis of the impacts for reactors other than the ABWR and the AP1000 affect the logic of the Staff conclusions?**

**A4:** 11. (JR) With respect to the difference between the FEIS and the FSER in connection with the treatment of certified and non-certified designs, the Staff reviewed how it addressed designs other than the ABWR and AP1000 in Section 5.10 of the FEIS and in Chapter 15 of the FSER. The Staff does not believe that the depth of its analyses for these designs is markedly different. In both the FEIS and the FSER, the analyses related to accidents focused on the ABWR and the AP1000 because of the level of information available for these designs. The Staff had already performed a site-independent evaluation of accidents for these designs as part of the design certification reviews. So, in essence, most of the work had already been done. For the FSER and FEIS, the Staff was, for the first time, evaluating the environmental impacts of accidents for these designs at a site, so that analysis was new. For the other reactor designs in both the FEIS and the FSER, the Staff indicated that there was not as much information available, but the Staff judged the results for the ABWR and the AP1000 as likely to bound the results for the other designs. In both documents, the Staff indicated that, if a design other than the ABWR or AP1000 were chosen at the COL stage, the assumption that the results were bounded would have to be confirmed.

**Q5: Given that the Staff must "independently evaluate and be responsible for" information in the EIS, to what extent does the Staff's environmental analysis rely on the Applicant's assumptions, and how are those assumptions documented?**

**A5:** 12. (EH, TK) Pursuant to 10 C.F.R. §§ 51.70(b) and 51.90, the NRC is required to independently evaluate and be responsible for the reliability of all information used in the EIS, including an EIS prepared for a COL. In carrying out its responsibilities under

10 C.F.R. § 51.70(b), the Staff may (1) inquire into the continued validity of information disclosed in an EIS for an ESP that is referenced in a COL application and (2) look for any new information that may affect the assumptions, analysis, or conclusions reached in the ESP EIS.

13. (EH, TK) The initial burden to assess newly identified information and those issues that were deferred to the COL, CP, or OL application (including unresolved issues) falls to the applicant. The applicant is required to provide information sufficient to resolve any significant environmental issue not considered in the ESP proceeding, either for the site or the design, and the information contained in the application should be sufficient to aid the Commission in its development of an independent analysis (see 10 C.F.R. § 51.45). Therefore, the environmental report must contain any significant new information for issues related to the impacts of construction and operation of the facility that were resolved in the ESP proceeding. The Staff, in the context of a COL application that references an ESP, defines “new” in the phrase “new and significant information” as any information that was not considered in preparing the environmental report included in the ESP application or the ESP EIS and that was not generally known or publicly available during the preparation of the ESP EIS.

14. (EH, TK) This new information may include (but is not limited to) specific design information that was not contained in the application, especially where the design interacts with the environment, or information that was in the ESP application, but has changed by the time of the COL application. Such new information may or may not be significant. See the NRC letter to NEI dated July 6, 2005, ADAMS ML051050031.

15. (EH, TK) All matters discussed in sections K-1, K-2, and K-3 of Appendix K to the FEIS are to be confirmed at the COL stage.<sup>3</sup> Matters discussed in K-1 that could be

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<sup>3</sup> (EH, TK) The Staff notes that there is no list documenting *all* of the commitments described in the ER, because some of these commitments were not relevant to the Staff’s review. As stated in Appendix K, the commitments that were considered in the Staff’s evaluation of the environmental impacts  
(continued...)

analyzed under the PPE concept were so analyzed in the EIS. Those matters will be reviewed at the COL stage to make sure the proposed parameters remain within the bounds of the PPE concept previously analyzed. Matters listed in K-2 are those matters that are identified in the ER but were not directly considered by the Staff in its evaluation; *i.e.*, they are assumptions that the Staff was aware of during its review but that did not impact the Staff's conclusions.

However, because these assumptions have the potential to affect the Staff's analysis should they change by the COL stage, the Staff will revisit these matters at that time. K-3 lists issues (related to transmission lines) that are not directly under the control or purview of Exelon.

AmerenIP, not Exelon, owns the transmission lines. AmerenIP is regulated by the Federal Energy Regulatory Commission (FERC) and the State of Illinois (State), and AmerenIP will bear the ultimate responsibility for defining the nature and extent of system improvement. To trigger the interconnection procedure regulated by 18 C.F.R. Part 35, Exelon must submit a large generator interconnection request to AmerenIP. The AmerenIP Open Access Transmission Tariff (State) also governs the eventual routing and siting of new transmission lines serving the Exelon ESP site. Therefore, these issues must be reviewed at the COL stage.

**Q6: Where the Staff intends to confirm certain assumptions at the CP or COL stage, what is the nature of the “verification” to be conducted by Staff at the COL stage beyond assuring that the actual plant design falls within those bounds?**

**A6:** 16. (EH, TK) The Staff would conduct the verification of key assumptions at the COL stage in a manner similar to that employed during the review of the ESP application. For example, the Staff would review information provided by the applicant in its ER and during the

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<sup>3</sup>(...continued)

related to the construction and operation of a new nuclear unit at the Exelon ESP site were listed in Table K-1. Other statements that may have been commitments, but that were *not* relevant to the review, were not included.

Staff's audit, and perform an independent review of these matters, including obtaining and reviewing information from local, State, Tribal, and Federal authorities.

**Q7: Where the Staff notes in the FEIS that the Applicant has not chosen a design with respect to a particular aspect of the facility (cooling towers, for example) or did not provide sufficient information to evaluate various impacts, and the Staff states that these impacts would be assessed at the CP or COL stage, how will the Staff ensure these impacts ultimately are evaluated (given the 20 year life of an ESP)?**

**A7:** 17. (EH, TK) If the Staff lacked sufficient information to resolve an issue, then it is not given finality under 10 C.F.R. § 52.39, and an applicant for a COL referencing the ESP would have to address the issue as it will any issue (e.g., the benefits assessment) that was not resolved in the proceeding on the ESP. However, in many cases for which the Staff lacked specific design information, it was still able to assign an impact level for an issue based on available information and assumptions. As discussed previously, in this situation, an applicant for a COL referencing the ESP would have to search for any new and significant information related to those impacts. The Staff will evaluate that applicant's process for identifying new and significant information and will also independently confirm the results of that review. The impacts of new and significant information on the analysis results in the ESP EIS will be evaluated in the COL EIS. (See the NRC letter to NEI dated July 6, 2005, ADAMS ML051050031.)

b. FEIS Chapter 2, "Affected Environment"

**Q8: Describe generally how the Staff characterized the affected environment.**

**A8:** 18. (DA) The proposed ESP site is located in DeWitt County, Illinois, within the existing boundaries of the current Clinton Power Station (CPS). FEIS at 2-1. The CPS

property is owned by AmerGen Energy Company, LLC (AmerGen), and the site is located on the shore of Clinton Lake approximately 10 km (6 mi) east of the City of Clinton (which is located more than 10 km (6 mi) west of the site, with a population of 7485). FEIS at 2-1, 2-6.

19. (DA) The ESP site is located in rural DeWitt County (approximate population in 2000 of 17,000), and is located between Bloomington and Decatur, which are 35 km (22 mi) to the north and 35 km (22 mi) to the south, respectively. FEIS at 2-1. In addition, the site is located between Lincoln and Champaign-Urbana, 45 km (28 mi) to the west and 48 km (30 mi) to the east, respectively. FEIS at 2-1. The ESP site vicinity is 84 percent agricultural land (24,622 ha [60,842 ac]); industrial land use within the vicinity is less than 1 percent and is limited to areas near Clinton and Weldon (located more than 8 km (5 mi) southeast of the site, with a population of 440). FEIS at 2-6. Illinois State Route (SR) 54 passes approximately 1.6 km (1 mi) north of the ESP site; Illinois SR 10 passes approximately 5 km (3 mi) south; and Illinois SR 48 is approximately 8 km (5 mi) east of the ESP site (see Figure 2-3 of the FEIS). FEIS at 2-1. There is one active railroad line within the vicinity: the Canadian National Railroad runs parallel to Illinois SR 54 and traverses the vicinity approximately 1.6 km (1 mi) north of the site. FEIS at 2-1. There are three active private airports nearby: the Martin Airport, approximately 6 km (4 mi) south of the site; the Thorp Airport, approximately 8 km (5 mi) northwest of the site; and the Baker Strip, approximately 8 km (5 mi) southeast of the site. FEIS at 2-1.

20. (DA) The ESP site is situated on Clinton Lake, which was formed by the construction of an earthen dam across Salt Creek, 366 m (1200 ft) downstream from the confluence of Salt Creek with the North Fork of Salt Creek. FEIS at 2-1. The ESP site is approximately 5 km (3 mi) northeast of the dam, located on a peninsula between the two arms of the lake, at an approximate grade elevation of 224 m (736 ft). FEIS at 2-1. The normal lake pool elevation is 210 m (690 ft), with a surface area of 1981 ha (4895 ac). FEIS at 2-1. The

station occupies approximately 187 ha (461 ac) of land, and all site land, subsurface lands, and mineral rights are owned by AmerGen, an Exelon subsidiary, with whom agreements are in place to ensure that Exelon has the necessary authority, control, and rights related to the proposed ESP site. FEIS at 2-1, 2-5.

21. (JR) The Exelon ESP site has a typical continental climate with moderately cold winters and warm summers. FEIS at 2-14. The site is relatively flat, with no topographic features that would cause the local climate to deviate significantly from the regional climate. FEIS at 2-14. With respect to atmospheric stability, temperature difference measurements made on the CPS meteorological tower indicate that unstable atmospheric conditions exist at the site approximately 18 percent of the time, and stable conditions exist about 44 percent of the time. During the remaining 38 percent of the time, the atmospheric stability is neutral, and atmospheric dispersion is moderate.<sup>4</sup> FEIS at 2-15.

22. (JR) The Staff viewed the meteorological site and instrumentation, reviewed the available information on the meteorological measurement program, and evaluated data collected by the program (which has existed at the Exelon ESP site since April 1972). FEIS at 2-18, 2-19. Based on this information, the Staff concluded that the program provides

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<sup>4</sup> (JR) The Staff performed a comparison of atmospheric stability for the period between 1972 and 1977 and between 2000 and 2002 and noted a shift in the distribution towards unstable conditions; the Staff suggested that the shift may be due to the existence of the Clinton Lake. For several reasons, the Staff did not examine regional stability changes as other possible explanations for this shift. First, the apparent shift was deemed not to be of significance with respect to the question of acceptability of the Exelon ESP site; therefore, hourly meteorological data for other nuclear power plants in the area were not provided by the Applicant or requested by the Staff. Second, the statement that there has been a shift in stability was an observation about the two sets of site data presented by the Applicant, and the Staff's suggestion is a simple explanation for the change, because, at nuclear power plants, atmospheric stability is determined by the difference in temperature between 10 m and a level greater than 46 m above ground level. The cooling pond, which was not in operation in the 1970s, is a ground-level source of heat. Finally, although methods exist for estimating stability from hourly meteorological observations made by the National Weather Service (NWS), the NWS does not make hourly atmospheric stability determinations. While atmospheric stability estimated from NWS data is generally correlated with the stability determinations made at nuclear power plants, it would be difficult to use stabilities determined from NWS data to evaluate the apparent shift in stabilities seen in the Clinton data.

data that represent the onsite meteorological conditions as required by 10 C.F.R. § 100.20. FEIS at 2-18, 2-19. The Staff found that the data also provide an acceptable basis for making estimates of atmospheric dispersion for the evaluation of the consequences of routine and accidental releases required by 10 C.F.R. § 50.34 and 10 C.F.R. Part 50, Appendix I. FEIS at 2-18, 2-19.

23. (DA) The Staff determined that the 80-km (50-mi) region for the ESP site would encompass the communities in the area of Pontiac, Chatsworth, Fairbury, Forrest, and Chenoa, Illinois, as would several of the alternative ESP sites considered. These communities would be within the 80-km (50-mi) region of seven nuclear power stations if a new nuclear unit were constructed at the Exelon ESP site.

24. (GS) With respect to the radiological environment, the Staff reviewed annual radioactive effluent release reports for calendar years 1999, 2000, and 2001, and found that doses to the maximally exposed individuals around CPS were a small fraction of the limits specified in Federal environmental radiation standards, 10 C.F.R. Part 20; 10 C.F.R. Part 50, Appendix I; and 40 C.F.R. Part 190. FEIS at 2-20.

25. (EH, TK) The purpose of Chapter 2 of the FEIS is to present some basic characteristics of the proposed ESP site, in order to provide a factual context for some analyses in subsequent FEIS chapters. Therefore, in this testimony, the Staff relocated some material that might otherwise have been part of its Chapter 2 discussion and integrated it with the testimony about the associated Staff technical evaluation.

c. FEIS Chapter 3, "Site Layout and Plant Parameter Envelope"

**Q9: Describe how the Staff evaluated the Applicant's site layout and Plant Parameter Envelope.**

**A9:** 26. (EH, TK) In Chapter 3 of the FEIS, the Staff reviewed the Application's description of the site layout and provided the Staff's characterization of the plant parameter envelope. A list of the applicable PPE parameters and values is reproduced in Appendix J to the FEIS.

27. (EH, TK) Through the use of the PPE, the Applicant intended to bound the value of a parameter for all of the designs under consideration. Therefore, the impacts of a given parameter on a particular resource should be less for any of the designs other than the design from which the limiting value was drawn.<sup>5</sup> This is true throughout the ER and the EIS.

28. (EH, TK) The Staff noted that because PPE values were to be used as a surrogate for design-specific values,<sup>6</sup> the Staff expected Exelon to provide sufficient information for the Staff to develop a reasonable independent assessment of potential impacts to specific environmental resources. FEIS at 3-5. In some cases, the Staff found that the design-specific information called for in the ESRP was not provided in the Exelon ESP application because it did not exist or was not available; as a result, the NRC Staff could not fully apply the ESRP

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<sup>5</sup> (EH, LV, TK) One illustration of this might be the value for heat rejection, where a smaller actual value than the one identified by the Staff (4420 MW for two AP-1000 reactors) would have a number of effects on the analyses in the EIS. For example, water withdrawals, water consumption (evaporation and drift), and blowdown would all be reduced for a plant with a significantly smaller heat rejection rate. However, the analyses in the EIS are meant to be bounding for the designs under consideration, and so no additional analyses for designs with smaller heat loads are necessary.

<sup>6</sup> (EH, TK) Exelon used 7 reactor designs to develop the PPE, including five light water reactors (LWRs) and two gas-cooled reactors. The 5 LWRs were the Advanced Canada Deuterium Uranium Reactor (ACR-700); the Advanced Boiling Water Reactor (ABWR); an earlier version of the Advanced Pressurized Water Reactor approved by the NRC (AP1000); the Economic Simplified Boiling Water Reactor (ESBWR); and the International Reactor Innovative and Secure (IRIS) next-generation pressurized water reactor (PWR). The two gas-cooled reactor designs used were the Gas Turbine Modular Helium Reactor (GT-MHR) and the Pebble Bed Modular Reactor (PBMR). FEIS at 3-2 to 3-4.

guidance in those review areas. FEIS at 3-5. In accordance with RS-002, in those cases, the Staff used its experience and judgment to adapt the review guidance in the ESRP and to develop assumptions necessary to evaluate impacts to certain environmental resources to account for missing information. FEIS at 3-5. The Staff identified these assumptions in the appropriate sections of the FEIS, as well as in Appendix K.<sup>7</sup> FEIS at 3-5, App. K.

29. (EH, TK) The Staff noted that, pursuant to RS-002, it did not review the PPE values for correctness. However, the Staff determined that Exelon's application was sufficient to enable the Staff to conduct its required environmental review and that the PPE values are not unreasonable for consideration by the Staff when making its finding on the application in accordance with 10 C.F.R. § 52.18. FEIS at 3-5. During its environmental review, the Staff used its judgment to determine whether Exelon provided sufficient information for the Staff to perform its independent assessment of the environmental impacts of construction and operation of a new nuclear unit or units. FEIS at 3-5. The Staff considered the PPE values to be bounding parameters. FEIS at 3-5. Therefore, for environmental issues that could be resolved, the Staff's evaluation serves as a bounding estimate of the potential environmental impacts resulting from constructing and operating the new nuclear unit at the ESP site. FEIS at 3-5. However, the Staff reiterated that environmental impacts not considered or not bounded at the ESP stage would be assessed at the CP or COL stage. FEIS at 3-7.

30. (EH, JR, TK) The Staff notes that the values used in its environmental review for the seven reactor designs are not necessarily the same values used in the safety evaluation. This is because there are some basic differences in the approach required for an environmental review (under the National Environmental Policy Act (NEPA) and 10 C.F.R. Part 51) as

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<sup>7</sup> (EH, TK) The Staff notes that Table K-1 of Appendix K lists the commitments that were considered in the Staff's evaluation of the environmental impacts related to the construction and operation of a new nuclear unit at the Exelon ESP site. However, other statements in the ER that may have been commitments, but that were *not* relevant to the Staff's review, were not included in that list.

compared to a safety review (under the Atomic Energy Act and 10 C.F.R. Parts 50 and 52). Starting from NEPA and Part 51, for an environmental review the Staff evaluates the reasonably foreseeable impacts. In addition, the Staff has the latitude, if numerical data are not available, to qualitatively evaluate the impacts.<sup>8</sup> In contrast, the safety review generally focuses on the results of conservative analyses. As an example, in considering  $\chi/Q$  values the Staff used “typical” meteorological conditions in the FEIS (see page 5-63). “Typical” is defined as those conditions that give atmospheric dispersion factors that are exceeded (i.e., dispersion is less) 50 percent of the time. In contrast, for the Chapter 15 analyses in the FSAR, the Staff used values for  $\chi/Q$  associated with “adverse” meteorological conditions (defined as those conditions that give atmospheric dispersion factors that are exceeded no more than 5 percent of the time).

31. (LV, TK) Another reason for differences in approach between the FEIS and the FSER is the matter of perspective. For example, both the FEIS and the FSER consider impacts related to hydrology. But in these two documents, the Staff is looking at hydrology for very different reasons. In the FEIS, the Staff is evaluating the impacts on the hydrology of the surrounding area of constructing and operating a nuclear plant (or plants). In the FSER, in contrast, the Staff is evaluating the potential impacts of local hydrology on the plant. Thus, in one case the Staff is looking from the inside out, and in the other case it is looking from the outside in. This difference in perspective leads to very different evaluations in relation to the same resource. Specifically, the analyses in the FSER address, for example, concerns related to the probable maximum flood, an issue unrelated to the environmental review. On the other

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<sup>8</sup> (EH, TK) As stated in 10 C.F.R. § 51.71(d), “The analysis for all draft environmental impact statements will, to the fullest extent practicable, quantify the various factors considered. To the extent that there are important qualitative considerations or factors that cannot be quantified, these considerations or factors will be discussed in qualitative terms.”

hand, the analyses in the FEIS address concerns related to issues such as reduced streamflow downstream of the plant.

32. (EH, TK) In summary, because of the differences in the basic goals of the analyses in the FEIS and the FSER, there are differences in the data used and the approaches applied by the Staff in the analyses. Based upon the reasoning described above, these differences are to be expected between the FEIS and FSER reviews.

d. FEIS Chapter 4, "Construction Impacts at the Proposed Site"

**Q10: Describe how the Staff evaluated the construction-related environmental impacts at the proposed site.**

**A10:** 33. (EH) In Chapter 4 of the FEIS, the Staff analyzed the potential impacts of construction on land use, air quality, water, ecosystems, socioeconomics, historic and cultural resources, environmental justice, nonradiological and radiological health effects, and applicable measures and controls that would limit the adverse impacts of station construction. FEIS at 4-1. Where possible, the Staff assigned a single significance level of potential impact - SMALL, MODERATE, or LARGE – to each issue, in accordance with 10 C.F.R. Part 51. FEIS at 4-1.

34. (DA) First, with respect to land use, the Staff noted that the area that would be affected on a long-term basis as a result of permanent facilities is approximately 39 ha (96 ac). The Staff found that because preconstruction and construction activities would be accomplished using best construction practices and would follow all applicable laws and regulations, because no new or modified highways or railroad lines are planned to support a new nuclear unit, and because offsite land-use changes as a result of construction activities are expected to be minimal (including little impact in terms of new housing construction), there are no land-use

impacts that would render the site unsuitable for a new nuclear unit. The Staff concluded that the environmental impact resulting from land use would be SMALL. FEIS at 4-3 to 4-4.

35. (DA, JR) The Staff also evaluated the potential construction impacts associated with new or upgraded transmission lines. The Staff determined that the likely pathway of any new transmission lines required to deliver power from a new unit at the ESP site would almost exclusively cross land currently in seasonal agricultural production. The Staff also found that the principal impacts from construction activities would be minimal and mostly temporary and would alter the land use on a relatively minimal amount of land. Therefore, the Staff concluded that construction-related impacts on land use in the transmission line rights-of-way that require upgrading and offsite areas would be SMALL, regardless of whether the existing rights-of-way are doubled or new rights-of-way are used. FEIS at 4-5.

36. (JR) With respect to meteorological and air quality impacts, the Staff noted that construction activities take place for a limited duration and can be controlled using standard measures (like wetting for fugitive dust and obtaining relevant State permits), so that impacts would be temporary and limited in magnitude. FEIS at 4-5. The Staff found that increased automobile traffic (and associated exhaust) was unlikely to have noticeable effects on air quality beyond the immediate vicinity of local highways, particularly given that air quality in DeWitt County and the surrounding counties is in compliance with all standards. FEIS at 4-6.

37. (LV) Concerning water-related impacts, the Staff determined that impacts from hydrologic alterations due to construction activities would be localized and temporary, and that the Illinois Environmental Protection Agency ("IEPA") FWPCA Section 401 and U.S. Army Corps of Engineers ("ACE") Clean Water Act Section 404 permit processes would be adequate

to ensure that impacts of hydrologic alterations are SMALL.<sup>9</sup> FEIS at 4-6 to 4-8. The Staff found that water-use requirements and water quality impacts from ESP construction activities would be similar to other large industrial construction projects and thus would be SMALL, localized, and temporary.<sup>10</sup> FEIS at 4-9.

38. (JB) With respect to impacts on ecological resources, the Staff evaluated terrestrial impacts, aquatic impacts, and impacts to threatened and endangered species. FEIS at 4-9. For terrestrial impacts, the Staff found that the impacts of onsite construction (including land-clearing, construction noise, fugitive dust, equipment emissions, avian collisions with structures, and traffic mortality) on wildlife, including State-listed species, and on wildlife habitat, including loss of forest, would be minimal, and that no construction impacts to wetlands onsite are anticipated. FEIS at 4-16. It concluded that impacts on wildlife habitat and wildlife populations associated with the transmission system could be SMALL if additional transmission capacity were to be accommodated within the existing right-of-way, and SMALL if the existing

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<sup>9</sup> (LV) As a result of Exelon's discussions with IEPA concerning FWPCA Section 401, Exelon proposed a permit condition under which the ESP holder could not conduct permit activities without first submitting to the NRC either a 401 certification issued by the IEPA or its determination that no 401 certification is required; the condition would also entail annual advisory letters to the IEPA (and copies to the NRC) identifying permit-related activities and stating whether those activities would require 401 certification. FEIS at 4-8. The Staff stated that if the IEPA found the proposed condition to be an appropriate approach to FWPCA compliance, the Staff would recommend including the condition in any ESP issued. FEIS at 4-8, 10-9.

<sup>10</sup> (LV) As noted in Appendix K to the FEIS, the Applicant does not intend to implement a permanent groundwater dewatering system. FEIS at K-14, K-18, K-27. The Staff determined that the only impacts to groundwater would be indirect and involve a) dewatering during construction and b) changes in lake elevation associated with consumptive water loss from the ESP plant's cooling system. The Staff concluded that the impacts of the dewatering would be localized and temporary given the location of the plant relative to Clinton Lake. The Staff concluded that the impact of the reduced elevation on the adjacent aquifers would be small and localized. Therefore, given that the ESP plant would have insignificant impacts on groundwater, the Staff concluded that a more detailed characterization of the groundwater resource was unnecessary. For these reasons, the percentage and source of groundwater supplies are not specifically mentioned in Appendix K.

In addition, the agency's decisions in the 1978 *Yellow Creek* proceeding restrict the ability of NRC Staff to specify or require non-radiological monitoring of water resources covered by the Clean Water Act. Therefore, the NRC Staff does not have a position regarding the adequacy of the Applicant's proposed thermal monitoring program. The adequacy of thermal monitoring programs is determined by the Illinois Environmental Protection Agency.

right-of-way required expansion, but could range from SMALL to LARGE if new rights-of-way were to be required. FEIS at 4-16. Therefore, the Staff considered the issue unresolved.

FEIS at 4-16.

39. (SS) With respect to impacts on aquatic ecological resources, the Staff found that best management practices to minimize sedimentation (and timing construction activities to minimize impacts on fish during critical spawning or rearing periods) would mitigate potential aquatic impacts, which would mainly be associated with construction of a new cooling water intake structure. FEIS at 4-16. The Staff found that adverse impacts were not anticipated for either of two State-listed mussel species potentially found in DeWitt County, and it stated that no impacts to any other State-listed aquatic animal or plant species is anticipated because none is known to occur in the vicinity of the ESP site. FEIS at 4-17. Exelon has committed to contact the Illinois Department of Natural Resources before commencement of construction activities to ensure that these assumptions remain valid. FEIS at 4-17. The Staff thus concluded that impacts to aquatic species and habitat from construction of a new nuclear unit at the Exelon ESP site are expected to be SMALL. FEIS at 4-17.

40. (JB, SS) Furthermore, the Staff found that construction impacts to Federally listed terrestrial animal species, the bald eagle and Indiana bat, are expected to be negligible; that no Federally listed aquatic species are known to occur within 16 km (10 mi) of the ESP site; and that there would be no construction impacts to other Federally listed or proposed terrestrial or aquatic plant and animal species or to designated or proposed critical habitat. FEIS at 4-20. Therefore, the Staff determined that construction impacts on Federally listed or proposed threatened or endangered aquatic or terrestrial species would be SMALL, predicated on certain

Staff assumptions,<sup>11</sup> including the current occurrence of Federally listed or proposed threatened and endangered species and designated or proposed critical habitat in the project area.

FEIS at 4-20.

41. (JJ) With respect to socioeconomic impacts, the Staff assessed physical impacts, demographics, and impacts to the community. The Staff found that physical impacts to workers and the local public would be SMALL because of dust and noise control measures and regulations, the relative isolation of the ESP site from neighboring residences and other sensitive receptors, and timing restrictions on particularly noisy activities. FEIS at 4-21, 4-22. The Staff found no impacts to offsite buildings, although it found that construction impacts on roads would be SMALL to MODERATE, depending on hauling weights. FEIS at 4-23. The Staff also found only SMALL aesthetic impacts, as most such impacts would be temporary or mitigated by the Applicant's measures to restrict construction laydown, by timely removal of construction debris from the site, and by controlling construction related runoff and sedimentation to Clinton Lake. FEIS at 4-24.

42. (JJ) The Staff concluded that demographic impacts of construction would be SMALL, based on the expectation that most of the 3150 construction workers Exelon anticipates employing to build a new unit will come from within the region; even if a larger than expected percentage choose to relocate from outside the region, this number represents a small percentage of the larger population base.<sup>12</sup> FEIS at 4-24, 4-25.

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<sup>11</sup> (JB, SS) The assumptions noted in the conclusion of this section of the FEIS constitute the primary assumptions made by the Staff that led to its determination of impacts. Other minor assumptions, such as the current FWS prescriptions for determining impacts to the Indiana bat and its habitat and the Applicant's responsibilities relative to those prescriptions, are spelled out in detail in the supporting text but were too lengthy to repeat in the conclusion. A similar situation exists for the conclusion of section 5.4.3 on page 5-26, for similar reasons.

<sup>12</sup> (JJ) In November 2005, the State of Illinois released new population projections through 2030 based on the 2000 Census. The Staff considered the updated county population projections and determined that the updated numbers would not change any of the Staff's conclusions regarding

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43. (JJ) Concerning community impacts, the Staff determined that the magnitude of the positive economic impacts of construction would be diffused in the larger economic bases of Macon, McLean, and Champaign Counties, such that impacts on the economy of the region would be beneficial and SMALL everywhere in the region except in DeWitt County, where the impacts could be beneficially MODERATE. FEIS at 4-27. Similarly, the Staff concluded that the potential beneficial impacts of taxes collected during construction would be SMALL and beneficial, except in DeWitt County where they would be MODERATE and beneficial. FEIS at 4-29.

44. (JJ) The Staff found only SMALL impacts on transportation because of Exelon's traffic control measures and because the roads are currently lightly traveled and, except at shift changes, would not be overly congested by increased construction traffic. FEIS at 4-31. The Staff determined recreational and aesthetic impacts to be SMALL as well, given the distance of recreational access points to the plant site, and Exelon's commitment to mitigation activities during construction. FEIS at 4-31, 4-32. The Staff found that impacts on housing would be SMALL, if all the workers generally come from within the region and chose not to locate closer to work in DeWitt, Piatt, or Logan counties, but could also be MODERATE in those counties, if the assumption that all the workers would come from within the region proves invalid, or if a number of construction workers decide to relocate to be closer to work.<sup>13</sup> FEIS at 4-33.

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<sup>12</sup>(...continued)

socioeconomic impact levels. In addition, changes from the draft EIS to the final were made only in response to a specific question or comment on the draft EIS and no questions were received on this issue. This information does not appear in Appendix K because the Staff determined that the population information supplied by the Applicant did not bound the socioeconomic analysis; therefore, the Staff's analysis relied on population information it obtained during its independent review.

<sup>13</sup> (JJ) Despite the popularity of the area around Clinton Lake as a summertime destination, the Staff for several reasons considered the MODERATE designation to be sufficient to bound any potential construction-related housing impacts on the smaller counties of DeWitt, Piatt and Logan. First, there are few rental properties around Clinton Lake proper. Most rental property is located in the City of Clinton, which is within six miles of the lake, and that rental property is not impacted by the seasonal use of the

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45. (JJ) In terms of construction impacts on public services, the Staff found that public water supply and waste water treatment are not a constraint to growth in the vicinity and region of the ESP site, assuming that growth increases hold to the historical norm, and that, because the construction workforce is expected to come predominantly from within the region, the demand for police, fire, and medical services would impact established entities, which could provide adequate services. FEIS at 4-35. The Staff further determined that construction would have a beneficial economic impact to the economically disadvantaged population, lessening the demand for social services, and that a possible initial increase in demand for social services at the beginning of the construction period would be considered manageable. FEIS at 4-35. The Staff also found that impacts on education would be SMALL, based on the expectation that, as the majority of the construction workers would be expected to come from the region, and most of those from outside would likely commute, there would be minimal impact of additional children being placed in the educational systems within the region. This conclusion is based on the expectation that the majority of the construction workers would come from the region and that most of those from outside the region would likely commute to the ESP site. FEIS at 4-35, 4-36.

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<sup>13</sup>(...continued)

lake. Most housing around the lake is owner-occupied by year-round residents. These property owners do not have "lake front" property, in that Amergen owns the property from the lake's edge back 100 yards from the lake. The only access to the lake is via public access points at certain locations.

Second, most construction workers are expected to come from within the 50-mile region and commute from their current residences to the ESP site. Given the temporary nature of the construction employment, it is unlikely that a large number of workers would seek to build permanent residences close to the ESP site. They would be more likely to rent housing. Third, there are several large cities located close to the ESP site (Decatur and Bloomfield-Normal are within approximately 20 miles of the ESP site) that have sufficient rental units (apartments and houses) to accommodate construction workers who might move to the region. If housing availability and rents in the smaller counties get too restrictive or high, respectively, then most workers would seek housing in the larger cities. Thus, given these facts, the probability of a large effect on the three counties is small, and the Staff considered the MODERATE impact level the most appropriate to bound potential impacts.

46. (DS) After its evaluation pursuant to NEPA and the National Historic Preservation Act of 1966, as amended through 2000 (NHPA), the Staff concluded that the potential construction impacts on historic and cultural resources would be SMALL, but that mitigation might be warranted in the event of an inadvertent discovery. FEIS at 4-36, 4-37. This conclusion was based on (1) the pre-construction and construction measures that Exelon would take to avoid adverse impacts to significant cultural resources, including methods such as tilling, surveying, and shovel testing, as well as consultation by the Applicant with the Illinois Historic Preservation Agency and (2) the Staff's cultural resource analysis and consultation, including with State and Native American tribal officials and via public scoping. FEIS at 4-37, 2-66 to 2-70.

47. (JJ) Environmental justice refers to a Federal policy under which each Federal agency identifies and addresses, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority or low-income populations; on August 24, 2004, the Commission issued its policy statement on the treatment of environmental justice matters in licensing actions. FEIS at 4-38; see 69 Fed. Reg. 52040. The Staff and the Applicant identified the locations of minority and low-income populations within an 80-km (50-mi) radius of the Exelon ESP site, and based on the Staff's analysis, including interviews during its site audit, the Staff found neither unusual resource dependencies or practices through which these minority and low-income populations could be disproportionately impacted by construction of a new nuclear unit and that would result in those populations being adversely affected, nor any location-dependent disproportionately high and adverse impacts. FEIS at 4-38.

48. (GS, JR) Based on the mitigation measures identified by Exelon in its ER (related to dust, smoke, engine exhaust, and concrete operations), the permits and authorizations required by State and local agencies, the distance from the construction site to

the public, and the Staff's independent review, the Staff concluded that the nonradiological health impacts to the public from construction activities would be SMALL. FEIS at 4-39. Likewise, based on similar factors; on NRC and OSHA safety standards, practices, and procedures; on the use of training and protective equipment; and on the fact that historically, injury and fatality rates at nuclear reactor facilities have been lower than the average U.S. industrial rates, the Staff concluded that the nonradiological health impacts to workers from construction activities would be SMALL. FEIS at 4-39, 4-40. Furthermore, with respect to noise, in light of the temporary nature of construction activities, Exelon's noise mitigation plans, and the distance from the Exelon ESP site to residences and public buildings, the Staff concluded that the noise impacts from construction would be SMALL. FEIS at 4-40, 4-41.

49. (GS) With respect to radiological health impacts, after reviewing Exelon's estimate of dose to site preparation workers during construction activities (from direct radiation as well as from gaseous and liquid effluents), the Staff found the doses to be well within NRC exposure limits designed to protect the public health, even if workers exceeded the 2080 hr/yr occupancy factor. FEIS at 4-44. (The Applicant's evaluation included an annual dose estimate for the site preparation workers of approximately 0.25 mSv (25 mrem), which is less than the 1 mSv (100 mrem) annual dose limit to an individual member of the public found in 10 C.F.R. § 20.1301.) Therefore, assuming the location of the proposed new nuclear unit does not change, the Staff concluded that the impacts of radiological exposures to site preparation workers would be SMALL. FEIS at 4-44.

50. (DA) The Staff identified a variety of measures and controls to limit adverse impacts during site-preparation activities, including the Applicant's compliance with state, federal, and local laws and regulations, as well as with applicable permits and licenses; compliance with the Applicant's own processes and procedures; incorporation of environmental requirements into construction contracts; and continued identification of environmental

resources and potential impacts during the development of the ER and the ESP process. FEIS at 4-45.

e. FEIS Chapter 5, "Operation Impacts at the Proposed Site"

**Q11: Describe how the Staff evaluated the operation-related environmental impacts at the proposed site.**

**A11:** 51. (EH) In Chapter 5 of the FEIS, the Staff analyzed the potential impacts of operation on land use, air quality, water, ecosystems, socioeconomics, historic and cultural resources, and environmental justice, as well as nonradiological and radiological health effects and the environmental impacts of postulated accidents. Where possible, the Staff assigned a single significance level of potential impact – SMALL, MODERATE, or LARGE – to each issue, in accordance with 10 C.F.R. Part 51. FEIS at 5-1.

52. (DA) The Staff concluded that impacts to land use in the vicinity of the ESP unit due to operations, including potential minor land cover alterations (depending on the need for new housing for workers) and the impact of salt drift (found in NUREG-1437, the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* ("GEIS") to be of only minor significance) would be SMALL. FEIS at 5-1, 5-2. Similarly, the Staff found that, in the event that upgraded transmission lines are constructed in the existing transmission line rights-of-way, only SMALL impacts to land use would occur as a result of normal transmission maintenance activities such as right-of-way vegetation clearing, line maintenance, and other normal access needs. FEIS at 5-3.

53. (JR) In evaluating meteorological and air quality impacts, the Staff reviewed impacts from cooling towers as well as from transmission lines. Based on the lack of major air pollution sources near the Exelon ESP site, and the assumption that the impacts (such as salt drift and deposition) of cooling towers associated with a new nuclear unit would be similar to

those of cooling towers at existing nuclear facilities, the Staff concluded that cooling tower impacts on air quality would be SMALL. FEIS at 5-3, 5-4.

54. (JR) Likewise, because at a new nuclear unit additional standby diesel generators and auxiliary power systems for emergency power and auxiliary steam purposes would be used on an infrequent basis, because pollutants discharged (e.g., particulates, sulfur oxides, carbon monoxide, hydrocarbons, and nitrogen oxides) would be in accordance with State and Federal regulatory requirements, and because there are no significant industrial activities within 16 km (10 mi) of the Exelon ESP site, the Staff concluded that the environmental impact of pollutants from these sources would be SMALL. FEIS at 5-4. The Staff also estimated that uranium fuel cycle carbon dioxide emissions for the postulated plant would be less than 0.8 million metric tons (0.9 million tons).<sup>14</sup> FEIS at 5-4. Finally, because the largest lines currently used by the transmission system to which the new unit would connect are well within the range of lines considered in the GEIS, the Staff concluded that the potential operational impacts of transmission lines on air quality are SMALL. FEIS at 5-5.

55. (LV) With respect to water-use impacts, the Staff found that the frequency and duration of low water conditions would increase if the ESP unit were constructed, both directly because of the consumptive use of water and indirectly because reducing the lake volume

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<sup>14</sup> (JR) This Staff estimate involved extrapolation from data in Table S-3, which states that NO<sub>x</sub> emissions from the fuel cycle for a 1000 MWe nuclear plant are equivalent to the emissions from a 45 MWe coal-fired plant. From these data, Staff estimated NO<sub>x</sub> from a nuclear plant to be <5% of the NO<sub>x</sub> from a coal-fired plant. Furthermore, "Carbon Dioxide Emissions from the Generation of Electric Power in the United States," (U.S. Department of Energy, U.S. Environmental Protection Agency, July 2000 [no document number]) lists the CO<sub>2</sub> emissions for coal generation as 2 lb/kwhr for a 2200 MWt coal-fired plant, and the Applicant's ER gives a 0.85 capacity factor for coal-fired plants. From these values, the Staff estimated the CO<sub>2</sub> emissions for a coal-fired plant to be about 16.4 million metric tons per year. Therefore, assuming that CO<sub>2</sub> emissions are <5% based on the NO<sub>x</sub> analogy, the Staff estimated CO<sub>2</sub> emissions for the fuel cycle to be < 0.8 million metric tons.

would increase the induced evaporation in Clinton Lake.<sup>15</sup> FEIS at 5-6. The Staff noted that impacts could be minor during periods with average or above average precipitation. FEIS at 5-8. Therefore, the Staff concluded that during normal water years, the water use impacts would be SMALL, but during years of below-average precipitation, impacts could be MODERATE until normal water conditions return.<sup>16</sup> FEIS at 5-8. The Staff noted that in such cases, Exelon would need to coordinate with IEPA on appropriate measures, such as derating or even temporary shutdown of the unit. FEIS at 5-8. Pursuant to Section 401 of the Clean Water Act, the Staff has recommended that any ESP permit issued for the Exelon ESP site have a permit condition requiring Exelon to obtain a certification from the State of Illinois – which has jurisdiction to impose conditions on the use of water by Exelon that can limit water use in periods of below normal precipitation – prior to any construction or operation activities that could impact the waters of the State. This permit condition would ensure that the Applicant will coordinate with IEPA to fulfill its duties in managing the State's water resources.

56. (LV) With respect to water quality impacts, the Staff concluded that because Exelon has committed to keeping the combined discharge of the CPS and ESP unit effluent within the bounds of the CPS's existing NPDES permit, which IEPA has determined provides

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<sup>15</sup> (LV) Lowered lake levels will cause the frequency and duration (persistence) of the times that the releases from Clinton Lake will be at 5 cfs [0.14 m<sup>3</sup>/sec] – the minimum release that is required to maintain the aquatic environment in Salt Creek below Clinton Lake – to increase. The minimum is released when surplus water is not available in Clinton Lake, which occurs at lake surface elevations below 210 m (690 ft). Greater water consumption by the ESP facility is estimated to increase the amount of time when surface elevations in Clinton Lake would be below 210 m, which would in turn increase the amount of time when only minimum flows could be released to Salt Creek. Thus, more water consumption corresponds to an overall *decrease* in water released, by increasing the number of days when only the minimum could be released.

<sup>16</sup> (LV) As noted in Appendix K to the FEIS, the Applicant does not intend to use groundwater as a water source or implement a permanent groundwater dewatering system. FEIS at K-14, K-18, K-27.

adequate protection to the environment, impacts of a new nuclear unit on lake water quality would be SMALL.<sup>17</sup> FEIS at 5-9.

57. (JB) With respect to impacts on ecological resources, the Staff evaluated terrestrial impacts, aquatic impacts, and impacts to threatened and endangered species. FEIS at 5-9. For terrestrial impacts, based on the prior GEIS analysis (finding salt drift to have insignificant impacts at existing plants with cooling towers), a lack of important terrestrial plant species and habitats, as well as extensive agricultural land use onsite and in the immediate vicinity of the ESP site, the Staff concluded that the potential impacts on crops, ornamental vegetation, and native plants from addition of one or more cooling towers for a new nuclear unit at the Exelon ESP site would be minimal. FEIS at 5-10. The Staff also relied on the GEIS analysis in concluding that the impacts of bird collisions with cooling towers would be negligible. FEIS at 5-10, 5-11. The Staff found that noise from operating cooling towers would not be likely to disturb wildlife beyond the ESP site and that, based on water budget analyses, changes in shoreline vegetation and wildlife use due to the addition of a new nuclear unit would be negligible. FEIS at 5-11, 5-12. Concerning transmission line impacts, the Staff concluded, based on analyses in the GEIS, that impacts from right-of-way maintenance (including on floodplains and wetlands), bird collisions, and electromagnetic fields (“EMFs”) would be of small significance. FEIS at 5-12 to 5-14.

58. (SS) For aquatic impacts, the Staff found that impacts on aquatic ecosystems from operation of the intake system would likely be SMALL during normal water years, provided the velocity through the intake screens is less than 0.5 ft/sec and the Applicant uses a closed cycle or a hybrid cooling system. FEIS at 5-23. Because the intake structure design and permit requirements that would be set by the IEPA are presently unknown, the Staff found that

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<sup>17</sup> (LV) See previous footnote.

cooling water intake system impacts could be MODERATE if best available technology is not utilized at the CPS and localized reduction or “cropping” of fish occurs beyond what natural spawning or “recruitment” can replace, as a result of joint operation of the CPS and ESP units. FEIS at 5-23, 5-24. The Staff also concluded that, during normal water years, operational impacts of the plant cooling water system other than impingement and entrainment would be SMALL, but that, during low water years, the impact to the water level (and thus to the water temperature and available habitat) could be MODERATE until normal water conditions and lake level returned. FEIS at 5-24. The Staff determined that an applicant for a CP or COL referencing any ESP that may be issued for the Exelon ESP site would need to provide additional information on the intake structure design and expected NPDES permit requirements regarding impingement, entrainment, and thermal effects on aquatic organisms in order for the Staff to make a significance determination with respect to this resource.<sup>18</sup> FEIS at 5-24. Therefore, the Staff concluded that the aquatic ecology issues associated with operation of a proposed ESP unit are unresolved. FEIS at 5-24.

59. (JB, SS) The Staff found that there would be no operational impacts to Federally listed or proposed terrestrial or aquatic plant species and no operational impacts to Federally listed or proposed aquatic animal species, and that operational impacts to Federally listed terrestrial animal species, the bald eagle and Indiana bat, are expected to be negligible given

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<sup>18</sup> (SS) The Staff also noted that an Environmental Protection Plan (“EPP”) – essentially a set of conditions placed on a license to ensure that the licensee carries out certain activities related to the protection of the environment – as well as requirements for the disclosure, investigation, and analysis of nonroutine environmental impacts of operation would be expected to be part of an OL for a new nuclear unit and could be included as part of a COL. For current operating plants, the EPP generally consists of near-term (up to around 5 years) monitoring programs for specific resources and long-term programs to ensure that (1) proposed changes to the plant with the potential to significantly affect the environment are reviewed and approved by the Staff and that (2) unexpected impacts to the environment are reported to the Staff. The Staff plans to propose an EPP for any ESP that includes an approved site redress plan allowing the permit holder to carry out the activities listed in 10 C.F.R. § 50.10(e)(1). (See 10 C.F.R. § 52.25.) The Staff expects that an EPP for a COL would include additional conditions related to the operation of the facility.

the expected insignificant impacts from transmission line right-of-way maintenance and from bird collisions with cooling towers and transmission lines. FEIS at 5-25, 5-26. The Staff also determined that there would be no operational impacts to designated or proposed critical habitat for Federally listed or proposed terrestrial or aquatic animal species. FEIS at 5-26. Therefore, the Staff concluded that the impacts of operation on Federally listed or proposed threatened or endangered aquatic or terrestrial species would be SMALL, predicated on certain Staff assumptions, including the current occurrence of Federally listed or proposed threatened and endangered species and designated or proposed critical habitat in the project area. FEIS at 5-26.

60. (JJ) With respect to socioeconomic impacts, the Staff assessed physical impacts, demographics, and impacts to the community. In terms of physical impacts, the Staff found that offsite noise impacts likely would be minor because of noise control devices on vehicles, the adherence to applicable State and Federal criteria, the distance of nearby residences to the site, and the fact that operations activities entailing significant noise would be limited to normal weekday business hours. FEIS at 5-29. The Staff also noted Exelon's stated intention to adhere to applicable air-pollution control regulations as they relate to the operation of fuel-burning equipment, and the fact that central Illinois is not classified as in violation of applicable air-pollution standards. FEIS at 5-29. Therefore, the Staff concluded that the physical impacts of station operation on the workers and the local public would be SMALL. FEIS at 5-29.

61. (JJ) The Staff found no significant physical impacts of station operation on offsite buildings or on nearby roads (particularly compared to road loads during construction). FEIS at 5-29, 5-30. The Staff determined that a new nuclear unit at the Exelon ESP site would have visual impacts similar to those of the existing CPS and that, because the area is sparsely populated, the facility would have a small impact on aesthetic quality for nearby residences and

on recreational users of Clinton Lake. FEIS at 5-31. The Staff found that the aesthetic impacts could also be MODERATE due to the consumptive use of water for cooling and impacts on Clinton Lake during times of severe drought; however, the Staff stated that mitigation would not be generally warranted due to the temporary nature of this impact. FEIS at 5-31.

62. (JJ) The Staff determined that the expected number of new employees and their families - approximately 580 additional permanent employees, translating into an estimated increase in population of about 2320 (assuming each new employee represents a family of four) – would represent a very small increase to the relevant counties' total population, even if the new workers were to come from outside the region or if new area jobs emerged as part of a "multiplier effect." FEIS at 5-31, 5-32. Therefore, the Staff concluded that the demographic impacts of station operation would be SMALL. FEIS at 5-32.

63. (JJ) The Staff found that the magnitude of the economic impacts (taking into account possible multiplier effects) would be diffused in the larger economic bases of Macon, McLean, and Champaign Counties, and that DeWitt County, as the ESP site county, would consequently benefit more than Piatt and Logan Counties. FEIS at 5-33. The Staff concluded that the impacts of station operation on the economy would be beneficial and SMALL everywhere in the region except DeWitt County, where the impacts could be beneficial and MODERATE. FEIS at 5-33. Likewise, the Staff evaluated the effect of income, sales, use, and property taxes of additional Exelon employees, as well as taxes on Exelon's corporate profits, finding that tax paid by Exelon would directly benefit DeWitt County (and other jurisdictions that would receive property tax from the proposed nuclear unit), as would property taxes from employees living in the county. FEIS at 5-35. The Staff found that sales and use taxes could beneficially impact DeWitt County and the City of Clinton, due to its proximity to a new nuclear unit, while personal and corporate income taxes would be paid to the State of Illinois. FEIS at 5-33 to 5-35. The Staff concluded that, although the amount of sales, use, and income taxes

collected over the potential lifetime of the project could be large in absolute amounts, it is small when compared to the total amount of taxes Illinois collects in any given year or would collect over the 60-year life of operation of a new facility. Property taxes collected over the life of the facility could be substantial when compared to the total property taxes collected by DeWitt County. The overall beneficial impacts would likely range from SMALL in most areas of the region to LARGE in DeWitt County.<sup>19</sup> FEIS at 5-35, 5-36.

64. (JJ) In terms of community impacts, the Staff found that as the rural roads are well maintained and lightly traveled, and congestion is expected only at shift changes, impacts of station operation on the transportation system would be SMALL. FEIS at 5-36. The Staff also found that impacts on recreation would be SMALL to MODERATE, depending on whether a larger-than-expected proportion of the workforce would relocate from outside the region and increase recreational use of Clinton Lake, and on whether severe drought conditions in conjunction with the consumptive use of water for cooling at both the CPS and a new nuclear unit could impact lake pool elevations and temperature (which could be mitigated by plant operations). FEIS at 5-37, 5-38.

65. (JJ) The Staff concluded that potential impacts on housing would be SMALL in the region and potentially MODERATE in DeWitt, Piatt, and Logan Counties, depending on

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<sup>19</sup> (JJ) The Staff considered this analysis of taxes to be bounding, as represented by the LARGE impacts (beneficial) to DeWitt County, which is the most impacted by the location of the ESP site within its boundaries. The other counties do not contain the ESP site and thus would benefit only from the sale and use taxes and property taxes of the operation workforce already living in, or choosing to move to, the counties. The sales and use and property taxes collected and tied to the new nuclear unit, while large in absolute amount, would be small when compared to the total taxes collected by the counties. The Staff did not consider mitigation related to this impact assessment, as mitigation is warranted only for adverse impacts, not beneficial ones.

whether the operations workforce comes from outside the region and/or locates in DeWitt, Piatt, or Logan counties to be nearer the work site.<sup>20</sup> FEIS at 5-39.

66. (JJ) In terms of impacts of operation on public services, the Staff found that public water supply and waste water treatment have excess capacity to accommodate potential population increases, and that the projected capacity of police, fire, and medical services is currently adequate and is expected to expand modestly to meet the demands of a slight population growth. FEIS at 5-41. The Staff further determined that increases in tax revenue could help with the infrastructure and resource requirements for any potential increase in demand for services, and that operations would have a beneficial economic impact to the economically disadvantaged population by lessening the demand for social services. FEIS at 5-41. The Staff also found that impacts on education would be SMALL, noting that even if a higher than expected proportion of new employees relocate to Clinton and DeWitt County to be closer to the site, the local school district appears to have the capacity to accommodate an associated increase in the student population and, if not, increased tax revenues could be used to expand school infrastructure. FEIS at 5-42.

67. (DS) The Staff stated that it did not expect any significant impacts on cultural and historic resources during ESP unit operation (most would have been identified as part of

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<sup>20</sup> (JJ) The potential MODERATE impact for the smaller counties of DeWitt, Logan and Piatt is based on several considerations. First, there is up to a 20-year period in which the ESP could be valid without being acted on. From a socioeconomic standpoint, many things could happen that would impact the housing market in the region during that time, and it is difficult to anticipate the nature of these events so far into the future. Second, at the CP/COL stage, the Staff would look for new and significant information related to potential housing impacts. Third, there is no shortage of housing in some of the larger counties surrounding the ESP site (e.g., Champaign-Urban, Bloomington-Normal, Decatur, etc.). Therefore, even if a number of the operation workforce decided to move to the smaller counties, the larger counties could help ease, on a temporary or permanent basis, any housing shortage while the market responded to the increased demand for housing in the smaller counties. Fourth, if Exelon's assumptions are correct and the operations workforce comes from within the region and commutes to the ESP site, then the impacts on the smaller counties would be SMALL. Given these considerations, the Staff considers the MODERATE impact level to be the most appropriate in bounding the potential housing impacts.

construction), and it noted that any new ground-disturbing activities that might occur during operation would follow Exelon procedures, which would require further evaluation to determine if additional archaeological review is necessary. FEIS at 5-43. The Staff concluded that the impacts from operations would be SMALL, although mitigation might be warranted in the event of an inadvertent discovery. FEIS at 5-43.

68. (JJ) As discussed with respect to construction, the Staff did not find any disproportionately high or adverse health or environmental effects from operation of a new nuclear unit at the ESP site that would impact minority or low-income populations, and it thus concluded that impacts related to environmental justice considerations would be SMALL. FEIS at 5-43.

69. (GS, JR) The Staff determined that the small temperature increase in Clinton Lake expected as a result of operating the new nuclear unit would not significantly increase the abundance of thermophilic microorganisms, making any associated human health effects SMALL. FEIS at 5-44. Also, in light of the postulated noise levels for cooling towers, the distance from plant facilities to the site boundary, and the evaluation of noise impacts reflected in the *Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities, Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors*, NUREG-0586 ("Decommissioning GEIS"), the Staff concluded that the noise impacts to the public from operation would be SMALL. FEIS at 5-44, 5-45. Based on Exelon's assertion that the transmission lines that would connect new units to the grid would be constructed to NESC and other industry standards, the Staff concluded that impacts associated with acute effects of EMFs would be SMALL, but it determined (with reference to NUREG-1437, the GEIS for License Renewal) that the issue of chronic EMF effects is not resolved because conclusive

information is not available.<sup>21</sup> FEIS at 5-46. The Staff noted that health impacts to workers from noise and EMFs would be monitored and controlled in accordance with the applicable OSHA regulations and would be SMALL, and that worker health risks are expected to be dominated by occupational injuries, for which nuclear industry rates are, historically, lower than the average U.S. industrial rates. FEIS at 5-47.

70. (GS) The Staff evaluated the health impacts from routine gaseous and liquid radiological effluent releases from a new nuclear unit at the Exelon ESP site. After independently evaluating Exelon's assessment of likely exposure pathways and its use of the LADTAP II and GASPAR II modeling programs to calculate the dose to a maximally exposed individual and a collective whole body dose for the population within 80 km (50 mi) of the Exelon ESP site, and comparing the calculated doses to regulatory design objectives, the Staff concluded that there would be no observable health impacts to the public from normal operation of a new nuclear unit, and the health impacts would be SMALL.<sup>22</sup> FEIS at 5-47 to 5-56.

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<sup>21</sup> (JR) The difference between the Staff's EMF analyses with respect to impacts on flora and fauna (Section 5.4.1.5) and for nonradiological health (Section 5.8.4) is consistent with the analyses in the review of impacts of transmission lines in NUREG-1437 (GEIS on License Renewal). In NUREG-1437 (Section 4.5.4.2.3), the Staff evaluated the literature on the potential impacts of EMF on human health and determined that there is evidence suggesting, but not proof of, a causal link between EMF and leukemia, lymphoma, and cancer of the central nervous system. The Staff noted that the evidence is inconsistent and that "the pieces still do not fit together very well." Because the scientific evidence is not conclusive, the Staff did not reach a conclusion related to the impact of EMF on human health.

The Staff also evaluated the literature on potential effects of EMFs on flora and fauna (License Renewal GEIS, Section 4.5.6.3.4). However, the Staff concluded that, for flora and fauna, the impacts of prolonged exposure to EMFs were small and that mitigation measures could create additional environmental impacts and would be costly.

Both conclusions are set out in Appendix B of 10 C.F.R. Part 51. The National Institute of Environmental Health Sciences is responsible for directing EMF biological research funded through the Department of Energy and claims to have sole responsibility for determining whether a hazard exists and, if so, the magnitude of that hazard. EMF research is also carried out by other organizations, as noted in FEIS section 5.4.1.5. The Staff continues to monitor research on the impacts of EMFs.

<sup>22</sup> (GS) The values in Tables 5-3 and 5-4 of the FEIS were taken from the Applicant's ER to allow direct comparison to 10 C.F.R. Part 50, Appendix I dose objectives and 40 C.F.R. Part 190 dose standards, respectively. Table 5-3 in the FEIS (which compared doses to Appendix I dose objectives) was a composite of the liquid effluent doses in Table 5.4-7 of the ER and gaseous effluent doses in Table 5.4-9 of the ER. Table 5-4 in the FEIS (which compared doses to 40 C.F.R. 190 dose standards) was the  
(continued...)

Furthermore, based on a determination that occupational exposures for the new nuclear unit would likely be bounded by occupational exposures from currently operating LWRs and that the licensee of a new plant will need to maintain individual doses to workers within 0.05 Sv (5 rem) annually as specified in 10 C.F.R. § 20.1201 and apply the ALARA process to maintain doses below this limit, the Staff concluded that the health impacts from occupational radiation exposure would be SMALL. FEIS at 5-56, 5-57.

71. (GS) The Staff examined the Applicant's estimated doses to surrogate biota species for both liquid and gaseous effluent pathways. FEIS at 5-57, 5-58. The Staff's independent evaluation of biota doses produced similar results. FEIS at 5-59. As stated in Appendix H, the Staff used the LADTAP II code, GASPAP II code, and input parameters supplied by Exelon in its ER to calculate doses to the biota. As part of its independent review, the Staff requested Exelon's input values for these codes, and reviewed them for reasonableness. It then ran the codes using Exelon's input and default values from Regulatory Guide 1.109 (when input values were not provided) to verify the results of Exelon's dose assessment. The Staff concluded there was sufficient protection because the cumulative effects of the CPS and the new nuclear unit would result in dose rates significantly less than those noted in studies by the National Council on Radiation Protection and Measurements ("NCRP") and International Atomic Energy Agency ("IAEA") that found adequate protection for biota. FEIS at 5-59. Therefore, the Staff concluded that the radiological impact on biota other than members of the public from routine operation would be SMALL. FEIS at 5-59.

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<sup>22</sup>(...continued)

sum of the liquid effluent doses in Table 5.4-8 of the ER and the gaseous effluent doses in Table 5.4-10 of the ER. The estimated doses in these tables are somewhat different because they were presented for different purposes (i.e., Table 5-3 doses were presented for comparison to 10 C.F.R. Part 50, Appendix I dose objectives and Table 5-4 doses were presented for comparison to 40 C.F.R. Part 190 dose standards, but were not presented for direct comparison to each other) and thus included doses to different organs. Therefore, these differences are to be expected.

72. (GS) Finally, the Staff reviewed the documentation for Exelon's proposed radiological environmental monitoring program ("REMP"). The Staff found the proposed REMP to be adequate, noting that Exelon will provide an annual Radiological Environmental Operating Report for the entire site (including both the CPS and a new nuclear unit) to compare data with those for previous years; that the REMP would utilize the sampling locations used by the CPS to the greatest extent practical; that an inter-laboratory comparison program currently exists; that an independent laboratory will continue to verify the program results; and that Exelon will implement a quality assurance program for the REMP. FEIS at 5-59 to 5-61.

73. (JR) In Section 5.10 of the FEIS, the Staff considered the radiological consequences on the human environment of potential accidents at a new nuclear units at the Exelon ESP site. In its application, Exelon evaluated the potential consequences of postulated accidents, using a set of surrogate design basis accidents ("DBAs") intended to be representative of the range of reactor designs<sup>23</sup> being considered for the ESP site and site-specific meteorological data. FEIS at 5-62. Exelon evaluated the potential consequences of DBAs using procedures outlined in regulatory guides and standard review plans, including TID-14844, NUREG-0800, Regulatory Guide 1.3, Regulatory Guide 1.25, and Regulatory Guide 1.183. FEIS at 5-63. The Staff reviewed the Applicant's selection of DBAs for the AP1000 and ABWR reactor designs and considered the DBAs selected by the Applicant to be appropriate for these designs; the Staff reviewed these DBAs in detail in the design certification process. The Staff reviewed the Applicant's dose calculation methods and confirmed that they give appropriate site-specific doses. The Staff also verified a sample of the Applicant's numerical values and determined that the results of the remainder of the calculations were

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<sup>23</sup> (JR) Exelon's review focused on two LWR designs, the ABWR and the pre-certification surrogate AP1000 design, which are expected to bound the consequence analyses for the other possible reactor designs. FEIS at 5-62.

reasonable. The Staff reviewed the atmospheric dispersion characteristics (including atmospheric dispersion factors, or  $\chi/Q$ ) used by Exelon and found them to be acceptable with respect to the potential environmental consequences of postulated DBAs for the Exelon ESP site.<sup>24</sup> FEIS at 5-64. (At the CP or COL stage, the applicant would need to demonstrate that the design specific  $\chi/Q$  values for the reactor design proposed at the CP or COL stage are equal to or greater than the site  $\chi/Q$  values specified in the ESP.<sup>25</sup> FEIS at 5-64.)

74. (JR) The Staff then independently evaluated Exelon's estimates of the environmental consequences of each DBA in terms of total effective dose equivalent ("TEDE"). FEIS at 5-66. Because in all cases, the calculated TEDE values were considerably smaller than the TEDE doses used as safety review criteria, the Staff concluded that the consequences of DBAs at the Exelon ESP site are of SMALL significance for advanced LWRs and that the Exelon ESP site is suitable for operation of advanced LWRs. FEIS at 5-67.

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<sup>24</sup> (JR) The atmospheric dispersion factor for a reactor design is generally a calculated value based on 1) atmospheric releases (source terms) derived from the evaluation of the accident and release path, and 2) dose limits found in regulations and guidance. These values are the maximum atmospheric dispersion factors for which the design will meet the Commission's regulations. A large dispersion factor means that a site does not need much dispersion to be an acceptable site for the design, and a small dispersion factor means that a site needs to have good dispersion to be an acceptable site for the design.

Atmospheric dispersion factors calculated for a specific site, such as the Exelon ESP site, are based on atmospheric conditions and the distance to site boundaries. A large atmospheric dispersion factor (e.g.,  $1.0 \times 10^{-3}$  s/m<sup>3</sup> for the exclusion area boundary) indicates that the site does not have very good dispersion, while a small atmospheric dispersion factor (e.g.,  $1.0 \times 10^{-4}$  s/m<sup>3</sup> for the exclusion area boundary) indicates that the site has good dispersion. Applicants can reduce the magnitude of these dispersion factors by increasing distance to the site boundaries.

Differences exist between Table 5-7 of the FEIS and Table 2.3.4-1 of the SER because the SER evaluation is done using "adverse" meteorological conditions, while the NEPA-based FEIS review has historically been based on reasonable expectations. As a result, the evaluation of DBAs for the FEIS are based on "typical" or "representative" meteorological conditions. NRC guidance to applicants and licensees has defined "adverse" meteorological conditions as those conditions that give atmospheric dispersion factors that are exceeded no more than 5% of the time. "Typical" meteorological conditions are those conditions that give atmospheric conditions that are exceeded 50% of the time (i.e., they are conditions that give median atmospheric dispersion factors).

<sup>25</sup> (JR) By showing that the design  $\chi/Q$  is greater than the Site  $\chi/Q$ , a COL or CP applicant would be demonstrating that the dispersion at the site is such that the consequences of DBAs evaluated for the design fall within regulatory limits.

75. (JR) With respect to severe accidents, the Staff reviewed Exelon's analysis in the ER and then requested that Exelon perform a site-specific analysis using the MACCS2 computer code, which was developed to evaluate the potential consequences of severe accidents for NUREG-1150. FEIS at 5-67. The results of that analysis were submitted by Exelon in a letter dated July 23, 2004. FEIS at 5-67. The Staff conducted a confirmatory site-specific analysis using the MACCS2 code to evaluate potential impacts for the atmospheric, surface water, and groundwater pathways. FEIS at 5-75 to 5-77. The Applicant and Staff analyses examined consequences in terms of human health, economic costs, and land contamination. FEIS at 5-68. The Staff found that the environmental risks associated with severe accidents if an advanced LWR were to be located at the Exelon ESP site would be small compared to risks associated with operation of current-generation reactors at the Exelon ESP site and other sites (as identified in the analyses in the GEIS and its Supplements), and that these risks are well below the NRC safety goals.<sup>26</sup> FEIS at 5-77. Therefore, the Staff concluded that the probability-weighted consequences of severe accidents at the Exelon ESP site are of SMALL significance for an advanced LWR and that the Exelon ESP site is suitable for operation of an advanced LWR. FEIS at 5-77.

76. (JR) The Staff noted that the environmental impacts of both DBAs and severe accidents of designs not evaluated in the FEIS, including gas-cooled designs, are unresolved

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<sup>26</sup> (JR) The Staff notes that post-NUREG-1150 severe accident analyses related to license renewal have focused on internal initiating events, and the same approach has been followed for the ESP environmental reviews. The Staff further notes that the risks calculated for ABWR and AP1000 reactor designs at the Exelon ESP site are well within the Commission's safety goals, and even if external events had been considered and even if they had doubled or tripled the risk, the risk would still be well within the safety goals.

because information is lacking; these impacts would need to be evaluated at the CP or COL stage.<sup>27</sup> FEIS at 5-67, 5-77.

77. (EH) The Staff identified a variety of measures and controls to limit adverse impacts during operations, including the Applicant's compliance with state, federal, and local laws and regulations, as well as with applicable permits and licenses; compliance with the Applicant's own processes and procedures; and various mitigative actions with respect to factors such as noise levels, dust and exhaust, erosion and sedimentation, traffic, transmission line right-of-way maintenance, chemical discharge, and health-related monitoring. FEIS at 5-78 to 5-80.

f. FEIS Chapter 6, "Fuel Cycle, Transportation, and Decommissioning"

**Q12: Describe how the Staff evaluated the environmental impacts from the fuel cycle, from transportation, and from decommissioning.**

**A12:** 78. (EH) In Chapter 6 of the FEIS, the Staff evaluated the environmental impacts from (1) the uranium fuel cycle and solid waste management, (2) transportation of radioactive material, and (3) decommissioning for the proposed Exelon ESP site. FEIS at 6-1.

**Q13: Please describe the Staff's analysis with respect to fuel cycle impacts.**

**A13:** 79. (GS) The Staff first examined the Applicant's assessment of the environmental impacts from the uranium fuel cycle and solid waste management, for both the advanced light

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<sup>27</sup> (JR) In both the SER and the EIS, the Staff indicated that it will verify the acceptability of its bounding analysis of radiological consequences with respect to reactor design DBAs other than those for the AP1000 and ABWR designs at the COL or CP stage. However, the Staff notes that the SER does not evaluate the consequences of severe accidents as is done in the FEIS.

water reactor<sup>28</sup> and gas-cooled reactor designs.<sup>29</sup> The Staff noted that Exelon would have to perform a new evaluation of uranium fuel cycle impacts at the construction permit or COL stage, if a reactor other than an LWR is chosen. At the COL stage, in accordance with 10 C.F.R. § 52.79(a)(1), an applicant is required to submit information sufficient to demonstrate that the design of the facility falls within the parameters specified in the early site permit, and to resolve any other significant environmental issues not considered in any previous proceeding on the site or design. Therefore, for unresolved issues, the applicant is required to submit the information and the Staff will evaluate it in the EIS issued for the COL.<sup>30</sup> The Staff believes that the determinations made in Chapter 6, as well as the demonstrations required at the COL stage, are sufficient to ensure that the issue of uranium fuel cycle impacts will be properly addressed.

**Q14: What was the Staff's analysis with respect to fuel cycle impacts for light-water reactors?**

**A14:** 80. (GS) In the Applicant's analysis of LWR designs, the PPE for the new unit at the Exelon ESP site uses the bounding input parameters from several LWR designs, all of which use uranium dioxide fuel. FEIS at 6-2. As a result, the Staff determined that Table S-3 found at 10 C.F.R. § 51.51(b), which states key uranium fuel cycle environmental data calculated by the NRC, can be used to assess environmental impacts. FEIS at 6-2. The Staff is confident

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<sup>28</sup> (GS) The five LWR designs Exelon considered are the Advanced Canada Deuterium Uranium Reactor ("ACR-700"), the Advanced Boiling Water Reactor ("ABWR"), the Advanced Pressurized Water Reactor ("AP1000"), the Economic Simplified Boiling Water Reactor ("ESBWR"), and the International Reactor Innovative and Secure ("IRIS") next-generation pressurized water reactor ("PWR").

<sup>29</sup> (GS) The two gas-cooled designs Exelon considered are the Gas Turbine Modular Helium Reactor ("GT-MHR") and the Pebble Bed Modular Reactor ("PBMR").

<sup>30</sup> (TK) Pursuant to 10 C.F.R. § 52.39(a)(2), the Commission treats as resolved those matters resolved in the proceeding on the application for issuance or renewal of an early site permit.

that the contemporary fuel cycle impacts weighed in its analysis are below those identified in Table S-3. FEIS at 6-8.

81. (GS) Because the fuel cycle impacts in Table S-3 are based on a reference 1000 MW(e) LWR operating at an annual capacity factor of 80 percent for a net electric output of 800 MW(e), the Staff used the Exelon PPE of 6800 MW(t) [equivalent to total net electric output of 2200 MW(e)] for the ESP site (referred to by the Staff in its review as "the 1000-MW(e) LWR scaled model") resulting in approximately three times the impact values in Table S-3. FEIS at 6-7, 6-8.

82. (GS) The Staff then examined the fuel cycle environmental impacts associated with three times the values in Table S-3 to assess the impacts of the proposed ESP site. The Staff determined these impacts to be SMALL for each primary impact area, including land use, water use, fossil fuel impacts, chemical and radioactive effluents,<sup>31</sup> radioactive wastes, occupational dose, and transportation. FEIS at 6-9 to 6-15.

**Q15: What was the Staff's analysis with respect to fuel cycle impacts for gas-cooled reactors?**

**A15:** 83. (GS) The Staff considered issues related to reactors based on non-LWR designs, such as gas-cooled reactors, not to be resolved because there is insufficient design information at this time to validate values and impacts. FEIS at 6-15. However, the Staff attempted to estimate the impacts using data provided by the Applicant, with respect to the two potential gas-cooled designs, the GT-MHR and the PBMR. FEIS at 6-15, 6-16.

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<sup>31</sup> (GS) The Staff's analysis of the impacts of radioactive effluents included a discussion of the potential health effects associated with the releases of technetium-99 during the gaseous diffusion enrichment. Technetium-99 is present because gaseous diffusion enrichment plants at Paducah, Oak Ridge, and Portsmouth had uranium hexafluoride feed plants which converted uranium oxide to uranium hexafluoride for subsequent introduction into the gaseous diffusion enrichment cascade. Recycled uranium was used as feed for these feed plants at specific time periods in the 1950s, 1960s, and 1970s. The Paducah facility received approximately 100,000 tons (90,000 metric tons) of recycled uranium, containing an estimated 661 kilograms of technetium-99. Further details are available at <http://www.ne.doe.gov/home/9-29-99.html>.

84. (GS) Exelon sought to demonstrate in its ER that the impacts for the gas-cooled reactor designs were comparable to the environmental impacts identified in the technical basis document, WASH-1248, *Environmental Summary of the Uranium Fuel Cycle*, and its Supplement 1 (NUREG-0116) for Table S-3. FEIS at 6-16. Both Exelon and the Staff performed this assessment by comparing key parameters – including energy usage, material involved, and number of shipments for each major fuel cycle activity – for the gas-cooled reactor designs to those used to generate the impacts in Table S-3. FEIS at 6-16. As with its evaluation of the LWR designs, the Staff used the 1000-MW(e) LWR scaled model to compare impacts, and it determined that the Applicant could site 2 GT-MHR units or 1 PBMR unit to remain below the site PPE of 2200 MW(e) total net electric output. FEIS at 6-16. Because the Applicant considered the higher thermal efficiencies of the gas-cooled reactor designs compared to LWRs, and normalized impacts from gas-cooled reactors to 1000 MW(e) reference LWR, the Staff's approach does not overestimate impacts.

85. (GS) With respect to fuel fabrication, the Staff concluded it could not directly assess environmental impacts for uranium dioxide, because there are no currently operating large-scale fuel fabrication facilities producing gas-cooled reactor fuels in the United States.<sup>32</sup> FEIS at 6-18. Although the Staff found, based on some small-scale facilities, that the environmental impacts from producing gas-cooled reactor fuel likely would be small in

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<sup>32</sup> (GS) The estimates of the  $UO_2$ ,  $UF_6$ , and enrichment separative work units ("SWU") needed for the gas-cooled reactors (as presented in Table 6-3 of the FEIS and discussed in Sections 6.1.2.1-6.1.2.3) were derived from Table 5.7-1 of the Exelon ER. As explained in Appendix E of the FEIS, the Staff used a scaling approach to derive the values in Table 6-3 of the FEIS. The number of four-module GT-MHR units (with a net power rating of 1003 MW(e)) that could be placed on the ESP site and remain within the PPE net power rating for the site of 2200 MW(e) is two. The number of eight-module PBMR units (with a net power rating of 1254 MW(e)) that could be placed on the ESP site and remain within the PPE net power rating for the site of 2200 MW(e) is one. These scaling factors were multiplied times the appropriate values in Table 5.7-1 of the ER to estimate fuel cycle impacts from the gas-cooled reactor designs. For example, the enriched  $UO_2$  MT estimate for fuel fabrication plant operations in Table 6-3 of the EIS would equal 12.2 MT for the GT-MHR and 9.5 MT for the PBMR. FEIS at E-139. The value of 12.2 MT of enriched  $UO_2$  for the GT-MHR was derived by multiplying 6.11 MT in Table 5.7-1 of the ER by the scaling factor of two.

comparison with the fuel fabrication impacts for LWR technologies, it concluded that these impacts would need to be assessed at the CP or COL stage. FEIS at 6-18. Similarly, after evaluating the slightly higher amount of energy required to enrich gas-cooled fuel and the smaller amount of uranium hexafluoride needed, the Staff concluded that, on balance, the environmental impacts of enriching gas-cooled fuels, when compared to the impacts of enriching LWR fuel, would likely be small, but that the impacts still would need to be assessed at the CP or COL stage. FEIS at 6-19.

86. (GS) In terms of uranium hexafluoride production, yellowcake milling, and uranium ore mining, because the scaled gas-cooled reactor  $UF_6$ , yellowcake, and ore needs are less than or comparable to those for the scaled LWR model, the Staff concluded that the associated environmental impacts would likely be less for gas-cooled reactors and therefore would be small. FEIS at 6-19 to 6-20. During operations, gas-cooled reactor technologies are projected to generate far smaller amounts of low-level waste scaled annually compared to the amounts for the reference LWR, prompting the Staff's conclusion that the environmental impacts from low-level radioactive waste generated during operation of gas-cooled reactors would be small. During decontamination and decommissioning activities, the presence of less waste and less heavy metal radioactive waste (because of gas-cooled reactors' higher thermal efficiency and higher fuel burnup) is expected to result in less decontamination and decommissioning waste than for the scaled LWR model. The Staff did not confirm the Applicant's determination that gas-cooled technologies would generate less waste and produce less heavy metal radioactive waste during decontamination and decommissioning activities.<sup>33</sup>

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<sup>33</sup> (GS) With respect to impacts from low-level radioactive waste generated by decommissioning, the Staff relied on the analysis in NUREG-0586 Supplement 1, *Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities*, published in 2002, which took into consideration experience from waste generation of all plants being decommissioned or having completed decommissioning at that time. The Decommissioning GEIS's evaluation included information concerning the Fort St. Vrain reactor, but the Staff determined that information was insufficient to support conclusions on the impacts of any

Because the ER did not present quantitative data to support this conclusion, the Staff concluded that this was an unresolved issue that would need to be reviewed at the CP or COL stage should Exelon propose to put a gas-cooled reactor on the ESP site. FEIS at 6-21.

**Q16: Please describe the Staff's analysis with respect to impacts associated with transportation of radioactive materials.**

**A16:** 87. (PD) The Staff evaluated the radiological and nonradiological environmental impacts from normal operating and accident conditions resulting from (1) shipment of unirradiated fuel to new nuclear units at the Exelon ESP site, (2) shipment of spent fuel to a monitored retrievable storage facility or a permanent repository, and (3) shipment of low-level radioactive waste and mixed waste to offsite disposal facilities. The Staff also evaluated the transportation impacts of advanced LWR designs and gas-cooled reactor designs. FEIS at 6-21.

88. (PD) Previously in WASH-1238 and NUREG-75/038, the NRC evaluated the environmental effects of transportation of fuel and waste for LWRs and found the impact to be small. FEIS at 6-21. These documents provided the basis for Table S-4 in 10 C.F.R. § 51.52, which summarizes the environmental impacts of transportation of fuel and waste to and from one LWR of 3000 to 5000 megawatts thermal (MW(t))(1000 to 1500 MW(e)) and provides impacts for normal conditions of transport and accidents in transport for a reference 1100-MW(e) LWR. FEIS at 6-21. Dose to transportation workers during normal transportation operations was estimated to result in a collective dose of 0.04 person-Sv (4 person-rem) per reference reactor year, while combined dose to the public along the route and dose to onlookers were estimated to result in a collective dose of 0.03 person-Sv (3 person-rem) per reference reactor year. FEIS at 6-21. Environmental risks (radiological) during accident

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<sup>33</sup>(...continued)  
advanced gas-cooled designs with respect to the Exelon ESP site.

conditions were determined to be small, while nonradiological impacts during accident conditions were estimated as one fatal injury in 100 reference reactor years and one nonfatal injury in 10 reference reactor years. FEIS at 6-21. At least one subsequent Staff review of transportation impacts concluded that those impacts were bounded by Table S-4. FEIS at 6-21, 6-22.

89. (PD) A full description and detailed analysis of transportation impacts is not required when licensing an LWR if it meets certain criteria pursuant to 10 C.F.R. 51.52(a). If the LWR meets the criteria specified in 10 C.F.R. § 51.52(a), the impacts are assumed to be bounded by Table S-4. However, the Staff determined that none of Exelon's proposed designs meet all the relevant criteria. FEIS at 6-22, 6-23. Therefore, Exelon was required to provide a full transportation description and detailed analysis for each LWR design. FEIS at 6-23. Exelon used a sensitivity analysis in order to show that transportation impacts from advanced LWR designs (as well as gas-cooled designs) would be bounded by the criteria identified in Table S-4. FEIS at 6-23.

90. (PD) Consequently, the Staff conducted an independent analysis of the impacts under normal operating and accident conditions of transporting unirradiated fuel to advanced reactor sites and spent fuel and wastes from advanced reactor sites to disposal facilities.<sup>34</sup> FEIS at 6-24 to 6-42. In order to make comparisons to the bounding values in Table S-4, the Staff normalized impacts to a reference reactor year. FEIS at 6-42. The Staff determined that

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<sup>34</sup> (PD) The Staff notes that its analysis of Maximally-Exposed Individual (MEI) doses in Section 6.2.1.1 is generic and applies to transportation of unirradiated fuel, spent fuel, and radioactive waste. MEIs are individuals who may be located in close-proximity to shipments of radioactive materials and waste as a result of their occupation (e.g., truck crew), their presence on a highway as a shipment passes, or because their residences are near a highway used by a majority of the shipments. As stated on page 6-27 of the FEIS, the analysis is conservative with respect to unirradiated fuel and radioactive waste because the radiation dose rates emitted from shipments of unirradiated fuel and radioactive waste are typically much lower than the dose rate from a spent fuel shipment. Because the dose rate assumed in the MEI analysis was set to the regulatory limit, the analysis is bounding for all three types of materials and more so for unirradiated fuel and radioactive waste. The Staff made an administrative decision to locate the analysis in the first of these three sections (6.2.1, 6.2.2, and 6.2.3).

because of the conservative approaches and data (with respect to the Table S-4 values) used to calculate doses, actual environmental effects are not likely to exceed those in the Staff's FEIS calculations. FEIS at 6-42.

91. (PD) The Staff concluded that the environmental impacts of transportation of fuel and radioactive wastes to and from advanced LWR designs would be SMALL, and would be consistent with the risks from current-generation reactors presented in Table S-4.<sup>35</sup> FEIS at 6-42. However, the Staff found that for gas-cooled designs, while the impacts are likely to be small, it could not resolve the issue because verifiable information is not yet available for the designs. FEIS at 6-42. It therefore found that an applicant would need to provide appropriate data at the COL stage and the Staff would need to validate the assumptions in its EIS. FEIS at 6-42. These validations concerned fuel and cladding integrity following a traffic accident, as well as the bounding nature of assumptions about shipping cask design, unirradiated fuel initial core/refueling requirements, spent fuel generation rates, radioactive waste generation rates, and shipping cask capacities and accident source terms.<sup>36</sup> FEIS at 6-42.

**Q17: Please describe the Staff's analysis with respect to decommissioning impacts.**

**A17:** 92. (EH) The Staff noted that applicants at the ESP stage are not required to submit information regarding the process of decommissioning. FEIS at 6-43. Environmental impacts from the activities associated with the decommissioning of any LWR before or at the end of an

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<sup>35</sup> (PD) The Staff noted that the impact of crud and activation products on spent fuel shipment would have to be evaluated at the CP or COL stage. As noted earlier with respect to other issues, although this need is not tabulated in the FEIS, the Staff believes that its Chapter 6 determinations, as well as the demonstrations required at the COL stage pursuant to 10 C.F.R. § 52.79(a)(1), are sufficient to ensure that the issue will be properly addressed.

<sup>36</sup> (PD) As noted earlier with respect to other issues, although these needs are not tabulated in the FEIS, the Staff believes that its Chapter 6 determinations, as well as the demonstrations required at the COL stage pursuant to 10 C.F.R. § 52.79(a)(1), are sufficient to ensure that these issues will be properly addressed.

initial or renewed license are evaluated in the Decommissioning GEIS, and if impacts from decommissioning are within the bounds described in NUREG-0586, the Staff expects they will be small. FEIS at 6-43. As Exelon did not provide data on decommissioning in its application, for whatever design ultimately selected, the Staff concluded that the impacts from decommissioning are not resolved and would have to be assessed at the CP or COL stage. FEIS at 6-43.

g. FEIS Chapter 7, "Cumulative Impacts"

**Q18: Describe how the Staff evaluated cumulative impacts of construction and operation at the proposed site.**

**A18:** 93. (EH) In Chapter 7 of the FEIS, the Staff evaluated the potential cumulative impacts of constructing and operating a proposed new unit at the Exelon ESP site. FEIS at 7-1. To determine cumulative impacts, the Staff examined the impacts of the proposed action in combination with other past, present, and reasonably foreseeable future actions in the vicinity of the Exelon ESP site that would affect the same resources impacted by the current CPS. FEIS at 7-1. Pursuant to the definition of "cumulative" established in 40 C.F.R. § 1508.7, the Staff assessed these combined impacts, including consideration of individually minor but collectively significant actions taking place over a period of time. FEIS at 7-1.

94. (DA) The Staff reviewed the cumulative impacts associated with land use, including additional growth and land conversions to accommodate new workers and services. The Staff expected impacts to be minor, as the construction and operations work forces are predicted to be drawn from a much wider area than DeWitt County alone, including the large cities of Bloomington-Normal, Champaign-Urbana, and Decatur. FEIS at 7-2. The Staff also found that while lower tax rates or better services might encourage development,

DeWitt County's comprehensive development plan would control development. FEIS at 7-2.

Therefore, the Staff concluded that cumulative land-use impacts would be SMALL. FEIS at 7-2.

95. (JR) The Staff reviewed the cumulative impacts associated with air quality, noting that the Exelon ESP site is located in an area that is in attainment for criteria pollutants, that the State regulates any emissions to the atmosphere, and that the air-quality impacts of construction and operations are estimated to be small. As no other significant impacts from other actions were identified, the Staff concluded that the cumulative impacts of air quality would be SMALL.<sup>37</sup> FEIS at 7-2.

96. (LV) The Staff reviewed the cumulative impacts associated with water use and quality, and noted that, as with the existing CPS, the intake of water from, and the discharge of water to, Clinton Lake from a new nuclear unit would be regulated by the IEPA. FEIS at 7-3. Likewise, compliance with the NPDES permit would minimize the cumulative effects on aquatic resources. FEIS at 7-3. The Staff concluded that the potential cumulative water impacts of construction and operation of a new nuclear unit at the ESP site would be SMALL in normal years, but would be MODERATE in dry years. FEIS at 7-3.

97. (JB) The Staff reviewed the cumulative impacts associated with the terrestrial ecosystem, including the effects on plant and animal species and associated habitats from construction, cooling tower operation, transmission line operation, and right-of-way maintenance. FEIS at 7-3. The Staff concluded that the contribution of operations (including cooling tower operation, operation of the upgraded transmission system, and maintenance of

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<sup>37</sup> (JR) Chapters 4 and 5 of the FEIS provided the Staff's rationale for its determination that the impacts on air quality of construction and operation of a new reactor at the Exelon ESP site are small. The Exelon ESP site is isolated from other industrial facilities and is in a region of good air quality. Consequently, because the impacts of construction and operation are small when considered alone and the site is in an area of good air quality, isolated from other industrial facilities, the Staff concluded that the cumulative air quality impacts likewise would be small. This rationale for concluding that air quality impacts are small generally applies to the alternative sites evaluated in Chapter 8 of the FEIS, unless otherwise noted.

the associated transmission line rights-of-way) and eventual decommissioning of the unit to cumulative impacts on terrestrial ecological resources in the region would be SMALL.

FEIS at 7-5. However, because Exelon anticipates the addition of new transmission lines to upgrade the existing transmission system, but has not initiated selection of one or more transmission-system routes at this time, the actual need for and nature of transmission-system upgrades and the magnitude of associated construction impacts to terrestrial ecosystems would be evaluated by the transmission and distribution system owner and operator prior to or during the CP or COL phase. FEIS at 7-4, 7-5. Therefore, the Staff concluded that the contribution of construction of the ESP unit to cumulative impacts on terrestrial ecological resources in the region is unresolved. FEIS at 7-5.

98. (SS) The Staff reviewed the cumulative impacts associated with the aquatic ecosystem, including impacts from construction, and from water intake, consumption, and discharge. FEIS at 7-5. The Staff concluded that the contribution of construction of a new unit would be SMALL, because the amount of open water, shoreline, benthic habitat, and benthic fauna that would be lost due to construction represents a small fraction of the total found in Clinton Lake; further, fish and other mobile aquatic organisms temporarily displaced at the construction site would be expected to return once construction was completed. FEIS at 7-5, 7-6. The Staff concluded that the contribution of operational activities associated with the proposed Exelon ESP unit to the cumulative impacts related to water consumption and to impingement and entrainment of aquatic organisms would be SMALL to MODERATE, depending on whether best available technology is utilized at the Exelon ESP site<sup>38</sup> and on whether localized reduction of fish occurs, beyond what natural recruitment can replace, as a

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<sup>38</sup> (SS) However, the Staff cannot make the use of best available technology a condition of the ESP, because the Clean Water Act (CWA) requires the use of the best technology available and, as determined in past NRC proceedings such as *Yellow Creek*, the NRC is prohibited from imposing on licensees requirements that fall within the purview of the CWA.

result of joint operation of the CPS and the ESP unit. The contribution to cumulative impacts of thermal discharge could be SMALL (during normal years) to MODERATE (during dry years). FEIS at 7-6, 7-7. However, because additional information on the intake structure design and NPDES permit requirements for the ESP unit is needed in order to determine the impacts to aquatic ecology due to the operation of one or more nuclear units at the Exelon ESP site, the Staff concluded that the cumulative aquatic ecology issues associated with operation of a proposed ESP unit are unresolved. FEIS at 7-8. Finally, the Staff concluded that the contribution of eventual decommissioning of the facility to the cumulative impact on aquatic ecological resources in the region would be SMALL, as it would result in the cessation of water consumption from the lake by the power plants and impingement and entrainment impacts would end. FEIS at 7-7.

99. (DS, JJ) The Staff reviewed the cumulative impacts associated with socioeconomic, historic and cultural resources, and environmental justice. These include impacts on housing, aesthetics, transportation, tax revenues, and public services. FEIS at 7-8, 7-9. Because most of the Staff's earlier analysis of these topics already involve metrics that incorporate total and cumulative effects, and because the Staff did not identify any additional cumulative impacts, the Staff concluded that the contribution of the ESP facility to cumulative socioeconomic impacts (both adverse and beneficial) in these areas would still be SMALL or MODERATE. FEIS at 7-8, 7-9. The Staff found no unusual resource dependencies or practices through which minority or low income populations would be disproportionately affected. The Staff likewise concluded that the cumulative impacts associated with historic and cultural resources and with environmental justice would be SMALL. FEIS at 7-9.

100. (GS, JR) The Staff reviewed the cumulative impacts associated with nonradiological health. Because the Staff found minimal risk from thermophilic microorganisms in Clinton Lake, low occupational injury rates, and minimal impacts on the public and workers

from noise and dust emissions and from acute EMFs, the Staff concluded that the ESP facility's cumulative impacts on nonradiological health would be small, although impacts from chronic EMFs remain unresolved. FEIS at 7-9.

101. (GS, JR) The Staff reviewed the cumulative impacts associated with radiological impacts of normal operations. The Staff concluded that the cumulative radiological impacts of operations would be small. This conclusion was based on an earlier Staff evaluation, which determined that the predicted doses to employees and the public would be below regulatory limits and standards, as well as on the fact that the limits and standards are developed assuming long-term exposure, which incorporates cumulative impact into the analysis. FEIS at 7-10. However, issues related to gas-cooled reactor design accidents are unresolved because of the lack of information. FEIS at 7-10.

102. (GS, PD) Finally, the Staff reviewed the cumulative impacts associated with fuel cycle, transportation, and decommissioning. In light of the determinations made in its earlier analysis in Chapter 6 of the FEIS concerning the environmental impacts, the Staff concluded that the cumulative fuel cycle impacts of operating CPS and the proposed ESP unit(s) for the 1000-MW(e) light-water reactor scaled model would be SMALL. FEIS at 7-11. However, the Staff considered unresolved the cumulative impacts for other than light-water reactor designs because of a lack of information. FEIS at 7-11. With respect to transportation, the Staff noted that the addition of the proposed ESP facility would result in additional shipments of unirradiated fuel to the site and additional shipments of spent fuel and waste from the site, such that cumulative impacts would be approximately twice that of the existing operating plant. FEIS at 7-11. The Staff determined that because the proposed site values fell within the criteria specified in Table S-4 of 10 C.F.R. § 51.52, the cumulative impacts of transportation for operating both CPS and the proposed ESP unit would be SMALL, although cumulative impacts for non-LWR designs again were not considered to be resolved. FEIS at 7-11. Finally, as

Exelon was not required to (and did not) address decommissioning in its ESP application, this issue is not resolved, although environmental impacts from decommissioning are expected to be small in accordance with the analysis in the Decommissioning GEIS. FEIS at 7-11.

103. (EH) For the range of impact areas it evaluated, the Staff concluded that the potential cumulative impacts resulting from construction and operation are generally SMALL, although several areas (water use and socioeconomic impacts) have the potential for a MODERATE impact. FEIS at 7-11. In certain cases (terrestrial and aquatic ecosystems, nonradiological health, and radiological impacts of operation of non-light-water reactor designs), because information was not available to resolve issues, an applicant for a construction permit or a combined license referencing the Exelon ESP would have to provide the necessary information at that stage.<sup>39</sup> FEIS at 7-12.

h. FEIS Chapter 8, "Environmental Impacts of the Alternatives"

**Q19: Describe how the Staff evaluated the environmental impacts of alternatives to the proposed action.**

**A19:** 104. (JR) In Chapter 8 of the FEIS, the Staff evaluated alternatives to the proposed action and the environmental impacts of those alternatives. FEIS at 8-1. In the initial part of its evaluation, the Staff examined the no-action alternative, alternative energy sources, and plant design alternatives. FEIS at 8-1. In the remainder of the Chapter, the Staff evaluated the alternative sites using a two-step evaluation process: the Staff first examined environmental issues at a reconnaissance level to determine if any alternative sites were environmentally

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<sup>39</sup> (EH) With respect to documenting unavailable information relevant to the resolution of issues within the Staff's cumulative impact analysis, the information needed to evaluate an issue was generally described in the text of the FEIS. Likewise, information that was not available but necessary was discussed in the appropriate earlier chapters of the FEIS. The issues the Staff considered unresolved in the Chapter 7 analysis were the same as those considered unresolved in the earlier chapters of the FEIS. Therefore, the Staff did not consider an additional table summarizing the unavailable information in Chapter 7 to be necessary at the time the FEIS was finalized.

preferable to the proposed ESP site; second, had any alternative site appeared environmentally preferable, the Staff would have considered various factors to determine if any such site would be obviously superior to the proposed site. FEIS at 8-1.

**Q20: How did the Staff evaluate the no-action alternative?**

**A20:** 105. (JR) The no-action alternative would entail denial of the ESP request. The Staff noted that in that scenario, no impacts from preliminary site work and preparation would occur, and, because no construction or operation would occur, the impacts assessed in the FEIS would not occur. FEIS at 8-2. However, the Staff stated that the no-action alternative would also preclude the benefits of the ESP process, including early resolution of siting issues prior to large resource investments in new plant design and construction, and early resolution of issues on the environmental impacts of construction and operation. FEIS at 8-2.

**Q21: How did the Staff conduct its evaluation of energy alternatives?**

**A21:** 106. (JR) The Staff addressed several alternative energy plans, including alternatives not requiring new generating capacity, those relying on new generating capacity, and combinations of options.

107. (JR) The Staff considered three alternatives that would not involve new generating capacity. These consisted of initiation energy-conservation measures (including implementing demand-side management actions), purchasing power from other utilities or power generators, or reactivating or extending the service life of existing plants within the power system. FEIS at 8-3. Particularly in light of the deregulated Illinois power market, the Staff concluded that conservation or demand side management was not a reasonable alternative to an ESP directed at baseload electricity generation, and did not further consider this alternative. FEIS at 8-3. With respect to the purchased power alternative, the Staff noted that the environmental impacts of power production would still occur, but would be located elsewhere

within the region, nation, or in another country. FEIS at 8-3, 8-4. The impacts would depend on the generation technology and location of the generation site and, therefore, are unknown.

FEIS at 8-4. Finally, depending on whether new transmission lines and rights-of-way are necessary to receive the purchased power, the Staff concluded that the local environmental impacts could range from SMALL to LARGE. FEIS at 8-4. With respect to extension of the life of existing nuclear power plants, the Staff found that although the environmental impacts are significantly less than those of new construction, continued operation does not provide additional generation capacity. FEIS at 8-5. Similarly, additional power uprates for Exelon's existing nuclear plants will not provide the new generating capacity being considered.

FEIS at 8-5. With respect to refurbishment, the Staff noted that most fossil plants available for refurbishment are older and would require extensive and expensive work to meet environmental standards. FEIS at 8-5. Therefore, the Staff concluded that these three alternatives are not reasonable alternatives to providing new baseload power generation capacity. FEIS at 8-5.

108. (JR) The Staff also considered alternatives involving new generating capacity. The Staff concentrated on methods of generation that were technically reasonable and commercially viable. FEIS at 8-5, 8-6. The two primary alternatives considered viable were coal-fired generation and natural-gas fired generation. Other sources of generation were considered and determined not to be reasonable or viable.

**Q22: Describe the Staff's evaluation of the coal-fired generation alternative.**

**A22:** 109. (JR) The Applicant evaluated coal-fired generation in its environmental report, and in its evaluation the Staff (like the Applicant) assumed construction of four 550 MW(e) coal-fired units at the Exelon ESP site. FEIS at 8-6.

110. (JR) In terms of air quality, the Applicant estimated the coal-fired plant's annual emissions, including those for sulfur oxides (SO<sub>x</sub>) (7373 MT [8127 tons]), nitrogen oxides (NO<sub>x</sub>) (1863 MT [2054 tons]), carbon monoxide (CO) (1921 MT [2118 tons]), total suspended

particulates (“TSP”) (265 MT [292 tons]), and its subset of particulate matter (PM) of 10 microns in diameter or less (PM10) (61 MT [67 tons]). FEIS at 8-7. Exelon assumed a plant design that would minimize air emissions through a combination of boiler technology and post-combustion pollutant removal. FEIS at 8-6, 8-7.

111. (JR) A coal-fired plant would be subject to emissions caps and would have to obtain pollution credits, certain permits pursuant to the Clean Air Act, and comply with other source performance and visibility standards. FEIS at 8-7, 8-8. The Staff concluded that air quality impacts from coal-fired generation of 2200 MW(e) at the Exelon ESP site would be MODERATE to LARGE, with impacts that would be clearly noticeable and that, given the current state of Illinois air quality for SO<sub>x</sub> and NO<sub>x</sub>, could destabilize air quality. FEIS at 8-8.

112. (JR) The Applicant estimated that the coal-fired plant would consume approximately  $7.7 \times 10^6$  MT ( $8.5 \times 10^6$  tons) of coal and produce approximately  $5.3 \times 10^5$  MT ( $5.8 \times 10^5$  tons) of recoverable ash per year. FEIS at 8-8. Eighty-seven percent of the ash would be recycled, leaving approximately  $6.9 \times 10^4$  MT ( $7.6 \times 10^4$  tons) of ash per year for disposal, while SO<sub>x</sub>-control equipment would generate another  $4.0 \times 10^5$  MT ( $4.4 \times 10^5$  tons) per year of waste in the form of scrubber sludge. FEIS at 8-8. Approximately 94 ha (234 ac) would be required as a waste disposal site for both the ash and sludge over the 40-year life of the plant. FEIS at 8-8. The Staff thus concluded that the impacts of disposing of waste generated from burning coal would be MODERATE. FEIS at 8-9.

113. (JR) Given the regulatory oversight exercised by the EPA and State agencies, the Staff concluded that the human health impacts from radiological doses and inhaling toxins and particulates generated by burning coal at newly constructed coal-fired plants would be SMALL. FEIS at 8-9.

114. (JR) In terms of other impacts, the Staff concluded that the land-use impacts of siting, constructing, and operating a coal-fired unit at the ESP site would be MODERATE, as

construction of the power block and coal storage area would impact approximately 120 ha (300 ac) of land at the Clinton site and further impacts for coal and limestone mining would occur in areas remote from the ESP site.<sup>40</sup> FEIS at 8-9. As a result of construction and operations, including coal and limestone mining, construction of a rail spur, and fly ash disposal, the Staff concluded that the ecological impacts could be MODERATE to LARGE. FEIS at 8-10. The Staff found that the impacts to water resources would be SMALL, if cooling towers were employed, or MODERATE, if once-through cooling were used.<sup>41</sup> FEIS at 8-10.

115. (JR) The Staff found that socioeconomic impacts from the coal-fired plant would be SMALL, based on the proximity to the surrounding population area and the relatively small number of workers (about 250) needed to operate the plant. FEIS at 8-10. The Staff also concluded that tax revenues would have a MODERATE to LARGE beneficial impact for DeWitt County. FEIS at 8-10. The Staff determined that the visual and aesthetic impacts of a

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<sup>40</sup> (JR) In comparing the impacts of a new nuclear unit with those of other energy generation sources, a reader may wonder why, where a particular characteristic of both sources appears facially somewhat similar, the Staff has found the associated impact levels to be different (i.e., MODERATE instead of SMALL). The Staff notes that in many instances, including, for example, the determination of land use impacts, the difference between a small impact and a moderate impact is one of degree. A new nuclear plant would involve long-term commitment of about 39 ha (96 ac) (page 4-3); a coal-fired plant at the site would involve long-term commitment of about 120 ha (300 ac). Much of the land associated with a coal-fired plant would be used for storage of coal, limestone, and ash. In addition, construction of either a nuclear plant or a coal-fired plant is likely to involve use of a rail-line to the site. However, operation of a coal-fired plant would entail regular use of the rail-line to deliver coal and limestone for the entire period of operation, while the rail-line would receive little, if any, use during the period of operation of the nuclear plant. Hence, the Staff considers land use impacts to be moderate for the coal-fired plant and small for the nuclear plant. For similar reasons, with respect to the other specific issue areas associated with coal-fired generation (and identified in Table 8-1 of the FEIS), the Staff based its impact level determinations on the facts noted in Section 8.2.2.1 of the FEIS and does not believe these determinations are inconsistent with the comparable analyses presented for the impacts of a new nuclear unit.

<sup>41</sup> (JR) The text in Section 8.2.2.1 (FEIS at 8-10) and Table 8-1 (FEIS at 8-12) incorrectly identified the impacts of coal-fired generation on water use and quality as SMALL to LARGE; in fact, the Staff's determination was that these impacts would be SMALL to MODERATE. This correction does not affect the outcome of the Staff's comparative analysis of alternative energy sources because the impacts from the other alternative generation sources on water use and quality were likewise incorrectly stated to be SMALL to LARGE; these impacts were in fact determined by the Staff to be SMALL to MODERATE. (See also footnotes 42, 48, and 49 of this testimony.)

coal-fired generation plant would be MODERATE, based on the presence of large physical structures and exhaust stacks and plumes visible offsite, potential cooling towers, and noise audible offsite (particularly in connection with coal delivery). FEIS at 8-10. The Staff found that the historic and cultural resource impacts would be SMALL (in light of the ability to minimize impacts with survey and recovery techniques), that environmental justice impacts would be SMALL (as there is no evidence of environmental justice issues at the ESP site), and that other construction and operation impacts would be SMALL. FEIS at 8-10 to 8-11.

**Q23: Describe the Staff's evaluation of the natural gas-fired generation alternative.**

**A23:** 116. (JR) The Applicant also evaluated natural gas-fired generation in its environmental report. The Staff (like the Applicant) assumed the use of four natural-gas-fired, combined-cycle plants of 550-MW(e) net capacity, consisting of two 184-MW(e) gas turbines (e.g., General Electric Frame 7FA) and 182 MW(e) of heat-recovery capacity, for a total of 2200 MW(e). FEIS at 8-11.

117. (JR) In terms of air quality, the Staff found that, compared with a coal-fired plant, a natural gas-fired plant would release similar types of emissions but in lower quantities. FEIS at 8-13. The Applicant estimated that a natural gas-fired plant would annually emit approximately 161 MT (177 tons) of SO<sub>x</sub>, 515 MT (568 tons) of NO<sub>x</sub>, 109 MT (120 tons) of CO, and 90 MT (99 tons) of TSP (all PM<sub>10</sub>). FEIS at 8-13. The plant would also have to obtain certain permits pursuant to the Clean Air Act, and comply with other stationary source and visibility standards. FEIS at 8-13. The Staff concluded that air quality impacts from natural gas-fired power generation at the ESP site would be SMALL to MODERATE. FEIS at 8-13.

118. (JR) With respect to waste management, as combustion of natural gas results in few by-products because of the clean nature of the fuel, the Staff thus concluded that waste impacts from natural gas-fired power generation would be SMALL. FEIS at 8-13.

119. (JR) With respect to human health risks, while the Staff noted its finding in the GEIS analysis that cancer and emphysema are potential health risks from natural gas-fired plants, it concluded that the impacts would be SMALL because it is not expected that human health effects would be detectable. FEIS at 8-14.

120. (JR) In terms of other environmental impacts, the Applicant estimated that a natural gas plant would need approximately 44 ha (110 ac), and there could be some temporary ecological damage associated with the burial of the pipeline underground. FEIS at 8-14. In light of this relatively small land disturbance, the Staff concluded that land-use impacts from new natural gas-fired power generation would be SMALL, and ecological impacts (such as from withdrawal of cooling makeup water, or construction of the pipeline) would be SMALL to MODERATE. FEIS at 8-14. The Staff found that the impacts to water resources would be SMALL, if cooling towers were employed, or MODERATE, if once-through cooling were used.<sup>42</sup> FEIS at 8-14.

121. (JR) The Staff found that socioeconomic impacts from the natural gas-fired plant would be SMALL, based on the proximity to the surrounding population area and the relatively small number of workers (approximately 40-80) needed to operate the plant. FEIS at 8-14, 8-15. The Staff also concluded that tax revenues would have a MODERATE to LARGE beneficial impact for DeWitt County. FEIS at 8-15. The Staff also concluded that the visual and aesthetic impacts of a natural gas-fired generation plant would be MODERATE, based on the presence of large physical structures and exhaust stacks and plumes visible offsite, as well as potential cooling towers. FEIS at 8-15. The Staff found that the historic and cultural

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<sup>42</sup> (JR) The text in Section 8.2.2.2 (FEIS at 8-14) and Table 8-2 (FEIS at 8-16) incorrectly identified the impacts of natural gas-fired generation on water use and quality as SMALL to LARGE; in fact, the Staff's determination was that these impacts would be SMALL to MODERATE. This correction does not affect the outcome of the Staff's comparative analysis of alternative energy sources because the impacts from the other alternative generation sources on water use and quality were likewise incorrectly stated to be SMALL to LARGE; these impacts were in fact determined by the Staff to be SMALL to MODERATE. (See also footnotes 41, 48, and 49 of this testimony.)

resource impacts would be SMALL (in light of the ability to minimize impacts with survey and recovery techniques), that environmental justice impacts would be SMALL (as there is no evidence of environmental justice issues at the ESP site), and that other construction and operation impacts would be SMALL. FEIS at 8-15.<sup>43</sup>

**Q24: What other energy alternatives did the Staff consider?**

**A24:** 122. (JR) Because a new nuclear unit at the ESP site would be a baseload generator and merchant plant, any feasible alternative to this facility would need to generate baseload power. FEIS at 8-17. Exelon's application identified other energy alternatives besides coal-fired and natural gas-fired generation, but because the Applicant determined that these alternatives either could not generate baseload power or could not do so economically, it concluded that these alternatives were not reasonable. FEIS at 8-17. These alternatives included wind, geothermal, hydropower, solar thermal power and photovoltaic cells, wood waste, municipal solid waste, biomass-derived fuels, fuel cells, and oil-fired generation. FEIS at 8-17 to 8-21. Based on its independent review (including, for some issues, reliance on the analysis in the GEIS), the Staff determined that Exelon's conclusion – that these alternatives are not reasonable – is acceptable. FEIS at 8-17.

123. (JR) The Staff found that wind power, by itself, is not suitable for large baseload capacity, because, as discussed in the GEIS, wind has a high degree of intermittence, and average annual capacity factors for wind plants are relatively low (less than 30 percent). FEIS at 8-17. The Staff also noted that current energy storage technologies are too expensive for wind power to serve as a large baseload generator.<sup>44</sup> FEIS at 8-17. The Staff found that

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<sup>43</sup> (JR) The projected impacts of both the coal-fired and natural gas-fired alternatives are summarized in Tables 8-1 and 8-2 of the FEIS.

<sup>44</sup> (JR) The Staff determined that stored energy is not an economic means for mitigating the intermittence of wind (and solar) power. Pumped hydroelectric storage is a common method of storing  
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there are no high-temperature geothermal sites in Illinois, making geothermal power an unreasonable alternative to a new nuclear unit at the proposed ESP site.<sup>45</sup> FEIS at 8-18.

Similarly, because there are no remaining sites in Illinois that would be environmentally suitable for a large hydroelectric facility, and because of the large land-use and related environmental and ecological resource impacts (flooding, destruction of natural habitat, and alteration of natural river courses) associated with siting large hydroelectric facilities, the Staff concluded that hydropower was not a feasible alternative. FEIS at 8-18.

124. (JR) With respect to solar thermal power and photovoltaic cells, the Staff found that it would be uneconomical because of solar power's higher capital cost per kilowatt of capacity, high energy storage requirements (limiting its use as a baseload supply), and high land use. FEIS at 8-18, 8-19. Because of uncertainties associated with obtaining sufficient wood and wood waste to fuel a baseload power plant (larger wood-waste power plants are only 40 to 50 MW(e) in size), the ecological impacts of large-scale timber cutting (for example, soil erosion and loss of wildlife habitat), and high inefficiency, the Staff determined that wood waste is not a feasible alternative.<sup>46</sup> FEIS at 8-19, 8-20. Similarly, with respect to use of municipal

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<sup>44</sup>(...continued)

large quantities of energy. A paper, "Pumped Storage Situational Analysis," presented at the Wind Water Prospects Meeting on November 15, 2004, by L. Baccari, Aspen Power Systems, which reviews the status of pumped storage, gives the efficiency of pumped storage as 75% to 85%. Assuming an efficiency of 80%, the cost of energy generated by pumped storage is 25% higher than the cost of the power used to pump water to the upper reservoir plus the added costs associated with the capital equipment and maintenance of the pumping and hydro generation facilities. Similar reasoning applies to compressed air energy storage and other large-scale methods of energy storage. The cost of the stored energy is the sum of the costs of original generation, energy storage, and conversion of stored energy.

<sup>45</sup> (JR) The Geo-Heat Center at Oregon Institute of Technology compiles information on geothermal resource areas direct use projects in the United States. Further information is available at <http://geoheat.oit.edu/dusys.htm>.

<sup>46</sup> (JR) The Department of Energy Office of Biomass Program lists the typical range for biomass (including wood waste) power boilers as typically in the 20 to 50 MW range [see [http://www1.eere.energy.gov/biomass/electrical\\_power.html](http://www1.eere.energy.gov/biomass/electrical_power.html)] and plant efficiencies as in the low 20% range. However, typical plant size was not a significant factor in the Staff's rejection of the wood waste alternative. As discussed in the FEIS, the significant environmental impacts of plants of this type include

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solid waste, because of high initial capital costs, stringent environmental regulation of municipal-waste combustion facilities, and significant air and waste disposal impacts, the Staff concluded that this would not constitute a reasonable alternative to a new nuclear unit at the proposed ESP site. FEIS at 8-20. With respect to other biomass-derived fuels, including burning crops, converting crops to a liquid fuel such as ethanol, and gasifying crops (including wood waste), the Staff concluded, based on the analysis in the GEIS, that none of these technologies has progressed to the point of being competitive on a large scale or of being reliable enough to replace a large baseload plant, and thus they do not represent reasonable alternatives. FEIS at 8-20, 8-21.

125. (JR) With respect to fuel cells, although significant efforts have been made to develop more practical and affordable fuel cell designs for stationary power applications, the Staff concluded that fuel cells currently are not economically or technologically competitive with other alternatives for baseload electricity generation, and their future competitiveness compared to other fuels is speculative.<sup>47</sup> FEIS at 8-21. The Staff therefore concluded that fuel cells are not a reasonable alternative to the proposed ESP site. FEIS at 8-21. Finally, the Staff concluded that oil-fired generation has become more expensive than nuclear or coal-fired generation options and is likely to become even less economical in the future in light of higher fuel costs and lower efficiencies. FEIS at 8-21, 8-22.

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<sup>46</sup>(...continued)

ecological impacts of large-scale timber cutting (e.g., soil erosion and loss of wildlife habitat), and potential air pollution from emissions.

<sup>47</sup> (JR) The Staff does not consider its conclusion that fuel cells are not economically competitive to be inconsistent with the Department of Energy's 2004 initiative to lower costs to the \$400 per kWh goal. Environmental reviews are conducted based on existing conditions, and the DOE goal is, in itself, an indication that fuel cells are not economically viable at this time. Recent DOE programmatic actions indicate that fuel cell technology is not currently viable. Projects were initiated by the Department of Energy in FY2005 "...to *develop* and *demonstrate* the fuel cell technology required for central power station applications..." [emphasis added] (see DOE's website at <http://fossil.energy.gov/programs/powersystems/fuelcells>).

**Q25: Did the Staff consider the possibility that some combination of alternatives might be environmentally preferable to the construction of a new nuclear unit at the proposed ESP site?**

**A25:** 126. (JR) Yes. Of the many possible combinations, the Staff evaluated the environmental impacts of an assumed combination of three 550 MW(e) natural gas combined-cycle generating units, 60 MW(e) of wind energy, hydropower, or pumped storage; 90 MW(e) from biomass sources, including municipal solid waste; and 400 MW(e) from purchased power, conservation and demand-side management. FEIS at 8-22. The Staff determined that the impacts associated with the combined-cycle natural-gas-fired units would be as discussed earlier (with magnitudes scaled for reduction in capacity), and while the demand-side management measures would have few environmental impacts, operation of the new natural gas-fired plant would result in increased emissions and other environmental impacts. FEIS at 8-22. Furthermore, the environmental impacts associated with power purchased from other generators would still occur, but would be located elsewhere within the region or the Nation, or in another country. FEIS at 8-22.

127. (JR) The Staff selected the combination of alternatives presented in the FEIS on the assumption that to meet base load needs, a significant portion of the generation would have to be either coal-fired or gas-fired generation. Gas-fired generation was included in the combination on the basis of comparative environmental impacts of gas-fired generation and coal-fired generation. A combination of alternatives including gas-fired generation was more likely to compare favorably with nuclear power than one with coal-fired generation.

128. (JR) The combination of alternatives selected by the Staff as reasonable included 75% gas-fired generation (three of the four 550-MWe units considered in FEIS Section 8.2.2.1). As just noted, the remaining 25% was made up of various energy sources

and demand-side management. The mixture chosen for the 25% is only of limited interest because, although potentially adverse impacts for some of the alternatives that might be included in the mixture are identified in the comments for Table 8-3, in evaluating the impacts of the combination, the Staff assigned *no* adverse impacts to the mix generating the 25% not generated by gas; all of the impacts of the combination were attributed to gas-fired generation. For environmental review purposes, the combination of alternatives considered represents many possible combinations, as long as the combination includes 75% gas-fired generation. Therefore, the Staff considered the analysis of this combination to be sufficiently bounding for any reasonable combination of alternatives that would satisfy baseload needs. This description should also further clarify the purpose of Table 8-3 in the FEIS, which summarizes the potential environmental impacts of the combination of alternatives, just as Table 8-1 summarizes the potential impacts of coal-fired generation, and Table 8-2 summarizes the potential impacts of gas-fired generation.<sup>48</sup>

129. (JR) Table 8-4 summarizes the Staff's evaluation of information on the significance levels of environmental impacts of nuclear power, coal-fired power, gas-fired power, and a combination of power generation alternatives including gas-fired power. The significance levels for nuclear power are based on the significance levels shown in Table 9-1, which compares construction impacts at the Exelon ESP site and alternative sites, and Table 9-2, which compares the impacts of operation at the same sites. The significance levels for the coal-fired alternative, gas-fired alternative, and combination of alternatives are taken directly from Tables 8-1, 8-2, and 8-3, respectively. The general significance levels assigned to

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<sup>48</sup> (JR) FEIS Table 8-3 (FEIS at 8-23) incorrectly identified the impacts associated with a combination of alternatives on water use and quality as SMALL to LARGE; in fact, the Staff's determination was that these impacts would be SMALL to MODERATE. This correction does not affect the outcome of the Staff's comparative analysis of alternative energy sources because the impacts from the other alternative generation sources on water use and quality were likewise incorrectly stated to be SMALL to LARGE; these impacts were in fact determined by the Staff to be SMALL to MODERATE. (See also footnotes 41, 42 and 49 of this testimony.)

nuclear power in Table 8-4 represent a composite of the impacts at the Exelon ESP site and the alternative sites. The Staff inadvertently did not update the text of Section 8.2.4 of the FEIS to reflect this approach. Also, Table 8-4 incorrectly identified the impacts on water use and quality as SMALL instead of SMALL to MODERATE for nuclear power. This correction does not affect the outcome of the Staff's comparative analysis of alternative energy sources because the impacts from the other generation sources should also be SMALL to MODERATE for water use and quality.<sup>49</sup>

130. (JR) Therefore, after comparing the environmental impacts with those assessed for a new nuclear unit at the ESP site, the Staff concluded that, from an environmental perspective, none of the viable energy alternatives (including a combination of alternatives) was preferable to construction of a new baseload nuclear unit. FEIS at 8-22 to 8-24; Tbl. 8-4.

**Q26: Did the Staff consider plant design alternatives as well?**

**A26:** 131. (LV) Yes, the Staff also addressed plant design alternatives. The Application discusses wet cooling tower heat dissipation systems, hybrid wet/dry cooling tower heat dissipation systems, and dry cooling tower heat dissipation systems, but Exelon stated that full wet or hybrid wet/dry cooling processes have been assumed for most purposes because they have the greatest consumptive water use of the proposed options. FEIS at 8-25. As the specific cooling system design for a new nuclear unit at the Exelon ESP site has not been selected, system design alternatives would be discussed at the CP or COL stage if an application were submitted to build a new nuclear unit at the site. FEIS at 8-25.

132. (LV) With respect to wet cooling towers, the Staff noted that use of wet cooling towers (mechanical or natural draft) systems would, through evaporation, result in a

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<sup>49</sup> (JR) As noted earlier in this testimony, the impacts from the other alternative generation sources on water use and quality were incorrectly stated in the FEIS as being SMALL to LARGE; these impacts were in fact determined by the Staff to be SMALL to MODERATE. (See footnotes 41, 42 and 48.)

consumptive loss of about 2.0 m<sup>3</sup>/s (70 cfs) from Clinton Lake's water budget, which in turn would result in reduced downstream flows and lower lake elevations during dry periods.

FEIS at 8-25. The Staff stated that while this system would not discharge significant amounts of heat as blowdown to the lake, a new nuclear unit would also contribute to higher temperatures in Clinton Lake by decreasing the volume of water available in the lake to assimilate and dissipate the rejected heat in the once-through discharge from the existing CPS unit; these higher temperatures, in turn, would contribute to greater induced evaporation. FEIS at 8-25.

133. (LV) With respect to hybrid wet/dry cooling towers, because Exelon did not include bounding data for a hybrid wet/dry cooling system design in the PPE, the Staff assumed that a hybrid wet/dry design would be bounded by the combined maximum values of the wet and dry cooling towers, an assumption that would need to be validated at the COL stage if Exelon were to proceed with a hybrid wet/dry design at that time. FEIS at 8-25, 8-26. Finally, because Exelon did not provide information on a dry cooling system or address its adverse environmental impacts, the Staff did not perform a detailed site-specific evaluation of a dry cooling system during its review. FEIS at 8-25, 8-26. If a COL applicant proposed to use such a system, the Staff would have to evaluate the environmental impacts of a dry cooling system at that time.

**Q27: Please describe how the Staff examined the Applicant's region of interest for possible siting of a new nuclear power plant.**

**A27:** 134. (JR) Because Exelon's proposal involves siting a merchant plant that would sell generated power in a deregulated marketplace, Exelon defines its region of interest ("ROI") to be the State of Illinois on the basis of current deregulation policies, the availability of transmission facilities in the state, market flexibility, and the proximity of Exelon's customer

base. FEIS at 8-26. For several reasons, the Staff considered this definition to be reasonable. With respect to Exelon's status as a merchant plant in a deregulated market, the Staff notes that states have had the authority to regulate power generation utilities within their boundaries and may or may not choose to change from a traditional regulated structure to a less-regulated structure; consequently, the regulatory structure varies from state to state. Although the Staff considers that the phrase "deregulation policies" may not reflect precise terminology, the State of Illinois has embarked on deregulation of power generation. It is a large state, which offers a selection of viable alternative power generation sites under a common regulatory structure. In short, the large number of alternative sites within Illinois allows for a meaningful NEPA evaluation of alternative sites within the Applicant's ROI.

135. (JR) Moreover, as stated in ESRP 9.3 (page 9.3-2), "[t]he basis for an ROI [region of interest] is the state in which the proposed site is located or relevant service area to the proposed site." Section 9.3 of the ESRP also states that there may

... be special cases in which the proposed site was not selected on the basis of a systematic site-selection process. Examples include plants proposed to be constructed on the site of an existing nuclear power plant previously found acceptable on the basis of a NEPA review and/or demonstrated to be environmentally satisfactory on the basis of operating experience....

Further, Section 9.3 of the ESRP states that "[a]s a corollary, all nuclear power plant sites within the identified region of interest having an operating nuclear power plant or a construction permit issued by the NRC should be compared with the applicant's proposed site."

136. (JR) The Applicant has six nuclear power plant sites within the State of Illinois that were reviewed as potential alternative sites. The Exelon ESP site is located centrally in the State. The Staff, therefore, considers the State of Illinois to be an appropriate region of interest.

**Q28: How did the Staff evaluate the Applicant's alternative site selection process?**

**A28:** 137. (JR) With respect to Exelon's alternative site selection process, Exelon considered existing nuclear power plant sites, greenfield sites, and brownfield sites within its ROI, and it used the candidate site criteria presented in NUREG-1555 to select six alternative sites from among the candidate sites. FEIS at 8-27. The alternative sites selected were the Braidwood Generating Station, Byron Generating Station, Dresden Generating Station, LaSalle County Generating Station, Quad Cities Generating Station, and Zion Generating Station. FEIS at 8-27.

138. (JR) Exelon identified these alternative sites as the result of a three-step process. The first step was to identify existing nuclear facilities within the ROI because the proposed ESP facility would be co-located with an existing facility; these consisted of the six Exelon nuclear facilities in the ROI. FEIS at 8-27. As part of its second step, the Applicant evaluated undeveloped greenfield and brownfield sites and concluded that, compared to sites with existing nuclear facilities, the environmental impacts from building on either a greenfield or brownfield site would be greater than or equal to those at the proposed ESP site. FEIS at 8-27. Also as part of its second step, the Applicant evaluated sites with an existing nuclear facility to determine if the sites met the minimum land requirements specified in the PPE; although the Applicant determined that three of the six sites were not environmentally preferable because they would have insufficient land for a new nuclear unit, the Staff considered all six sites in its review. FEIS at 8-29. As its final step, the Applicant compared the alternative sites with the proposed site, and did not find that any of the sites were environmentally preferable. FEIS at 8-29.

139. (JR) The Applicant's ER summarized the advantages of the proposed ESP site, noting criteria such as equivalent consumptive water use; the lack of critical habitat or spawning grounds for endangered species; comparable NPDES effluent discharge and impact on

terrestrial and aquatic environments; population density meeting 10 C.F.R. Part 100 criteria; and the lack of need for either a) preemption or land-use changes for construction and operation or b) decommissioning or dismantlement of an existing facility. FEIS at 8-29, 8-30. The Staff reviewed the methodology used by Exelon for selecting and evaluating the alternative sites and considered Exelon's methodology to be reasonable. FEIS at 8-30.

**Q29: How did the Staff go about evaluating the six alternate sites?**

**A29:** 140. (JR) In addition to its detailed evaluation of the Exelon ESP site, the Staff conducted its own independent examination of each of the six alternative sites, an evaluation that included visiting each to collect reconnaissance-level information not provided by the Applicant. FEIS at 8-30.

**Q30: Please describe the Staff's evaluation of the Dresden Generating Station site.**

**A30:** 141. (DA) The Dresden site is located in Goose Lake Township, Grundy County, Illinois, on the south shoreline of the Illinois River at the confluence of the Des Plaines and Kankakee Rivers, and consists of approximately 1000 ha (2500 ac) owned by Exelon with an additional 0.4 ha (1 ac) of river frontage leased from the State of Illinois. FEIS at 8-30. In addition to the two operating nuclear reactors and their turbine building, intake and discharge canals, cooling pond and canals, and auxiliary buildings, the site includes switchyards and Dresden Unit 1, which permanently ceased operation on August 31, 1984. FEIS at 8-30. The station uses once-through cooling with the Illinois River as the source and receiving water, and it also has a cooling canal and cooling pond to reduce heat load in the river during periods of high water temperature. FEIS at 8-31.

142. (DA) With respect to land use, the Staff found that, given the largely rural character of the site area, the fact that the entire Dresden site has been a large power-generating facility since 1965, and the likelihood that a new unit could be configured to fit

within previously disturbed land on the existing Dresden site, land-use impacts associated with a new nuclear unit at the Dresden site would be SMALL. FEIS at 8-31. Similarly, because the Staff assumed that any transmission system additions or modifications would likely involve expansions of existing rights-of-way, the Staff concluded that, for reasons similar to those identified in Chapters 4 and 5 of the FEIS, the land-use impacts of transmission-line rights-of-way expansion at Dresden would be SMALL. FEIS at 8-32.

143. (JB, LV) Based on NPDES permit requirements and the assumption that a new unit at Dresden would withdraw makeup water from the Illinois River and use wet cooling towers, the Staff concluded that the water-use and water quality impacts of an additional unit at the Dresden site would be SMALL. FEIS at 8-32. For terrestrial resources, the Staff concluded that construction impacts on terrestrial resources and on Federally listed threatened or endangered species could range from SMALL to LARGE, depending primarily on the potential impacts from transmission system upgrades on various wildlife areas and on six Federally listed or candidate species in the vicinity. FEIS at 8-33 to 8-35.

144. (SS) Similarly, for aquatic resources, the Staff concluded that construction and operational impacts would be SMALL because any construction disturbance would be localized and of relatively short duration, and because a new nuclear unit at Dresden would be required to meet the new EPA Phase I ruling, which is likely to require closed-cycle cooling, resulting in little additional impingement and entrainment loss. FEIS at 8-36, 8-37. As no Federally listed aquatic plant or animal species have been found in the vicinity of the Dresden site, and the three Illinois listed endangered or threatened species that have been collected near the site either have only been collected downstream of Dresden Island Lock and Dam or prefer a more complex channel substrate than is found near Dresden, the Staff concluded that the overall impact on Federally and State listed threatened or endangered aquatic species from construction and operation would be SMALL. FEIS at 8-37.

145. (JJ) In terms of socioeconomic impacts, because the potential increases in population (including those associated with a potential multiplier effect of new jobs) do not represent a large percentage increase in the total population for the most impacted counties, the Staff concluded that the demographic impact of both construction and operation of a new unit at Dresden would be SMALL. FEIS at 8-37, 8-38. The Staff similarly concluded that the beneficial impacts of construction and station operation on the economy of the region would be SMALL everywhere in the region except Grundy County, where the impacts could be MODERATE because of its relatively smaller economic base. FEIS at 8-39. The Staff found that, in light of the total amount of taxes Illinois collects annually, overall beneficial impacts of corporate and personal income, sales, use, and property taxes would be SMALL during construction, and SMALL to MODERATE during operation (depending on the impacts of deregulation) for Grundy County and SMALL for Will County. FEIS at 8-39, 8-40.

146. (JJ) The Staff determined that construction impacts on transportation would be SMALL to MODERATE (where some mitigation might be warranted) due to highway congestion, although subsequent operational impacts from the workforce would be SMALL. FEIS at 8-41. The Staff found only SMALL aesthetic impacts, generally similar to those of the existing Dresden facility. FEIS at 8-41, 8-42. In terms of housing, the Staff concluded that construction impacts would be SMALL given the significant population within 50 miles of the site, while operational impacts would be SMALL in both Will and Grundy counties, if workers came mostly from the region, to SMALL (Will County) to MODERATE (Grundy County), if a larger percentage of workers relocate to the region. FEIS at 8-42. Finally, while minority and low-income populations exist in the site vicinity, the Staff did not identify or observe any location-dependent disproportionate impacts affecting these populations, and it concluded that the environmental justice consequences of the construction and operation of a new nuclear unit at Dresden would be SMALL. FEIS at 8-43.

**Q31: Please describe the Staff's evaluation of the Braidwood Generating Station site.**

**A31:** 147. (DA) The Braidwood site is located in the southwest corner of Will County, southwest of Joliet about 17 km (11 mi) southeast of the Dresden Generating Station, and covers 1804 ha (4457 ac), of which the cooling pond occupies about 1027 ha (2537 ac); two nuclear units are currently operating. FEIS at 8-44. The site is approximately 5 km (3 mi) west of the Kankakee River at a point 22 km (14 mi) upstream from its confluence with the Des Plaines River. FEIS at 8-44.

148. (DA) With respect to land use, the Staff found that, because the area is still largely agricultural, and because a new unit could be configured to fit within the existing, previously disturbed site area, impacts associated with site-preparation, construction, and operation of a new nuclear unit at Braidwood would be SMALL. FEIS at 8-44. Similarly, because the Staff assumed that any transmission system additions or modifications would likely involve expansions of existing rights-of-way, the Staff concluded that, for reasons similar to those identified in Chapters 4 and 5 of the FEIS, the land-use impacts of transmission-line rights-of-way expansion at Braidwood would be SMALL. FEIS at 8-45.

149. (JB, LV) Based on NPDES permit requirements and the assumption that a new unit at Braidwood would withdraw makeup water from the Kankakee River and use wet cooling towers, the Staff concluded that the water-use and water quality impacts of an additional unit at the Braidwood site would be SMALL. FEIS at 8-45. For terrestrial resources, the Staff concluded that construction impacts on terrestrial resources and on Federally listed threatened or endangered species would be SMALL, because structures for a new nuclear unit would be primarily constructed in areas already cleared of forest; because most of the land cover potentially affected by transmission line upgrades is agricultural and the associated loss of woodland would be insignificant; and because the one Federally listed threatened or

endangered terrestrial species that may occur in the vicinity of the Braidwood site and transmission lines is considered unlikely to be found on the site. FEIS at 8-45 to 8-47.

150. (SS) Similarly, for aquatic resources, the Staff concluded that construction and operational impacts would be SMALL because any construction disturbance would be localized and of relatively short duration, and because a new nuclear unit at Braidwood would be required to meet the new EPA Phase I ruling, which is likely to require closed-cycle cooling, resulting in little additional impingement and entrainment loss. FEIS at 8-47, 8-48. As no Federally protected aquatic species are found in the vicinity of the Braidwood site, the Staff concluded that the overall impact on Federally listed threatened or endangered aquatic species from construction and operation would be SMALL. FEIS at 8-48.

151. (JJ) In terms of socioeconomic impacts, because the potential increases in population (including those associated with a potential multiplier effect of new jobs) do not represent a large percentage increase in the total regional population, the Staff concluded that, as with Dresden, the demographic impact of both construction and operation of a new unit at Braidwood would be SMALL. FEIS at 8-49. The Staff similarly concluded that the beneficial impacts of construction and station operation on the economy of the region would be SMALL, as the magnitude of the impacts in Will County would be diffused within the larger economic base. FEIS at 8-49. The Staff found that, in light of the total taxes Illinois and Will County collect annually, overall beneficial impacts from all taxes would be SMALL. FEIS at 8-50.

152. (JJ) The Staff determined that construction impacts on transportation would be SMALL to MODERATE (where some mitigation measures might be warranted) due to highway congestion, though subsequent operational impacts from the workforce would be SMALL. FEIS at 8-50, 8-51. The Staff found only SMALL aesthetic impacts, generally similar to those of the existing Braidwood units. FEIS at 8-51. In terms of housing, the Staff concluded that construction impacts would be SMALL given the significant population within 50 miles of the

site, while operational impacts (in the event of larger-than-expected relocation of new workers) would be SMALL for Will County and MODERATE for Grundy County given its smaller housing base and vacant units. FEIS at 8-52. Finally, while minority and low-income populations exist in the site vicinity, the Staff did not identify or observe any location-dependent disproportionate impacts affecting these populations, and it concluded that the environmental justice consequences of the construction and operation of a new nuclear unit at Braidwood would be SMALL. FEIS at 8-53.

**Q32: Please describe the Staff's evaluation of the LaSalle County Generating Station site.**

**A32:** 153. (DA) The LaSalle County site is located in the southeast corner of LaSalle County, Illinois, approximately 112 km (70 mi) southwest of the center of Chicago and 39 km (24 mi) west-southwest of Dresden Nuclear Power Station, and 8 km (5 mi) south of the Illinois River. FEIS at 8-53. LaSalle occupies approximately 1238 ha (3060 ac) and has two nuclear units in operation, and although the Illinois River is its primary surface-water source, LaSalle does not significantly affect the river's surface-water use because of an 833-ha (2058-ac) cooling pond. FEIS at 8-53, 8-54.

154. (DA) With respect to land use, the Staff found that, because the area is predominantly agricultural, and because a new unit could be configured to fit within previously disturbed land on the site, impacts associated with site-preparation, construction, and operation of a new nuclear unit at LaSalle would be SMALL. FEIS at 8-54. Similarly, because the Staff assumed that any transmission system additions or modifications would likely involve expansions of existing rights-of-way, the Staff concluded that, for reasons similar to those identified in Chapters 4 and 5 of the FEIS, the land-use impacts of transmission-line rights-of-way expansion at LaSalle would be SMALL. FEIS at 8-54.

155. (JB, LV) Based on NPDES permit requirements and the assumption that a new unit at LaSalle would withdraw makeup water from the Illinois River and use wet cooling towers, the Staff concluded that the water-use and water quality impacts of an additional unit would be SMALL. FEIS at 8-55. For terrestrial resources, the Staff concluded that construction impacts on terrestrial resources and on Federally listed threatened or endangered species would be SMALL, because structures for a new nuclear unit would be primarily constructed in areas already cleared of forest; because most of the land cover potentially affected by transmission line upgrades is agricultural; and because the two Federally listed threatened or endangered terrestrial species that may occur in the vicinity of the LaSalle site and transmission lines are not known to have night roost sites in LaSalle County (bald eagle) or have suitable or critical habitat close to the site (Indiana bat). FEIS at 8-56, 8-57.

156. (SS) Similarly, for aquatic resources, the Staff concluded that construction and operational impacts would be SMALL because any construction disturbance would be localized and of relatively short duration; because the Illinois River is a recovering river system and operation of the current LaSalle nuclear facility is not a significant factor in the overall quality of aquatic habitats in the vicinity of the plant; and because a new nuclear unit at LaSalle would be required to meet the new EPA Phase I ruling, which is likely to require closed-cycle cooling, resulting in little additional impingement and entrainment loss. FEIS at 8-57, 8-58. As no Federally protected aquatic species have been found in the vicinity of the LaSalle site, the Staff concluded that the overall impact on Federally listed threatened or endangered aquatic species from construction and operation would be SMALL. FEIS at 8-58.

157. (JJ) In terms of socioeconomic impacts, because the potential increases in population (including those associated with a potential multiplier effect of new jobs) do not represent a large percentage increase in the total population for LaSalle County and the region, the Staff concluded that the demographic impact of both construction and operation of a new

unit at LaSalle would be SMALL. FEIS at 8-59. The Staff similarly concluded that the beneficial impacts of construction and station operation on the economy of the region would be SMALL everywhere in the region except LaSalle County, where the impacts could be MODERATE because of Exelon's relatively larger contribution to its tax base. FEIS at 8-60. The Staff found that, in light of the total taxes Illinois and LaSalle County collect annually, overall beneficial tax impacts would be SMALL in LaSalle County during construction, and SMALL to MODERATE during operation. FEIS at 8-60.

158. (JJ) The Staff determined that construction impacts on transportation would be SMALL to MODERATE (depending on mitigation measures) due to highway congestion, though subsequent operational impacts from the workforce would be SMALL. FEIS at 8-61, 8-62. The Staff found that aesthetic impacts, mainly from the new unit's cooling tower and its plume, would be SMALL. FEIS at 8-62. In terms of housing, the Staff concluded that construction and operational impacts, in the context of the nearby six-county area and in light of housing availability in LaSalle County itself, would both be SMALL. FEIS at 8-62, 8-63. Finally, while minority and low-income populations exist in the site vicinity, the Staff did not identify or observe any location-dependent disproportionate impacts affecting these populations, and it concluded that the environmental justice consequences of the construction and operation of a new nuclear unit at LaSalle would be SMALL. FEIS at 8-63, 8-64.

**Q33: Please describe the Staff's evaluation of the Quad Cities Generating Station site.**

**A33:** 159. (DA) The Quad Cities site is located in Rock Island County, Illinois, on the east bank of Pool 14 of the Mississippi River, about 26 km (16 mi) below Dam 13 and 21 km (13 mi) from Dam 14, and the station is approximately 800 km (500 mi) upstream from the Mississippi's confluence with the Ohio River. FEIS at 8-64. The region within 10 km (6 mi) of the site includes portions of Rock Island and Whiteside Counties in Illinois and Scott and Clinton Counties in Iowa. FEIS at 8-64. The site consists of 331 ha (817 ac), including two nuclear

reactors and their turbine buildings, intake and discharge canals, and ancillary buildings, switchyards, and a retired spray canal now used to raise fish. The station uses a once-through cooling system with the Mississippi River as source and receiving waters. FEIS at 8-64.

160. (DA) With respect to land use, the Staff found that, as a new unit could be configured to fit within the existing, previously disturbed site area, impacts associated with site-preparation, construction, and operation of a new nuclear unit at Quad Cities would be SMALL. FEIS at 8-65. Similarly, because the Staff assumed that any transmission system additions or modifications would likely involve expansions of existing rights-of-way, the Staff concluded that, for reasons similar to those identified in Chapters 4 and 5 of the FEIS, the land-use impacts of transmission-line rights-of-way expansion at Quad Cities would be SMALL. FEIS at 8-65.

161. (JB, LV) Based on NPDES permit requirements and the assumption that a new unit at Quad Cities would withdraw makeup water from the Mississippi River and use wet cooling towers, the Staff concluded that the water-use and water quality impacts of an additional unit at the Quad Cities site would be SMALL. FEIS at 8-65, 8-66. The Staff concluded that construction impacts on terrestrial resources could range from SMALL to LARGE, depending primarily on the potential impacts from transmission system upgrades on various wildlife areas in the vicinity. FEIS at 8-66 to 8-67. The Staff found that the impacts from construction or transmission system upgrades on the six Federally listed threatened or endangered species that may occur in the site vicinity would be SMALL, because occurrences of the Indiana bat, Iowa Pleistocene snail, western and eastern prairie fringed orchids, and prairie bush clover on the Quad Cities site are unlikely, and because the closest bald eagle nest is sufficiently distant to preclude disturbance. FEIS at 8-68, 8-69.

162. (SS) Similarly, for aquatic resources, the Staff concluded that construction and operational impacts would be SMALL because any construction disturbance would be localized

and of relatively short duration; because a new nuclear unit at Quad Cities would be required to meet the new EPA Phase I ruling, which is likely to require closed-cycle cooling, resulting in little additional impingement and entrainment loss. FEIS at 8-70. However, the Staff concluded that impacts on Federally listed threatened or endangered aquatic species from construction and operation of a new nuclear unit at the Quad Cities site would be SMALL if mitigation measures are followed, but could be MODERATE if measures are not followed to protect the endangered Higgins' eye pearlymussel. FEIS at 8-70, 8-71.

163. (JJ) In terms of socioeconomic impacts, because the potential increases in population (including those associated with a potential multiplier effect of new jobs) do not represent a large percentage increase in the total population base for the region, the Staff concluded that the demographic impact of both construction and operation of a new unit at Quad Cities would be SMALL. FEIS at 8-71, 8-72. The Staff similarly concluded that the beneficial impacts of construction and operation on the economy of the region would be SMALL because it would be diffused within the larger economic base of the Quad Cities region. FEIS at 8-72. The Staff found that, in light of the total taxes Illinois and Rock Island County collect annually, overall beneficial tax impacts of both construction and operation would be SMALL. FEIS at 8-73.

164. (JJ) The Staff determined that construction impacts on transportation would be SMALL to MODERATE due to highway congestion (and depending on mitigative measures), although subsequent operational impacts from the workforce would be SMALL. FEIS at 8-73, 8-74. The Staff found only SMALL aesthetic impacts, generally similar to those of the existing Quad Cities units (such as the cooling tower plume). FEIS at 8-74, 8-75. In terms of housing, the Staff concluded that construction and operational impacts would be SMALL given housing availability in the six-county area, even if a greater percentage of workers relocated to the region. FEIS at 8-75, 8-76. Finally, while minority and low-income populations exist in the site

vicinity, the Staff did not identify or observe any location-dependent disproportionate impacts affecting them, and it concluded that the environmental justice consequences of the construction and operation of a new nuclear unit at Quad Cities would be SMALL. FEIS at 8-76.

**Q34: Please describe the Staff's evaluation of the Byron Generating Station site.**

**A34:** 165. (DA) The Byron site is located in Ogle County in northern Illinois, 6 km (3.7 mi) south-southwest of the City of Byron (pop. 2917), 27 km (17 mi) southwest of Rockford, Illinois (pop. 150,115), 3.5 km (2.2 mi) east of the Rock River, and approximately 112 km (70 mi) west of downtown Chicago. FEIS at 8-77. Byron occupies approximately 721 ha (1782 ac) of land; two nuclear units are in operation at the site, and Rock River provides source and receiving waters. FEIS at 8-77.

166. (DA) With respect to land use, the Staff found that, because the area is still largely agricultural, and because a new unit could be configured to fit within the existing area of the main site, impacts associated with site-preparation, construction, and operation of a new nuclear unit at Byron would be SMALL. FEIS at 8-77. Similarly, because the Staff assumed that any transmission system additions or modifications would likely involve expansions of existing rights-of-way, the Staff concluded that, for reasons similar to those identified in Chapters 4 and 5 of the FEIS, the land-use impacts of transmission-line rights-of-way expansion at Byron would be SMALL. FEIS at 8-78.

167. (JB, LV) Based on NPDES permit requirements and the assumption that a new unit at Byron would withdraw makeup water from the Rock River and use wet cooling towers, the Staff concluded that the water-use and water quality impacts of an additional unit would be SMALL. FEIS at 8-78. For terrestrial resources, the Staff concluded that construction impacts on terrestrial resources and on Federally listed threatened or endangered species would be SMALL, because structures for a new nuclear unit would be primarily constructed in agricultural

or fallow field areas; because most of the land cover potentially affected by transmission line upgrades is agricultural and the associated loss of woodland would be insignificant; and because the four Federally listed threatened or endangered terrestrial species that may occur in the vicinity of the Byron site and transmission lines are unlikely (or not known) to occur and do not have critical habitat on the site. FEIS at 8-79 to 8-80.

168. (SS) Similarly, for aquatic resources, the Staff concluded that construction and operational impacts would be SMALL because any construction disturbance would be localized and of relatively short duration, and because a new nuclear unit at Byron would be required to meet the new EPA Phase I ruling, which is likely to require closed-cycle cooling, resulting in little additional impingement and entrainment loss. FEIS at 8-81. As no Federally protected aquatic species have been found in the site vicinity, the Staff concluded that the overall impact on Federally listed threatened or endangered aquatic species from construction and operation would be SMALL. FEIS at 8-81, 8-82.

169. (JJ) In terms of socioeconomic impacts, because the potential increases in population (including those associated with a potential multiplier effect of new jobs) do not represent a large percentage increase in the total population base in the region, the Staff concluded that the demographic impact of both construction and operation of a new unit at Byron would be SMALL. FEIS at 8-82. The Staff similarly concluded that the beneficial impacts of construction and station operation on the economy of the region would be SMALL everywhere in the region (because the impacts would be diffused within the larger economic base of the surrounding counties) except Ogle County, where the impacts could be MODERATE in light of the contributions of the existing units to the tax base. FEIS at 8-83. The Staff found that, in light of the total taxes Illinois and Ogle County collect annually, overall beneficial tax impacts would be SMALL during construction, and SMALL, to MODERATE in

Ogle County because of property tax collections, during operation (and in all instances beneficial). FEIS at 8-83.

170. (JJ) The Staff determined that construction impacts on transportation would be SMALL to MODERATE due to highway congestion (depending on mitigative actions), though subsequent operational impacts from the workforce would be SMALL. FEIS at 8-84, 8-85. The Staff found only SMALL aesthetic impacts, generally similar to those of the existing Byron units (such as from the cooling tower and its plume). FEIS at 8-85. In terms of housing, the Staff concluded that construction and operational impacts would be SMALL in light of the housing availability in the three-county area around Byron. FEIS at 8-85, 8-86. Finally, while minority and low-income populations exist in the site vicinity, the Staff did not identify or observe any location-dependent disproportionate impacts affecting these populations, and it concluded that the environmental justice consequences of the construction and operation of a new nuclear unit at Byron would be SMALL. FEIS at 8-86.

**Q35: Please describe the Staff's evaluation of the Zion Generating Station site.**

**A35:** 171. (DA) The Zion site is located at the extreme eastern edge of the City of Zion (pop. 22,866) in Lake County Illinois, on the western shore of Lake Michigan, approximately 5 km (3 mi) south of the Illinois-Wisconsin state line, 67 km (42 mi) south of Milwaukee, Wisconsin (pop. 596,574), about 13 km (8 mi) south of Kenosha, Wisconsin (pop. 90,352), and 10 km (6 mi) north-northeast of Waukegan, Illinois (pop. 87,901). FEIS at 8-87. Lake County (pop. 644,356) is in the northern suburb region of the Chicago metropolitan area. FEIS at 8-87. Both nuclear units at Zion Generating Station permanently ceased operation in 1998 and are currently in SAFSTOR with active decontamination and dismantling scheduled to begin in 2014. FEIS at 8-86.

172. (DA) With respect to land use, the Staff found that impacts associated with site-preparation, construction, and operation of a new nuclear unit at Zion would be SMALL,

assuming that the existing units are decommissioned and removed. FEIS at 8-87. However, as stated in the FEIS and based on the March 2004 site visit, the Staff assumed that sufficient land does not exist within the current Zion site to accommodate use of cooling towers, which would most likely be required to meet the new EPA Phase I regulations. FEIS at 8-87. Similarly, because the Staff assumed that a new unit could use the existing transmission lines, and any transmission system additions or modifications would likely involve expansions of existing rights-of-way, the Staff concluded that, for reasons similar to those identified in Chapters 4 and 5 of the FEIS, the land-use impacts of transmission-line rights-of-way expansion at Zion would be SMALL. FEIS at 8-87, 8-88.

173. (JB, LV) Based on NPDES permit requirements and the assumption that a new unit at Zion would withdraw makeup water from Lake Michigan, the Staff concluded that the water-use and water quality impacts of an additional unit at the Zion site would be SMALL. FEIS at 8-88. For terrestrial resources, the Staff concluded that construction impacts on terrestrial resources and on Federally listed threatened or endangered species could range from SMALL to LARGE, depending primarily on the potential impacts from acquiring additional offsite land for normal closed-cycle wet cooling towers and from effects of transmission system upgrades on Illinois Beach State Park biota. FEIS at 8-89, 8-90.

174. (SS) For aquatic resources, the Staff concluded that construction and operational impacts would be SMALL because any construction disturbance would be localized and of relatively short duration, because construction and in-water work could be timed to mitigate impacts to potential fish spawning areas, and because a new nuclear unit at Zion would be required to meet the new EPA Phase I ruling, which is likely to require closed-cycle cooling, resulting in minimal impingement and entrainment loss. FEIS at 8-91. As no Federally protected aquatic species have been found in the vicinity of the Zion site, the Staff concluded

that the overall impact on Federally listed threatened or endangered aquatic species from construction and operation would be SMALL. FEIS at 8-92.

175. (JJ) In terms of socioeconomic impacts, because the potential increases in population (including those associated with a potential multiplier effect of new jobs) do not represent a large percentage increase in the total base population, the Staff concluded that the demographic impact of both construction and operation of a new unit at Zion would be SMALL. FEIS at 8-92. The Staff similarly concluded that the beneficial impacts of construction and station operation on the economy of the region would be SMALL because it would be diffused within the larger economic base of Lake County and the Chicago Metropolitan area. FEIS at 8-93. The Staff found that, in light of the total taxes Illinois and Lake County collect annually, overall beneficial tax impacts would be SMALL. FEIS at 8-93.

176. (JJ) The Staff determined that construction impacts on transportation would be MODERATE to LARGE due to significant highway traffic (depending on mitigative actions), though subsequent operational impacts from the workforce would be SMALL. FEIS at 8-94. The Staff found that aesthetic impacts from construction and operation of the new nuclear unit would be SMALL. The reason is that Staff assumed that sufficient land does not exist within the current Zion site to accommodate the use of cooling towers, which would most likely be necessary to meet the new EPA Phase I regulations. FEIS at 8-95. In terms of housing, the Staff concluded that construction and operational impacts would be SMALL given the housing availability in the nearby metropolitan areas (including Chicago). FEIS at 8-95. Finally, while minority and low-income populations exist in the site vicinity, the Staff did not identify or observe any location-dependent disproportionate impacts affecting these populations, and it concluded that the environmental justice consequences of the construction and operation of a new nuclear unit at Zion would be SMALL. FEIS at 8-96.

**Q36: In its evaluation of the alternative sites, did the Staff find that any impacts were consistent among the sites and could be assessed generically?**

**A36:** 177. (JR) Yes. Because the Staff found that impacts in several impact areas did not vary among the sites analyzed – and therefore did not affect the evaluation of whether an alternative site is environmentally preferable to the proposed site – the Staff discussed these issues generically rather than with respect to each site.

178. (JR) First, the Staff found that air quality impacts of construction and operation of a new nuclear unit – including dust from disturbed land, roads, and construction activities and emissions from construction equipment – would likely be similar at the proposed ESP site and the alternative sites and would be similar to the impacts associated with any large construction project. FEIS at 8-97. The Applicant discussed measures that it would take to mitigate air quality impacts at the proposed ESP site, and as the Staff assumed that the same or similar measures would be taken if a new nuclear unit were to be constructed at any of the alternative sites, it concluded that air quality impacts of construction of a new nuclear unit at the alternative sites likely would be SMALL. FEIS at 8-97. Likewise, the Staff assumed that the air quality impacts of emissions from vehicles used for construction worker transportation likely would be SMALL at all sites (although sites in nonattainment of ambient air quality standards might require further analysis if those sites were found to be environmentally preferable) and that operational impacts would be SMALL assuming that Exelon would comply with all regulations related to emissions from generators and boilers and that cooling towers would use current technology to minimize drift. FEIS at 8-97.

179. (JB, SS) The Staff relied on conclusions in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437 in finding that terrestrial impacts resulting from the operation of cooling towers and upgraded transmission

lines and from transmission line right-of-way maintenance would be SMALL at all the alternative sites, as would certain operational impacts of cooling water systems on aquatic ecology. FEIS at 8-97 to 8-100.

180. (JJ) The Staff found that the physical socioeconomic impacts of station construction and operation, both on workers and on the local public, would be similar at all six sites. Because residential and commercial areas are located well away from the alternative site boundaries, because applicable air-pollution regulations would have to be met by Exelon, and because applicable best management practices would be put in place, the Staff determined that those impacts would be SMALL. FEIS at 8-101. Similarly, the Staff found that, given distances from site boundaries, impacts to offsite buildings would be SMALL at each of the sites. FEIS at 8-101. The Staff concluded that physical impacts of construction on roads in the vicinity of the alternative sites would be SMALL, if railroad spurs were used for delivery of heavy construction materials and equipment, but MODERATE if they are not. The operational effects on roads would be SMALL for all sites, as it is not expected that increased commuter traffic from station operations would place undue wear and tear on the roads or cause physical deterioration at a faster rate than at present. FEIS at 8-102. The Staff also determined that both construction and operational impacts on aesthetics would be SMALL, in light of onsite erosion and stormwater runoff control measures, and the mostly rural locations of the alternative sites. FEIS at 8-102, 8-103. The Staff further found that the potential impacts of the facility construction and operations on public services and education would be SMALL at all sites, in light of the generally minor demographic impacts from the relocation of workers (and of potential associated families) expected at each of the sites. FEIS at 8-103, 8-104.

181. (DS) Based on (1) the Staff's reconnaissance-level review of information obtained from IHPA, (2) previous environmental reports, and (3) the protective measures that would be in place before and during construction and operation, the Staff concluded that the

impacts of construction and operation of an ESP unit on historic and cultural resources at any of the alternative sites would be SMALL. FEIS at 8-104. The Staff determined that, at all sites, the Environmental Justice impacts would be SMALL. However, because of the importance of site-specific factors considered in reaching these conclusions, the Staff discussed Environmental Justice in the FEIS for each alternative site. FEIS at 8-105.

182. (GS, JR) With respect to nonradiological health impacts, the Staff found that health impacts to construction workers resulting from the construction of a new nuclear unit at any of the alternative sites would be SMALL, noting that applicable Federal and State regulations on air quality and noise would be complied with during the plant construction phase, and that none of the alternative sites has site characteristics that would be expected to lead to fewer or more construction accidents than would be expected for any of the other alternative sites; occupational and public health impacts would likewise be equivalent and SMALL. FEIS at 8-105.

183. (GS) Even with differences in exposure pathways and atmospheric and water dispersion factors, doses estimated to the maximally exposed individual for the alternative sites would be expected to be well within the 10 C.F.R. Part 50, Appendix I design objectives. FEIS at 8-106. The Staff determined that population doses within 80 km (50 mi) of the proposed facility would be higher for those alternative sites closer to major population centers (i.e., Braidwood, Dresden, and Zion), but would still be small compared to the population dose from natural background radiation; the Staff concluded that radiation doses and resultant health impacts from a new nuclear unit's operations would be SMALL at all of the alternative sites. FEIS at 8-106. Similarly, noting that the advanced reactor design of a new unit would likely result in less occupational exposure annually than from current operating plants, the Staff concluded that the occupational radiation doses from a new nuclear unit's operation would be SMALL for all of the alternative sites. FEIS at 8-106. The Staff concluded that no measurable

radiological impact on biota is expected from the radiation and radioactive material released to the environment as a result of the routine operation of a new nuclear unit and that the impacts to biota of radiation doses at any one of the alternative sites would be SMALL. FEIS at 8-106.

184. (JR) Finally, because the probability-weighted consequences estimated for severe accidents for a new nuclear unit at the proposed site are well below the consequences estimated for severe accidents at current generation reactors, the Staff noted that the consequences of severe accidents at the any of the alternative sites likely would be less than the consequences of a severe accident at an existing plant at the site. FEIS at 8-107. Therefore, because the Commission has determined that the probability-weighted consequences of severe accidents are SMALL for all existing plants (10 C.F.R. Part 51, Subpart A, Table B-1), the Staff concluded that, for the purposes of consideration of alternative sites, the impact of severe accidents at each of the alternative sites likely would be SMALL. FEIS at 8-107.

i. FEIS Chapter 9, "Comparison of the Impacts of the Proposed and Alternative Sites

**Q37: Describe how the Staff compared the environmental impacts of a new unit at the proposed site with those at the alternative sites.**

**A37:** 185. (EH, TK) In Chapter 9 of the FEIS, the Staff compared the environmental impacts of a new facility at Clinton (ESP site) with the impacts (discussed in Chapter 8) of the alternatives to the proposed action, in order to determine 1) if any of the alternative sites are environmentally preferable, and 2) if so, whether there is a site that is obviously superior to the proposed site. FEIS at 9-1, 9-2.

186. (EH, TK) In its analysis earlier in the FEIS – supported by examination of the application and supporting documents, the Staff's site visits, and its independent review – the Staff found that Exelon reasonably identified alternative sites, adequately evaluated the

environmental impacts of construction and operation, and used a logical means of comparing sites. FEIS at 9-2. To compare the proposed action with the alternatives, the Staff weighed the impact significance levels (SMALL, MODERATE, or LARGE) it had determined with respect to Clinton (ESP site) for each major impact area with the corresponding levels for each of the six identified alternative sites. FEIS at 9-2, 9-3, Tbls. 9-1 & 9-2. Where the Staff had been unable to reach a single determination level for Clinton (ESP site) due to insufficient information, the Staff indicated a likely impact level for unresolved issues – so that a comparison could be made – based on professional judgment, experience, and consideration of controls likely to be imposed under required Federal, State, or local permits that would not be acquired until an application for a construction permit or combined license is underway. FEIS at 9-2, 9-3.

187. (EH) The Staff determined that the impact level from construction would be SMALL for most of the environmental issues at each of the sites. See FEIS at Table 9-1. The Staff's issue-by-issue impact determinations were explained more fully in Chapter 4 for Clinton (ESP site) and in Chapter 8 for the alternative sites. Similarly, the Staff determined that the impact level from operations would be SMALL for most of the environmental issues at each site. See FEIS Table 9-2. Once again, the Staff's issue-by-issue impact determinations were explained more fully in Chapter 5 for Clinton (ESP site) and in Chapter 8 for the alternative sites.

188. (EH, JB, JJ, SS) The Staff then analyzed whether any of the alternative sites are environmentally preferable. First, with respect to construction impacts, while the Staff concluded that impacts were generally small for all seven analyzed sites, the Staff identified several differences between the environmental impacts of construction at the proposed and alternative ESP sites. FEIS at 9-8. The SMALL to MODERATE impact of construction traffic on roads is common to Clinton (ESP site) and the alternative sites, while the potential MODERATE impact of construction on housing could occur if the construction workers

relocated closer to the ESP sites (Clinton, Dresden and Braidwood) rather than commute from their present residences, a situation the Staff judged to have a low probability of occurrence. FEIS at 8-42, 8-52, and 9-8. The Staff determined that social and economic (beneficial) impacts would be SMALL (Braidwood, Quad Cities and Zion) or SMALL to MODERATE (Clinton, Dresden, LaSalle and Byron). FEIS at 9-5. However, there would be SMALL to potentially LARGE impacts on general terrestrial resources and SMALL to potentially MODERATE impacts on Federally listed threatened and endangered species at Quad Cities, and SMALL to potentially LARGE impacts on general terrestrial resources and Federally listed threatened or endangered species at Dresden and Zion, while, in addition to the SMALL to MODERATE impact of construction traffic on roads at all sites, construction workers would be expected to have potentially SMALL to MODERATE impacts on transportation at six of the sites, including Clinton. At Zion, the impacts could be MODERATE to LARGE. FEIS at 8-109 and 9-8. The impacts to community infrastructure (except with respect to transportation and housing, as noted earlier) would be SMALL at all sites. FEIS at 4-50 and 8-109. Likewise, Environmental Justice impacts at all sites would be SMALL. FEIS at 9-5. The Staff concluded that none of these differences was sufficient to determine that any of the alternative sites is environmentally preferable to the Exelon ESP site. FEIS at 9-8.

189. (EH, JJ, LV) Second, with respect to operational impacts, the Staff again noted that impacts were generally small for all seven analyzed sites, and identified several differences between the environmental impacts at the proposed and alternative ESP sites. FEIS at 9-8, 9-9. For example, under normal water availability, the impact of operation of a new nuclear unit at Clinton (ESP site) on recreation would be SMALL, but in severe drought years, the impact level could be MODERATE if the water use of the unit caused the level of Clinton Lake to drop enough to limit use of the lake for recreational purposes. FEIS at 9-8, 9-9. Similarly, impacts on housing would be SMALL if, as expected, the residences of the workforce

required to operate a nuclear unit at Clinton (ESP site) are distributed throughout the area; however, impacts could be MODERATE should the workforce locate predominately in the smaller towns in the area. FEIS at 9-9.

190. (JB, JJ) By contrast, while most of the impacts of operating a new nuclear unit at the alternative sites would be SMALL, there could be MODERATE impacts on housing at either the Dresden or Braidwood sites depending on the location of the operational workforce; these impacts would be similar to the housing impacts that could occur in small towns near the Clinton ESP site. FEIS at 9-9. The Staff determined that the remaining impacts to community infrastructure would be SMALL for all alternative sites and Clinton, with the exception of recreation, which would be SMALL to MODERATE. FEIS at 5-82, 9-7 and 9-9. Environmental Justice impacts would be SMALL. FEIS at 5-83, 9-7 to 9-9. The social and economic (beneficial) impacts would be SMALL (Braidwood, Quad Cities and Zion), SMALL to MODERATE (Dresden, LaSalle and Byron) or SMALL to LARGE (Clinton). FEIS at 9-7. Also, for Dresden there could be SMALL to LARGE impacts if there were Federally listed threatened or endangered species located on the site or in the transmission line rights-of-way; for Quad Cities, there could be SMALL to MODERATE impacts if a Federally listed endangered species (Higgins' eye pearl mussel) was located in affected areas of the river and not relocated. FEIS at 9-9. However, the Staff again concluded that none of the differences was sufficient to determine that any of the alternative sites is environmentally preferable to the Clinton ESP site. FEIS at 9-8, 9-9.

191. (EH) Because the Staff determined that none of the alternative sites was environmentally preferable to Clinton (ESP site), it concluded by extension that none of the alternative sites is obviously superior to Clinton (ESP site). FEIS at 9-9.

192. (EH) Finally, the Staff compared the proposed action with the no-action alternative. The Staff noted that denial of the ESP application would prevent early resolution of

safety and environmental issues for the site, and it further found that although Exelon could follow any of several paths to satisfy its electric power needs, each of the paths would have associated environmental impacts. FEIS at 9-9, 9-10. The Staff additionally reiterated its conclusion that the potential site-preparation activities described in Exelon's site redress plan would not result in any significant adverse impacts that could not be redressed. FEIS at 9-10.

j. FEIS Chapter 10, "Conclusions and Recommendations" & Ultimate Findings

**Q38: Describe how the Staff came to its ultimate conclusions with respect to the NEPA determinations concerning the ESP application.**

**A38:** 193. (EH, TK) In reaching its ultimate findings and recommendation concerning the ESP application, the Staff provided its conclusions on a number of determinations required by NEPA. These determinations included analysis of any unavoidable adverse environmental impacts, any irreversible and irretrievable commitments of resources, the relationship between short-term uses and long-term productivity of the human environment, and the cumulative impacts of the proposed action. The associated conclusions are discussed in Chapter 10 of the FEIS.

194. (EH, TK) With respect to unavoidable adverse environmental impacts (NEPA section 102(2)(C)(ii)), the Staff concluded that there will be no unavoidable adverse environmental impacts associated with the granting of the ESP, with the exception of impacts associated with the limited site-preparation and preliminary construction activities (defined in 10 C.F.R. § 50.10(e)(1); see *also* FEIS at 10-4) and identified in the site redress plan (as provided by 10 C.F.R. § 52.17(c) and 10 C.F.R. § 52.25). FEIS at 10-4. The Staff further found reasonable assurance that redress carried out under the Applicant's plan will achieve an environmentally stable and aesthetically acceptable site suitable for whatever non-nuclear use may conform with local zoning laws; therefore, the Staff concluded that the potential site

preparation and preliminary construction activities described in Exelon's site redress plan would not result in any significant adverse impacts that could not be redressed. FEIS at 10-5.

195. (EH, TK) The Staff found that although impacts associated with the site preparation and preliminary construction activities are bounded by the construction activities, there are unavoidable adverse environmental impacts associated with the construction and operation of a new nuclear unit at the Exelon ESP site. FEIS at 10-4. Therefore, although final assessment of adverse environmental impacts from construction and operation at the Exelon ESP site would be performed at the CP or COL stage for issues that were not resolved in the ESP review,<sup>50</sup> the Staff summarized the impacts described in Chapters 4 and 5 of its ESP FEIS analysis. FEIS at 10-5 to 10-7.

196. (DA) With respect to construction activities, such unavoidable impacts were primarily related to land use (involving ground disturbance for permanent facilities and removal of some forested habitat), but also included some potential socioeconomic impacts resulting from increased traffic. FEIS at 10-5 to 10-6. The Staff reiterated from its earlier analysis the ways in which most impacts would be mitigated, such as actions to reduce equipment emissions and fugitive dust. FEIS at 10-5 to 10-6, Tbl. 10-1.

197. (JJ, LV) Likewise, with respect to operations, the Staff reiterated that unavoidable impacts would be small, and it summarized mitigation activities, such as State regulation of water use and water quality to mitigate cooling system impacts, and the use of tax revenues and local land management plans to mitigate increased growth and use of public services. FEIS at 10-6, 10-7, Tbl. 10-2.

198. (EH) With respect to irreversible and irretrievable commitments of resources (NEPA section 102(2)(C)(v)), the Staff found that the only such commitments would be

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<sup>50</sup> (EH, TK) See FEIS at tables in chapters 4, 5, 9, and 10.

resources used by Exelon for site-preparation activities, and that such resources not used during the ESP stage would be used at the CP or COL stage or could be used for other activities even if Exelon does not eventually seek a CP or a COL for the ESP location. FEIS at 10-8. The Staff noted, however, that irretrievable commitments of resources during construction generally would be similar to those of any major construction project and would depend on the specific design. The Staff also determined that the materials required for construction and uranium required for operations would be of small consequence with respect to the availability of such resources. FEIS at 10-8.

199. (EH) With respect to the relationship between short-term uses and long-term productivity of the human environment (NEPA section 102(2)(C)(iv)), the Staff found that the only short-term use of the environment that could occur if the proposed action is implemented would be site preparation activities authorized in an ESP, and any such activities are unlikely to adversely affect the long-term productivity of the environment. FEIS at 10-8. The assessment of the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity would be performed at the CP or COL stage. FEIS at 10-8, 10-9.

200. (EH) With respect to cumulative impacts, the Staff repeated its conclusions from FEIS Chapter 7 that potential cumulative impacts were determined to be small. FEIS at 10-9. The Staff noted that some impact issues had the potential for MODERATE adverse impacts, most of which would occur under temporary circumstances or as the result of a larger-than-expected concentration of construction workers settling near the Exelon ESP site. FEIS at 10-9.

201. (EH) In light of its findings and conclusions, the Staff's recommendation to the Commission related to the environmental impacts of the proposed action was that the ESP

should be issued.<sup>51</sup> FEIS at 10-9 to 10-11. These Staff conclusions and recommendations flowed from the analyses documented in each chapter of the FEIS.

**Q39: Describe the Staff's conclusions with respect to the "baseline" NEPA determinations to be reached by the Board.**

**A39:** 202. (EH, TK) First, with respect to the Staff's compliance with Section 102(2)(A),(C), and (E) of NEPA and Subpart A of 10 C.F.R. Part 51, the record demonstrates that (1) the Staff utilized a systematic, interdisciplinary approach integrating its use of the natural and social sciences in its decision-making regarding environmental impacts as required under NEPA; and (2) the Staff has complied with the requirements set forth in section 102(2)(A),(C), and (E) of NEPA.<sup>52</sup> The FEIS documents the Staff's environmental review, in which the Staff considered the potential environmental impacts of the proposed action, i.e., issuance of an ESP. The Staff considered numerous subjects and impacts, including the purpose and need for the proposed action, the alternatives to the proposed action, compliance with applicable regulations, meteorology and air quality, geology, the radiological environment, water resources and water use, local ecology, socioeconomics, aesthetics, cultural resources, environmental justice, threatened and endangered species, transportation, noise, land use, public and worker health, accidents, waste management and fuel cycle impacts, decommissioning, cumulative impacts, and resource commitments. See FEIS at v to xviii. The Staff utilized the expertise of

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<sup>51</sup> (LV) As noted in the discussion of FEIS chapter 4, *infra*, the Staff recommended that the permit be issued with a permit condition related to compliance with the Federal Water Pollution Control Act ("FWPCA"), Section 401, certification process managed by the Illinois Environmental Protection Agency ("IEPA"). FEIS at 4-8, 10-9.

<sup>52</sup> (EH, TK) NEPA section 102(2)(A) requires all federal agencies to "utilize a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decision-making which may have an impact on man's environment." 42 U.S.C. § 4332(2)(A).

professional scientists, engineers, and social scientists in conducting its review. See *id.* at Appendices A and B.

203. (EH, TK) Second, Section 102(2)(c) of NEPA requires a federal agency to address in its environmental impact statement: (1) the environmental impact of the proposed action; (2) any unavoidable adverse impacts associated with implementation of the proposed action; (3) alternatives to the proposed action; (4) the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity; and (5) any irreversible and irretrievable commitment of resources that might result from the proposed action. See 42 U.S.C. § 4332(2)(c). The Staff has complied with these requirements in performing its environmental review. Chapters 1, 8, and 9 of the FEIS describe the proposed action and examine reasonable alternatives, including the no-action alternative. See FEIS at 1-6 to 1-8, ch. 8, ch. 9. Chapters 4, 5, and 6 detail the potential impacts associated with the construction, operation, and decommissioning of a reactor or reactors having characteristics that fall within the parameters for the site, while Chapter 7 addresses the cumulative impacts. See *id.* at ch. 4, ch. 5, ch. 6, ch. 7.

204. (EH, TK) Third, NEPA section 102(2)(c) also requires that an agency "consult with and obtain the comments of any Federal agency which has jurisdiction by law or special expertise with respect to any environmental impact involved." 42 U.S.C. § 4332(2)(c). The Staff has complied with this requirement. Appendix B lists the agencies and persons consulted during the Staff's review. See FEIS at Appendix B. Appendices D and E contain public comments received by the Staff at its scoping meeting and in response to its DEIS. See *id.* at Apps. D, E.

205. (EH, TK) Fourth, section 102(2)(E) of NEPA requires a federal agency to "study, develop, and describe appropriate alternatives to the recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available

resources.” 42 U.S.C. § 4332(2)(E). The FEIS includes a detailed discussion of alternatives to the proposed action. See FEIS at chs. 8 and 9.

206. (EH, TK) Finally, subpart A to 10 C.F.R. Part 51 contains various requirements, both procedural and substantive, that are applicable to an ESP EIS. These requirements include notice of intent to prepare an EIS and conduct scoping, distribution of a draft EIS, responding to public comments, notice and public availability of the final EIS, and identifying in the EIS the purpose and need for the action, alternatives to the action, and the affected environment. As reflected in the contents of the FEIS (in particular, Chapters 1, 2, 8, and 9, and Appendices D and E) and associated Federal Register notices (referenced therein), the Staff concluded that the applicable Subpart A requirements have been satisfied.

**Q40: Did the Staff consider balance among factors and reasonable alternatives?**

**A40:** 207. (EH, TK) In performing its evaluation, the Staff considered energy alternatives, plant design alternatives, the Applicant’s alternative site selection process, and the Applicant’s six alternative sites. See FEIS at chs. 8 and 9. The Staff considered whether the ESP Applicant (1) reasonably identified alternative sites, (2) evaluated the likely environmental impacts of construction and operation at these sites, and (3) used a logical means of comparing sites that led to the Applicant’s selection of the proposed site. FEIS at 9-2. While the Staff identified some differences in the environmental impacts of both construction and operation at the proposed and alternative ESP sites, the Staff concluded that none of these differences is sufficient to determine that any of the alternative sites is environmentally preferable to the Exelon ESP site. FEIS at 9-8, 9-9. The Staff concluded that none of the alternative sites identified is environmentally preferable or obviously superior to the proposed Exelon ESP site. FEIS at 9-8, 9-9.

**Q41: What was the Staff's ultimate NEPA determination regarding issuance of the ESP permit?**

**A41:** 208. (EH, TK) As previously stated, the Staff's recommendation to the Commission related to the environmental impacts of the proposed action was that the ESP should be issued. The Staff submits that, based upon the Board's independent review of the record – primarily the material in the FEIS – the Board should agree with the Staff that none of the alternative sites identified is environmentally preferable or obviously superior to the proposed Exelon ESP site. Accordingly, the Board should agree with the Staff's recommendation that the early site permit be issued to Exelon, and find that protection of the environment does not require denial or any further conditioning of the permit.