Exelon Generation.

10 CFR 50.54(f)

RS-17-025

March 8, 2017

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

LaSalle County Station, Units 1 and 2
Renewed Facility Operating License Nos. NPF-11 and NPF-18
NRC Docket Nos. 50-373 and 50-374

Subject: Exelon Generation Company, LLC Response to March 12, 2012, Request for Information Enclosure 2, Recommendation 2.1, Flooding, Required Response 3, Flooding Focused Evaluation Summary 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-14-055)

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 May 5, 2015 (RS-15-110)

5. Exelon Generation Company, LLC Letter to USNRC, Response to Request for Additional Information Regarding Fukushima Lessons Learned – Flood Hazard Reevaluation Report, dated October 4, 2016 (RS-16-186)

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 16-05, Revision 1, External Flooding Assessment Guidelines, dated June 2016

10. U.S. Nuclear Regulatory Commission, JLD-ISG-2016-01, Revision 0, Guidance for Activities Related to Near-Term Task Force Recommendation 2.1, Flood Hazard Reevaluation; Focused Evaluation and Integrated Assessment, dated July 11, 2016

11. NRC Letter, LaSalle County Station, Units 1 and 2 – Interim Staff Response to Reevaluated Flood Hazards Submitted in Response to 10 CFR 50.54(f) Information Request – Flood-Causing Mechanism Reevaluation (TAC Nos. MF3655 and MF 3656), dated September 3, 2015

12. NRC Letter, LaSalle County Station, Units 1 and 2 – Staff Assessment of Response to 10 CFR 50.54(f) Information Request – Flood-Causing Mechanism Reevaluation (CAC Nos. MF3655 and MF 3656), dated January 10, 2017

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 LaSalle County Station, Units 1 and 2 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".

Following the Commission's directive to NRC Staff (Reference 7), the NRC issued a letter to industry (Reference 8) indicating that new guidance is being prepared to replace instructions (Reference 7), and provide for a "graded approach to flooding reevaluations" and "more focused evaluations of local intense precipitation and available physical margin in lieu of proceeding to an integrated assessment".

The Nuclear Energy Institute (NEI) prepared NEI 16-05, "External Flooding Assessment Guidelines" (Reference 9). The NRC endorsed NEI 16-05 (Reference 10) and recommended changes, which have been incorporated into NEI 16-05, Revision 1. NEI 16-05 indicates that each flood-causing mechanism not bounded by the Design Basis (DB) flood (using only stillwater and/or wind-wave runup level) should follow one of the following five assessment paths:

- Path 1: Demonstrate Flood Mechanism is Bounded Through Improved Realism

- Path 2: Demonstrate Effective Flood Protection
- Path 3: Demonstrate a Feasible Response to Local Intense Precipitation (LIP)
- Path 4: Demonstrate Effective Mitigation
- Path 5: Scenario Based Approach

Non-bounded flood-causing mechanisms in Paths 1, 2, or 3 would only require a Focused Evaluation to complete the actions related to external flooding required by the March 12, 2012 10 CFR 50.54(f) letter. Mechanisms in Paths 4 or 5 require an Integrated Assessment.

The enclosure to this letter provides the Flooding Focused Evaluation Summary Report for the LaSalle County Station, Units 1 and 2.

The reevaluated flood hazard, summarized by the NRC in References 11 and 12, was utilized as input to this Flooding Focused Evaluation. The Flooding Focused Evaluation reaffirms that LaSalle County Station's SSCs that support Key Safety Functions are effectively protected from the non-bounded reevaluated flood-causing mechanisms (LIP and Storm Surge in the Cooling Lake) with adequate margin. The LaSalle County Station site does not require human actions to protect Key SSCs so an evaluation of the overall site response is not necessary.

The Flooding Focused Evaluation follows Path 2 of NEI 16-05, Revision 1 (Reference 9), and utilized Appendix B for guidance on evaluating the site protection features. This submittal completes the actions related to external flooding required by the March 12, 2012 10 CFR 50.54(f) letter.

This letter contains no new regulatory commitments. If you have any questions regarding this report, please contact David J. Distel at (610) 765-5517.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 8th day of March 2017.

Respectfully submitted,

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

Enclosure: LaSalle County Station, Units 1 and 2, Flooding Focused Evaluation Summary, dated March 10, 2017

cc: Director, Office of Nuclear Reactor Regulation
NRC Regional Administrator - Region III
NRC Senior Resident Inspector – LaSalle County Station
NRC Project Manager, NRR – LaSalle County Station
Ms. Tekia V. Govan, NRR/JLD/JHMB, NRC
Illinois Emergency Management Agency – Division of Nuclear Safety

Enclosure

LaSalle County Station, Units 1 and 2

Flooding Focused Evaluation Summary

dated March 8, 2017

(17 Pages)

LASALLE COUNTY STATION UNITS 1 & 2 FLOODING FOCUSED EVALUATION SUMMARY

MARCH 08, 2017
LETTER # RS-17-025
ENCLOSURE

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LASALLE COUNTY STATION FLOODING FOCUSED EVALUATION SUMMARY

1 EXECUTIVE SUMMARY

The LaSalle County Station (LSCS) has reevaluated its flooding hazard in accordance with the Near-Term Task Force (NTTF) Rec. 2.1 and NRC's 10 CFR 50.54(f) request for information (RFI). The RFI was issued as part of implementing lessons learned from the Fukushima Dai-ichi accident; specifically, to address Recommendation 2.1 of the NRC's Near-Term Task Force report. This information was submitted to NRC in a flood hazard reevaluation report (FHRR) on March 12, 2014 and is provided in the Mitigating Strategies Flood Hazard Assessment (MSFHA) documented in NRC's "Interim Staff Response to Reevaluated Flood Hazards" letter dated October 28, 2016. No changes to the flooding analysis have been performed since the issuance of the MSFHA letter and the flooding analysis will serve as the input to this Focused Evaluation (FE). There are two mechanisms that were found to exceed the plant's design basis (DB) flood at LSCS. These mechanisms are listed below and addressed in this FE:

1. Local Intense Precipitation (LIP); and
2. Storm Surge.

Associated effects (AE) and flood event duration (FED) parameters were assessed and submitted as a part of the March 2014 FHRR and supplemental information submittals, including the October 4, 2016 submittal. The FE concludes that the site's flood strategy is effective in protecting SSCs that support key safety functions (key SSCs), through demonstrating adequate Available Physical Margin (APM) and reliable flood protection features, for LIP and Storm Surge. The site does not require actions by plant personnel to protect key SSCs so an evaluation of the overall site response was not necessary. This FE followed Path 2 of NEI 16-05, Revision 1 and utilized Appendix B for guidance on evaluating the site strategy. This submittal completes the actions related to External Flooding required by the March 12, 2012 10 CFR 50.54(f) letter without the need for the NRC staff to perform Phase 2 decision making per JLD-ISG-2016-01 and NEI 16-05.

2 BACKGROUND

On March 12, 2012, the NRC issued Reference 1 to request information associated with Near-Term Task Force (NTTF) Recommendation 2.1 for flooding. The RFI directed licensees, in part, to submit a Flood Hazard Reevaluation Report (FHRR) to reevaluate the flood hazards for their sites using present-day methods and guidance used for early site permits and combined operating licenses. For LaSalle County Station, Units 1 and 2, the FHRR was submitted on March 12, 2014 (Reference 2).

Following the Commission's directive to NRC Staff in Reference 6, the NRC issued a letter to industry (Reference 7) indicating that new guidance is being prepared to replace instructions in Reference 6 and provide for a "graded approach to flooding reevaluations" and "more focused evaluations of local intense precipitation and available physical margin in lieu of proceeding to an integrated assessment." NEI prepared the new "External Flooding Assessment Guidelines" in NEI 16-05 (Reference 18), which was endorsed by the NRC in Reference 8. NEI 16-05 indicates that each flood-causing mechanism not bounded by the design basis flood (using only stillwater and/or wind-wave runup level) should follow one of the following five assessment paths:

- Path 1: Demonstrate Flood Mechanism is Bounded Through Improved Realism
- Path 2: Demonstrate Effective Flood Protection
- Path 3: Demonstrate a Feasible Response to LIP
- Path 4: Demonstrate Effective Mitigation
- Path 5: Scenario Based Approach

Non-bounded flood-causing mechanisms in Paths 1, 2, or 3 would only require an FE to complete the actions related to external flooding required by the March 12, 2012 10 CFR 50.54(f) letter. Mechanisms in Paths 4 or 5 require an Integrated Assessment. LSCS follows Path 2 since key SSCs and KSFs are effectively protected from flooding.

3 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-14-055).
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 May 5, 2015 (RS-15-110).
5. 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.
6. 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.
7. NRC Letter, Coordination of Requests for Information Regarding Flooding Hazard Reevaluations and Mitigating Strategies for Beyond-Design-Basis External Events, dated September 1, 2015.
8. 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.
9. NRC Letter to Exelon, "LaSalle County Station, Units 1 and 2 – Interim Staff Response to Reevaluated Flood Hazards Submitted in Response to 10 CFR 50.54(f) Information Request – Flood-Causing Mechanism Reevaluation (TAC NOS. MF3655 and MF3656)", dated September 3, 2015.
10. NRC Letter, LaSalle County Station, Units 1 and 2 – Staff Assessment of Response to 10 CFR 50.54(f) Information Request – Flood-Causing Mechanism Reevaluation (CAC Nos. MF3655 and MF 3656), dated January 10, 2017.
11. NRC Letter, NRC Integrated Inspection Report 05000373/2014005; 05000374/2014005, Temporary Instruction 2515/190 – Inspection of the Proposed Interim Actions Associated with Near-Term Task Force Recommendation 2.1 Flooding Hazard Evaluations, dated February 10, 2015.

12. Design-Basis Flood Estimation for Site Characterization at Nuclear Power Plants in the United States of America, NUREG/CR-7046 November 2011.
13. Exelon Generation Company, LaSalle Updated Final Safety Analysis (UFSAR), Revision 22.
14. Exelon, EC 397436, Lake Screen House and CSCS Inlet Structure Technical Evaluation for Beyond Design Basis External Event Flood Levels, Revision 0.
15. Exelon, EC 399280, Beyond Design Basis Flooding Analysis for NRC Fukushima NTTF Recommendation 2.1 – Plant LIP Ingress, Revision 4.
16. Exelon Generation Company, LLC Letter to USNRC, Response to March 12, 2012, Request for Information Enclosure 2, Recommendation 2.1, Flooding, Required Response 2, Flood Hazard Reevaluation Supplemental Information Regarding Associated Effects and Flood Event Duration Parameters, dated October 4, 2016 (RS-16-186, RA-16-074, and TMI-16-087).
17. Exelon Generation Company, LLC Letter to USNRC, Mitigating Strategies Flood Hazard Assessment (MSFHA) Submittal, dated October 28, 2016 (RS-16-182).
18. Nuclear Energy Institute Report NEI 16-05, Revision 1, External Flooding Assessment Guidelines, June 2016.
19. Exelon, Calculation L-003856, Beyond Design Basis Effects of Local Intense Precipitation Analysis (Fukushima), Revision 1, December 5, 2015.
20. Exelon, EC 398381, Beyond Design Basis Flooding Analysis for NRC Fukushima NTTF Recommendation 2.1 – Plant Foundation Reevaluation, Revision 0.

4 TERMS AND DEFINITIONS

- APM – Available Physical Margin
- BDBEE – Beyond Design Basis External Event
- BDB – Beyond Design Basis
- CLB – Current Licensing Basis
- DB – Design Basis
- FE – Focused Evaluation
- FHRR – Flood Hazard Reevaluation Report
- FLEX – Diverse and Flexible Coping Strategies
- Key SSC – A System, Structure, or Component relied upon to fulfill a Key Safety Function
- KSF – Key Safety Function
- LIP – Local Intense Precipitation
- LSH – Lake Screen House
- MSA – Mitigating Strategies Assessment
- MSFHA – Mitigating Strategy Flood Hazard Assessment
- MSFHI – Mitigating Strategy Flood Hazard Information
- MSL – Mean Sea Level
- NEI – Nuclear Energy Institute
- NRC – Nuclear Regulatory Commission
- NTTF – Near-Term Task Force
- PMF – Probable Maximum Flood
- PMP – Probable Maximum Precipitation
- PMSS – Probable Maximum Storm Surge
- RB – Reactor Building
- RCIC – Reactor Core Isolation Cooling
- RFI – Request for Information
- SSC – Structures, Systems, and Components
- TB – Turbine Building
- TSA – Time Sensitive Action
- UFSAR – Updated Final Analysis Report

5 FLOOD HAZARD PARAMETERS FOR UNBOUNDED MECHANISMS

NRC has completed the Interim Staff Response (Reference 9) and Staff Assessment Report (Reference 10) to Reevaluated Flood Hazards related to the LSCS Flood Hazard Reevaluation Report (FHRR) (Reference 2). In Reference 3, the NRC states that the "staff has concluded that the licensee's reevaluated flood hazards information is suitable for the assessment of mitigation strategies developed in response to Order EA-12-049 (i.e., defines the mitigating strategies flood hazard information described in Nuclear Energy Institute (NEI) guidance document NEI 12-06, 'Diverse and Flexible Coping Strategies (FLEX) Implementation Guide') for LSCS. Further, the NRC staff has concluded that the "licensee's reevaluated flood hazard information is suitable input for the focused evaluations associated with Near-Term Task Force Recommendation 2.1 'Flooding'." The enclosure to Reference 2 includes a summary of the current design basis and reevaluated flood hazard parameters, respectively. In Table 3.1.1 of the enclosure to Reference 10, the NRC lists design basis flood hazard information for the following flood-causing mechanisms:

- Local Intense Precipitation;
- Streams and Rivers;
- Failure of Dams and Onsite Water Control/Storage Structures;
- Storm Surge;
- Seiche;
- Tsunami;
- Ice Induced Flooding; and
- Channel Migrations/Diversions.

Tables 4.1-1 through 4.3-1 of Reference 10, the NRC lists flood hazard information for the following flood-causing mechanisms that are not bounded by the design basis hazard flood level:

- Local Intense Precipitation
- Probable Maximum Storm Surge (PMSS) flooding in the Cooling Lake

It should be noted that the "storm surge" flood-causing mechanism for LSCS's Cooling Lake represents the NUREG/CR-7046 (Reference 12), Section H.4.2, Combined-Effects Flood (Floods along Shores of Enclosed Bodies of Water (Streamside Location)). These are the reevaluated flood-causing mechanisms that should be addressed in the external flooding assessment. The non-bounding flood mechanisms for LSCS are described in detail in References 2, 3, and 4 FHRR submittals. Table 5-1 below summarizes how the unbounded mechanisms were addressed in this external flooding assessment. Table 5-2 provides a summary of the reevaluated flood elevations (Stillwater and wind-wave runup). Table 5-3 through Table 5-5, along with Figure 5-1, provide additional flood hazard parameters for LIP and Cooling Lake flooding.

Table 5-1 – Summary of Flood Impact Assessment

	Flood Mechanism	Summary of Assessment
1	Local Intense Precipitation	Path 2 was determined to be the appropriate path for LSCS since, while ingress does occur, no actions are taken to protect key SSCs and available physical margin is adequate to protect KSFs (see FIAP Path Determination Table, Section 6.3.3 of NEI 16-05).
2	Cooling Lake PMSS	Path 2 was determined to be the appropriate path for LSCS since existing passive protection features and available physical margin are adequate to protect KSFs (see FIAP Path Determination Table, Section 6.3.3 of NEI 16-05).

Table 5-2 – Summary of Reevaluated Flood Hazard Reevaluation Elevations

Flood-Causing Mechanism	Stillwater Elevation (feet MSL)	Wind-Wave Runup Height (feet)	Maximum Flood Elevation (feet MSL)
Local Intense Precipitation[1]	711.0	Minimal	711.0
Cooling Lake PMF[2]			
• Lake Screen House	705.7	1.6	707.3
• CSCS Inlet Structure	705.7	2.9	708.6
Cooling Lake PMSS[3]			
• Lake Screen House	701.0	9.6	710.6
• CSCS Inlet Structure	701.0	11.0	712.0

1 See Reference 19 for stillwater, hydrodynamic loads and flood event duration parameters; and Enclosure 1 to Reference 2 for other associated effects. See also Enclosure 2 of Reference 16 for addition flood event duration parameters.

2 See Enclosure 1 to Reference 2 for stillwater, wind-wave runup, associated effects, and flood event duration parameters. Note that the PMF stillwater elevation is bounded by the nominal plant elevation and the wind-generated wave elevation is bounded by the PMSS. Therefore, no additional external flooding assessment was performed for this mechanism.

3 See Enclosure 1 to Reference 2 for stillwater, wind-wave runup, associated effects, and flood event duration parameters. Additional information for debris loads is provided in Enclosure 2 to Reference 16.

Table 5-3 – Summary of Flood Mechanism Parameters for LIP

	Parameter Description	Values/Discussion
1	Max Stillwater Elevation	710.6 ft MSL (RB) and 711.0 ft MSL (TB)
2	Max Wave Run-up Elevation	N/A
3	Max Hydrodynamic/Debris Loading	Minimal
4	Effects of Sediment Deposition/Erosion	N/A
5	Other Associated Effects	N/A
6	Concurrent Site Conditions	N/A
7	Effects on Ground Water	None
8	Warning Time	N/A
9	Period of Site Preparation	N/A
10	Period of Inundation	84 minutes (RB) and 144 minutes (TB)
11	Period of Recession	N/A
12	Plant Mode of Operation	Modes 1-5 or defueled

Table 5-3 above for the LIP parameters shows the most bounding values on site. However, it should be noted that various locations around the site have different flooding depths. The LIP flood elevation at plant door locations is shown in Table 5-4. The location of the doors is shown in Figure 5-1.

Table 5-4 – LIP Flood at Plant Door Locations

Door Number	Building	BDB Flood Elevation	Door Threshold Elevation	Head of Water above Door Threshold Elevation	Duration of Flooding above Threshold Elevation
		ft, MSL		ft	mins
D20/19	Reactor	710.61	710.34	0.27	84
D391	Reactor	710.61	710.34	0.27	84
D557	Off-Gas	710.68	710.47	0.21	66
D554	Off-Gas	710.70	710.40	0.30	96
D479	Auxiliary	710.71	710.35	0.36	138
D508	Auxiliary	710.44	710.29	0.15	84
D894	N. Turbine	710.32	710.39	N/A	N/A
D895	N. Turbine	710.18	710.39	N/A	N/A
D165	N. Turbine	710.41	710.47	N/A	N/A
D164	N. Turbine	710.54	710.39	0.15	24
D642	Old Service	710.40	710.34	0.06	72
D649	Old Service	710.21	710.17	0.05*	N/A
D671	Old Service	709.81	709.76	0.05*	N/A
D756a	Old Service	709.85	709.80	0.05*	N/A
D756b	Old Service	709.88	709.83	0.05*	N/A
D672	Old Service	710.46	710.39	0.07	6
D673	Old Service	710.39	710.24	0.15	72
Ramp	Radwaste	709.51	710.33	N/A	N/A
D133 (D529)	Radwaste	710.49	710.39	0.10	144
D140 (D538)	Radwaste	710.49	710.36	0.13	144
Tkw.D1	Trackway	710.95	710.58	0.37	144
Tkw.D2	Trackway	710.48	710.36	0.12	144
Tkw.D3	Trackway	710.62	710.32	0.30	144
Tkw.D4	Trackway	710.69	710.01	0.68	144
D144	Turbine	710.55	710.43	0.12	90
D146	Turbine	710.95	710.42	0.53	144
D146A	Turbine	710.95	710.39	0.56	144

* The minimum computed water depth of 0.05 ft or less is due to surface detention in the FLO-2D software; therefore, no ingress was assumed.

** D146/D146A are interior doors. The maximum WSEL/duration of flooding at these doors was conservatively based on the maximum WSEL/duration of flooding at the Tkw.D1 door.

Note - For simplicity of evaluation, Reference 15 used duration above threshold set to duration above CLB LIP (Reference 19).

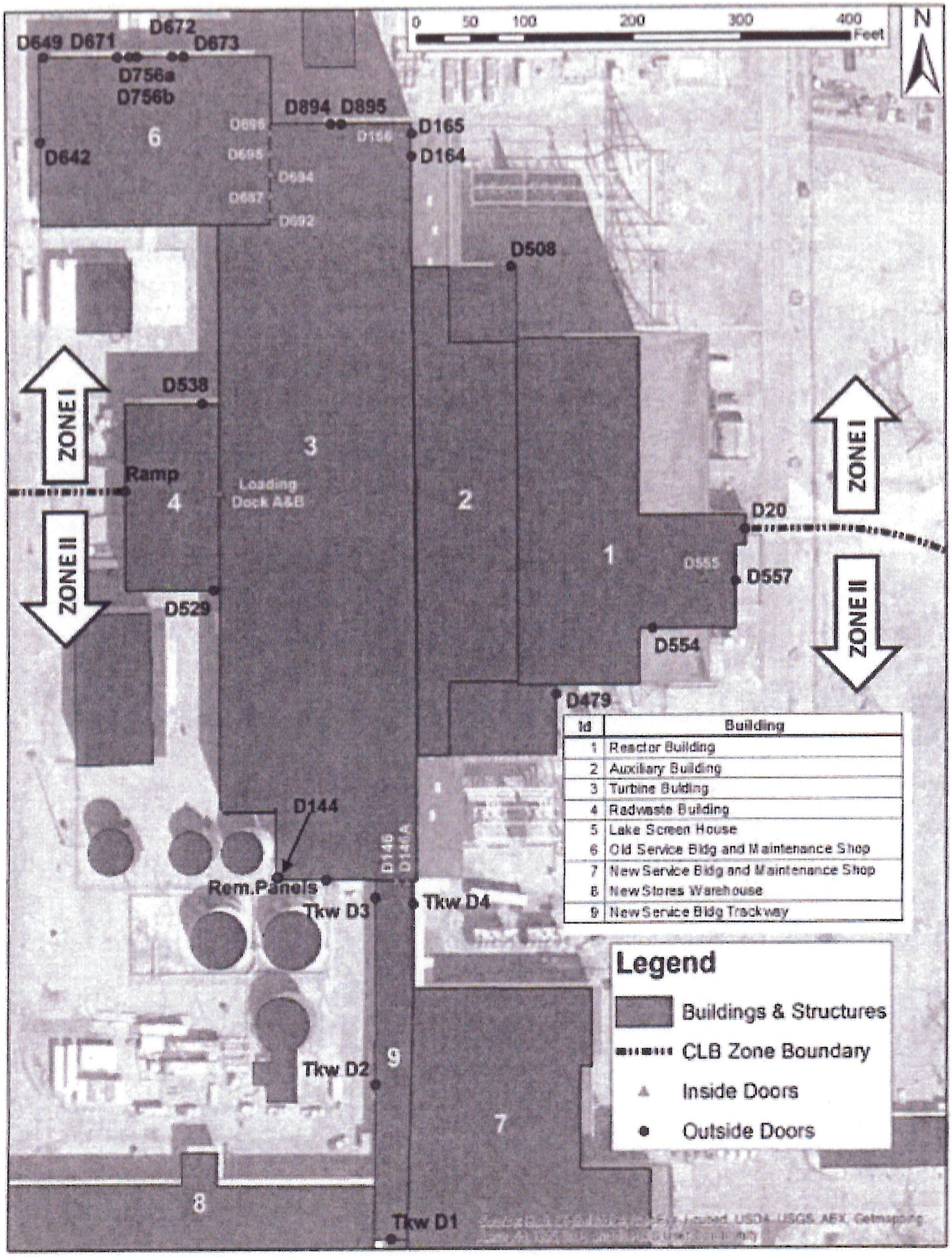

Figure 5-1 – Door Location Map (Reference 19)

Table 5-5 – Summary of Flood Mechanism Parameters for Cooling Lake Flooding

	Parameter Description	Values/Discussion
1	Max Stillwater Elevation	701.0 ft MSL (PMSS) & 705.7 ft MSL (PMF)
2	Max Wave Run-up Elevation	710.6 ft MSL (lake screen house) and 712.0 (CSCS inlet structure)
3	Max Hydrodynamic/Debris Loading	Wave loading 1,208 lb/ft (lake screen house) and 4,759 lb/ft (CSCS inlet structure). Debris loading is N/A.
4	Effects of Sediment Deposition/Erosion	Negligible
5	Other Associated Effects	N/A
6	Concurrent Site Conditions	N/A
7	Effects on Ground Water	705.7 ft MSL maximum
8	Warning Time	N/A
9	Period of Site Preparation	N/A
10	Period of Inundation	N/A
11	Period of Recession	N/A
12	Plant Mode of Operation	Modes 1-5 or defueled
13	Other Factors	N/A

6 OVERALL SITE FLOODING RESPONSE

6.1 DESCRIPTION OF OVERALL SITE FLOODING RESPONSE

LSCS site occupies approximately 3,060 acres in the southeastern part of LaSalle County, 6 miles southeast of Marseilles, Illinois. The Cooling Lake has an area of 2,058 acres at normal pool elevation 700.0 feet MSL. The plant grade and floor elevations are 710.0 feet and 710.5 feet MSL, respectively. The terrain around the plant has elevations ranging from 700 feet to 724 feet MSL, approximately 217 feet above the normal water surface elevation of the Illinois River.

Based on the FHRR (Reference 2, Section 4) and the "Staff Assessment of Response to 10 CFR 50.54(f) Information Request – Flood-Causing Mechanism Reevaluation" (Reference 10), LSCS is potentially exposed to the flood hazards due to the LIP event and Cooling Lake Storm Surge (PMSS) flooding. These two flood causing mechanisms are not bounded by the current design basis. To clarify further, the potentially impactful non-bounding aspect associated with Cooling Lake Storm Surge is wind-wave runup. The maximum stillwater elevation for the Cooling Lake PMF is not bounded by the current design basis stillwater but is below the plant's grade. Therefore, no further external flooding assessment was performed for the Cooling Lake PMF stillwater.

The site relies on permanent passive flooding protection features (site topography, man-made fill areas, and the elevation of the key SSCs) and existing doors that limit the inleakage during the LIP event. There are no active flooding protection features or required site response. The plant buildings affected by flooding loads were evaluated and found to be structurally adequate.

The potential ingress of flood waters resulting from the LIP event can impact key SSC components in the Unit 1 Emergency Core Cooling System (ECCS) corner rooms on the 673-ft MSL elevation of the Unit 1 Reactor Building. The specific key SSCs that could be impacted are as follows:

- Unit 1 – LPCS/RCIC Pump Cubicle – Fire Zone 2I4 (elevation 673.33 feet MSL)

  This zone contains the following safety-related equipment: LPCS pump; LPCS water leg pump; RCIC pump, turbine, and condenser; RCIC instrumentation panels; LPCS instrumentation panel; and various ESF Division 1 cables.

- Unit 1 – RHR Pump A Cubicle – Fire Zone 2I5 (elevation 673.33 feet MSL)

  This zone contains the following safety-related equipment: RHR pump A, the RHR instrumentation panel A, and various ESF Division 1 cables.

There are no external flooding pathways for LIP ingress to occur directly into Unit 2 safety-related areas. Potential pathways through Unit 1 to Unit 2 are restricted by intervening stairwells and floor drains that direct flow to lower levels and limit accumulation of water whereby water would not enter Unit 2. See Reference 15.

6.1.1 LIP Site Response

While ingress into buildings where safety equipment exist occurs, the results of an evaluation to estimate the potential ingress of water into the areas containing key SSCs indicate that key SSCs will not be impacted by the LIP event and no plant response (either operator or mitigation actions) is required to ensure the plant's safe shutdown equipment will be capable of performing their key safety functions during the potential LIP event (Reference 15). As discussed further in Section 7.1, LIP ingress does not accumulate to the level that would impact key SSCs.

The site determined that all vulnerabilities due to the LIP mechanism are addressed with APM, which was deemed adequate to protect key SSCs (Reference 15). This places LSCS in Path 2 to address this unbounded flooding mechanism.

6.1.2 PMSS Site Response

Per Section 3.4.4 of Enclosure 1 to Reference 2, even though the maximum water elevation (including wind-wave runup) at the lake screen house (710.6 feet MSL) is above the plant grade elevation (710.0 feet MSL), the PMSS does not result in a flooding hazard for the site because the lake flood level is below the ground surface elevation around the lake screen house and intake flume (approximately 713.8 feet MSL). Therefore, the water at its maximum level is contained in the intake flume; with an available margin of 3.2 feet (713.8 feet MSL – 710.6 feet MSL). The CSCS inlet structure is located approximately 0.9 miles to the west of the lake screen house and is exposed to much greater wind-wave activity. However, the higher wind-wave runup elevation would not impact the remainder of the site.

The lake screen house and the CSCS inlet structure could be inundated by flood waters but they do not contain any key SSCs or equipment that would affect the ability to maintain any of the KSFs. However, an evaluation was performed to evaluate the structural integrity and establish design margin based on load check of both structures for increased flood/wave heights under the reevaluated loads. The results of the evaluation indicate that both buildings are structurally adequate for the PMSS flooding loads (Reference 14).

The results of additional actions and interim evaluations performed following the submittal of the FHRR also concluded that no plant response (either operator or mitigation actions) is required to ensure the plant's safe shutdown equipment will be capable of performing their key safety functions due to the PMSS event.

6.2 Summary of Plant Modifications and Changes

There are no remaining actions, including planned plant modifications, procedural changes or procurement activities, necessary to implement the flood strategy described above. All interim evaluations and actions identified in Reference 2 to address the LIP and PMSS events have been completed. The interim evaluations and actions for flooding mitigation at LSCS were also previously evaluated by the NRC (Reference 11, TI 190 Process).

7 FLOOD IMPACT ASSESSMENT

7.1 Local Intense Precipitation – Path 2

7.1.1 Description of Flood Impact

The maximum reevaluated flood elevations of the BDB LIP event are not bounded by the current design basis flood elevation at all exterior locations of the plant. The BDB flood water surface elevations are above the plant floor elevations at some locations and have the potential to cause internal flooding to plant buildings. Table 5-4 above provides a summary of the maximum water surface elevations at the exterior door openings, maximum flood depths above the door threshold and duration of when the flood levels are above the door threshold. If water accumulates on the exterior of these doors for an extended period of time, ingress into the rooms behind these doors will occur and water will accumulate in those rooms. Additionally, flood levels on the exterior walls of the plant buildings create hydrostatic and hydrodynamic loading due to water depth and velocity.

The evaluation conducted by the site (Reference 15) concluded that:

- Flood water ingress due to higher LIP levels would not impact the plant's key safety functions;
- The effects of the combined reevaluated hydrodynamic and hydrostatic flood loads to the exterior plant concrete foundation walls are negligible; and
- The walls were structurally adequate with significant margin to withstand flood loading.

7.1.2 Adequate APM Justification and Reliability Flood Protection

7.1.2.1 Hydrostatic Loads on Exterior Doors

The plant exterior doors in safety related areas are all metal construction and open outwards and, therefore, the external water force on the door would be distributed on both sides of the door frame. Furthermore, personnel entrance to the reactor building is through an interlocking double door airlock, providing additional barrier against water ingress. Rail car access openings in the reactor building are also provided with double doors (D19/D20) to assure that building access will not interfere with maintaining integrity of the secondary containment. The secondary containment structure protects the equipment in the building from externally generated missiles. The Reactor Building is a Category I structure (Reference 13), which is designed for wind loads of 24 psf from grade to 50 ft above grade (Reference 15). The wind load applied to the area of the typical personnel door (3 ft x 7 ft - 2 in) is equal to 516 lb force. The wind load applied to the area of doors D19/D20 (15 ft x 21 ft) is equal to 7,560 lb force.

The external hydrostatic load for the typical 3-ft personnel door was calculated to be 17 lb force. For doors D19/D20 the hydrostatic load was calculated to be 34 lb force (Reference 15). Therefore, it can be concluded that the resultant LIP load is bounded by the existing qualification for wind loading.

7.1.2.2 Water Ingress through Exterior Doors

Key SSCs, including safety related equipment in the lower corner rooms of the Reactor Building, could potentially be affected if the accumulation of water in the rooms exceeds 18 inches or 28,613 gallons. However, the potential water ingress through the Reactor Building D19/D20/D391 doors at ground level was estimated to be 7,477 gallons, resulting in less than 5 inches of flooding depth in the reactor basement (Unit 1 Northeast Corner Room, elevation 673 feet MSL). The reactor basement could accommodate an additional 21,136 gallons, resulting in APM of 13 inches (Reference 15). Therefore, it can be concluded that the key SSCs in the Reactor Building would not be impacted by the LIP flood.

The remaining adjacent buildings with potential water ingress connected to the Reactor Building all have APM exceeding the APM for the Reactor Building. Furthermore, the buildings or the zones where water could potentially accumulate do not house key SSCs. Therefore, it can be concluded that key SSCs would not be impacted by the LIP flood.

7.1.2.3 Combined Loads on Exterior Plant Concrete Foundation Walls

The plant evaluation (Reference 15) also showed that the effects of the combined reevaluated hydrodynamic and hydrostatic flood loads to the exterior plant concrete foundation walls are negligible (combined loads of less than 85 psf) and that the walls were structurally adequate with significant margin to withstand flood loading based on a comparison with the tornado loads.

7.1.3 Adequate Overall Site Response

There are no required actions by plant personnel for this response to be successful and, therefore, an evaluation of the overall site response is not necessary.

7.2 Probable Maximum Storm Surge – Path 2

7.2.1 Description of Flood Impact

The maximum stillwater elevation of 701.0 feet MSL due to the PMSS does not have impact on the site since it is well below the plant grade elevation of 710 feet MSL. The maximum wind-generated wave runup elevation at the lake screen house (710.6 feet MSL) and the CSCS inlet structure (712 feet MSL) is above the plant grade elevation; however, the ground surface around the lake screen house and CSCS inlet structure is approximately at elevation of 713. 8 feet MSL and would prevent any flood waters from inundating or impacting the site and any key SSCs. Furthermore, the maximum PMSS elevation is below the top of the intake flume where it would be contained. No equipment is required to be protected from flooding in the lake screen house or at the CSCS inlet structure. However, these safety-related structures would be subject to the wave loads and hydrodynamic loads. The maximum stillwater elevation of 705.7 feet MSL due to the PMF in the Cooling Lake would produce a surcharge on groundwater levels at the plant foundation.

7.2.2 Adequate APM Justification and Reliability for Flood Protection

The maximum wind-wave runup elevation due to the PMSS at the lake screen house was estimated to be 710.6 feet MSL. The ground surface elevation around the lake screen house and the intake flume is approximately 713.8 feet MSL and as such the water at its maximum level is contained in the intake flume. The APM can be calculated as 3.2 feet, which is considered adequate given the estimated errors and uncertainties provided in Reference 2. The primary impact of the reevaluated PMSS is higher wind-wave runup levels and hydrodynamic loads at the lake screen house and the CSCS inlet structure. Nevertheless, a plant evaluation showed that these structures can withstand the higher levels and loads and are structurally stable under these loads (Reference 14). In addition, the groundwater surcharge, caused by the PMF maximum stillwater elevation of 705.7 feet MSL in the Cooling Lake, was evaluated for hydrostatic load at the plant foundation and found to be structural stable with adequate margin (Reference 20).

7.2.3 Adequate Overall Site Response for Flood Protection

There are no required actions by plant personnel for this response to be successful and, therefore, an evaluation of the overall site response is not necessary.

8 CONCLUSION

In conclusion, SSCs that support LSCS's key safety functions are protected from the non-bounded reevaluated flood-causing mechanisms (LIP and PMSS) by plant grade or a corresponding critical elevation.

The LIP event results in potential water ingress through the Reactor Building D19/D20/D391 doors at ground level and causes less than 5 inches of flooding in the reactor basement (Unit 1 Northeast Corner Room, elevation 673 feet Mean Seal Level (MSL) datum). However, this location has adequate APM of 13 inches that accumulated flood water will not impact installed plant safety related equipment and the plant will be able to maintain all KSFs throughout the event.

The second mechanism that was not bounded by the CLB is PMSS. The primary impact of the reevaluated PMSS is higher wind-wave runup levels and hydrodynamic loads at the lake screen house and the CSCS inlet structure. Nevertheless, a plant evaluation (Reference 14) showed that these structures can withstand the higher levels and loads.

This submittal completes the actions related to External Flooding required by the March 12, 2012 10 CFR 50.54(f) letter.