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April 3, 2017

L-MT-17-024
10 CFR 50.54(f)

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Monticello Nuclear Generating Plant
Docket No. 50-263
Renewed Facility Operating License No. DPR-22

Monticello Nuclear Generating Plant, Response to March 12, 2012, Request for Information Enclosure 2, Recommendation 2.1, Flooding, Required Response 3, Focused Evaluation (CAC No. MF7712)

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. (ADAMS Accession No. ML12056A046)

2) NRC Letter, "Coordination of Requests for Information Regarding Flooding Hazard Reevaluations and Mitigating Strategies for Beyond-Design-Basis External Events," dated September 1, 2015. (ADAMS Accession No. ML15174A257)

3) NRC COMSECY-15-0019, "Closure Plan for the Reevaluation of Flooding Hazards for Operating Nuclear Power Plants," dated June 30, 2015. (ADAMS Accession No. ML15153A104)

4) NRC SRM COMSECY-15-0019, "Staff Requirements - COMSECY-15-0019 - Closure Plan for the Reevaluation of Flooding Hazards for Operating Nuclear Power Plants," dated July 28, 2015. (ADAMS Accession No. ML15209A682)

5) NEI 16-05, "External Flooding Assessment Guidelines," Revision 1, June 2016. (ADAMS Accession No. ML16165A178)

6) NRC JLD-ISG-2016-01, "Guidance for Activities Related to Near-Term Task Force Recommendation 2.1, Flooding Hazard Reevaluation; Focused Evaluation and Integrated Assessment," Revision 0, dated July 11, 2016. (ADAMS Accession No. ML16162A301)

7) NSPM Letter to NRC, "Monticello Nuclear Generating Plant: Response to Post-Fukushima Near-Term Task Force (NTTF) Recommendation 2.1, Flooding - Flood Hazard Reevaluation Report," L-MT-16-024, dated May 12, 2016. (ADAMS Accession No. ML16145A179)

8) NRC Letter to NSPM, "Monticello Nuclear Generating Plant – Interim Staff Response to Reevaluated Flood Hazards Submitted in Response to 10 CFR 50.54(f) Information Request – Flood-Causing Mechanism Reevaluation (CAC No. MF7712)," dated September 16, 2016. (ADAMS Accession No. ML16248A004)

With this letter Northern States Power Company, a Minnesota corporation (NSPM), doing business as Xcel Energy, hereby submits the Monticello Nuclear Generating Plant (MNGP) Flooding Focused Evaluation (FE).

On March 12, 2012, the NRC issued Reference 1, which included a request for information associated with Near-Term Task Force (NTTF) Recommendation 2.1 for flooding. In Enclosure 2 of Reference 1, the NRC Staff requested licensees to perform a Flood Hazard Reevaluation (Requested Information Item 1) and submit the Flood Hazard Reevaluation Report (Required Response Item 2). Enclosure 2 of Reference 1 also requested licensees to perform an Integrated Assessment if the design basis flood did not bound the reevaluated hazard for all flood causing mechanisms (Requested Information Item 2). Reference 1 required a written response for the Integrated Assessment (Required Response Item 3).

Subsequent to the Reference 1 requests, discussions within the NRC and industry resulted in a reassessment of the Flooding Impact Assessment Process (Reference 2). On June 30, 2015, the NRC staff issued COMSECY-15-0019 (Reference 3) that described the closure plan for NTTF Recommendation 2.1 regarding the reevaluation of flooding hazards. As discussed in COMSECY-15-0019, the majority of sites with flooding hazards exceeding the design-basis flood screen out from the integrated assessments. The NRC staff concluded that licensees that screened out would provide a focused evaluation (FE) instead of an integrated assessment. The FE would ensure appropriate actions are taken and that these actions are effective and reasonable. The Commission approved the NRC staff's plans to implement a graded approach to the flood hazard reevaluations in Staff Requirements Memorandum (SRM) COMSECY-15-0019 (Reference 4) on July 28, 2015.

The guidance in Nuclear Energy Institute (NEI) 16-05 (Reference 5) addresses the Reference 1 request for information and describes the methodology for performing FEs and integrated assessments of flood mechanisms that exceed the design basis flood parameters for a facility. The NRC endorsed NEI 16-05, Revision 1 with clarifications as described in the enclosure to JLD-ISG-2016-01 (Reference 6). The Interim Staff Guidance (ISG) states that licensees may use the methodology of NEI 16-05, with clarifications, upon receipt of the flood hazard parameters for use in the Mitigating Strategies Assessments of NEI 12-06, Appendix G.

In Reference 7 NSPM submitted the flood hazard reevaluation report (FHRR) for MNGP in May 2016. In October 2016, NSPM received the flood hazard parameters from the NRC (Reference 8) needed to begin the FE.

The Enclosure to this letter provides the MNGP Flooding FE. This FE follows Path 2 of NEI 16-05 (Reference 5), and utilizes Appendix B for guidance for evaluating the site protection features. The FE concludes that during local intense precipitation (LIP) events the site has effective flood protection through the determination of available physical margin and the reliability of flood protection features. No human actions are required to protect the MNGP structures, systems and components, therefore, an evaluation of the overall site response was not necessary. Responses to the documentation requirements in Section 9 of NEI 16-05 are included in Appendix 1 of the enclosed evaluation. The Appendix 1 responses fulfill Reference 1, Enclosure 2, Requested Information Item 2.

Please contact John Fields, at 763-271-6707, if additional information or clarification is required.

Summary of Commitments

This letter makes no new commitments and no revisions to existing commitments.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on April 3, 2017.

Peter A. Gardner
Site Vice President, Monticello Nuclear Generating Plant
Northern States Power Company - Minnesota

Enclosure

cc: Administrator, Region III, USNRC
Project Manager, Monticello Nuclear Generating Plant, USNRC
Resident Inspector, Monticello Nuclear Generating Plant, USNRC

ENCLOSURE

MONTICELLO NUCLEAR GENERATING PLANT

Monticello External Flooding Assessment
Focused Evaluation

21 pages follow

Xcel Energy

Contract No. 00048375

Monticello External Flooding Assessment Focused Evaluation

CLIENT APP.: N/A

BLACK & VEATCH

Overland Park, KS

NO.	DATE	DESCRIPTION	DRN	DES	CHK	APP
0	3/13/2017	Issued for Client Use (RAR-180999-0003)	SDT	N/A	DVR-180999-0020	SDT

FILE NUMBER 50.2000

REVIEW LEVEL N/A

THIS DOCUMENT CONTAINS SAFETY-RELATED ITEMS ☒ YES ☐ NO

THIS DOCUMENT CONTAINS SEISMIC CATEGORY I ITEMS ☒ YES ☐ NO

CLIENT DOCUMENT REFERENCE NUMBER	TOTAL SHEETS	PROJECT DOCUMENT NUMBER
N/A	21	180999.50.2300-04

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MONTICELLO NUCLEAR GENERATING PLANT

FLOODING FOCUSED EVALUATION SUMMARY

1.0 EXECUTIVE SUMMARY

The Monticello Nuclear Generating Plant (MNGP) has reevaluated its flooding hazard in accordance with the NRC's March 12, 2012, 10 CFR 50.54(f) request for information (RFI) (Reference 1). 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 May 12, 2016, (Reference 2) and is provided in the Mitigating Strategies Flood Hazard Information (MSFHI) documented in NRC's "Interim Staff Response to Reevaluated Flood Hazards" letter dated September 16, 2016 (Reference 9). There is one mechanism that was found to exceed the design basis flood level at the MNGP. This mechanism is listed below and addressed in this FE:

1. Local Intense Precipitation (LIP)

   Associated effects (AE) and flood event duration (FED) parameters were assessed and submitted as a part of the FHRR. Subsequent to submittal of the FHRR (Reference 2), the MNGP performed additional more refined flooding analysis for the LIP (Reference 10). Reference 10 uses site specific precipitation inputs in lieu of the applicable HMR methods for determining precipitation inputs, and includes an unsteady flow approach to better quantify the impacts of water outside of various plant doors. This revised LIP flooding analysis will serve as the input to this Focused Evaluation (FE). The FE affirms that during LIP events the site has effective flood protection through the determination of adequate Available Physical Margin (APM) and the reliability of protection features. The site does not require any human actions to protect Key SSCs so an evaluation of the overall site response was not necessary. This FE follows Path 2 of NEI 16-05, Rev. 1 (Reference 7), and utilizes Appendix B for guidance for 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.

2.0 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 the MNGP, Units 1 and 2, the FHRR was submitted on May 12, 2016 (Reference 2).

Following the Commission's directive to NRC Staff in Reference 6, the NRC issued a letter to industry (Reference 5) indicating that new guidance is being prepared to replace instructions in Reference 4 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 7), 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 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.

3.0 REFERENCES

1. U.S. Nuclear Regulatory Commission 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. NSPM Letter L-M-16-024 to the U.S. Nuclear Regulatory Commission, "Monticello Nuclear Generating Plant, Units 1 and 2, Response to March 12, 2012 Request for Information Enclosure 2, Recommendation 2.1, Flooding, Required Response 2, Flooding Hazard Reevaluation Report," dated May 12, 2016, (ADAMS Accession No. ML16145A233).

3. U.S. Nuclear Regulatory Commission 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.

4. U.S. Nuclear Regulatory Commission Letter, "Trigger Conditions For Performing An Integrated Assessment And Due Date For Response," dated December 3, 2012, (ADAMS Accession No. ML12326A912).

5. U.S. Nuclear Regulatory Commission Letter, "Coordination of Requests for Information Regarding Flooding Hazard Reevaluations and Mitigating Strategies for Beyond-Design-Basis External Events," dated September 1, 2015, (ADAMS Accession No. ML15174A257).

6. Commission Staff Requirements Memo (SRM), "SRM-COMSECY-14-0037: Integration of Mitigating Strategies for Beyond-Design-Basis External Events and the Reevaluation of Flooding Hazards," dated March 30, 2015, (ADAMS Accession No. ML15089A236).

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

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

9. U.S. Nuclear Regulatory Commission, Letter to Peter A. Gardner, Northern States Power Company – Minnesota, "Subject: Monticello Nuclear Generator Plant – Interim Staff Response to Reevaluated Flood Hazards Submitted in Response to 10 CFR 50.54(f) Information Request – Flood-Causing Mechanism Reevaluation (CAC Nos. MF7712)," Dated September 16, 2016, (ADAMS Accession No. ML16248A003).

10. Black & Veatch, "Local Intense PMP & Hydrology," Calculation 180999.51.1005, Revision 4.

11. NSPM, "Monticello Updated Safety Analysis Report," Section 2.4, “Hydrology,” Revision 32.

12. NSPM, Procedure A.6, "Acts of Nature,” Revision 55.

13. NSPM, Procedure 8300-02, “External Flooding Protection, Implementation to Support A.6, Acts of Nature,” Revision 7.

14. NSPM, EC 12421 – Engineering Evaluation, “Effect of EPU Reactor Building HELB Liquid Breaks on EQ Specifications, Part B.

15. NSPM, Calculation 03-200, “Internal Flooding Evaluation Due to a Postulated Break in 2.5” Fire Line,” Revision 0.

16. NSPM, Calculation 07-035, “Internal Flooding Analysis,” Revision 0.

17. NSPM, Drawing NF-36989, “Diesel Fuel Pump House,” Revision 78.

18. Black & Veatch, "Evaluation of Structural Elements - Flood," Calculation 180999.51.1010, Revision 1.

19. Black & Veatch, “Site Specific PMP and Ancillary Meteorological Analysis,” Calculation 180999.51.1008, Revision 1.

4.0 TERMS AND DEFINITIONS

AE – Associated Effects
AIM – Assumption, Input, Method
APM – Available Physical Margin
EDG – Emergency Diesel Generator
FE – Focused Evaluation
FED – Flood Event Duration
FFE – Finished Floor Elevation
FHRR – Flood Hazard Reevaluation Report
FIAP – Flooding Impact Assessment Process
FLEX – Diverse and flexible coping strategies covered by NRC order EA-12-049
HMR – Hydro Meteorological 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
MSA – Mitigating Strategies Assessment
MSFHI – Mitigating Strategies Flood Hazard Information
NTTF – Near Term Task Force commissioned by the NRC to recommend actions following the Fukushima Dai-ichi accidents
MNGP – Monticello Nuclear Generating Plant
NB – Not Bounded
NEI – Nuclear Energy Institute
NGVD29 – National Geodetic Vertical Datum of 1929
PAB – Plant Administration Building
PMF – Probable Maximum Flood
RFI – Request for Information
USAR – Updated Safety Analysis Report
WSE – Water Surface Elevation

5.0 FLOOD HAZARD PARAMETERS FOR UNBOUNDED MECHANISMS

The NRC has completed the "Interim Staff Response to Reevaluated Flood Hazards" to the flood hazards information submitted in the MNGP FHRR (Reference 9); which states:

> The NRC staff has concluded that the licensee's reevaluated flood hazard information is suitable for the assessment of mitigating strategies developed in response to Order EA-12-049 (i.e., defines the mitigating strategies flood hazard information described in guidance documents currently being finalized by the industry and NRC staff) for Monticello. Further, the NRC staff has concluded that the licensee's reevaluated flood hazard information is a suitable input for other assessments associated with Near-Term Task Force Recommendation 2.1, "Flooding."

The summary of the reevaluated flood hazard (i.e., MSFHI) parameters was provided in Reference 9. The following flood-causing mechanisms were considered as part of the FHRR:

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

Table 2 in the Enclosure to Reference 9 identifies the reevaluated flood hazards. Per Reference 9, this information is suitable input for other assessments associated with Near Term Task Force Recommendation 2.1, "Flooding." The Focused Evaluation is considered to be one of the other assessments associated with Near Term Task Force Recommendation 2.1.

The one non-bounding flood mechanism for the MNGP is described in detail in Reference 2, the FHRR submittal.

Table 5-1 Reevaluated Flood Hazards for Flood-Causing Mechanisms

Mechanism	Stillwater Elevation	Waves/Runup	Reevaluated Flood Hazard
Local Intense Precipitation	935.8 ft NGVD29	Minimal	935.8 ft NGVD29

This is the reevaluated flood-causing mechanism that should be addressed in the external flooding assessment. The one non-bounding flood mechanism for the MNGP is described in detail in Reference 2, the FHRR submittal. Table 5-2 summarizes how the unbounded mechanism is addressed in this external flooding assessment:

Table 5-2 Approach for Evaluation of Non-Bounded Flood Mechanism

	Flood Mechanism	Summary of Assessment
1	Local Intense Precipitation	Path 2 is pursued for the MNGP since permanent passive protection features are solely relied upon to maintain KSFs (see FIAP Path Determination Table, Section 6.3.3 of NEI 16-05). During the LIP, some water ingress does occur at plant structures; however, KSFs are not impacted. For the MNGP, Path 2 includes additional more refined flooding analysis for the LIP.

5.1 REVISED LIP ANALYSIS

Subsequent to submittal of the FHRR (Reference 2), the MNGP performed additional more refined flooding analysis for the LIP (Reference 10). The changes to the assumptions, inputs, and methods (AIM) are summarized in Table 5.1-1.

Table 5.1-1 Discussion of Revised AIMs

	Description of Revised AIM	Justification of Reduced Conservatism
1	Reference 10 uses site specific precipitation inputs in lieu of the applicable HMR methods for determining precipitation inputs	Rainfall inputs used are based on a site-specific LIP study performed for the MNGP site by Applied Weather Associates (AWA) and documented in Reference 19.
2	An unsteady flow approach is used to better quantify the impacts of water outside of various plant doors	The change in approach provides a more rigorous determination of the length of time that the water levels are above the door thresholds. Based on these time durations and the water levels the impact of the water intrusion can be determined.
3	Credit is taken for two openings in the security barrier in the vicinity of the Off-Gas Stack	The openings are part of the design. The openings are not expected to be reduced by potential debris sources based on minimal debris sources available, the long sections of chain link fencing that will preclude larger debris sources from reaching the opening, and the relatively large opening size within the security barrier.

The results from Reference 10 are summarized in Table 5.1-2, below. The primary differences in the results as compared to the FHRR are the inundation and recession times. These are discussed in more detail in Section 7.1.1. Elevations given in this report are in the NGVD29 datum.

Table 5.1-2 Local Intense Precipitation

Flood Scenario Parameter		CDB Flood Hazard	Reevaluated Flood Hazard	Bounded (B) or Not Bounded (NB)
Flood Level and Associated Effects	1. Max Stillwater Elevation (ft NGVD29)	LIP was not specifically addressed in the USAR	935.72	NB
	2. Max Wave Run-up Elevation (ft)		See Note 2	N/A
	3. Max Hydrodynamic/Debris Loading (psf)		See Note 3	N/A
	4. Effects of Sediment Deposition/Erosion		See Note 4	N/A
	5. Concurrent Site Conditions		See Note 5	N/A
	6. Effects on Groundwater		See Note 6	N/A
Flood Event Duration	7. Warning Time (hours)		See Note 7	N/A
	8. Period of Site Preparation (hours)		See Note 8	N/A
	9. Period of Inundation (hours)		See Note 9	NB
	10. Period of Recession (hours)		See Note 10	NB
Other	11. Plant Mode of Operations		See Note 11	N/A
	12. Other Factors		See Note 12	N/A

Additional notes, "N/A" justifications (why a particular parameter is judged not to affect the site), and explanations regarding the bounded/non-bounded determination.

1. None
2. Consideration of wind-generated wave action for the LIP event is not explicitly required in NUREG/CR-7046, ANS-2.8 or the 50.54(f) letter. Furthermore, wave runup is considered negligible due to limited flood depths and fetch.
3. Hydrodynamic loading was not considered plausible due to surface water flow direction is not towards the buildings. Debris impact loading was not considered plausible due to limited velocities and flood depths.
4. Due to limited velocities, and short duration of flooding, sediment deposition and erosion is not considered to have an effect on the LIP flood levels.
5. High winds and hail could coincide with the LIP event. In general, no manual actions are required to be performed outside. Personnel may be, however, exposed to the elements while moving between locations. Environmental conditions would be considered prior to personnel being directed to move between locations.
6. Due to relatively short duration of the LIP event, surcharge to groundwater is not considered.
7. Warning time is not credited in the flood protection strategy (since only permanent/passive measures are used for the LIP flood) and, therefore, was not considered as part of the analysis.
8. SSCs important to safety are protected by means of permanent/passive measures and, therefore, site preparation was not considered as part of the analysis.
9. The period of inundation varies throughout the site; the time that the water surface elevation exceeds the height of openings for plant access doors is provided in Table 7.1-2.
10. The time for water to recede from the site varies by site location. Once the flood waters recede below finished floor elevation it would take approximately 2 to 4 hours for flood waters to completely recede from areas near the plant access doors.
11. There are no limitations on plant modes of operation prior to, or during, the LIP event.
12. There are no other factors, including waterborne projectiles, applicable to this flood causing mechanism.

6.0 OVERALL SITE FLOODING RESPONSE

6.1 Description of Overall Site Flooding Response

The LIP calculation for the MNGP is provided in Reference 10; which describes the inputs, assumptions, methodology, and results. Permanent protection features such as characterized topographic and man-made features that affected runoff from a LIP were modeled. The timelines for the cumulative precipitation and precipitation rates during the LIP are shown in Table 6.1-1. The precipitation rate is determined by dividing the change in cumulative precipitation by the change in time duration.

Table 6.1-1, Precipitation Cumulative Precipitation and Rates

Time Duration	Cumulative Precipitation (inches)	Precipitation Rate (inches/hour)
5 min	4.5	54.0
15 min	7.2	16.2
30 min	10.2	12.0
1 hr	13.2	6.0
6 hr	20.6	1.5

The period of inundation during the LIP varies throughout the site. Table 7.1-2 shows the length of time that the water level remains above the door sill/invert height for the various plant doors; column labeled “Total Estimated Inflow Time (min).”

The MNGP is licensed for a PMF from the Mississippi River with a flood water elevation up to 939.2 ft (USAR - Reference 11). Procedural actions are implemented based on river water elevation projections to provide flood protection for a PMF. Flood preparation measures for a PMF are implemented per procedures A.6 and 8300-02 (References 12 and 13, respectively). Specific measures are taken as part of References 12 and 13 for preparation for a flood from the Mississippi River. These protective measures include construction of a levee and bin wall extensions around the power block and sealing penetrations in the Intake Structure in order to keep water out of the plant. Implementation of these preparation measures can take several days. Based on the time duration of the PMF there is sufficient time to implement the protective measures.

For a LIP event the levee and bin wall extensions would not be constructed due to an absence of warning time and because, if constructed, the levee and bin wall extensions could exacerbate the LIP event by precluding water drainage from the site. With the exception of Door 209, penetrations in the Intake Structure will not see water during the LIP. During the LIP flood, the predicted water levels exceed threshold elevations of several pathways as the doors are not protected. The evaluation of the robustness of plant flood protection features during a LIP considers (1) the impact of water intrusion at doors that would not be protected, and (2) the structural impacts of the hydraulic loads to doors that would not be protected.

6.2 Summary of Plant Modifications and Changes

The MNGP has completed the flooding evaluations for the LIP. There are no remaining actions (plant modifications, procedural changes, or procurement activities) necessary to implement flood strategies described.

7.0 FLOOD IMPACT ASSESSMENT

7.1 LOCAL INTENSE PRECIPITATION

7.1.1 Description of Flood Impact

As described in Section 6.1, with the exception of the plant doors, the plant is passively protected for the LIP. These doors are protected from the PMF through installation of protective features. These same protective features would not be in place for the LIP.

Table 7.1-1 below summarizes Key SSCs and the minimum critical water elevation in each structure that could impact Key SSCs. There may be other Key SSCs located in the structure at higher elevations. To be conservative only the lowest elevation is identified.

Table 7-1.1, Key SSCs and Associated Critical Elevation

Structure	Key SSC	Critical Elevation (ft)	Notes
Turbine Building	Division II Electrical Equipment	931.3	(1)
Reactor Building	MCCs 311 and 312	896.7	(2)
Plant Administration Building	AC Component for Division I and II 125 VDC Battery Chargers	928.4	(3)
Emergency Diesel Generator Building	Components Inside of Panels C-91 and C-92	932.3	(4)
Intake Structure	Pump Motors and Associated Electrical Components	921	(5)
Fuel Oil Pump House	Fuel Oil Pumps	927.3	(6)

Notes:

(1) In a flooding scenario in the Turbine Building, water would accumulate in the lower elevation of the building at elevation 911 ft. The available volume at elevation 911 ft to accept inleakage is greater than 140,874 ft^3; which corresponds to a limiting internal flooding scenario in the Turbine Building. The minimum elevation of 3.75 in. above the FFE is the minimum water height that could affect the 4KV switchgear.

(2) The minimum level of 8.5 in. above the FFE is the height off the floor to the bottom of the MCCs (Reference 14). Electrical equipment inside the MCCs is above the bottom of the cabinet.

(3) At a level of 4.75 in. above the FFE in the PAB basement, the Division I and II 125 VDC battery chargers could be affected (Reference 15).

(4) At a level of 16 in. above the FFE in the EDG Building, the speed sensing switches and other terminals within panels C-91 and C-92 would start to be submerged. There are 9 in. curbs which separate the two EDG rooms from each other and separate the EDG Building from the Turbine Building. At a water level of 9 inches in the EDG Building, the water would overtop the curbs and flow into the Turbine Building. Thus, the curbs limit the maximum water level in the EDG rooms to 9 in., or below the critical elevation.

(5) Key SSCs pump motors and associated electrical components are at least 2 ft above the FFE. In addition, leakage into the Intake Structure from the Screenhouse will flow into the Turbine Building through a tunnel connecting the Intake Structure with the Turbine Building. This tunnel precludes water accumulation in the Intake Structure (Reference 16). With the available volume identified in Note (1), above, the water level in the Turbine Building could be approximately six inches above the FFE for the Intake Structure.

(6) The Fuel Oil Pump pedestals are 1 ft 4 in. above the FFE (Reference 17).

Table 7.1-2 shows the predicted maximum water surface elevations (WSE) at the plant access doors during the LIP (Reference 10). As shown in Table 7.1-2, the maximum water surface elevations around the plant structures can be up to 1.0 ft above the opening for plant access doors. Table 7.1-2 includes the maximum water depth at each door, the door opening width, door gap or if the door is assumed to be open, the peak water inflow rate and total inflow volume and time duration that the water elevation exceeds the door opening. The locations of the plant access doors are shown in Figure 7.1-1.

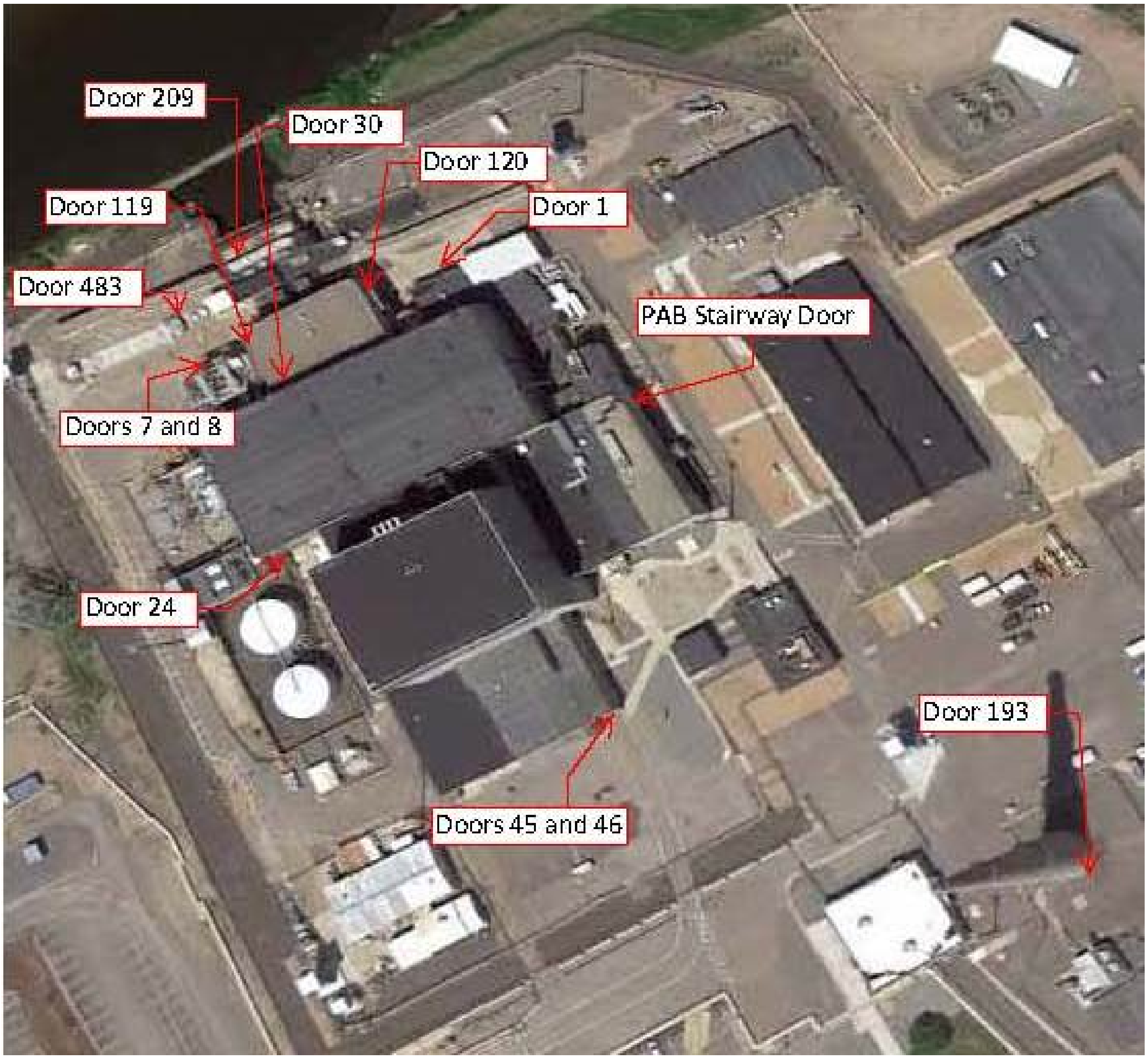
Table 7.1-2 Water Depth at Plant Access Doors

Opening Location	Opening Invert/Sill Level (ft)	Estimated Maximum WSE (ft)	Maximum Water Depth at Opening		Door Opening Width (ft)	Gap at Bottom of Door (in) (Note 1)	Peak Inflow		Total Estimated Inflow Volume (ft^3)	Total Estimated Inflow Time (min)
			(ft)	(in)			(cfs)	(gpm)		
Intake Structure Door (Door 209) – interior between Screen House and Intake Structure	919.50	920.02	0.52	6.24	3	3/4	0.77	346	707	30
						1/2	0.51	229	472	30
						Open	3.23	1,450	1,520	30
West Roll-Up Door-Turbine Bldg Addition (Door 119)	931.25	931.11	n/a	n/a	n/a	n/a	Turbine Building Door 119 Open (Notes 2 and 3)		n/a	n/a
East Roll-Up Door-Turbine Bldg Addition (Door 120)	931.25	931.53	0.28	3.36	n/a	n/a	Turbine Building Door 120 Open (Notes 2 and 3)		n/a	n/a
Turbine Bldg Door (Door 30)	931	931.53	0.53	6.36	3	1	1.04	467	2,242	66
						3/4	0.78	350	1,681	66
Railcar Entry – Turbine Bldg (Door 24)	935.00	935.72	0.72	8.64	16	1	6.5	2,918	17,700	86
						1/4	1.6	719	4,425	86
Railcar Entry – Reactor Bldg (Doors 45 and 46)	935.00	935.23	0.23	2.76	17	1/8	0.48	216	617	36
						1/16	0.24	108	309	36
Emergency Diesel Generator – East- (Door 8)	931.00	931.11	0.11	1.32	3	1/4	0.12	54	33	7
Emergency Diesel Generator – West- (Door 7)	931.00	931.11	0.11	1.32	3	1/4	0.12	54	33	7
PAB Stairway Door (Adjacent to Door 341)	932.83	933.09	0.26	3.12	4	1/2	0.48	216	177	9
						5/16	0.30	135	111	9
13.8 KV Room (Door 1)	931.00	931.52	0.52	6.24	6	1/2	1.03	463	2,253	67
						1/4	0.51	229	1,127	67
Off Gas Stack (Door 193)	932.50	933.50	1.00	12.00	5	1/4	0.65	292	2,720	101
						1/8	0.33	149	1,360	101
Fuel Oil Transfer Pump House (Door 483)	931.00	931.11	0.11	1.32	2.5	1/4	0.10	45	28	7
						1/8	0.05	23	14	7
						Open	0.26	117	52	7

Notes:

1. Where more than one gap for a door is shown, the smaller gap is based on site measurements. The larger gap is an assumed value that is conservative relative to the measured gap.
2. Doors 119 and 120 can be open or closed and are assumed to be open for this evaluation. Also see Note 3.
3. Doors 119 and 120 are exterior doors from the outside to the Turbine Building Addition. Door 30 is between the Turbine Building Addition and the Turbine Building. Door 30 is credited with precluding water ingress in lieu of Doors 119 and 120.

Figure 7.1-1, Plant Access Door Locations



7.1.2 Adequate APM Justification

The APM for each of the Key SSCs is determined based on the difference between the critical water elevation in Table 7.1-1 and the maximum water surface elevation in Table 7.1-2. This is shown for each of the structures in Tables 7.1-3 through 7.1-8.

Table 7.1-3, APM Determination – Intake Structure

Door Number	Affected Structure	Max WSE (ft) (Table 7.1-2)	Critical Elevation (Table 7.1-1)	APM (ft)	Key SSC Affected
209	Intake Structure	920.02	921	0.98	No

The Intake Structure FFE is 919 ft. As shown in Table 7.1-2 the sill for Door 209 is at 919.5 ft, or 6 in. above the FFE. The maximum water depth in the Intake Structure is based on the assumption that Door 209 is open between the Screenhouse and the Intake Structure. As shown in Table 7.1-2, the WSE exceeds the door sill for 30 minutes. Inleakage into the Intake Structure from the Screenhouse will accumulate in the Turbine Building through a tunnel that connects the Turbine Building to the Intake Structure. This will further preclude water accumulation in the Intake Structure. Therefore, given the relatively short duration of the LIP, the APM, and the significant available volume in the Turbine Building to accommodate inleakage, there is adequate APM for the Intake Structure.

Table 7.1-4, APM Determination – Turbine Building

Door Number	Affected Structure	Max WSE (ft) (Table 7.1-2)	Critical Elevation (Table 7.1-1)	APM	Key SSC Affected
1	Turbine Building	931.52	931.3	See Below	No
24	Turbine Building	935.72	931.3	See Below	No
30	Turbine Building	931.53	931.3	See Below	No
119	Turbine Building	931.11	931.3	See Below	No
120	Turbine Building	931.53	931.3	See Below	No
209	Turbine Building	920.02	931.3	See Below	No

Leakage past Doors 1, 24, and 30 would drain to the 911 ft elevation of the Turbine Building and not accumulate at the 931 ft elevation. The drainage to the 911 ft elevation precludes water from affecting KSFs at the 931 ft elevation. As discussed, above, in the section associated with Table 7.1-3, leakage past Door 209 can also accumulate in the Turbine Building. Doors 1, 24, and 30 are normally closed. As shown in Table 7.1-2, the WSE exceeds the door sill for Doors 1, 24, 30, and 209 for 67, 86, 66, and 30 minutes, respectively. Leakage past Door 1 can accumulate in either the Turbine Building, 911 ft elevation, or the PAB Basement; thus, leakage past Door 1 is included in the determination of total water accumulation for both structures. Turbine Building Addition Doors 119 and 120 can either be open or closed, thus, Doors 119 and 120 are not credited with precluding water ingress. Door 30 is credited in lieu of crediting Doors 119 and 120. As discussed above, leakage past Door 209 from the Screen House to the Intake Structure could accumulate in the Turbine Building 911 ft elevation. Door 209 is normally closed, but for the purpose of this calculation is assumed to be open.

Two gap sizes are provided for Doors 1, 24, and 30 in Table 7.1-2. The smaller gap is the actual gap at the bottom of the door; this is referred to as the realistic gap. The larger gap is simply increasing the realistic gap to add margin; this is referred to as the conservative gap. For the purposes of this evaluation Door 209 is assumed to be open.

Using realistic door gap sizes for Doors 1, 24, and 30 and with Door 209 open, the total water volume that could accumulate in the Turbine Building is 1,127 + 4,425 + 1,681 + 1,520 = 8,753 ft^3. This is a small fraction of the available volume of 140,874 ft^3 to accept inleakage. Using conservative door gap sizes for Doors 1, 24, 30, and 209 (Door 209 is assumed to be open) the total water volume that could accumulate in the Turbine Building is 2,253 + 17,700 + 2,242 + 1,520 = 23,715 ft^3. As expected with the larger door gap size, there is a greater total inleakage volume, but the total inleakage volume is still well within the available volume to accept inleakage.

Leakage through a door gap is calculated in Reference 10 using the orifice equation. In the orifice equation, the flow rate is (1) proportional to the door gap, and (2) proportional to the square root of the head of water outside the door gap. Thus, the effect on the flow rate from conservatively increasing the gap is equivalent to an increase in the head of water multiplied by the door gap ratio (conservative to realistic) squared.

The ratio of the conservative to realistic doors gaps for Doors 1, 24, and 30 are: 2, 4, and 1.33, respectively. This can be translated into the substantial margin of equivalent water depth at the realistic door gaps. As described above, even at these conservatisms, the resulting total inleakage is well within the available volume.

Therefore, based on the margin available in the head of water outside the door used in determining the total inleakage and the margin between the total inleakage and the available volume, there is adequate APM for the Turbine Building.

Table 7.1-5, APM Determination – Reactor Building

Door Number	Affected Structure	Max WSE (ft) (Table 7.1-2)	Critical Elevation (Table 7.1-1)	APM	Key SSC Affected
45 and 46	Reactor Building	935.23	896.7	See Below	No
193	Reactor Building	933.50	896.7	See Below	No

Leakage past Doors 45/46 could accumulate in the Reactor Building. Leakage past Door 193 would initially start to accumulate in the Off-Gas Stack. There are no key SSCs located in the Off-Gas Stack that could be affected by the LIP. Leakage into the Off-Gas Stack would flow through the floor drain and accumulate in the Reactor Building. As shown in Table 7.1-2, the WSE exceeds the door sill for Doors 45/46 and 193 for 36 and 101 minutes, respectively.

Two gap sizes are provided for Doors 45/46 and 193 in Table 7.1-2. The smaller gap is the actual gap at the bottom of the door; this is referred to as the realistic gap. The larger gap is simply increasing the realistic gap to add margin; this is referred to as the conservative gap.

Using realistic door gap sizes for Doors 45/46 and 193, the total water volume that accumulates in the Reactor Building is 309 + 1,360 = 1,669 ft^3. The critical elevation corresponds to a water volume of 6,713 ft^3 in the Reactor Building. The total inleakage is approximately 25% of the available capacity. Using the conservative door gap size for Doors 45/46 and Door 193 the total water volume that could accumulate in the Reactor Building is 617 + 2,720 = 3,337 ft^3. In this case the total inleakage is approximately 50% of the available capacity.

Leakage through a door gap is calculated in Reference 10 using the orifice equation. In the orifice equation, the flow rate is (1) proportional to the door gap, and (2) proportional to the square root of the head of water outside the door gap. Thus, the effect on the flow rate from conservatively increasing the gap is equivalent to an increase in the head of water multiplied by the door gap ratio (conservative to realistic) squared.

The ratio of the conservative to realistic doors gaps for Doors 45/46 and 193 are both 2. This can be translated into the substantial margin of equivalent water depth at the realistic door gaps. As described above, even at these conservatisms, there is significant margin (approximately 50%) between the total inleakage volume and the available volume to accept inleakage.

Therefore, based on the margin available in the head of water outside the door used in determining the total inleakage and the margin between the total inleakage and the available volume, there is adequate APM for the Reactor Building.

Table 7.1-6, APM Determination – Emergency Diesel Generator Building

Door Number	Affected Structure	Max WSE (ft) (Table 7.1-2)	Critical Elevation (Table 7.1-1)	APM (ft)	Key SSC Affected
7	EDG Building – West	931.11	932.33	1.2	No
8	EDG Building - East	931.11	932.33	1.2	No

As shown in Table 7.1-2, the WSE exceeds the Door 7 and 8 sill for 7 minutes. The peak water elevation outside the doors is 931.11 or approximately 1.3 inches above the EDG room floor; which is less than the water depth of 16 inches that can be accommodated. In addition, there are 9 in. curbs which separate the two EDG rooms from each other and separate the EDG Building from the Turbine Building. At a water level of 9 inches in the EDG Building, the water would flow overtop the curbs and flow into the Turbine Building. Thus, the curbs limit the maximum water level in the EDG rooms to 9 in. The maximum water depth is below 9 in., thus, inleakage would be contained within the EDG rooms.

Given, the relatively short time period that the WSE exceeds the door sill; that the maximum water level that would be reached in the room assuming the drains were blocked is less than the critical elevation; and that the maximum water level is limited by the curbs to less than the critical elevation, there is adequate APM.

Table 7.1-7, APM Determination – Plant Administration Building

Door Number	Affected Structure	Max WSE (ft) (Table 7.1-2)	Critical Elevation (Table 7.1-1)	APM (ft)	Key SSC Affected
PAB Stairway Door	PAB	933.09	928.4	See Below	No
1	PAB	931.52	928.4	See Below	No

The PAB Stairway Door provides access to the PAB. Leakage past Door 1 could also enter the PAB. Thus, leakage past the PAB Stairway Door and Door 1 could accumulate in the PAB Basement. As shown in Table 7.1-2, the WSE exceeds the door sill for the PAB Stairway Door and Door 1 for 9 and 67 minutes, respectively.

Two gap sizes are provided for Doors 1 and the PAB Stairway Door in Table 7.1-2. The smaller gap is the realistic gap at the bottom of the door; this is referred to as the realistic gap. The larger gap is simply increasing the actual gap to add margin; this is referred to as the conservative gap.

Using realistic door gaps for the two doors, the total water volume that could accumulate in the PAB Basement is 111 + 1,127 = 1,238 ft^3. This is equivalent to a water depth of 1.6 in. This is approximately 33% of the critical elevation of 4.75 in. Using the conservative door gap sizes for the PAB Stairway Door and Door 1 the total water volume that could accumulate in the PAB Basement is 177 + 2,253 = 2,430 ft^3. This is equivalent to a water depth of 3.2 in., or approximately 67% of the critical elevation.

Leakage through a door gap is calculated in Reference 10 using the orifice equation. In the orifice equation, the flow rate is (1) proportional to the door gap, and (2) proportional to the square root of the head of water outside the door gap. Thus, the effect on the flow rate from conservatively increasing the gap is equivalent to an increase in the head of water multiplied by the door gap ratio (conservative to realistic) squared.

The ratio of the conservative to realistic doors gaps for Doors 1 and the PAB Stairway Door are: 2 and 1.6, respectively. This can be translated into the substantial margin of equivalent water depth at the realistic door gaps. As shown above, even with these increases in the water elevation, there is margin (approximately 33%) between the total inleakage volume and the available volume to accept inleakage.

Therefore, based on the margin available in the head of water outside the door used in determining the total inleakage and the margin between the total inleakage and the available volume, there is adequate APM for the Plant Administration Building.

Table 7.1-8, APM Determination – Fuel Oil Pump House

Door Number	Affected Structure	Max WSE (ft) (Table 7.1-2)	Critical Elevation (Table 7.1-1)	APM (ft)	Key SSC Affected
483	Fuel Oil Pump House	931.11	927.33	See Below	No

Door 483 is maintained closed. As shown in Table 7.1-2, the WSE exceeds the door sill for 7 minutes. The critical water elevation in the Fuel Oil Pump House corresponds to an allowable total inleakage of 80 ft^3. Using a conservative door gap with the door closed the inleakage is 28 ft^3; 35% of the available volume. The conservative door gap is larger than the actual physical door gap without credit for weather stripping. Furthermore, if it is conservatively assumed that Door 483 is open the total water volume that could accumulate in the Fuel Oil Pump House is 52 ft^3; 65% of the available volume.

Given that there is margin between the total inleakage and the available volume, even with the normally closed door assumed to be open, there is adequate APM for the Fuel Oil Pump House.

Summary

As described above the limiting flood elevations are below the critical elevations for Key SSCs. Therefore, the KSFs are protected by the characteristics of the site itself such as plant grading, by locations of the Key SSCs, and by the capability of the structures to accommodate inleakage. Therefore, the LIP is not a consequential flood for the MNGP. Furthermore, any flood up to the LIP flood described above would also not be considered a consequential flood for the MNGP.

7.1.3 Reliability of Flood Protection

As described above, flood protection for the LIP is provided by the permanently installed plant structures that are designed for a PMF. The WSE for the PMF is much higher than a LIP, thus the permanently installed plant structures will provide flood protection for the LIP. Since plant doors will not be protected for the LIP by the same protection that would be installed as part of the PMF flood response, potential loads during the LIP event were evaluated at the doors. These doors and supporting structures have been evaluated (Reference 18) and determined to be capable of withstanding the loads from the LIP water level. The LIP event will not include debris impact or appreciable hydrodynamic effects due to the direction of flow being away from the buildings.

7.1.4 Adequate Overall Site Response

The site does not require any human actions to protect Key SSCs during the LIP. Thus, an evaluation of the overall site response was not necessary.

8.0 CONCLUSION

Associated effects (AE) and flood event duration (FED) parameters were assessed and submitted as a part of the FHRR. The FE affirms that during LIP events the site has effective flood protection through the determination of Available Physical Margin (APM) and the reliability of protection features. The site does not require any human actions to protect Key SSCs so an evaluation of the overall site response was not necessary. This FE follows Path 2 of NEI 16-05, Rev. 1, and utilizes Appendix B for guidance for 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.

APPENDIX 1

This appendix provides a matrix of the items identified in Section 9.2, "Documentation," of NEI 16-05, for Path 2, with the corresponding section(s) in the MNGP Focused Evaluation where the requested information is provided.

- **Characterization of Flood Parameters**
  Flood hazard parameters are summarized in Table 5.1-2.

- **Evaluation and Description of Flood Impacts**
  Section 6.1 provides a description of the overall site flooding response during a LIP. Section 7.1 summarizes the impacts to the site during a LIP. Table 7.1-2 identifies the maximum water surface elevations at each of the plant access doors during the LIP.

- **Key SSCs Potentially Impacted by Flood Waters**
  Table 7.1-1, including the notes identifies the Key SSCs that could potentially be impacted by flood waters during a LIP. As described in Section 7.1.1, the Key SSCs identified are those that would be initially impacted by water in each structure; i.e., those at the lowest elevation.

- **Critical Elevations That Could Impact Key SSCs**
  Table 7.1-1 identifies the critical elevations for the Key SSCs for each of the structures. As described in Section 7.1.1, to be conservative, the critical elevation corresponding to the Key SSC at the lowest elevation is identified.

- **Flood Features Relied On To Protect Key SSCs**
  During a LIP permanent passive protection features are relied on to protect Key SSCs to maintain KSFs. Section 6.1 describes the permanent passive protection as the plant structures. To be conservative, gaps at plant access doors were considered in a conservative manner during a LIP. The actual gaps are smaller than the gaps assumed and would further reduce the amount of water inleakage. As summarized in Section 7.1.3, plant access doors were evaluated to ensure that they are capable of withstanding the loads from the LIP.

- **Demonstration of Effective Protection, Including:**

  - **Calculation of APM for Each Flood Protection Feature**
    The determination of APM for the flood protection features for each of the plant structures are provided in Tables 7.1-3 through 7.1-8.

  - **Justification that Calculated APM is Adequate**
    Appropriate justification that the APM for the flood protection features for each of the plant structures is adequate is provided in the discussion associated with Tables 7.1-3 through 7.1-8.

  - **Evaluation of Reliability of Each Flood Protection Feature**

As described in Section 7.1.3, flood protection for the LIP is provided by permanently installed plant structures (passive protection) that are designed for a PMF. The WSE for the PMF is much higher than a LIP, thus the permanently installed plant structures will provide reliable flood protection for the LIP. Doors and the associated supporting structures have been evaluated and determined to be capable of withstanding the loads from the LIP water level.

- **Evaluation of Human Actions and an Adequate Site Response**
  As described in Section 7.1.4, the site does not require any human actions to protect Key SSCs during the LIP. Thus, an evaluation of the adequacy of the overall site response was not necessary.

- **Summary of Results and Conclusions of Assessment Demonstrating Effective Protection**
  As summarized in Section 8.0, associated effects and flood event duration parameters were assessed and submitted as a part of the FHRR. The FE affirms that during LIP events the site has effective flood protection through the determination of Available Physical Margin and the reliability of protection features. The site does not require any human actions to protect Key SSCs so an evaluation of the overall site response was not necessary. This FE follows Path 2 of NEI 16-05, Rev. 1, and utilizes Appendix B for guidance for 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.