Exelon Generation.

10 CFR 50.54(f)

RS-17-028
RA-17-013

April 28, 2017

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

Oyster Creek Nuclear Generating Station
Renewed Facility Operating License No. DPR-16
NRC Docket No. 50-219

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, 2015, RS-15-063

3. Exelon Generation Company, LLC Letter to USNRC, Supplemental Response to NRC Audit Review Request for Additional Information Regarding Fukushima Lessons Learned - Flood Hazard Reevaluation Report, dated April 15, 2016, RS-16-051

4. 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)

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. Nuclear Energy Institute (NEI) Report, NEI 16-05, Rev. 1, External Flooding Assessment Guidelines, dated June 2016

9. 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

10. NRC Letter, Oyster Creek Nuclear Generating Station – Interim Staff Response to Reevaluated Flood Hazards Submitted in Response to 10 CFR 50.54(f) Information Request – Flood-Causing Mechanism Reevaluation (CAC No. MF6111), dated February 9, 2016

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 Oyster Creek Nuclear Generating Station the FHRR was submitted on March 12, 2015 (Reference 2). Additional information was provided with References 3 and 4. Per Reference 5, 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 6), the NRC issued a letter to industry (Reference 7) indicating that new guidance is being prepared to replace instructions (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".

The Nuclear Energy Institute (NEI) prepared NEI 16-05, "External Flooding Assessment Guidelines" (Reference 8). The NRC endorsed NEI 16-05 (Reference 9) 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 Oyster Creek Nuclear Generating Station.

The reevaluated flood hazard, summarized by the NRC in Reference 10, was utilized as input to this Flooding Focused Evaluation. The Flooding Focused Evaluation reaffirms that Oyster Creek Nuclear Generating Station's SSCs that support Key Safety Functions are effectively protected from the non-bounded reevaluated flood-causing mechanisms (LIP and Storm Surge) with adequate margin. The Oyster Creek Nuclear Generating 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, Rev. 1 (Reference 8), 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 28th day of April 2017.

Respectfully submitted,

James Barstow
Director - Licensing & Regulatory Affairs
Exelon Generation Company, LLC

Enclosure: Oyster Creek Nuclear Generating Station, Flooding Focused Evaluation Summary, dated April 28, 2017

cc: Director, Office of Nuclear Reactor Regulation
NRC Regional Administrator - Region I
NRC Senior Resident Inspector – Oyster Creek Nuclear Generating Station
NRC Project Manager, NRR – Oyster Creek Nuclear Generating Station
Ms. Tekia V. Govan, NRR/JLD/JHMB, NRC
Manager, Bureau of Nuclear Engineering – New Jersey Department of Environmental Protection
Mayor of Lacey Township, Forked River, NJ

Enclosure

Oyster Creek Nuclear Generating Station

Flooding Focused Evaluation Summary

dated April 28, 2017

(18 Pages)

OYSTER CREEK NUCLEAR GENERATING STATION FLOODING FOCUSED EVALUATION SUMMARY

APRIL 28, 2017

LETTER # RS-17-028

ENCLOSURE

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OCNGS FLOODING FOCUSED EVALUATION SUMMARY

1 EXECUTIVE SUMMARY

The Oyster Creek Nuclear Generating Station (OCNGS) has reevaluated its flooding hazard in accordance with the NRC's March 12, 2012, 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, 2015 and is provided in the Mitigating Strategies Flood Hazard Information (MSFHI) documented in NRC's "Interim Staff Response to Reevaluated Flood Hazards" letter dated February 9, 2016. No changes to the flooding analysis have been performed since the issuance of the MSFHI letter and this flooding analysis will serve as the input to this Focused Evaluation (FE). However, OCNGS amended the Local Intense Precipitation Evaluation Report on March 8, 2016 to document the changes to the analysis that were communicated with the NRC and included in the MSFHI letter. There are two mechanisms that were found to exceed the design basis flood level at OCNGS. These mechanisms are listed below and included in this FE:

1. Local Intense Precipitation
2. Storm Surge

Associated Effects (AE) and Flood Event Duration (FED) parameters were assessed and submitted as a part of the FHRR and the October 4, 2016 letter submitted to the NRC The FE concludes that OCNGS 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. This FE followed Path 2 of NEI 16-05, Rev. 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.

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 (Reference 1) 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 OCNGS the FHRR was submitted on March 12, 2015 (Reference 2). Additional information was provided with References 3 and 4.

Following the Commission's directive to NRC Staff in Reference 5, the NRC issued a letter to industry (Reference 8) indicating that new guidance is being prepared to replace instructions in Reference 5 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 6), which was endorsed by the NRC in Reference 7. 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.

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 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, 2015 (RS-15-063).

3. Exelon Generation Letter to USNRC, Supplemental Response to NRC Audit Review Request for Additional Information Regarding Fukushima Lessons Learned – Flood Hazard Reevaluation Report dated April 15, 2016 (RS-16-051).

4. 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).

5. 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.

6. Nuclear Energy Institute (NEI), Report NEI 16-05 [Rev 1], External Flooding Assessment Guidelines, dated June 2016.

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

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. NRC Letter, Oyster Creek Nuclear Generating Station – Interim Staff Response to Reevaluated Flood Hazards Submitted in Response to 10 CFR 50.54(f) Information Request – Flood-Causing Mechanism Reevaluation (CAC NO. MF6111), dated February 9, 2016.

10. U.S. Nuclear Regulatory Commission, Design-Basis Flood Estimation for Site Characterization at Nuclear Power Plants in the United States of America (NUREG/CR-7046), published November 2011.

11. Exelon Generation, OCNGS Calculation OYS-16-001 Revision 1, Consequential and Interior Flooding Analysis, dated April 7, 2017.

12. Exelon Generation, OCNGS Procedure OP-OC-108-109-1001 Revision 35.

13. Exelon Calculation, C-1302-120-E310-014, Analysis and Determination of Associated Effects at OCNGS, Rev 0.

14. Exelon Calculation, C-1302-120-E310-010, Hydrodynamic Model/Combined Events Flood Assessment at OCNGS, Rev 0.

15. U.S. Army Corps of Engineers, Coastal Engineering Manual, Report Number 1110-2-1100 Part VI, Chapter 5, Fundamentals of Design, VI-5-136, USACE Coastal and Hydraulics Laboratory – Engineer Research and Development Center, Waterways Experiment Station – Vicksburg, Mississippi, August 2008.

4 TERMS AND DEFINITIONS

APM – Available Physical Margin
CLB – Current Licensing Basis
FIAP – Flooding Impact Assessment Process
FE – Focused Evaluation
FHRR – Flood Hazard Reevaluation Report
FLEX – Diverse and flexible coping strategies covered by NRC order EA-12-049
HMR – Hydrometeorological Report
Key SSC – A system Structure or Component relied upon to fulfill a Key Safety Function
KSF – Key Safety function, i.e. core cooling, spent fuel pool cooling, or containment function.
LIP – Local Intense Precipitation
MSFHI – Mitigating Strategies Flood Hazard Information
NEI – Nuclear Energy Institute
NRC – Nuclear Regulatory Commission
NTTF – Near Term Task Force commissioned by the NRC to recommend actions following the Fukushima Dai-ichi accidents
OCNGS – Oyster Creek Nuclear Generating Station
PMH – Probable Maximum Hurricane
PMSS – Probable Maximum Storm Surge
PMP – Probable Maximum Precipitation
PMF – Probable Maximum Flood
RB – Reactor Building
RFI – Request for Information
TB – Turbine Building
USACE – US Army Corps of Engineers

5 FLOOD HAZARD PARAMETERS FOR UNBOUNDED MECHANISMS

NRC has completed the "Interim Staff Response to Reevaluated Flood Hazards" (Reference 9) which contains the Mitigating Strategies Flood Hazard Information (MSFHI) related to OCNGS's Flood Hazard Reevaluation Report (Reference 2). In Reference 9, 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 Oyster Creek. Further, the NRC staff has concluded that the licensee's reevaluated flood hazard information is suitable input for other assessment associated with Near-Term Task Force Recommendation 2.1 'Flooding'." The enclosure to Reference 9 includes a summary of the current design basis and reevaluated flood hazard parameters, respectively. In Table 1 of the enclosure to Reference 9, the NRC lists the following flood-causing mechanisms for the design basis flood:

- 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.

In Table 2 of the enclosure to Reference 9, the NRC lists flood hazard information (specifically stillwater elevation and wind-wave runup elevation) for the following flood-causing mechanisms that are not bounded by the design basis hazard flood level:

- Local Intense Precipitation
- Storm Surge

It should be noted that the "storm surge" flood-causing mechanism represents the NUREG/CR-7046 (Reference 10), Section H.3.2, Alternative 4, Combined-Effects Flood. These are the reevaluated flood-causing mechanisms that should be addressed in the external flooding assessment. The two non-bounding flood mechanisms for OCNGS are described in detail in References 2 and 3, the FHRR submittals. Table 5-1 summarizes how each of these unbounded mechanisms was addressed in this external flooding assessment. Table 5-2 and Table 5-3 provide a summary of flood parameters for each flood mechanism. Stillwater and runup elevations for the LIP mechanism at Door #9

(RB) and Door #14 (RB) were obtained from the MSFHI letter (Reference 9) and the supplemental response to NRC audit (Reference 3), respectively. Stillwater and wave runup elevations for the storm surge mechanism at the Site Emergency Building, Turbine Building and Intake Structure were obtained from the MSFHI letter. Flood elevations for the RB were obtained from the FHRR submittal (Reference 2). Period of inundation for LIP and storm surge were obtained from Reference 3 (Enclosure 1, Table 5) and Reference 2 (Table 2), respectively.

Table 5-1 – Summary of Flood Impact Statement

	Flood Mechanism	Summary of Assessment
1	Local Intense Precipitation	Path 2 was determined to be the appropriate path for OCNGS since, while ingress does occur in the RB, no actions need to be 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). Sandbags are installed at two RB door locations as a defense-in-depth measure only.
2	Storm Surge	Path 2 was determined to be the appropriate path for OCNGS since key SSCs are protected by plant grade, which is inherently permanently-installed and passive. Available physical margin is adequate to protect KSFs (see FIAP Path Determination Table, Section 6.3.3 of NEI 16-05). Any potential ingress into other areas of the plant does not impact KSFs.

Table 5-2 – LIP Flood Mechanism Parameters

	Parameter Description	Values/Discussion	
1	Max Stillwater Elevation	Door #9 (RB)	24.4 feet MSL
		Door #14 (RB)	24.4 feet MSL
2	Max Wave Run-up Elevation	Door #9 (RB)	24.4 feet MSL
		Door #14 (RB)	24.4 feet MSL
3	Max Hydrodynamic/Debris Loading	See Table 4 of Reference 3, Enclosure 1.	
4	Effects of Sediment Deposition/Erosion	N/A due to low velocities, which are well below permissible velocities for both gravel and paved surfaces per USACE EM 1110-3-136.	
5	Other Associated Effects	N/A	
6	Concurrent Site Conditions	High winds could potentially be generated concurrent to the LIP but would not impact the implementation of the flood protection strategy.	
7	Effects on Ground Water	Groundwater changes are not expected due to the compacted soil and impervious cover around the power block and the short duration of the flood event.	
8	Warning Time	Warning time is not credited since RB doors are maintained closed and there is adequate margin to protect KSFs without operator actions. See Section 7.1 for addition information.	
9	Period of Site Preparation	Preparation time is not credited since RB doors are maintained closed and there is adequate margin to protect KSFs without operator actions. See Section 7.1 for addition information.	
10	Period of Inundation	1.5 hours	
11	Period of Recession	0 hours (For LIP, it is understood that period of recession is the period	

	Parameter Description	Values/Discussion
		floodwaters drop below a penetration or door threshold elevation and drains from the site (or, if site topography has depressions and storm drains are assumed blocked, to a relatively constant and shallow depth)).
12	Plant Mode of Operation	Modes 1-5 or Defueled
13	Other Factors	None

Table 5-3 – Storm Surge Flood Mechanism Parameters

	Parameter Description	Values/Discussion	
1	Max Stillwater Elevation	Site Emergency Building	22.9 feet MSL
		Turbine Building	23.2 feet MSL
		Intake Structure	23.2 feet MSL
		Reactor Building	22.8 feet MSL
2	Max Wave Run-up Elevation	Site Emergency Building	26.6 feet MSL
		Turbine Building	25.9 feet MSL
		Intake Structure	24.6 feet MSL
		Reactor Building	23.5 feet MSL
3	Max Hydrodynamic/Debris Loading	See Table 8-1 of Reference 13.	
4	Effects of Sediment Deposition/Erosion	N/A due to low velocities, which are well below permissible velocities for both gravel and paved surfaces per USACE EM 1110-3-136.	
5	Other Associated Effects	None	
6	Concurrent Site Conditions	High winds could potentially be generated concurrent to the PMH/PMSS but would not impact the implementation of the flood protection strategy.	

	Parameter Description	Values/Discussion
7	Effects on Ground Water	Per Section 2.4.11 of the USAR (Rev. 19) the groundwater table is expected to rise with rising surface water during the occurrence of a PMH event. The increase in stillwater level is expected to result in a corresponding increase in groundwater level, up to side grade.
8	Warning Time	Warning time is not credited since key SSCs are protected by plant grade and no other actions are required to maintain KSFs.
9	Period of Site Preparation	Preparation time is not credited since key SSCs are protected by plant grade and no other actions are required to maintain KSFs.
10	Period of Inundation	0.3 hours (at the TB)
11	Period of Recession	Period of recession, as defined in NEI 16-05, is not applicable since the site maintains a safe and stable state indefinitely once floodwaters recede below site grade.
12	Plant Mode of Operation	Modes 1-5 or Defueled
13	Other Factors	None

6 OVERALL SITE FLOODING RESPONSE

6.1 DESCRIPTION OF OVERALL SITE FLOODING RESPONSE

The site response for LIP is as follows:

OCNGS relies on permanent passive flooding protection features (site topography with a finished floor/door threshold elevation of 23.5 feet MSL in the RB, berms inside the RB, and the elevation of the key SSCs) and existing doors that limit the in-leakage during the LIP event. There are no active flooding protection features or required site response.

The specific key SSCs located in the RB are as follows:

- 480 Volt Switchgear Room
- Containment Spray Pump Corner Rooms
- Core Spray Pump Corner Rooms.

The site response for storm surge is as follows:

As indicated in Table 5-3, the buildings of concern that are potentially challenged by the storm surge are the Site Emergency Building, TB, and Intake Structure. None of these buildings, however, contain key SSCs required to maintain the KSFs. The only structure containing key SSCs is the RB, which has a storm surge peak flood elevation equal to the finished floor elevation (door threshold) of 23.5 feet MSL.

For both flood causing mechanisms, as a defense-in-depth measure and for asset protection purposes, sandbags are installed at selected entrances to the Site Emergency Building, RB, and TB. Additional sandbags are also installed at the Administration Building and Material Warehouse (Procedure OP-OC-108-109-1001, Reference 12). However, the installation of the sandbags is not required to maintain KSFs and, as such, will not be evaluated in the impact assessment for both mechanisms (other than supporting that the available margin is adequate as discussed further in Sections 7.1.2 and 7.2.2).

6.2 SUMMARY OF PLANT MODIFICATIONS AND CHANGES

All modifications or changes to account for the increase in flood levels were completed as interim actions and made permanent. These modifications or changes are listed in References 2 and 3. There are no additional open items or planned modifications/changes.

7 FLOOD IMPACT ASSESSMENT

7.1 LOCAL INTENSE PRECIPITATION – PATH 2

7.1.1 Description of Flood Impact

Table 5-2 shows the LIP maximum water surface elevation at Door #9 (RB northwest Door DR-814-11) and Door #14 (RB northeast Door DR-814-39 (outer door) or DR-814-38 (inner door)). A consequential and interior drainage analysis (Reference 11) performed for OCNGS estimated the potential in-leakage and flood depths inside the RB. The analysis included two inner areas that were subject to ingress through Doors #9 and 14, separated by a non-watertight double airlock door (Figure 7-1), and considered two scenarios: 1) ingress flooding volume equalizes between the two areas, and 2) separation is maintained by the airlock doors for the ingress flooding volume into the two areas (Figure 7-1). Furthermore, the inner area for Door #9 is connected to the TB by a staircase through which water would flow to the TB basement and reduce the flooding depth in the RB.

For the vital switchgear located in the 480 Volt Switchgear Room ("Inner Area for Door 9"), the more conservative ingress result is Scenario 1 (ingress flooding volume equalizes between the two areas), which produces a maximum flood depth of 0.11 feet (or approximately 1.3 inches) inside the RB. The vital switchgear located in the 480 Volt Switchgear Room is elevated by at least 2.5 inches and, therefore, would not be impacted by the potential flooding at an APM of 1.2 inches.

For the "Inner Area for Door 14", the more conservative ingress result is Scenario 2 (ingress volume separation is maintained by the airlock doors), which produces a maximum flood depth of 0.14 feet or 1.7 inches inside the RB. Additional pathways to the RB basement include staircases located in the northeast and southeast corners of the RB. These staircases lead to the corner rooms in the RB basement, where additional SSCs (containment spray pumps) are located. However, 3-inch installed berms/ramps, located at the entrances to the staircase, would prevent flood waters, up to the depth of 3 inches, from flowing down the stairs and impacting the SSCs. Therefore, the corner rooms and containment spray pumps are protected by the berms/ramps at an APM of 1.3 inches.

Based on results of the interior drainage analysis, it can be concluded that the key SSCs located in the 480 Volt Switchgear Room and corner rooms of the RB basement would not be impacted.

Since Doors #9 and #14 are credited with providing some flood protection by reducing the ingress of flood waters, an evaluation of potential hydrostatic and dynamic loads on the doors was performed. Doors #9 and #14 are steel construction and open outwards and, therefore, the external water force on the door would distribute along the entire door frame. The secondary containment structure protects the equipment in the building from externally generated missiles. As demonstrated in Table 7-1, the resultant design loads (based on high winds) for RB Doors #9 and #14 bound the reevaluated hydrostatic and dynamic flooding loads. Adequate APM justification has been provided in the next section and no further evaluation is required.

Table 7-1 – Flooding Impact Load Comparison for Local Intense Precipitation

	Parameter	Door #9	Door #14
(1)	Width, feet	4.0	3.3
(2)	Height, feet	6.6	7.2
(3)	Area, sq. feet (1) x (2)	26.4	23.8
	Design Basis for Wind		
(4)	Design Pressure, psf[1]	40.3	40.3
(5)	Design Load, lb (3) x (4)	**1,064**	**959**
	Reevaluated		
(6)	Unit Load, lb/lineal ft[2]	148.7	98.8
(7)	Resultant Load, lb (1) x (6)	**595**	**326**

[1] From Section 3.3.1.2 of the UFSAR Rev 14 (October 2005).

[2] Total of the "Max Resultant Impact Load" and "Max Resultant Static Load" from Table 4 of Reference 3, Enclosure 1.

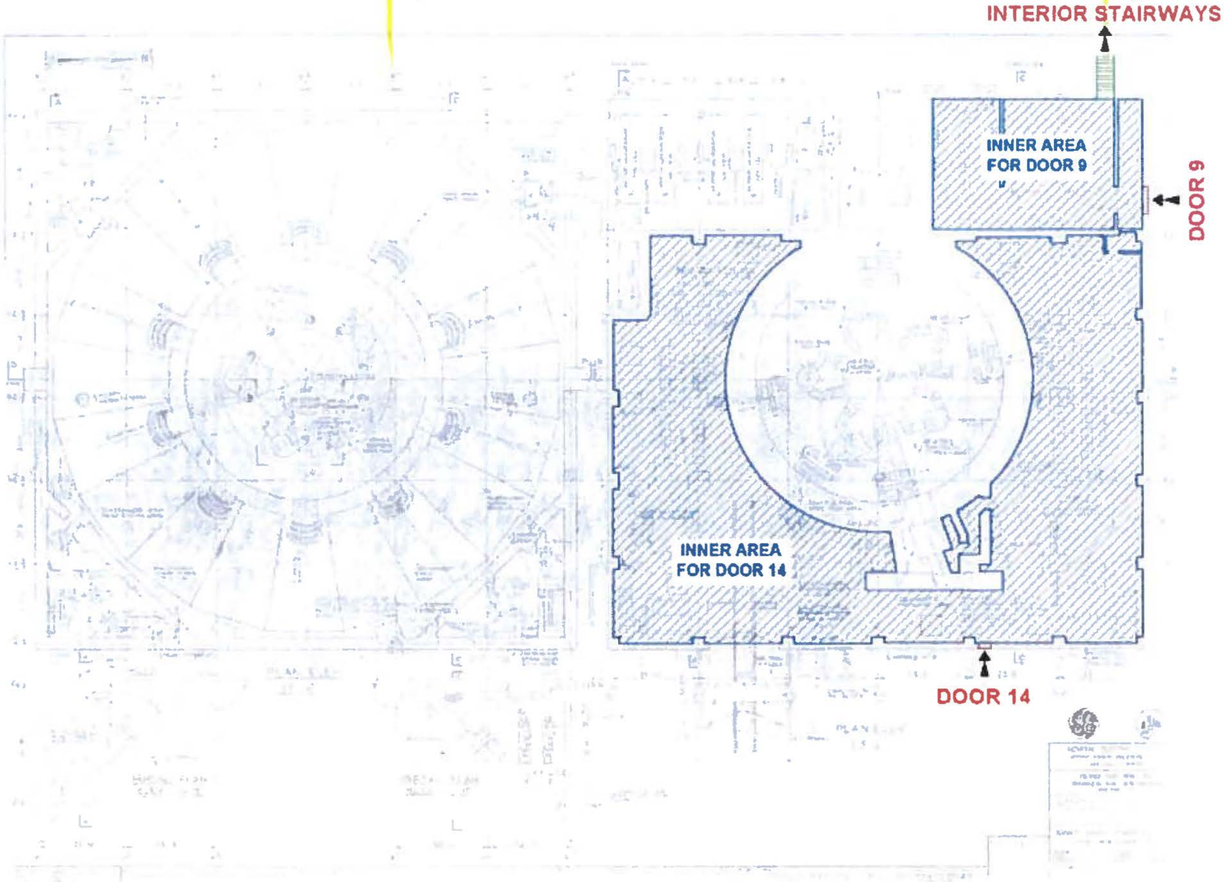

Figure 7-1- Reactor Building Inner Areas (Reference 11)

7.1.2 Adequate APM Justification and Reliability for Flood Protection

The APM for the switchgear located in the 480 Volt Switchgear Room is approximately 1.2 inches. The APM for the berms/ramps in the inner area for Door #14 is approximately 1.3 inches. The APM is deemed adequate due to the following reasons:

- The use of HMR-51 and HMR-52 PMP values is generally considered conservative compared to site-specific PMP studies, particularly for localized, short-duration PMP scenarios.
- Losses due to infiltration and other surface retention were conservatively ignored in the analysis. The entire ground surface was essentially treated as impervious in the model.
- The use of conservative Manning's n-values.
- The interior drainage analysis did not account for potential attenuation between the exterior and interior of double doors.

- Per site procedure, sandbags are installed at Doors #9 and #14 as a defense-in-depth measure and for asset protection purposes. The protection and ingress restriction provided by the sandbags were conservatively ignored.

7.1.3 Adequate Overall Site Response for Flood Protection

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

7.2 Storm Surge – Path 2

7.2.1 Description of Flood Impact

Table 5-3 shows the storm surge stillwater and wave run-up elevations for structures identified in the MSFHI letter and the RB. Of those structures, only the RB houses key SSCs needed to maintain the KSFs. Protection for all key SSCs located in the RB is provided by the plant grade, which is inherently permanently-installed and passive. Adequate APM justification for the RB has been provided below and no further evaluation is required.

7.2.2 Adequate APM Justification and Reliability for Flood Protection

The probable maximum water surface elevation due to the NUREG/CR-7046 (Reference 10), Section H.3.2, Alternative 4, Combined-Effects Flood is estimated to produce a maximum wave run-up elevation of 23.5 feet MSL at the RB, which is equal to the finished floor elevation (door threshold) of 23.5 feet MSL. Zero APM for wind-wave runup is deemed adequate due to the following reasons:

- The maximum storm surge elevation at the RB is not a constant water level as the wind-waves are intermittent, so the zero APM is only realized at each peak wave runup height. The maximum still water elevation only reaches 22.8 feet MSL, which is well below the finished floor elevation of the RB.
- As indicated in Sections 7.1.1 and 7.1.2, existing doors to the RB provide an additional barrier that would limit water ingress.
- OCNGS's procedure includes installation of sandbags at key locations as a defense-in-depth measure.
- Per Reference 14, Section 6.3.4, the method used to calculate the wind-wave runup assumed waves are impacting a vertical structure and is based on the condition that the stillwater level is above grade and directly against the structure. (See the illustration in Table VI-5-52 of Reference 15.) Since the maximum stillwater level is only approximately 0.2 foot above nominal site grade and the RB is set back from the canal by approximately 300 feet, the wind-wave

runup at the RB will likely attenuate and never reach the computed maximum elevation.

Therefore, the APM has been determined as adequate based on the conditions required to produce this water elevation, the relatively short exposure time that the maximum water levels will pose a challenge to the site, and the presence of additional flood protection measures.

7.2.3 Adequate Overall Site Response for Flood Protection

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

8 CONCLUSION

The FHRR showed two flooding mechanisms that were not bounded by the CLB and were required to be evaluated in this FE. The LIP event was estimated to generate water levels that exceed the door thresholds on two doors of the RB (Doors #9 and #14). These doors lead to emergency power distribution components and to RB basement corner rooms with containment spray pumps. However, an interior drainage analysis performed for OCNGS predicted that the maximum ingress through the doors will not result in flood heights that could impact key SSCs. Furthermore, as a defense-in-depth measure, OCNGS's procedures include the installation of sandbags in front of the two doors upon receipt of a weather warning for extreme precipitation. The sandbags are pre-filled and staged in an area near the doors. This FE concluded that the OCNGS flood protection effectively protects key SSCs that maintain KSFs without operator actions.

The second mechanism that was not bounded by the CLB is the storm surge/PMF event combination. The FHRR estimated the storm surge would produce flooding elevations and wave action that could exceed door thresholds for some buildings that do not house key SSCs. The FE concluded that the RB, which does house key SSCs, is effectively protected without operator actions. Therefore, no water intrusion or accumulation is anticipated inside the RB and the plant will be able to maintain all KSFs throughout the event.

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