UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

April 9, 2014

Mr. Michael J. Pacilio
Senior Vice President
Exelon Generation Company, LLC
President and Chief Nuclear Officer
Exelon Generation Company, LLC
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: DRESDEN NUCLEAR POWER STATION, UNITS 2 AND 3 - REQUEST FOR ADDITIONAL INFORMATION REGARDING FUKUSHIMA LESSONS LEARNED – FLOOD HAZARD REEVALUATION REPORT (TAC NOS. MF1795 AND MF1796)

Dear Mr. Pacilio:

By letter dated March 12, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12053A340), the U.S. Nuclear Regulatory Commission (NRC) issued a request for information pursuant to Title 10 of the *Code of Federal Regulations*, Part 50, Section 50.54(f) (50.54(f) letter). The 50.54(f) letter was issued as a part of implementing lessons-learned from the accident at the Fukushima Dai-ichi nuclear power plant. Enclosure 2, "Recommendation 2.1: Flooding," of the 50.54(f) letter requested, in part, licensees perform a flood hazard reevaluation using present-day methodologies and guidance.

By letter dated May 10, 2013 (ADAMS Accession No. ML13135A120), Exelon Generation Company, LLC submitted a flood hazard reevaluation report and a local intense precipitation evaluation report for Dresden Nuclear Power Station, Units 2 and 3, in response to the request in Enclosure 2 of the 50.54(f) letter. The NRC staff is reviewing the submittal and has determined that additional information is needed to complete its review.

A response to the enclosed request for additional information is requested by May 19, 2014. This request was discussed with Mr. David Distell of your staff on February 5, 2014.

Should you have any questions, please contact me at 301-415-1380.

Sincerely,

Blake Purnell, Project Manager
Plant Licensing Branch III-2 and Planning
and Analysis Branch
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-237 and 50-249

Enclosure:
Request for Additional Information

cc w/encl: Listserv

REQUEST FOR ADDITIONAL INFORMATION

FUKUSHIMA LESSONS-LEARNED

FLOOD HAZARD REEVALUATION REPORT

DRESDEN NUCLEAR POWER STATION, UNITS 2 AND 3

DOCKET NOS. 50-237 AND 50-249

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By letter dated May 10, 2013 (ADAMS Accession No. ML13135A120), Exelon Generation Company, LLC (the licensee) submitted a flood hazard reevaluation report (FHRR) and a local intense precipitation evaluation report for Dresden Nuclear Power Station, Units 2 and 3, in response to the request in Enclosure 2 of the 50.54(f) letter. The NRC staff is reviewing the submittal and has determined that additional information is needed to complete its review.

RAI 1: Site Information

Background: The FHRR states that the maximum peak stillwater elevation during the probable maximum flood (PMF) is 525 feet (ft) mean sea level (MSL, National Geodetic Vertical Datum of 1929 (NGVD 29)) at the site based on the current licensing basis (CLB). However, the local intense precipitation evaluation report states that the maximum peak stillwater elevation during the PMF is 524.5 ft MSL at the site based on the 1982 Systematic Evaluation Program.

Request: Clarify which stillwater elevation is the CLB flooding height and, if necessary, revise Table 5 of the FHRR.

RAI 2: Local Intense Precipitation and Associated Drainage

Background: The most conservative case (Case 3 of NRC NUREG/CR-7046, "Design-Basis Flood Estimation for Site Characterization at Nuclear Power Plants in the United States of America," November 2011 (ADAMS Accession No. ML11321A195), in which all drainage is non-functioning is modeled with significant site drainage occurring via the cooling water canals. The canals which are integral to the site drainage appear to be unobstructed which does not conform to Case 3. In addition, the analysis uses the 1-square-mile probable maximum precipitation (PMP) with no discussion of PMP impacts on areas directly adjacent to the 29-acre site, such as potential offsite runoff and debris flows into the canal.

Enclosure

Request: Describe the potential effect of debris and additional flow from offsite on the cooling water canal boundary conditions during the design event to support the assumptions of the most conservative scenario.

RAI 3: Local Intense Precipitation and Associated Drainage

Background: The FHRR does not describe the calibration and sensitivity analysis for the FLO-2D two-dimensional transient flow computer model.

Request: Describe the effect of the uncertainty in the FLO-2D model regarding sensitivity of water surface elevations to Manning's roughness coefficients (n-values). Provide the input and output files for the FLO-2D model for the local intense precipitation that results in the highest water surface elevations discussed in the FHRR.

RAI 4: Stream and River Flooding

Background: The Alternative 2 PMF flow calculated in the FHRR is approximately 20 percent less than the PMF peak flow calculated by the hydrologic model (HEC-1) in the CLB. More significantly, the Alternative 1 PMF flow of 318,000 cubic feet per second (cfs) for the all-season PMP is approximately 35 percent less than CLB all-season PMP flow. In Table 5 of the FHRR, the licensee listed comparisons between two hydrologic computer models, the FHRR HEC-HMS (Hydrologic Modeling System) and the CLB HEC-1 Flood Hydrograph Package, that show significantly increased levels of imperviousness and slight reductions in drainage area.

Request: Describe in detail the decrease in peak flow in light of increasing impervious area and slight reduction in basin area including relevant HEC-1 parameters and HEC-1 output from the CLB.

RAI 5: Stream and River Flooding

Background: For the calibration of HEC-RAS (River Analysis System) computer model, there are possibly multiple sets of input values for pool inflow and gate operation that could achieve the same water surface elevation at the dam pool.

Request: Describe the effect of pool inflow and gate operation uncertainty on the HEC-RAS model results.

RAI 6: Failure of Dams and Water Control Structures

Background: On the basis of results from the HEC-HMS model, the scenarios of the critical storm centers CMSC17, DPSC5, and DPSC2 with front temporal distribution (no antecedent storm) have faster arrival times down to 9.5 hours to reach the 509 ft NGVD elevation. These scenarios could logically represent the possible shortest flood arrival time (fastest flood response time per FHRR) in the coincident dam failures scenarios.

Request: Provide an evaluation of those scenarios that show the shortest arrival time in the following analyses (e.g., DRE12-0018): (1) Alternative 2 with critical storm center CMSC09, front temporal distribution and no antecedent storm, and (2) Alternative 2 with critical storm center CMSC17 front temporal distribution and no antecedent storm with coincident dam failure. Describe the process used for determining shortest arrival times and how it impacts the level of conservatism. In addition, provide a table comparing results which includes assumptions about spatial distribution/storm center, antecedent conditions, and temporal distribution for each of the alternatives.

RAI 7: Failure of Dams and Water Control Structures

Background: The FHRR does not discuss calibration or sensitivity analyses with respect to the two dimensional hydraulic computer models RiverFlo-2D and FLO-2D. Parameters are different in those models from those used in the calibrated HEC-RAS model, most notably a reduction in Manning's n-values.

Request: Describe the sensitivity of water surface elevations to Manning's n-values in the RiverFlo-2D and FLO-2D models.

RAI 8: Failure of Dams and Water Control Structures

Background: The PMF coincident with dam failure may result in transport of sediments and debris carried by flood water. The FHRR does not discuss the effect of transport of sediment near the Dresden Nuclear Power Station site during the PMF and dam failure events.

Request: Describe the evaluation of transport of sediment near the site, including potential changes in water surface elevation and velocity at various structures at the site due to sediment transport.

RAI 9: Failure of Dams and Water Control Structures/Stream and River Flooding

Background: The licensee modeled numerous flooding scenarios to determine several flood causing mechanisms that would trigger an integrated assessment. Detailed flooding characteristics are needed to evaluate the minimum warning times that would cover the range of flooding scenarios for each flood causing mechanism for use in the integrated assessment.

Request: Identify the conservative flooding scenarios from both the flooding in streams and rivers mechanism and the dam breaches and failures mechanism analyzed to determine the following criteria:

- Fastest arrival time to reach the critical water surface elevations 509 ft NGVD 29 from the beginning of the flooding event;
- Fastest arrival time to reach the critical water surface elevations 517 ft NGVD 29 from the beginning of the flooding event; and
- Highest water surface elevation at the site.

For all six scenarios, provide the input and output files for the computer models HMR-52 (National Weather Service's Hydrometerological Report 52), HEC-HMS and HEC-RAS. Provide the input and output files for FLO-2D model for the riverine flooding with dam failure and concurrent two-year wind event scenario. Identify and describe the fastest arrival time to reach the critical water surface elevations 509 ft NGVD 29 and peak water surface elevation subsequent to the seismic event that triggers dam failure without the addition of the one-half PMF.

RAI 10: Channel Migrations or Diversions

Background: The FHRR states that control structures and flows that might play a role in channel migration are outside of the licensee's authority and do not describe available information on the risk of channel migrations or diversions.

Request: Describe in detail the available morphological information, such as historical topographic maps and information on erosive quality of channel material (both adjacent rivers and the on-site channels for cooling water), consistent with NRC NUREG/CR-7046.

RAI 11: Hazard Input for the Integrated Assessment – Flood Event Duration Parameters

Background: Enclosure 2 of the 50.54(f) letter requests the licensee to perform an integrated assessment of the plant's response to the reevaluated hazard if the reevaluated flood hazard is not bounded by the current design basis. Flood scenario parameters from the flood hazard reevaluation serve as the input to the integrated assessment. To support efficient and effective evaluations under the integrated assessment, NRC staff will review flood scenario parameters as part of the flood hazard reevaluation and document results of the review as part of the NRC staff assessment of the flood hazard reevaluation.

Request: Provide the applicable flood event duration parameters (see definition and Figure 6 of the NRC interim staff guidance document JLD-ISG-2012-05, "Guidance for Performing an Integrated Assessment," November 2012 (ADAMS Accession No. ML12311A214)), associated with mechanisms that trigger an integrated assessment using the results of the flood hazard reevaluation. This includes (as applicable) the warning time the site will have to prepare for the event (e.g., the time between notification of an impending flood event and arrival of floodwaters on site) and the period of time the site is inundated for the mechanisms that are not bounded by the current design basis. The licensee is also requested to provide the basis or source of information for the flood event duration, which may include a description of relevant forecasting methods (e.g., products from local, regional, or national weather forecasting centers) and/or timing information derived from the hazard analysis.

RAI 12: Hazard Input for the Integrated Assessment – Flood Height and Associated Effects

Background: Enclosure 2 of the 50.54(f) letter requests the licensee to perform an integrated assessment of the plant's response to the reevaluated hazard if the flood hazard is not bounded by the current design basis. Flood scenario parameters from the flood hazard reevaluation serve as the input to the integrated assessment. To support efficient and effective evaluations under the integrated assessment, NRC staff will review flood scenario parameters as part of the flood hazard reevaluation and document results of the review as part of the staff assessment of the flood hazard reevaluation.

Request: Provide the flood height and associated effects (as defined in Section 9 of JLD-ISG-2012-05) that are not described in the flood hazard reevaluation report for mechanisms that trigger an integrated assessment. This includes the following quantified information for each mechanism (as applicable):

- Hydrodynamic loading, including debris;
- Effects caused by sediment deposition and erosion (e.g., flow velocities, scour); and
- Concurrent site conditions, including adverse weather;
- Groundwater ingress.

Should you have any questions, please contact me at 301-415-1380.

Sincerely,

/ RA /

Blake Purnell, Project Manager
Plant Licensing Branch III-2 and Planning
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