From: Nanette Gilles
To: Eddie Grant; Tom Mundy
Date: 7/27/04 12:02PM
Subject: RAI Letters

IT APPEARS THE FIRST ATTEMPT FAILED, SO I'M TRYING TO SEND THESE AGAIN.

Attached are advanced copies of four RAI Letters regarding the Exelon ESP application that were signed out today. Formal transmittal of the letters will follow shortly.

Mail Envelope Properties
(41067CA4.55C : 20 : 21456)

Subject: RAI Letters
Creation Date: 7/27/04 12:02PM
From: Nanette Gilles

Created By: NVG@nrc.gov

Recipients	Action	Date & Time
exeloncorp.com	Transferred	07/27/04 12:01PM
eddie.grant (Eddie Grant)		
thomas.mundy (Tom Mundy)		

Post Office	Delivered	Route
		exeloncorp.com

Files	Size	Date & Time
MESSAGE	895	07/27/04 12:02PM
RAI Letter No 4.wpd	127678	07/26/04 02:53PM
RAI Letter No 6.wpd	45995	07/26/04 02:53PM
RAI Letter No 7.wpd	60395	07/26/04 02:59PM
RAI Letter No 9.wpd	45060	07/26/04 03:02PM

Options
Auto Delete: No
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Notify Recipients: Yes
Priority: Standard
Reply Requested: No
Return Notification: None

Concealed Subject: No
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July 26, 2004

Ms. Marilyn Kray
Vice President, Project Development
Exelon Generation
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Kennett Square, PA 19348

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 4 - EXELON EARLY SITE PERMIT APPLICATION FOR THE CLINTON ESP SITE (TAC NO. MC1122)

Dear Ms. Kray:

By letter dated September 25, 2003, Exelon Generation Company, LLC (Exelon) submitted its application for an early site permit (ESP) for the Clinton ESP site.

The Nuclear Regulatory Commission (NRC) staff is performing a detailed review of the Site Safety Analysis Report in your ESP application to ensure that the information is sufficiently complete to enable the NRC staff to reach a final conclusion on all safety questions associated with the site before the ESP is issued. The NRC staff has determined that additional information is necessary to continue the review. The topic covered in the request for additional information (RAI) contained in Enclosure 1 is meteorology. These RAIs were sent to you via electronic mail (e-mail) on June 11 and July 8, 2004.

Receipt of requested information within 75 days of the date of this letter will support the NRC's efficient and timely review of Exelon's ESP application. Please note that failure to provide a response in a timely fashion may result in a delay of completion of the staff's safety evaluation report. If you have any questions or comments concerning this matter, you may contact me at (301) 415-1180 or nvg@nrc.gov.

Sincerely,

/RA/

Nanette V. Gilles, Exelon ESP Project Manager

New Reactors Section

New, Research and Test Reactors Program

Division of Regulatory Improvement Programs

Office of Nuclear Reactor Regulation

Docket No. 52-007

Enclosure: As stated

cc: See next page

July 26, 2004

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Enclosure: As stated

cc: See next page

DOCUMENT NAME: C:\ORPCheckout\FileNET\ML042440523.wpd
ACCESSION NO.   ML042010267

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DATE	07/20/04	07/21/04	07/22/04	07/23/04

OFFICIAL RECORD COPY

Exelon Early Site Permit Application
Site Safety Analysis Report (SSAR) Section 2.3, Meteorology
Requests for Additional Information (RAI)

SSAR Section 2.3.1, Regional Climatology

RAI 2.3.1-1

SSAR Table 2.3-3 shows the number of tornadoes reported for DeWitt and the immediately adjacent surrounding counties for the period of record 1950 through 2002. Subsequent to the period of record reported in SSAR Table 2.3-3, there were 63 tornadoes reported in Central Illinois in 2003, 23 of which occurred in DeWitt and its surrounding counties. These 63 tornadoes rank 2003 second on the list for the most tornadoes in a year for central Illinois since 1950. Please update the tornado statistics provided in SSAR Section 2.3.1.2.2 and Tables 2.3-2 and 2.3-3 to include data from 2003.

RAI 2.3.1-2

Please provide a 3-second gust wind speed that represents a 100-year return period for the Clinton early site permit (ESP) site. This site characteristic value potentially represents a typical design parameter input for new reactor designs. Because the National Weather Service has phased out the measurement of fastest-mile wind speeds, Structural Engineering Institute/American Society of Civil Engineers (SEI/ASCE) 7-02 has redefined the basic wind as the peak (3-second) gust, a value which is now recorded and archived at most National Weather Service Stations.

RAI 2.3.1-3

SSAR Table 2.3-1 reports a peak gust wind speed of 69 miles per hour (mph) as well as a fastest-mile wind speed of 75 mph for both Peoria and Springfield. Given the response characteristics of the instrumentation used, the peak gust measurement is associated with an averaging time of approximately 3 seconds whereas the fastest-mile wind speed measurement of 75 mph is associated with an averaging time of approximately 48 seconds. Typically, extreme wind values are expected to increase as the averaging time decreases; for example, the fastest 3-second-average wind speed would be expected to be higher than the fastest 48-second-average wind speed which would be expected to be higher than the fastest 5-minute-average wind speed. Consequently, please explain the apparent abnormality in SSAR Table 2.3-1 where the reported peak gust wind speeds are lower than the reported fastest-mile wind speeds.

RAI 2.3.1-4

There are inconsistences reported in the SSAR for the maximum monthly and maximum 24-hour snowfall value for Springfield. Section 2.3.1.2.3 states that the maximum monthly snowfall in the Springfield area is 24.4 inches whereas Table 2.3-1 reports a monthly maximum snowfall value of 22.7 inches. Likewise, Section 2.3.1.2.3 reports a maximum recorded 24-hour snowfall of 15.0 inches whereas Table 2.3-1 reports a 24-hour snowfall value of 10.9 inches. In addition, the Illinois State Climatologist Office's web site, http://www.sws.uiuc.edu/atmos/statecli/summary/118179.htm, reports a third value for the 1-day maximum snowfall: 17.0 inches (December 12, 1972) for the period of record 1908 through

2001. Please affirm the appropriate maximum monthly and maximum 24-hour snowfall values for Springfield.

RAI 2.3.1-5

SSAR Section 2.3.1.2.3 defines an appropriate 100-year return period snowpack for the Clinton ESP site as 22 psf, based on the ASCE Standard 7-98, “Minimum Design Loads for Buildings and Other Structures.” However, ASCE 7-98 Figure 7-1 shows a ground snow load of 20 performance shaping factor (psf) for the Clinton ESP site which, by definition, has a 2 percent annual probability of being exceeded or a 50-year mean recurrence interval. According to ASCE 7-98 Section C7.3.3, the ratio of the 100-year to 50-year mean recurrence interval values is typically 1.22, which means that the 50-year return period snowpack value of 20 psf corresponds to a 100-year return period snowpack value of 24 psf. Consequently, please justify the 100-year return period snowpack value of 22 psf presented in the Clinton ESP SSAR.

RAI 2.3.1-6

The 79 psf value presented in SSAR Section 2.3.1.2.3 as the 48-hour winter Probable Maximum Precipitation (PMP) for the Clinton ESP site is based on the winter PMP data cited in the Clinton Power Station (CPS) updated safety analysis report (USAR) Section 2.3.1.2.3. The CPS USAR winter PMP value (15.2 inches of precipitable water) was derived from Hydrometeorological Report (HMR) No. 33 published in 1956 by the United States Weather Bureau. HMR No. 33 has been superseded and updated with the issuance of HMR No. 53 in 1980. Please update the 48-hour winter PMP presented in the SSAR with data from HMR No. 53.

RAI 2.3.1-7

Please provide the meteorological data to be used to evaluate the performance of a mechanical draft cooling tower ultimate heat sink with respect to: (1) maximum evaporation and drift loss; and (2) minimum water cooling. The period of record examined should be identified, and the bases and procedures used for selection of the critical meteorological data should be provided and justified. Section C.1 of Regulatory Guide (RG) 1.27, “Ultimate Heat Sink for Nuclear Power Plants,” describes methods and approaches acceptable to the staff to ensure that a 30-day cooling supply is available and that design basis temperatures of safety-related equipment are not exceeded.

RAI 2.3.1-8

Please provide the ambient air temperature and humidity site characteristic values specified below. The bases for these values should also be provided. These site characteristic values represent typical design parameter information for a range of reactor designs.

a) Maximum ambient dry bulb temperatures (along with the concurrent wet bulb temperatures) that:
    i) will be exceeded no more than 2.0 percent of the time annually.
    ii) will be exceeded no more than 0.4 percent of the time annually.
    iii) represents a 100-year return period.

b) Minimum ambient dry bulb temperature that:
   i) will be exceeded no more than 1.0 percent of the time annually.
   Ii) will be exceeded no more than 0.4 percent of the time annually.
   iii) represents a 100-year return period.

c) Maximum ambient wet bulb temperature that:
   i) will be exceeded no more than 0.4 percent of the time annually.
   ii) represents a 100-year return period.

RAI 2.3.1-9

SSAR Section 2.3.1.2.2 states that the Clinton ESP site characteristic maximum tornado wind speed is 300 mph, based on SECY-93-087. The subject of the applicable section of SECY-93-087 is design-basis tornado for design of advanced light-water reactors (ALWRs). The staff does not agree that acceptance of a given design-basis tornado wind speed for design of ALWRs means that this speed is acceptable for all sites that might be the subject of an ESP. Site parameters are postulated for a design certification [10 CFR 52.47(a)(iii)] and are not required to bound every site on which an applicant might seek to construct a nuclear power plant of certified design.

SECY 93-087 states: "The staff expects that use of these criteria will not preclude siting the ALWR plant designs on most sites in the United States. However, should an actual site hazard exceed the design envelope in a certain area, the combined license (COL) applicant would have the option of performing a site specific analysis to verify that the design is still acceptable for that site."

The documented basis for the tornado-related conclusions in SECY-93-087 is NUREG/CR-4661, which shows 10^{-7}/yr tornado wind speeds above 300 mph in some parts of the United States. A letter dated March 25, 1988, from the NRC to the ALWR Utility Steering Committee, Subject: ALWR Design Basis Tornado, provided the staff's interim position on design basis tornado wind speed on a site-specific basis. This letter also cited design-basis tornado wind speeds higher than 300 mph in some parts of the United States, including the Clinton ESP site.

ESP applicants are not required to use either RG 1.76 or the staff's interim position on design basis tornado wind speed, although they may do so since both are staff-accepted approaches. ESP applicants may use any design-basis tornado wind speeds that are appropriately justified. However, the staff does not believe that citing SECY-93-087 (or any document related to design certification) is adequate justification for use of 300 mph. In particular, Figure 30 of NUREG/CR-4461 shows a 10^{-7} probability of occurrence of wind speed of 327 mph for the Clinton ESP site. Please provide a safety justification for choosing 300 mph as the site characteristic maximum tornado wind speed for the Clinton ESP site.

RAI 2.3.1-10

The site characteristic snow load being proposed is based, in part, on a maximum-recorded monthly snowfall in the Clinton ESP site area of 24.7 inches at Peoria, IL in January 1979. However, a higher maximum-recorded monthly snowfall, 30.5 inches, was recorded at Decatur, IL in March 1906 (Reference: Illinois State Climatologist Office website http://www.sws.uiuc.edu/atmos/statecli/Summary/112193.htm). Please revise the proposed site characteristic snow load using the higher maximum-recorded monthly snowfall recorded at Decatur.

SSAR Section 2.3.2, Local Meteorology

RAI 2.3.2-1

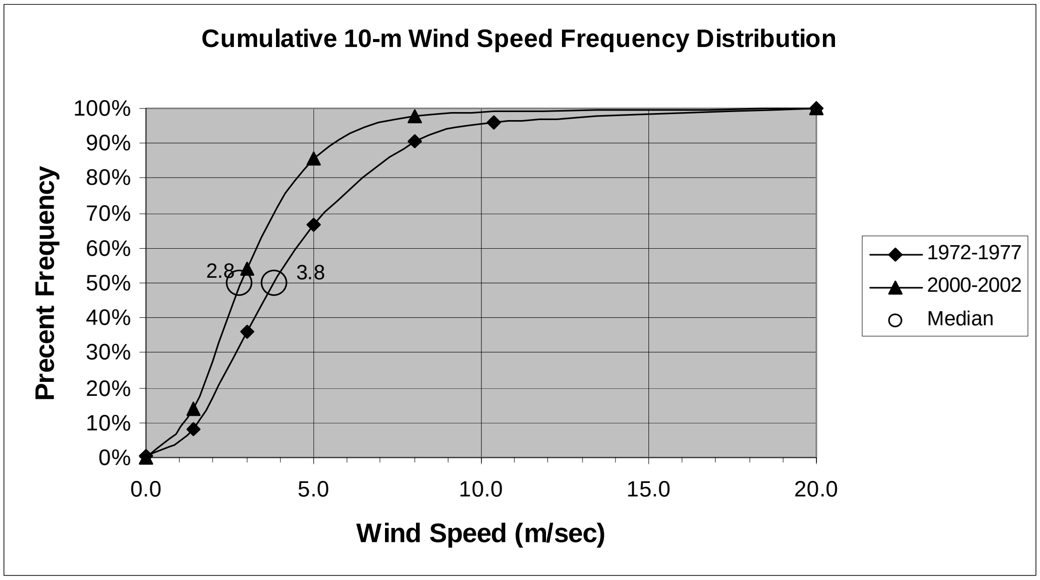
SSAR Sections 2.3.2.1.2 and 2.3.2.1.3 present temperature and humidity information from the onsite meteorological monitoring system for the period of record 1972-1977 and state that these data are believed to be representative of the site area. These data were collected prior to the installation of Clinton Lake and operation of the Clinton Power Station once-through cooling system. Please provide justification that these data remain representative of the Clinton ESP site, given that the site is now adjacent to a heated lake. Have any onsite data been analyzed since Clinton Power Station began operation to support this assumption?

RAI 2.3.2-2

SSAR Section 2.3.2.1.3.4 states that the average yearly precipitation for the Clinton ESP site is 25.47 inches, based on onsite data reported for the 1972-1977 period of record. The SSAR remarks that these data are believed to be representative of the site area and have been previously shown to be consistent with regional observations from Peoria and Springfield, Illinois when compared to long-term periods of record at those locations. However, SSAR Table 2.3-1 reports annual average precipitation totals of 34.89 inches and 33.78 inches for Peoria and Springfield, respectively. Likewise, the 1971-2000 normal annual precipitation reported for the Clinton cooperative weather station (located approximately 7 miles from the Clinton ESP site) is 39.86 inches. Please explain why the 1972-1977 onsite precipitation totals are only approximately 75 percent of the long-term precipitation totals reported for Peoria and Springfield.

RAI 2.3.2-3

The onsite 10-m wind speed frequency distributions presented in SSAR Table 2.3-8 show a general shift towards lower wind speeds in the more recent data. In particular, a plot of cumulative wind speed frequency distribution shows a median (50 percent) wind speed value of 2.8 m/sec for the 2000-2002 period of record as compared to a median wind speed value of 3.8 m/sec for the 1972-1977 period of record. Please explain what might have caused these differences in reported wind speed frequency distributions between these two periods of record.



RAI 2.3.2-4

The onsite (60m-10m delta-temperature) stability class frequency distributions presented in SSAR Table 2.3-37 show a high occurrence of unstable (stability class A, B, and C) conditions for 2000-2002 period of record as compared to 1972-1977 period of record (25.7 percent of the time versus 13.3 percent of the time, respectively). Please explain what might have caused these differences in reported stability class frequency distributions between these two periods of record.

RAI 2.3.2-5

Please identify the air quality characteristics of the site that would be design and operating bases for a nuclear plant or plants that might be constructed on the ESP site.

RAI 2.3.2-6

An hourly wet bulb temperature should never exceed the coincident dry bulb temperature. Consequently, please explain why nearly all of the CPS wet bulb temperature values presented in SSAR Table 2.3-13 exceed the corresponding (dry bulb) temperature values presented in SSAR Table 2.3-9.

SSAR Section 2.3.3, On-site Meteorological Measurements Program

RAI 2.3.3-2

SSAR Section 2.3.3 states that the onsite meteorological monitoring system is compliant with applicable requirements of Revision 0 (February 1972) to RG 1.23, “Onsite Meteorological Programs,” except for exceptions identified in the CPS USAR. However, USAR Section 1.8 states that the CPS meteorological monitoring system meets the requirements of American

Nuclear Society (ANS) 2.5-1984 with several exceptions. Please clarify the Clinton ESP meteorological monitoring program commitments to regulatory guidance documents and identify any exceptions to these documents.

RAI 2.3.3-3

SSAR Section 2.3.3 states that the existing Clinton Power Station onsite meteorological monitoring program will also be used as an operational system once the Clinton ESP facility becomes operational. The options being considered for the Clinton ESP facility normal heat sink include either 60-foot tall mechanical draft cooling towers or 550-foot tall natural draft cooling towers. Please describe the potential location of these cooling towers vis-a-vis the existing meteorological tower and the potential influence of these cooling towers on meteorological measurements.

RAI 2.3.3-4

Please explain why only 32 months of recent onsite data (January 2000-August 2002) have been used to generate the climatic data summaries and atmospheric dispersion analyses presented in the SSAR. Potential bias in these data exists due to the under representation of autumn and early winter months.

SSAR Section 2.3.4, Short-Term Diffusion Estimates

RAI 2.3.4-1

Please explain in more detail how the 50 percent exclusion area boundary (EAB) and low-population zone (LPZ) atmospheric dispersion factors (χ/Q values) were determined. In particular, please explain the apparent discrepancy in the SSAR where Section 2.3.4.3 states that these values represent direction independent (i.e., overall site) values whereas Table 2.3-52 states that these are maximum sector values.

RAI 2.3.4-2

Because potential release points could be located anywhere within the plant envelope area being proposed for the Clinton ESP site, please recalculate the EAB and LPZ χ/Q values using the shortest distances between the ESP plant envelope boundaries and the 1,025-m EAB radius and 4,018-m LPZ radius for each downwind sector. Also provide a copy of the resulting PAVAN input and output files used to generate the accident CHI/Q values that are being proposed as site characteristic values.

Distribution for Request For Additional Information Letter No. 4 dated July 26, 2004

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Exelon ESP

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July 26, 2004

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Sincerely,

/RA/

Nanette V. Gilles, Exelon ESP Project Manager
New Reactors Section
New, Research and Test Reactors Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No. 52-007

Enclosure: As stated

cc: See next page

July 26, 2004

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Office of Nuclear Reactor Regulation

Docket No. 52-007

Enclosure: As stated

cc: See next page

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ACCESSION NO. ML042020002

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DATE	07/20/04	07/20/04	07/21/04	07/23/04

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Exelon Early Site Permit (ESP) Application
Site Safety Analysis Report (SSAR) Sections 2.4, Hydrologic Engineering and 3.2, Thermal Discharges
Requests for Additional Information

SSAR Section 2.4.1, Hydrologic Description

RAI 2.4.1-1

Please provide survey coordinates (including elevations) for the bounding areas of all ESP safety-related structures including intake tunnels and piping corridors. Also provide the coordinates of existing aquifers in the bounding areas, particularly perched aquifers.

RAI 2.4.1-2

Please identify any limits on plant operation due to either water supply or intake water temperature for the ESP unit (e.g., need to derate or shutdown reactors if the intake temperature exceeds a certain threshold). Estimate the frequency and duration of the applicability of these operating limits.

RAI 2.4.1-3

The application states that no dams exist upstream of Clinton Lake that could affect the availability of water to the ESP site. Please provide references that confirm this assertion and that no future dams upstream of the site are currently proposed.

RAI 2.4.1-4

Please provide any information regarding proposed land use changes that might result in increased bed load in the tributaries upstream of Clinton Lake or sediment deposition in the ultimate heat sink (UHS).

RAI 2.4.1-5

Table 2.4-2 shows the percentage of rainfall as runoff and mean lake evaporation. Please provide copies of the references for these estimates.

SSAR Section 2.4.2, Floods

RAI 2.4.2-1

The Probable Maximum Precipitation (PMP) for Clinton Dam was obtained using Hydrometeorological Report No. 33 (HMR 33); however, the current standards are American National Standards Institute/American Nuclear Society (ANSI/ANS)-2.8-1992, HMR 51, and HMR 52. Please explain why the current standards were not used. Also, please explain why an estimate based on HMR 33 is conservative relative to an estimate based on HMR 51 and HMR 52.

RAI 2.4.2-2

Please provide a description of likely changes to both upstream land use and downstream water demand that would alter either the intensity or frequency of flood risk and low-flow conditions.

RAI 2.4.2-3

Please document any historical hill slope failures in the watershed. Also, please analyze the ability of a hypothetical hillslope failure to impact the plant. What would be the maximum terminal height of such a hypothetical wave?

RAI 2.4.2-4

Please document any seismically-induced seiches in Clinton Lake.

RAI 2.4.2-5

Please demonstrate that the drainage capacity at the existing grade is sufficient to accommodate local intense precipitation. If the capacity is not sufficient, please describe any active safety-related drainage systems that will be installed for the new units.

SSAR Section 2.4.3, Probable Maximum Flood on Streams and Rivers

RAI 2.4.3-1

Please describe the status of the U.S. Army Corps of Engineers SPRAT computer program referenced in Section 2.4.3.3 and any software quality assurance measures that were used to augment use of this software in support of the ESP application.

RAI 2.4.3-2

Please explain how the wave runup calculations were bounded through the examination of the Combined Events Criteria indicated in the ANS 2.8 1992 Standard. Discuss coincident wave calculation and the basis for applying a 40 miles per hour (mph) design wind.

SSAR Section 2.4.7, Ice Effects

RAI 2.4.7-1

Please discuss the potential for ice sheet collision impacts on the intake structure and quantify the force of impact.

RAI 2.4.7-2

Please explain how the ice sheet thickness identified in Section 2.4.7 was calculated and provide the input assumptions.

RAI 2.4.7-3

Please describe the relationship (layout and depth) of the ESP intake relative to the current Clinton Power Station (CPS) intake.

RAI 2.4.7-4

Please describe the site characteristics of frazil and anchor ice formation.

RAI 2.4.7-5

Please discuss the impacts to ice formation if the existing unit was no longer operating.

RAI 2.4.7-6

Please discuss whether or not ice sheet formation is likely to constrain the intake depth.

RAI 2.4.7-8

Please describe the reduction of UHS capacity caused by a loss of Clinton Dam during periods when an ice sheet is covering the lake.

SSAR Section 2.4.8, Cooling Water Canals and Reservoirs

RAI 2.4.8-1

Please explain how the cooling needs for the CPS and ESP facilities were calculated as discussed in Section 2.4.8.1.5.

RAI 2.4.8-2

Please discuss how the flow velocities were computed over the crest and toe of the submerged UHS dam discussed in Section 2.4.8.1.5. Please provide figures indicating where the toe of the UHS dam is relative to the fill shown in Figures 2.4-14 and 2.4-15.

RAI 2.4.8-3

Please describe lake drawdown calculations.

RAI 2.4.8-4

Please describe how UHS capacity loss due to sediment or debris loads during extreme events was estimated.

SSAR Section 2.4.9, Channel Diversions

RAI 2.4.9-1

Please provide references to studies related to geological features or other characteristics that preclude any likelihood of channel diversion upstream of the site.

SSAR Section 2.4.10, Flooding Protection Requirements

RAI 2.4.10-1

A design wind of 40 mph was mentioned in the second paragraph of Section 2.4.10 and earlier in Section 2.4.3.6. In the third paragraph of Section 2.4.10, 48 and 67 mph winds are mentioned for wave run up consideration at the intake facility. Please discuss the differences in these design winds and the methods for determining both these design winds.

SSAR Section 2.4.12, Dispersion, Dilution, and Travel Times of Accidental Releases of Liquid Effluents in Surface Waters

RAI 2.4.12-1

Please provide additional information regarding the likelihood for liquid effluents to reach a surface water body.

SSAR Section 2.4.13, Groundwater

RAI 2.4.13-1

Please provide a description of the local subsurface environment adequate to understand groundwater pathways from the plant including subsurface disturbances of local strata from structures and perched aquifers.

SSAR Section 3.2.2, Ultimate Heat Sink

RAI 3.2.2-1

Please provide a schematic that describes water circulation in the UHS.

RAI 3.2.2-2

Please describe the consequences of a failure of the baffle in the UHS.

Distribution for Request For Additional Information Letter No. 6 dated July 26, 2004

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July 26, 2004

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SUBJECT: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 7 - EXELON EARLY SITE PERMIT APPLICATION FOR THE CLINTON ESP SITE (TAC NO. MC1122)

Dear Ms. Kray:

By letter dated September 25, 2003, Exelon Generation Company, LLC (Exelon) submitted its application for an early site permit (ESP) for the Clinton ESP site.

The Nuclear Regulatory Commission (NRC) staff is performing a detailed review of the Site Safety Analysis Report (SSAR) in your ESP application to ensure that the information is sufficiently complete to enable the NRC staff to reach a final conclusion on all safety questions associated with the site before the ESP is issued. The NRC staff has determined that additional information is necessary to continue the review. The topics covered in the request for additional information (RAI) contained in Enclosure 1 are seismology and geology. These RAIs were sent to you via electronic mail (e-mail) on July 15, 2004.

Receipt of requested information within 75 days of the date of this letter will support the NRC's efficient and timely review of Exelon's ESP application. Please note that failure to provide a response in a timely fashion may result in a delay of completion of the staff's safety evaluation report. If you have any questions or comments concerning this matter, you may contact me at (301) 415-1180 or nvg@nrc.gov.

Sincerely,

/RA/

Nanette V. Gilles, Exelon ESP Project Manager
New Reactors Section
New, Research and Test Reactors Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No. 52-007

Enclosure: As stated

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July 26, 2004

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 7 - EXELON EARLY SITE PERMIT APPLICATION FOR THE CLINTON ESP SITE (TAC NO. MC1122)

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The Nuclear Regulatory Commission (NRC) staff is performing a detailed review of the Site Safety Analysis Report (SSAR) in your ESP application to ensure that the information is sufficiently complete to enable the NRC staff to reach a final conclusion on all safety questions associated with the site before the ESP is issued. The NRC staff has determined that additional information is necessary to continue the review. The topics covered in the request for additional information (RAI) contained in Enclosure 1 are seismology and geology. These RAIs were sent to you via electronic mail (e-mail) on July 15, 2004.

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Exelon Early Site Permit (ESP) Application
Site Safety Analysis Report (SSAR) Section 2.5, Geology, Seismology, and Geotechnical Engineering
Requests for Additional Information

SSAR Section 2.5.1, Site and Regional Geology

RAI 2.5.1-1

In characterizing the seismic hazard of the New Madrid seismic source zone, SSAR Appendix B (Sections 2.1.5.2.1, 4.1.1.2, and Tables 2.1-3 and 4.1-1) cites the preferred magnitudes of Bakun and Hooper (2003, in press) for the New Madrid main shocks of 1811-12 as M 7.2, 7.1, and 7.4. The work of Bakun and Hooper (2003, in press) has since been revised with magnitude estimates for the 1811-12 New Madrid main shocks as M 7.6, 7.5, and 7.8 (Bakun and Hooper, 2004, Bull. Seism. Soc. Am., v. 94, no. 1, p. 64-75). Please explain what changes these revised magnitude estimates may require in the weights listed in Table 4.1-2 for the size of the expected characteristic earthquake rupture for each fault within the New Madrid seismic zone. In addition, please quantify the effect of the revised magnitude estimates on the hazard at the site by providing a graph showing two long-period (1 Hz) hazard curves, one using the magnitudes of Bakun and Hooper (2003, in press) and the second one using the magnitudes of Bakun and Hooper (2004).

RAI 2.5.1-2

In characterizing the maximum-magnitude distribution for the Wabash Valley-Southern Illinois seismic source zone, SSAR Appendix B (Sections 2.1.5.2.2, 4.1.2, and Table B.1-1) cites electronic and personal communications from S.F. Obermeier and a U.S. Geological Survey (USGS) Open-File Report, which is in preparation. Please provide a copy or detailed summary of these communications and Open-File Report in order for the staff to evaluate the assumptions and conclusion made in SSAR Appendix B concerning the characterization of the Wabash Valley-southern Illinois seismic source zone.

RAI 2.5.1-3

SSAR Figure 2.1-13 in Appendix B shows earthquake locations in the study area (southern Illinois and Indiana, western Kentucky, and eastern Missouri) for the period 1974 to 1987. However, the ESP site is not shown in Figure 2.1-13. Please revise Figure 2.1-13 to show the ESP site together with the earthquake epicenters, using a projection that can easily be related to other figures.

RAI 2.5.1-4

SSAR Figures B-1-13, 14, 15 of Attachment 2 of Appendix B show paleoliquefaction features at three different locations. Some of the features described in Section 1.4 of Attachment 2 of Appendix B are not readily visible in these three figures. Please provide sketches or better labeled figures to allow the staff to identify the location and extent of the sand dikes up into the silt.

RAI 2.5.1-5

SSAR Attachment 1 to Appendix B summarizes Obermeier's paleoliquefaction studies and the recent Geomatrix field reconnaisance. The energy centers and their associated paleoliquefaction features from these studies are listed in Table B-1-1. Given the heterogeneous nature of till deposits, please explain how dike size can be reliably used to estimate the locations of the paleo-energy centers. In addition, the geo-environment (i.e., ground water level, compaction and overburden pressures) may have been significantly different from current conditions. Please explain how these potential differences in the environment are accounted for in the cyclic stress method, used by Obermeier to estimate the magnitude of paleoearthquakes.

SSAR Section 2.5.2, Vibratory Ground Motions

RAI 2.5.2-1

SSAR Section 2.5.2 describes the results of Exelon Generation's (Exelon's) determination of ground motion at the ESP site from possible earthquakes. Regulatory Guide (RG) 1.165 provides a method acceptable to the NRC staff with respect to the probabilistic evaluations that can be conducted to address the uncertainties associated with the Safe Shutdown Earthquake (SSE) determination. RG 1.165 specifies a target or reference probability (median 10^{-5} per year) that is used to determine the controlling earthquakes and subsequent site ground motion.

Please provide the following information related to the approach used to obtain the results in Section 2.5.2:

a) The approach described in SSAR Section 2.5.2 uses a Uniform Hazard Spectrum (UHS) at the mean 10^{-4} per year probability level as its starting point. Please justify the selection of mean 10^{-4} per year as the appropriate starting point.

b) Please provide site-specific response spectra from the controlling earthquakes at the reference probability level (median 10^{-5} per year) and demonstrate that the SSE envelops the response spectra from the controlling earthquakes at the reference probability level, or justify why this information is not needed in determining the site-specific SSE. Please also justify any reference probability level used other than median 10^{-5} per year. Appendix B to RG 1.165 discusses situations in which an alternative reference probability level may be appropriate.

c) The approach described in SSAR Section 2.5.2 incorporates component capacity or performance parameters into a scale factor used to compute the final SSE. Please justify the incorporation of equipment performance into determination of the final SSE.

RAI 2.5.2-2

SSAR Figure 2.2-2 in Appendix B shows a comparison between three older attenuation relationships (McGuire et al., 1988; Boore and Atkinson, 1987; Nuttli, 1986-Newmark and Hall, 1982) used for the 1989 Electric Power Research Institute (EPRI) study and the four model clusters developed by the EPRI 2003 ground motion study. However, SSAR 2.2.2 in Appendix B states that Figure 2.2-2 shows the Toro et al. (1997) and Atkinson and Boore (1995) ground motion models in comparison with the original ground motion models used for the 1989 EPRI study. Please clarify this discrepancy.

RAI 2.5.2-3

SSAR Section 2.2 in Appendix B describes the EPRI 2003 ground motion study. Many of the ground motion relationships that make up the four clusters use different distance measurements. Since the exact distance measure used by a ground motion model can make a large difference in ground motion estimates for small distances, please clarify the original distance measure used for each attenuation relationship and the assumptions used to convert each distance measure to a common measure.

RAI 2.5.2-4

SSAR Section 4.1.3 of Appendix B describes a Bayesian estimation of the maximum magnitude (M_{max}) for the central Illinois basin-background source that surrounds the site. The prior distribution for the Bayesian analysis comes from the global database of stable continental region (SCR) earthquakes of Johnston et al. (1994) and specifically from SCR earthquakes in non-extended continental crust like that of the central Illinois basin-background source. The prior distribution is adjusted for bias to imply a mean M_{max} of 6.3 with a standard error of 0.5. The prior distribution is then updated with likelihood functions developed from the paleoseismological record of the central Illinois basin-background source. The resulting posterior distribution has a mode at M_{max} 6.5. According to the database of Johnston et al. (1994), the two largest SCR earthquakes from non-extended crust through 1990 are (1) the Accra, Ghana earthquake of 1862 (M 6.75 + 0.35) and (2) the Meeberrie, Western Australia earthquake of 1941 (M 6.78 + 0.25). The reason for using Johnston's database is to increase the number of geologically analogous, seismologically indistinguishable terranes within which the rare largest possible earthquakes for those terranes have been included within the global historical record.

a) If central Illinois, Accra, and Meeberrie are seismologically indistinguishable, please explain why M_{max} for central Illinois should not be set at 6.8 and why the Bayesian analysis is necessary.

b) Please explain the bias that must be adjusted for in the database of Johnston et al. (1994) for non-extended crust and how the bias-adjusted estimate of M_{max} was calculated.

c) Does updating of the prior distribution require the assumption that the paleoseismological record of central Illinois is long enough to include the M_{max} earthquake? If yes, please explain why the assumption is valid. If updating does not require the assumption, explain why not.

d) Please explain the effect on the site hazard of estimating M_{max} for the central Illinois background source using the Bayesian analysis (i.e., with a distribution having a mode at M 6.5), as opposed to fixing M_{max} at M 6.8. Show the results of this sensitivity analysis in a graph with two short-period (10 Hz) hazard curves, one computed with the Bayesian analysis and the other using a M_{max} 6.8.

RAI 2.5.2-5

In Appendix B, Section 4.1.1.3, page B-4-7, the SSAR states that the New Madrid paleoseismological data of Tuttle et al. (2002)

> indicate that the Reelfoot fault (RF) has ruptured in all three sequences, but the New Madrid North fault (NN) and New Madrid South fault (NS) sources may not have produced large earthquakes in all three sequences. These observations were used to set the relative frequency of event sequences on the central New Madrid fault sources. The model used consists of: ruptures of all three sources NN, RF, and NS one third of the time, rupture of the NN and RF one-third of the time, and rupture of the NS and RF one third of the time.

However, Tuttle et al. (2002) conclude that all three sources (RF, NN, and NS) ruptured in each of the three sequences, but that one third of the time the NN rupture may have been smaller than in 1811-1812, and one third of the time NS may have been smaller than 1811-1812. Tuttle et al. (2002) also conclude that these smaller earthquakes are at least M 7 events. Please clarify this discrepancy.

RAI 2.5.2-6

SSAR Attachment 2 of Appendix B indicates that Geomatrix performed reconnaissance-level investigations of streams within about 30 miles of the ESP site. Along Salt Creek, they identified four sites with features considered likely to be seismic in origin, with the closest being 11.5 miles from the ESP site. No other sites with paleoliquefaction features were identified in the study area. The consultants concluded that, given how few features there were, the exposure was sufficient to suggest that there have been no repeated moderate- to large-magnitude events in the vicinity of the ESP site in latest Pleistocene to Holocene time and that the late Holocene record in particular is sufficient to demonstrate the absence of such events in the past approximately 6 to 7 thousand years.

a) Given the proximity of the Salt Creek paleoliquefaction sites to the ESP site, please provide a detailed map showing where exposure was present and the quality of the exposure (such as bank heights, material, and lengths of the exposures).

b) Explain why the streams northwest and southeast of the ESP site were not examined in this study.

c) Were other sites, besides river bank exposures, used to confirm the absence of liquefaction features in the vicinity of the ESP site? If so, please describe these sites. If not, please justify your conclusion that there have been no repeated moderate- to large-magnitude events in the vicinity of the ESP site in latest Pleistocene to Holocene time.

d) The geographic distribution of the Henry Formation appears to have been an important guide to which stream reaches were searched for paleoliquefaction features. Please explain the characteristics and importance of the Henry Formation, including describing where it belongs in the time-distance diagram of SSAR Figure B-1-9.

RAI 2.5.2-7

SSAR Subsection 2.5.2.6 describes an alternative approach to that recommended in RG 1.165 for determining the Safe Shutdown Earthquake (SSE) ground motion spectrum. Please provide the following information regarding this approach:

a) The approach described in SSAR Section 2.5.2 targets a performance goal of mean 10^{-5} per year of "unacceptable performance of nuclear structures, systems and components as a result of seismically initiated events." Please justify the selection of mean 10^{-5} per year as an appropriate performance goal and describe in detail what this probability represents.

b) The approach described in SSAR Section 2.5.2 starts with the risk equation and ends with a scale factor multiplier that is used to achieve the target performance goal. Please provide the details of this derivation and describe how the use of the scale factor achieves the target performance goal. In addition, please provide the details (beyond those provided in NUREG/CR-6728 and the ASCE Draft Standard, SSAR References 118 and 119) of the assumptions made for each of the key parameters such as the seismic margin ratio, combined standard deviation, amplitude ratio, and hazard curve slope.

SSAR Section 2.5.4, Stability of Subsurface Materials and Foundations

RAI 2.5.4-1

SSAR Chapter 3.1 in Appendix A states that, due to the expected consistency between the ESP and CPS sites, the scope of the drilling and sampling program consisted of two boreholes drilled to 100 feet below ground surface on the perimeter of the ESP footprint and two deep boreholes drilled into rock at the center of the footprint. In addition, four Cone Penetrometer Tests (CPT) were also performed between the borehole locations. Section 3.1.1 states, "If any significant soil property variations (for example, different soil types or different blowcounts from the [standard penetration test] SPT had been revealed during the drilling and sampling program, additional explorations would have been added to resolve the observed difference." Please describe the criteria used to determine whether the Uniform Hazard Spectrum difference in soil properties was significant enough to require additional exploration. In addition, provide a table showing a comparison between the static and dynamic soil properties for the CPS and ESP sites. For each soil property provide the sample size, average value, standard deviation, and range of values.

RAI 2.5.4-2

Section 2.5.4.2 of the SSAR states that the EPRI modulus and damping curves were used for the site response calculations, because a much larger database was used to develop the EPRI curves and, therefore, average EPRI results are expected to be representative of conditions at the Exelon Generation Company (EGC) ESP site. It is the staff's understanding that the EPRI soil nonlinear property curves were primarily based on the results of regression studies of recorded ground motions at California soil sites, not on the results of laboratory test data. In addition, the EPRI curves are typically considered to be appropriate for sands and non-plastic (low plasticity index [PI]) silts. In view of these two observations, please provide a detailed justification for using the EPRI modulus and damping curves for the ESP site. Also, the laboratory test data (Figure 5-21 of Appendix A) for hysteretic damping appears to be relatively high at low strain compared to the generic data from the EPRI report. Please comment on these results.

RAI 2.5.4-3

Section 2.5.4.10 (Page 2.5-29) of the ESP SSAR states that, while static stability considerations are not explicitly addressed for the EGC ESP site, high allowable bearing values and low compressibility are expected at the EGC ESP site because of the similarity in soil conditions to those occurring at the CPS site. The static stability discussions in the CPS USAR indicate that allowable bearing pressures range from 25 to 60 tons per square foot (tsf). Based on the bearing values given in the CPS USAR, the minimum site characteristic value for bearing pressures at the EGC ESP site is 25 tsf. This value is listed in the plant parameter envelope (PPE) table (Table 1.4-1). Please provide more detail regarding the method(s) used to determine the bearing capacities for the CPS site. Specifically, discuss how the minimum value of 25 tsf was determined.

RAI 2.5.4-4

In Table 5-2, "Summary of Shear and Compression Wave Velocity Test data," of Appendix A, "Geotechnical Report," to the SSAR, the range in shear wave velocities for some of the stratigraphic units is large. In addition, as indicated in Figure 5-6 of Appendix A, the SPT blow counts for Borings B1 and B4 (not shown in Figure 5-5) appear to be significantly different from those of B2 and B3 in the upper 100 feet of the site. Please justify the appropriateness of using a single "average" soil column for the site response analyses used to develop the site design response spectrum (DRS) rather than including a number of different base-case soil columns.

RAI 2.5.4-5

The data shown in Table 5-3, "Comparison of Laboratory Shear Wave to in situ Velocity," of Appendix A to the SSAR indicate that the ratio of the shear wave velocity measured from the laboratory test to that measured in the field is 0.68 for the till. Based on the staff's experience, this implies that the laboratory sample may have been overly disturbed. Please comment on this possibility.

RAI 2.5.4-6

Section 6.1 of Appendix A describes the method used to determine the potential for soil liquefaction at the ESP. Please provide a copy of a sample liquefaction analysis from one of the four ESP Site borehole locations and clearly show how the Factor of Safety (FOS) was determined for the different soil layers. Since each of the four boreholes sampled soil layers with FOS less than 1.1, provide a description of the methods that will be used to mitigate the potential for liquefaction. In addition, describe the extent (i.e., depth below ground surface, and thickness) of the non-cohesive (silts and sands) soil layer over the site area, particularly the ESP footprint.

RAI 2.5.4-7

Appendix B of the ESP application describes the process used to generate the soil surface design ground response spectrum. In particular, Figures 4.2-14 through 4.2-18 present the results of the randomizations for soil shear modulus degradation and hysteretic damping curves used for the site response calculations. Please explain how these curves were used in the randomization process with respect to both the different depth ranges and the soil types occurring within those depth ranges. For example, the boring logs indicate that some soils are clays and some soils are silty sands over a particular depth range. Secondly, the damping curves used in the calculations do not incorporate the 15 percent damping cutoff as recommended in SRP Section 3.7.2. Since the calculations are nonlinear, and since some of the randomizations can lead to relatively high strains, it is not clear how this influenced the computed site amplification factor. Please provide clarification regarding the use of high strain values in the randomization process.

Distribution for Request For Additional Information Letter No. 7 dated July 26, 2004

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July 26, 2004

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SUBJECT: REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 9 - EXELON EARLY SITE PERMIT APPLICATION FOR THE CLINTON ESP SITE (TAC NO. MC1122)

Dear Ms. Kray:

By letter dated September 25, 2003, Exelon Generation Company, LLC (Exelon) submitted its application for an early site permit (ESP) for the Clinton ESP site.

The Nuclear Regulatory Commission (NRC) staff is performing a detailed review of the Site Safety Analysis Report (SSAR) in your ESP application to ensure that the information is sufficiently complete to enable the NRC staff to reach a final conclusion on all safety questions associated with the site before the ESP is issued. The NRC staff has determined that additional information is necessary to continue the review. The topic covered in the request for additional information (RAI) contained in Enclosure 1 is quality assurance. These RAIs were sent to you via electronic mail (e-mail) on June 11 and July 19, 2004.

Receipt of requested information within 75 days of the date of this letter will support the NRC's efficient and timely review of Exelon's ESP application. Please note that failure to provide a response in a timely fashion may result in a delay of completion of the staff's safety evaluation report. If you have any questions or comments concerning this matter, you may contact me at (301) 415-1180 or nvg@nrc.gov.

Sincerely,

/RA/

Nanette V. Gilles, Exelon ESP Project Manager
New Reactors Section
New, Research and Test Reactors Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No. 52-007

Enclosure: As stated

cc: See next page

July 26, 2004

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Vice President, Project Development
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Kennett Square, PA 19348

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New Reactors Section
New, Research and Test Reactors Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket No. 52-007

Enclosure: As stated

cc: See next page

DOCUMENT NAME: C:\ORPCheckout\FileNET\ML042440523.wpd
ACCESSION NO. ML042020371

OFFICE	RNRP/PM	IPSB/SC	OGC	RNRP/SC
NAME	NGilles	DThatcher	AHodgdon	LDudes
DATE	07/20/04	07/21/04	07/23/04	07/23/04

Exelon Early Site Permit (ESP) Application
Site Safety Analysis Report (SSAR)
Quality Assurance
Requests for Additional Information (RAI)

ESP Quality Assurance

RAI 17.1.1-2

Please describe the quality assurance (QA) measures used to authenticate and verify data retrieved from internet websites that supports information in the SSAR that would affect the design, construction, or operation of structures, systems, and components important to safety.

RAI 17.1.1-3

a) Section 8 of Exelon Generation Company's (EGC's) document AP-AA-1000, "Early Site Permit Project Quality Assurance Instructions," Revision 0, and Section 2.8 of CH2M HILL's "Project Quality Plan for Exelon Early Site Permit," Revision 4, state that the safety-related scope of the development of the ESP application would not involve the use of QA measures for identification and control of materials, parts, or components. Please describe why these QA measures were not applicable to the development of the ESP application. Alternatively, if these QA measures were applicable to the ESP application, please describe the QA measures used by EGC and the primary contractor (CH2M HILL) for these activities.

b) Section 9 of EGC's document AP-AA-1000, "Early Site Permit Project Quality Assurance Instructions," Revision 0, and Section 2.9 of CH2M HILL's "Project Quality Plan for Exelon Early Site Permit," Revision 4, state that the safety-related scope of the development of the ESP application would not involve the use of QA measures for control of special processes. Please describe why these QA measures were not applicable to the development of the ESP application. Alternatively, if these QA measures were applicable to the ESP application, please describe the QA measures used by EGC and the primary contractor (CH2M HILL) for these activities.

c) Section 10 of EGC's document AP-AA-1000, "Early Site Permit Project Quality Assurance Instructions," Revision 0, and Section 2.10 of CH2M HILL's "Project Quality Plan for Exelon Early Site Permit," Revision 4, state that the safety-related scope of the development of the ESP application would not involve the use of QA measures for inspection. Please describe why these QA measures were not applicable to the development of the ESP application. Alternatively, if these QA measures were applicable to the ESP application, please describe the QA measures used by EGC and the primary contractor (CH2M HILL) for these activities.

d) Section 14 of EGC's document AP-AA-1000, "Early Site Permit Project Quality Assurance Instructions," Revision 0, and Section 2.14 of CH2M HILL's "Project Quality Plan for Exelon Early Site Permit," Revision 4, state that the safety-related scope of the development of the ESP application would not involve the use of QA measures for inspection, test, and operating status. Please describe why these QA measures were not applicable to the development of the ESP application. Alternatively, if these QA measures were applicable to the ESP application, please describe the QA measures used by EGC and the primary contractor (CH2M HILL) for these activities.

e) Section 15 of EGC’s document AP-AA-1000, “Early Site Permit Project Quality Assurance Instructions,” Revision 0, and Section 2.15 of CH2M HILL’s “Project Quality Plan for Exelon Early Site Permit,” Revision 4, state that the safety-related scope of the development of the ESP application would not involve the use of QA measures for nonconforming materials parts, or components. Please describe why these QA measures were not applicable to the development of the ESP application. Alternatively, if these QA measures were applicable to the ESP application, please describe the QA measures used by EGC and the primary contractor (CH2M HILL) for these activities.

RAI 17.1.1-4

Please provide copies of the following documents that were reviewed during the NRC’s special team inspection that was conducted from January 12-16, 2004, to review aspects of applicant and contractor quality control activities involved with the preparation of the application for the Clinton ESP:

a.) AP-AA-1000, “Early Site Permit Project Quality Assurance Instructions,” Revision 0

b.) DEL-012-4, “Project Quality Plan for Exelon Early Site Permit,” Revision 4, dated December 10, 2002

RAI 17.1.1-5

A special team inspection was conducted from January 12-16, 2004, to review aspects of applicant and contractor quality control activities involved with the preparation of the application for the Exelon ESP. The team identified an open item regarding an issue which was not addressed during the inspection. The open item involves the applicability of 10 CFR Part 21, “Report of Defects and Noncompliance,” to the Exelon ESP project. Please describe the actions taken to ensure the Exelon ESP project complies with Part 21. Refer to the NRC letter sent to Nuclear Energy Institute (NEI) and to all of the other ESP applicants dated June 22, 2004 (Accession No. ML040430041), on the subject “Applicability of 10 CFR Part 21” for further information.

Distribution for Request For Additional Information Letter No. 9 dated July 26, 2004

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