



Order No. EA-12-049

RS-16-055

March 24, 2016

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

Clinton Power Station, Unit 1  
Facility Operating License No. NPF-62  
NRC Docket No. 50-461

**Subject:** Mitigating Strategies Flood Hazard Assessment (MSFHA) Submittal

**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. Exelon Generation Company, LLC Letter to USNRC, Response to March 12, 2012 Request for Information Enclosure 2, Recommendation 2.1, Flooding, Required Response 2, Flooding Hazard Reevaluation Report, dated March 12, 2014 (RS-14-054)
3. Exelon Generation Company, LLC Letter to USNRC, Response to Request for Additional Information Regarding Fukushima Lessons Learned – Flood Hazard Reevaluation Report, dated July 14, 2014 (RS-14-194)
4. Exelon Generation Company, LLC Letter to USNRC, Response to Request for Additional Information Regarding Fukushima Lessons Learned – Flood Hazard Reevaluation Report, dated November 3, 2014 (RS-14-312)
5. Exelon Generation Company, LLC Letter to USNRC, Response to Request for Additional Information Regarding Fukushima Lessons Learned – Flood Hazard Reevaluation Report, dated May 5, 2015 (RS-15-110)
6. NRC Letter, Supplemental Information Related to Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) regarding Flooding Hazard Reevaluations for Recommendation 2.1 of the Near Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, dated March 1, 2013
7. NRC Staff Requirements Memoranda to COMSECY-14-0037, "Integration of Mitigating Strategies for Beyond-Design-Basis External Events and the Reevaluation of Flooding Hazards", dated March 30, 2015

8. NRC Letter, Coordination of Requests for Information Regarding Flooding Hazard Reevaluations and Mitigating Strategies for Beyond-Design-Basis External Events, dated September 1, 2015
9. Nuclear Energy Institute (NEI), Report NEI 12-06 [Rev 2], Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, dated December 2015
10. U.S. Nuclear Regulatory Commission, JLD-ISG-2012-01, Revision 1, Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigating Strategies for Beyond-Design-Basis External Events, dated January 22, 2016
11. NRC Letter, Clinton Power Station, Unit No. 1 – Interim Staff Response to Reevaluated Flood Hazards Submitted in Response to 10 CFR 50.54(f) Information Request – Flood-Causing Mechanism Reevaluation (TAC NO. MF3654), dated September 3, 2015
12. NRC Letter, Clinton Power Station, Unit No. 1 – Correction to Staff Assessment of Response to Request for Information Pursuant to 10 CFR 50.54(f) – Flood-Causing Mechanisms Reevaluation (TAC NO. MF3654), dated November 18, 2015
13. Clinton Power Station, Unit 1, Report of Full Compliance with March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049), dated July 15, 2015 (RS-15-138)

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 Reference 1 directed licensees to submit a Flood Hazard Reevaluation Report (FHRR). For Clinton Power Station (CPS), Unit 1, the FHRR was submitted on March 12, 2014 (Reference 2). Additional information was provided with References 3, 4, and 5. Per Reference 6, the NRC considers the reevaluated flood hazard to be “beyond the current design/licensing basis of operating plants”.

Concurrent to the flood hazard reevaluation, CPS developed and implemented mitigating strategies in accordance with NRC Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events". In Reference 7, the NRC affirmed that licensees need to address the reevaluated flooding hazards within their mitigating strategies for beyond-design-basis (BDB) external events, including the reevaluated flood hazards. This requirement was confirmed by the NRC in Reference 8. Guidance for performing mitigating strategies flood hazard assessments (MSFHAs) is contained in Appendix G of Reference 9, endorsed by the NRC in Reference 10. For the purpose of the MSFHAs and in Reference 8, the NRC termed the reevaluated flood hazard, summarized in References 11 and 12, as the “Mitigating Strategies Flood Hazard Information” (MSFHI). Reference 9, Appendix G, describes the MSFHA for flooding as containing the following elements:

- Section G.2 – Characterization of the MSFHI
- Section G.3 – Comparison of the MSFHI and FLEX DB Flood
- Section G.4.1 – Assessment of Current FLEX Strategies (if necessary)
- Section G.4.2 – Assessment for Modifying FLEX Strategies (if necessary)
- Section G.4.3 – Assessment of Alternative Mitigating Strategies (if necessary)
- Section G.4.4 – Assessment of Targeted Hazard Mitigating Strategies (if necessary)

If G.3 determines that the MSFHI is bounded by the FLEX DB Flood, then no further action is needed and remaining sections (G.4.1 through G.4.4) are not necessary.

The following provides the MSFHA results for the CPS.

#### Reference 9, Section G.2 – Characterization of the MSFHI

Characterization of the Mitigating Strategies Flood Hazard Information (MSFHI) is summarized in References 11 and 12; the NRC's responses to the flood hazard reevaluation submittal provided in Reference 2 and additional information submittals in References 3, 4, and 5. A more detailed description of the reevaluated flood hazard (i.e., MSFHI), along with the basis for inputs, assumptions, methodologies, and models, is provided in the following references:

- Local Intense Precipitation (LIP): See Section 3.1 of Reference 2, Enclosure 1.
- Flooding in Streams and Rivers: See Section 3.2 of Reference 2, Enclosure 1.
- Dam Breaches and Failures: See Section 3.4 of Reference 2, Enclosure 1.
- Storm Surge: See Section 3.3 of Reference 2, Enclosure 1.
- Seiche: See Section 3.3 of Reference 2, Enclosure 1.
- Tsunami: See Section 3.8 of Reference 2, Enclosure 1.
- Ice-Induced Flooding: See Section 3.6 of Reference 2, Enclosure 1.
- Channel Migration or Diversion: See Section 3.7 of Reference 2, Enclosure 1.
- Combined Effects (including wind-waves and runup effects): See Section 3.5 of Reference 2, Enclosure 1.
- Other Associated Effects (i.e. hydrodynamic loading, including debris; effects caused by sediment deposition and erosion; concurrent site conditions; and groundwater ingress): See Sections 3.10 and 4 of Reference 2, Enclosure 1.
- Flood Event Duration Parameters (i.e. warning time, period of site preparation, period of inundation, and period of recession): See Sections 3.10 and 4 of Reference 2, Enclosure 1.

At CPS, the seiche, tsunami, ice-induced flooding, channel migration or diversion, and NUREG/CR-7046, Appendix H combined-effect floods H.2 (seismically-induced dam failure) and H.4.1 (floods along the shores of enclosed bodies of water, shore location) flood-causing mechanisms were either determined to be not applicable 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. Only Local Intense Precipitation (LIP) and the NUREG/CR-7046, Appendix H, H.1 combined-effect flood (floods caused by precipitation events, including hydrologic dam failure) and H.4.2 (flooding along shores of enclosed bodies of water, stream location) for Lake Clinton were determined to be applicable flood-causing mechanisms at CPS.

In Reference 11, the NRC concluded that the “reevaluated flood hazards information, as summarized in the Enclosure [Summary Table of the Reevaluated Flood Hazard Levels], is suitable for the assessment of mitigating strategies developed in response to Order EA-12-049” for CPS. This conclusion is reaffirmed in Reference 12.

Reference 9, Section G.3 – Basis for Mitigating Strategies Assessment (FLEX Design Basis Comparison)

For CPS the FLEX design basis (FLEX DB) flood, described in Reference 13, is equivalent to the plant’s current design basis (CDB) flood. A complete comparison of the CDB and reevaluated flood hazards is provided in Section 4 of Reference 2, Enclosure 1. As described in Reference 2, the CDB and, by relationship, FLEX DB floods bound the reevaluated flood (i.e. MSFHI) for all applicable flood-causing mechanisms, including associated effects and flood event duration parameters.

The NRC further affirms in References 11 and 12 that the reevaluated flood hazard mechanisms are bounded by the CDB and it is unnecessary for CPS to perform an integrated assessment or focused evaluation.

Therefore, since the MSFHI is bounded by the FLEX DB (equivalent to the CDB), as affirmed by the NRC, CPS considers the requirement to address the reevaluated flooding hazards within its BDB mitigating strategies as being satisfied with no further action required.

It should be noted that, subsequent to the flood hazard reevaluation being submitted in Reference 2, the model used to develop the LIP flood-causing mechanism was found to incorrectly simulate rain-on-buildings. The issue was entered into the plant’s corrective action program (Issue Report (IR) No. 2406577) and the model was corrected to conservatively assume building runoff is conveyed directly to adjacent grade, ignoring storage on the roofs. The corrections resulted in maximum LIP flood elevations next to the main building in the power block area to generally range from 713.2 feet (NGVD29) at the southeast side of the main building to 737.1 feet (NGVD29) at the northeast and west sides of the main building, which is higher than the corresponding CDB LIP flood elevation. The increases also resulted in the maximum LIP flood exceeding the plant floor elevation of 737.0 feet (NGVD29) at the northeast and west sides of the main building by 0.1 foot, specifically near a roll-up door at the Radwaste Building and an airlock door. An evaluation was conducted in Calculation No. IP-S-0282 to assess the impact of potential LIP floodwater ingress on the plant, which concluded:

- The water depth inside the Radwaste Building, due to LIP flood ingress at the roll-up door, was conservatively calculated to be only approximately 1.1 inches.
- Minimal or no flow is expected through the airlock door, located at the west side of the main building, due to the air tight feature of these type of structures.

Additionally, no safe shutdown SSC’s are located in the Radwaste Building. Therefore, the evaluation concluded that the potential ingress of LIP floodwater, using results from the corrected LIP model, would have no adverse impact on the plant’s safety functions or FLEX equipment.

This letter contains no new regulatory commitments. If you have any questions regarding this report, please contact Ron Gaston at (630) 657-3359.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 24<sup>th</sup> day of March 2016.

Respectfully submitted,

A handwritten signature in black ink that reads "Glen T. Kaegi". The signature is written in a cursive style and is positioned above a horizontal line.

Glen T. Kaegi  
Director - Licensing & Regulatory Affairs  
Exelon Generation Company, LLC

cc: Director, Office of Nuclear Reactor Regulation  
NRC Regional Administrator - Region III  
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