



Exelon Generation®

10 CFR 50.54(f)

RS-14-052

March 12, 2014

U.S. Nuclear Regulatory Commission  
ATTN: Document Control Desk  
Washington, DC 20555

Braidwood Station, Units 1 and 2  
Facility Operating License Nos. NPF-72 and NPF-77  
NRC Docket Nos. STN 50-456 and 50-457

**Subject:** Exelon Generation Company, LLC Response to March 12, 2012, Request for Information Enclosure 2, Recommendation 2.1, Flooding, Required Response 2, Flood Hazard Reevaluation Report

**References:**

1. NRC Letter, Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3, of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident; dated March 12, 2012.
2. NRC Letter, Prioritization of Response Due Dates for Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Flooding Hazard Reevaluations for Recommendations 2.1 of the Near-Term Task Force Review of Insights From the Fukushima Dai-ichi Accident, dated May 11, 2012.
3. U.S. Nuclear Regulatory Commission, NUREG/CR-7046, "Design-Basis Flood Estimation for Site Characterization at Nuclear Power Plants in the United States of America", dated November 2011.
4. Letter from David L. Skeen, U.S. Nuclear Regulatory Commission, to Joseph E. Pollock, Nuclear Energy Institute – "Trigger Conditions for Performing an Integrated Assessment and Due Date for Response", dated December 3, 2012.
5. U.S. Nuclear Regulatory Commission, JLD-ISG-2012-05, "Guidance for Performing the Integrated Assessment for External Flooding", dated November 30, 2012.
6. Letter from Exelon Generation Company, LLC to U.S. Nuclear Regulatory Commission, "180-day Response to NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding the Flooding Aspects of Recommendation 2.3 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident," dated November 27, 2012 (RS-12-160).

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On March 12, 2012, the NRC issued Reference 1 to request information associated with Near-Term Task Force (NTTF) Recommendation 2.1 for Flooding. One of the Required Responses in this letter directed licensees to submit a Flood Hazard Reevaluation Report, including the interim action plan requested in Item 1.d of Reference 1, Enclosure 2, if appropriate. On May 11, 2012, the NRC issued the prioritization plan developed by the NRC and resultant Flood Hazard Reevaluation due dates for all sites. Reference 2, Enclosure 1 identified Braidwood Station, Units 1 and 2, as a Category 2 Site requiring a Flood Hazard Reevaluation Report submittal due date of March 12, 2014. The information in the enclosed provides Braidwood Station, Units 1 and 2, Flood Hazard Reevaluation Report. The Braidwood Station, Units 1 and 2, Flood Hazard Reevaluation Report follows the reevaluation process described in Reference 3.

Information Requested in Reference 1, Enclosure 2

***a. Site information related to the flood hazard. Relevant SSCs important to safety and the UHS are included in the scope of this reevaluation, and pertinent data concerning these SSCs should be included. Other relevant site data includes the following:***

***i. Detailed site information (both designed and as-built), including present-day site layout, elevation of pertinent SSCs important to safety, site topography, as well as pertinent spatial and temporal data sets;***

Response:

- Site layout and topography – See Section 2.1 and Figures 2.1.1 and 2.1.2 of Enclosure 1.
- Pertinent Site Data is provided in Enclosure 3.

***ii. Current design basis flood elevations for all flood causing mechanisms;***

Response:

- See Section 2.2 of Enclosure 1, which describes the current design basis flood hazards for all flood causing mechanisms.

***iii. Flood-related changes to the licensing basis and any flood protection changes (including mitigation) since license issuance;***

Response:

- See Section 2.3 of Enclosure 1 for a description of flood-related changes to the licensing basis and any flood protection changes (including mitigation) since license issuance.

***iv. Changes to the watershed and local area since license issuance;***

Response:

- See Section 2.4 of Enclosure 1 for a description of changes to the watershed and local area since license issuance.

**v. *Current licensing basis flood protection and pertinent flood mitigation features at the site;***

Response:

- See Section 2.5 of Enclosure 1 for a description of Current Licensing Basis (CLB) flood protection and pertinent flood mitigation features at the site.

**vi. *Additional site details, as necessary, to assess the flood hazard (i.e., bathymetry, walkdown results, etc.)***

Response:

- See Reference 6 for results of the flooding walkdowns.
- See Section 3 of Enclosure 1 for additional site and watershed information used to assess the flood hazard.

**b. *Evaluation of the flood hazard for each flood causing mechanism, based on present-day methodologies and regulatory guidance. Provide an analysis of each flood causing mechanism that may impact the site including local intense precipitation and site drainage, flooding in streams and rivers, dam breaches and failures, storm surge and seiche, tsunami, channel migration or diversion, and combined effects. Mechanisms that are not applicable at the site may be screened-out; however, a justification should be provided. Provide a basis for inputs and assumptions, methodologies and models used including input and output files, and other pertinent data.***

Response:

A description of the flood hazard reevaluation for each flood causing mechanism and the basis for inputs, assumptions, methodologies, and models are referenced below. Per NRC/NEI public meeting dated January 16, 2013, input-output files are not included with this submittal package but are available upon request.

- Local Intense Precipitation (LIP) and Site Drainage: See Section 3.1 of Enclosure 1.
- Flooding in Streams and Rivers (including Cooling Pond): See Sections 3.2 and 3.3 of Enclosure 1.
- Dam Breaches and Failures: See Section 3.5 of Enclosure 1.
- Storm Surge: See Section 3.4 of Enclosure 1.

- Seiche: See Section 3.4 of Enclosure 1.
- Tsunami: See Section 3.9 of Enclosure 1.
- Ice-Induced Flooding: See Section 3.7 of Enclosure 1.
- Channel Migration or Diversion: See Section 3.8 of Enclosure 1.
- Combined Effects (including wind-waves and runup effects): See Section 3.6 of Enclosure 1.
- Other Associated Effects (i.e. hydrodynamic loading, including debris; effects caused by sediment deposition and erosion; concurrent site conditions; and groundwater ingress) are addressed in the respective flood-causing mechanism sections and Section 4 of Enclosure 1.
- Flood Event Duration Parameters (i.e. warning time, period of site preparation, period of inundation, and period of recession) are addressed in the respective flood-causing mechanism sections and Section 4 of Enclosure 1.
- Error/Uncertainty analysis for the governing flood scenarios is addressed in Section 3.10 of Enclosure 1.

**c. Comparison of current and reevaluated flood causing mechanisms at the site. Provide an assessment of the current design basis flood elevation to the reevaluated flood elevation for each flood causing mechanism. Include how the findings from Enclosure 4 of the 50.54(f) letter (i.e., Recommendation 2.3 flooding walkdowns) support this determination. If the current design basis flood bounds the reevaluated hazard for all flood causing mechanisms, include how this finding was determined.**

Response:

The current design basis flood does not bound the reevaluated hazard for all applicable flood-causing mechanisms, combined-effect floods, associated effects, and/or flood event duration parameters. A complete comparison of current design basis and reevaluated flood hazards is provided in Section 4 of Enclosure 1. The summary below describes how this finding was determined for the applicable flood hazards. Kankakee River and Granary Creek flooding, tsunami, ice-induced flooding, channel migration or diversion, and seiche flood-causing mechanisms and combined-effect flood H.2 (from Reference 3) for the Mazon River and Cooling Pond were either determined to be implausible or completely bounded by other mechanisms. Some individual flood-causing mechanisms (i.e. flooding in streams and rivers, dam breaches and failures, and surge) are addressed in one or more of the combined-effect floods.

1. Local Intense Precipitation (LIP)

The maximum reevaluated flood elevation (601.67 feet Mean Sea Level (MSL)) is bounded by the design basis flood elevation (601.85 feet MSL). The associated

effects are also bounded or not applicable, as described in Section 4 of Enclosure 1. Flood event duration parameters are not applicable to the LIP flood since manual actions are not credited in the Current Licensing Basis (CLB) with providing protection.

2. Combined-Effect Flood in Section H.1, Reference 3, Floods Caused by Precipitation Events (including hydrologic dam failure) for the Mazon River

The three alternative precipitation-event combinations specified in Section H.1 of Reference 3, plus hydrologically-induced upstream dam failure, were evaluated for the Mazon River watershed. The maximum reevaluated stillwater elevation (594.25 feet MSL) for the prevailing alternative (Alternative 1) is not bounded by the design basis stillwater elevation (582.0 feet MSL). Similarly, the maximum reevaluated wind-wave runup elevation (596.51 feet MSL) is not bounded by the design basis wind-wave runup elevation (584.0 feet MSL). Note that the nominal plant grade elevation is 600.0 feet MSL.

The other associated effects are either bounded or not applicable, as described in Section 4 of Enclosure 1. Flood event duration parameters are not applicable to this combined-effect flood since manual actions are not credited in the CLB with providing protection to SSCs important to safety at the reevaluated flood levels.

3. Combined-Effect Flood in Section H.1, Reference 3, Floods Caused by Precipitation Events for the Cooling Pond

The three alternative precipitation-event combinations specified in Section H.1 of Reference 3 were evaluated for the cooling pond watershed. The maximum reevaluated stillwater elevation (599.36 feet MSL) for the prevailing alternative (Alternative 1) is not bounded by the design basis stillwater elevation (598.17 feet MSL). However, the maximum reevaluated wind-wave runup elevation (601.42 feet MSL) is bounded by the design basis wind-wave runup elevation (602.34 feet MSL). Note that the nominal plant grade elevation is 600.0 feet MSL and the top of the cooling pond dike is elevation 602.5 feet MSL.

The other associated effects are either bounded or not applicable, as described in Section 4 of Enclosure 1. Flood event duration parameters are not applicable to this combined-effect flood since manual actions are not credited in the CLB with providing protection to SSCs important to safety at the reevaluated flood levels.

4. Combined-Effect Flood in Section H.4.1, Reference 3, Floods along the Shores of Enclosed Bodies of Water, Shore Location, for the Cooling Pond

Section H.4.1, Reference 3, represents a combination for floods along enclosed bodies of water at a shore location that includes the probable maximum surge with wind-wave activity and the lesser of the 100-year or the maximum controlled water level in the enclosed body of water. This combined-effect flood only applies to the cooling pond. The maximum reevaluated stillwater elevation for this alternative (597.68 feet MSL) is bounded by the design basis stillwater elevation (598.17 feet

MSL). Similarly, the maximum reevaluated wind-wave runup elevation (602.15 feet MSL) is bounded by the design basis wind-wave runup elevation (602.34 feet MSL). Note that the design basis did not include a surge flood-causing mechanism. Therefore, this comparison is made to the precipitation-wave design basis combination.

The other associated effects are either bounded or not applicable, as described in Section 4 of Enclosure 1. Flood event duration parameters are not applicable to this combined-effect flood since manual actions are not credited in the CLB with providing protection to SSCs important to safety at the reevaluated flood levels.

***d. Interim evaluation and actions taken or planned to address any higher flooding hazards relative to the design basis, prior to completion of the integrated assessment described below, if necessary.***

Response:

Per Enclosure 2 of Reference 1, an Integrated Assessment is required for plants where the current design basis floods do not bound the reevaluated hazard for all flood causing mechanisms. Reference 4 presents four approaches for performing an Integrated Assessment based on the results of the flood hazard reevaluation.

- Scenario 1 - Reevaluated Hazard Bounded by Design Basis
- Scenario 2 - Only Local Intense Precipitation
- Scenario 3 - All Permanent and Passive Flood Protection
- Scenario 4 - Integrated Assessment Required

An Integrated Assessment is not necessary in Scenario 1. Limited evaluations can be conducted and submitted with the Flood Hazard Reevaluation Report under Scenarios 2 and 3 that only address specific sections of the Integrated Assessment Interim Staff Guidance (Reference 5). Licensees in Scenario 4 and those not including limited evaluations in the Flood Hazard Reevaluation Report under Scenarios 2 and 3 are required to perform a full Integrated Assessment.

Per "Part c" above, the current design basis flood does not bound the reevaluated hazard for the combined-effect flood specified in Section H.1, Reference 3 (Floods Caused by Precipitation Events), for the Mazon River and Cooling Pond. However, all permanent and passive flood features are used to protect the plant from flooding. Therefore, Scenario 3 (above) applies. Reference 4 states (regarding Scenario 3):

*If all flood protection is permanently installed and passive, as defined in the integrated assessment ISG, a licensee may show that the existing protection is reliable and has margin under the reevaluated hazard. This evaluation should be performed using Section 6 of the integrated assessment ISG, including appropriate considerations described in Appendix A to the integrated assessment ISG and present-day codes and standards. The results of this evaluation should be submitted with the hazard report. If the results of the evaluation do not show that the flood protection is reliable and has*

*margin, a full integrated assessment is necessary, and should be submitted within 2 years of submitting the hazard report.*

Braidwood Station opted to include an integrated assessment with this submittal based on a limited evaluation of existing permanent/passive flood protection features, credited in the CLB, for the non-bounding combined-effect floods. Following guidance in Section 6 and Appendix A of Reference 5, the integrated assessment (Enclosure 2) demonstrates that the current permanent and passive protection features provide adequate reliability and margin when subjected to the reevaluated flood hazard.

Interim Actions

No interim actions are required since the limited evaluation, discussed above, demonstrates that the current permanent and passive protection features provide adequate reliability and margin when subjected to the reevaluated flood hazard.

***e. Additional actions beyond Requested Information item 1.d taken or planned to address flooding hazards, if any.***

Response:

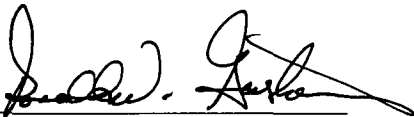
- None required.

This letter contains no new regulatory commitments and no revision to existing regulatory commitments.

If you have any questions regarding this submittal, please contact Ron Gaston at (630) 657-3359.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 12<sup>th</sup> day of March 2014.

Respectfully submitted,



Ronald W. Gaston  
Manager - Licensing & Regulatory Affairs  
Exelon Generation Company, LLC

Enclosures:

1. Braidwood Generating Station, Flood Hazard Reevaluation Report, Revision 0
2. Braidwood Generating Station, Units 1 and 2, Limited Integrated Assessment for External Flooding Report, Revision 0
3. CD-R labeled: "Braidwood Generating Station, Pertinent Site Data"

**Document Components:**

Braidwood (requires AutoCAD or similar program)

Illinois Clearinghouse Data (requires AutoCAD or similar program)

cc: Director, Office of Nuclear Reactor Regulation (w/o Enclosure 3)  
Regional Administrator – NRC Region III (w/o Enclosure 3)  
NRC Senior Resident Inspector – Braidwood Station  
NRC Project Manager, NRR – Braidwood Station  
Mr. G. Edward Miller, NRR/DORL/LPL2-1, NRC  
Illinois Emergency Management Agency - Division of Nuclear Safety (w/o Enclosure 3)