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10 CFR 50.54(f)

JAFP-17-0078
July 27, 2017

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

Subject: Focused Evaluation Summary Pursuant to 10 CFR 50.54(f) Request for Information Regarding Recommendation 2.1: Flooding of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident

James A FitzPatrick Nuclear Power Plant
Docket No. 50-333
Renewed Facility Operating License No. DPR-059

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, ML12053A340, dated March 12, 2012
2. Entergy letter, Flood Hazard Reevaluation Report - Response NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding the Flooding Aspects of Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, JAFP-15-0036, dated March 12, 2015
3. Entergy letter, Commitments for March 12, 2012, Information Request Pursuant to 10 CFR 50.54(f) Regarding Recommendation 2.1, Flooding and Seismic, JAFP-16-0168, dated November 7, 2016
4. NEI document, External Flooding Assessment Guidelines, Revision 1, NEI 16-05, dated June 2016
5. NRC interim staff guidance, Guidance for Activities Related to Near-Term Task Force Recommendation 2.1, Flood Hazard Reevaluation; Focused Evaluation and Integrated Assessment, Revision 0, JLD-ISG-2016-01, dated July 11, 2016
6. NRC letter, James A. FitzPatrick Nuclear Power Plant – Staff Assessment of Response to 10 CFR 50.54(f) Information Request – Flood-Causing Mechanism Reevaluation (TAC No. MF6106), ML17067A469, dated March 27, 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 James A. FitzPatrick Nuclear Power Plant (JAF) the FHRR was submitted on March 12, 2015 by Reference 2. This letter completes the assessment which incorporate the FHRR.

The approach, as committed to in Reference 3, for performing this assessment is specified by the Nuclear Energy Institute (NEI) 16-05, External Flooding Assessment Guidelines [Reference 4], as endorsed by the NRC [Reference 5]. 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 Flooding Focused Evaluation follows Path 2 of NEI 16-05, Revision 1 [Reference 4], and utilized Appendix B for guidance on evaluating the site protection features. The flooding analysis documented in Reference 6 (NRC Staff Assessment Report) was utilized as input to this Flooding Focused Evaluation.

The Enclosure to this letter provides the Flooding Focused Evaluation summary report for JAF.

This letter contains no new regulatory commitments. Should you have any questions regarding this submittal, please contact Mr. William C. Drews, Regulatory Assurance Manager at (315) 349-6562.

I declare under penalty of perjury that the foregoing is true and correct. Executed on 27th day of July, 2017.

Sincerely,

Joseph E. Pacher
Site Vice President

JEP/WCD/mh

Enclosure: James A. FitzPatrick Nuclear Power Plant Flooding Focused Evaluation Summary

cc: Director, Office of Nuclear Reactor Regulation
NRC Region I Administrator
NRC Resident Inspector
NRC Project Manager
NYSPSC
President NYSERDA

JAFP-17-0078

Enclosure

James A. FitzPatrick Nuclear Power Plant Flooding Focused Evaluation Summary

(21 Pages)

EXELON NUCLEAR
Engineering Report Cover Sheet

Engineering Report Title:

2017 FOCUSED EVALUATION FOR EXTERNAL FLOODING AT JAMES A. FITZPATRICK NUCLEAR POWER PLANT

Engineering Report Type:

New ☒ Revision ☐ Cancelled ☐ Superseded ☐
Superseded by: _____

Applicable Site(s)

IP1	☐	IP2	☐	IP3	☐	JAF	☒	PNPS	☐	VY	☐	WPO	☐
ANO1	☐	ANO2	☐	ECH	☐	GGNS	☐	RBS	☐	WF3	☐	PLP	☐

EC No. 70295

Report Origin: ☐ Entergy ☒ Vendor
Vendor Document No.: ENTCORP045-REPT-001

Quality-Related: ☐ Yes ☒ No

Prepared by: ENERCON — Date: 3/30/17
Responsible Engineer (Print Name/Sign)

Design Verified: N/A — Date: ---
Design Verifier (if required) (Print Name/Sign)

Reviewed by: AG Porch / — Date: 7/19/17
Reviewer (Print Name/Sign)

Approved by: Guy Foster/ — Date: 7/20/17
Supervisor / Manager (Print Name/Sign)

EN-DC-149 Review Status: 2 - ACCEPTED AS NOTED RESUBMITTAL NOT REQUIRED Exelon review comments have been incorporated into the final ENERCON submittal document by Exelon. Resubmittal by ENERCON is not required. Refer to EC 9000070295 attachment files for comments and resolution details.

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Title:	2017 FOCUSED EVALUATION FOR EXTERNAL FLOODING AT JAMES A. FITZPATRICK NUCLEAR POWER PLANT	REPORT NO.: ENTCORP045-REPT-001
		REVISION: 0
		Client: Entergy
		Project Identifier: ENTCORP045

Item	Cover Sheet Items	Yes	No
1	Does this Project Report contain any open assumptions, including preliminary information that require confirmation? (If **YES**, identify the assumptions.)	☐	☒
2	Does this Project Report supersede an existing Project Report? (If **YES**, identify the superseded Project Report.) **Superseded Project Report No.** _____	☐	☒

Scope of Revision:
Initial Issue

Revision Impact on Results:
N/A

Safety-Related ☐ **Non-Safety-Related** ☒

Originator: Brian Froese

Design Verifier [1] (Reviewer for Non-Safety-Related): Dora Garcia

Approver: Jared Monroe **Date:** 3/30/17

Note 1: Design Verification is required for all safety-related Project Reports. A review is adequate for non-safety-related Project Reports.

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2017 FOCUSED EVALUATION FOR EXTERNAL FLOODING AT JAMES A. FITZPATRICK NUCLEAR POWER PLANT	REPORT NO.: ENTCORP045-REPT-001
	REVISION: 0

PROJECT REPORT REVISION STATUS

REVISION	DATE	DESCRIPTION
0	3/30/17	Initial Issue

ATTACHMENT REVISION STATUS

APPENDIX NO.	NO. OF PAGES	REVISION	ATTACHMENT NO.	NO. OF PAGES	REVISION
N/A					

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JAMES A. FITZPATRICK NUCLEAR POWER PLANT FLOODING FOCUSED EVALUATION SUMMARY

1 EXECUTIVE SUMMARY

The James A. FitzPatrick (JAF) Nuclear Power Plant site 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 the NRC in a flood hazard re-evaluation report (FHRR) on March 12, 2015 (Reference 2) and is provided in the Mitigating Strategies Flood Hazard Information (MSFHI) documented in the NRC's "Interim Staff Response to Reevaluated Flood Hazards" letter dated September 4, 2015 (Reference 7) as well as the "Staff Assessment" letter dated March 27, 2017 (Reference 16). No changes to the flooding analysis have been performed since the issuance of the MSFHI letter and this flooding analysis will serve as input to this Focused Evaluation (FE). There are three (3) mechanisms that were found to exceed the design basis flood level at JAF. These mechanisms are listed below and are included in this FE:

1. Local Intense Precipitation (LIP)
2. Streams and Rivers (Unnamed Stream Probable Maximum Flood (PMF))
3. Storm Surge (Combined Effects Flood)

Associated effects (AE) and flood event duration (FED) parameters were assessed and submitted as a part of the Mitigating Strategies Assessment (MSA) and apply to the FE. This FE concludes there is effective flood protection for maintaining key safety functions (KSFs) during all three (3) mechanisms through the demonstration of adequate Available Physical Margin (APM) and reliability of flood protection features. 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 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 James A. FitzPatrick, the FHRR was submitted on March 12, 2015 (Reference 2).

Following the Commission's directive to NRC Staff in Reference 3, the NRC issued a letter to the industry (Reference 6) indicating that new guidance is being prepared to replace instructions in Reference 3 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 4), which was endorsed by the NRC in Reference 5. NEI 16-05 indicates that each flood-causing mechanism not bounded by the design basis flood (using only stillwater and/or wind-wave run-up 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 a 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 TERMS AND DEFINITIONS

- AE – Associated Effects
- AIMs – Assumptions, Inputs, and Methods
- APM – Available Physical Margin
- ARC – Antecedent Rainfall Condition
- CDB – Current Design Basis
- FE - Focused Evaluation
- FED – Flood Event Duration
- FHRR – Flood Hazard Re-evaluation Report
- FIAP – Flooding Impact Assessment Process
- HHA – Hierarchal Hazard Assessment
- 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
- MPH – Miles per Hour
- MSFHI – Mitigating Strategies Flood Hazard Information
- NTTF – Near Term Task Force commissioned by the NRC to recommend actions following the Fukushima Dai-ichi accidents
- PMF – Probable Maximum Flood
- PMP – Probable Maximum Precipitation
- PMSS – Probable Maximum Storm Surge
- PMWS – Probable Maximum Wind Storm
- RFI – Request for Information

- SAR - Staff Assessment Report
- USLS35 – U.S. Lake Survey of 1935
- VBS – Vehicle Barrier System

4 FLOOD HAZARD PARAMETERS FOR UNBOUNDED MECHANISMS

The NRC has completed the "Interim Staff Response to Reevaluated Flood Hazards" (Reference 7) as well as the "Staff Assessment (Reference 16) which summarize the flood hazard information related to JAF's FHRR (Reference 2). In Reference 7, the NRC states that the "staff has concluded that the licensee's reevaluated flood hazards information, as summarized in Enclosure 1, 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 FitzPatrick. Further, the 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 enclosure to Reference 16 includes a summary of the CDB and reevaluated flood hazard parameters. In Table 3.1-2 of the enclosure to Reference 16, 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 4.1-1 of the enclosure to Reference 16, the NRC lists flood hazard information (specifically stillwater elevation and wind-wave run-up elevation – see below for additional information relevant to stillwater elevation) for the following flood-causing mechanisms that are not bounded by the design basis hazard flood level:

- Local Intense Precipitation – Herein referred to as the LIP
- Streams and Rivers (Unnamed Stream) – Herein referred to as the PMF
- Storm Surge (PMSS+PMP+Waves) – Herein referred to as Combined Effects

It should be noted that the "storm surge" flood-causing mechanism for JAF represents the NUREG/CR-7046 (Reference 8), Section H.4, Combined-Effects Flood (Floods along Shores of Enclosed Bodies of Water).

These three mechanisms are the reevaluated flood-causing mechanisms that should be addressed in the external flooding assessment. The three non-bounding flood mechanisms for JAF are described in detail in Reference 2, the FHRR submittal. The following summarizes how these unbounded mechanisms were addressed in this external flooding assessment:

	Flood Mechanism	Summary of Assessment
1	Local Intense Precipitation (LIP)	Path 2 was determined to be pursued for all three (3) mechanisms at JAF since all flooding vulnerabilities are addressed by flood protection features (see FIAP Path Determination Table, Section 6.3.3 of NEI 16-05). Adequate APM and reliability of flood protection features are all demonstrated.
2	Streams and Rivers (PMF)	
3	Storm Surge (Combined Effects)	

Note that subsequent to the preparation and issuance of the FitzPatrick's FHRR (Reference 2) the International Joint Commission (IJC) issued new orders and directions under 'Regulation Plan 2014' (Reference 17) for controlling the discharge of waters from Lake Ontario and the St. Lawrence River; orders made effective December 8th, 2016.

The orders and their impact on Lake Ontario lake level would (going forward) impact stillwater level inputs to the FHRR. As the analyses performed in support of FitzPatrick's FHRR represent a snapshot in time, reanalysis has not been performed, nor would such analysis impact the FHRR results in a meaningful way. Additional discussion is provided in Section 6.3.2 of the FE with more detail on the change and its potential impact to FitzParick.

5 OVERALL SITE FLOODING RESPONSE

5.1 DESCRIPTION OF OVERALL SITE FLOODING RESPONSE

The HHA approach described in NUREG/CR-7046 (Reference 8) was used for the evaluation of the LIP, PMF, and Combined Effects mechanisms' resultant water surface elevations at JAF. Inleakage through doors associated with exterior flood levels was the source for potential interior flooding and impact to the Key SSC's. The doors and their seals & weather stripping are the principle protection features relied upon to ensure the availability of the Key SSC's.

Key SSC's evaluated for potential impact of infiltration by flood waters included: Residual Heat Removal pumps 10P-3A/B/C/D, Core Spray pumps 14 P-1A/B, High Pressure Coolant Injection pump 23P-1 & Reactor Core Isolation Cooling pump 13P-1 (Reactor Bldg. Crescents plan Elev. 227'-6"); Residual Heat Removal Service Water pumps 10P-1A/B/C/D & Emergency Service Water pumps 46P-2A/B (Screenwell Bldg. plan Elev. 255'-0"); Emergency Diesel Generators (93EDG-A/B/C & D and 4160 V Switchgear A & B (Emergency Diesel Generator Bldg. plan Elev. 272'-0"); and Standby Gas Treatment Fans(01-125FN-1A/B (Standby Gas Treatment Bldg. plan Elev. 272'-0"). The above elevations reference the USLS35 datum.

For the LIP and PMF, a two-dimensional hydrodynamic computer model, FLO-2D, was used to evaluate the LIP and PMF flood mechanisms. The FLO-2D models developed were based on JAF site features including: topography, site location, VBS layout, channels and structures. Infiltration through exterior doors was evaluated in JAF-RPT-14-00035 (Reference 10) since these features were not previously credited as part of the design basis. The results of this evaluation are summarized in Sections 5.1 and 5.2 of the FHRR (Reference 2) and support the conclusion that no Key SSCs as described in Section 3 are impacted.

For the Combined Effects flood mechanism, the PMSS stillwater elevation is 252.8 ft USLS35 and the maximum wave run-up elevation is 268.0 ft USLS35. These elevations are below site grade, which is considered 272 ft USLS35 (Reference 2, Section 2.1).

This FE demonstrates that no Key SSCs are impacted during any of the three (3) mechanisms. No time-sensitive or time-critical actions are required by the site to protect Key SSCs for any of the three (3) events; although plant Abnormal Operating Procedure AOP-13 "SEVERE WEATHER" mandates that, in an intense precipitation event as forecast by the National Weather Service "Flood Warning", it is verified that water intrusion is not occurring at building outer doors and a consideration for closing any open doors is made. The structural capacity of the affected (governing) doors, i.e. Reactor Building Track Bay door(s) and Standby Gas Treatment personnel door where flood depth can reach 0.6 ft (7.2 in.) are not in question. The hydrostatic pressure from the flood waters is significantly less than the pressure loads from a design basis tornado (3 psi).

5.2 SUMMARY OF PLANT MODIFICATIONS AND CHANGES

None.

6 FLOOD IMPACT ASSESSMENT

6.1 LOCAL INTENSE PRECIPITATION – PATH 2

6.1.1 Description of Flood Impact

The SAR (Reference 16) identified a LIP stillwater elevation of 272.8 ft USLS35. This is greater than the existing CDB controlling flood elevation of 262 ft USLS35 (PMSS with wind generated waves) and is slightly above site grade, which is nominally 272 ft USLS35 (Reference 2, Section 2.1). Other than potentially closing two exterior doors, there are no manual actions or active components credited in the site's flood strategy being evaluated in this FE. Leakage through exterior features at JAF were evaluated in JAF-RPT-14-00035 (Reference 10) using the reevaluated LIP flood heights. The conclusions are summarized in Sections 5.1 and 5.2 of the FHRR (Reference 2). It was determined that there are no impacts to Key SSC's, and the minimum margin is reported as 0.5 ft. for the Standby Gas Treatment system as flood water ingress into affected areas of the plant housing Key SSC's will not reach heights that could affect those SSC's. The 0.5 ft. conservatively represents the difference in potential height of the flood water and the height of the base of the Standby Gas Treatment fan pedestal.

6.1.2 Adequate APM Justification and Reliability of Flood Protection

Since external features were not previously credited as part of the design basis for flood protection, they were evaluated further in JAF-RPT-14-00035 (Reference 10) to demonstrate that they can be credited for protecting against the reevaluated LIP flood (Type 2 features in accordance with NEI 16-05). This evaluation included a walkdown and inspection of all potentially affected outer doors, hatches, and access-ways at JAF and calculation of conservative leakage rates through each pathway that had the potential to adversely affect Key SSCs. Per CR-JAF-2015-04387, which is summarized in Entergy letter JAFP-15-0146 (Reference 15), weather stripping on two roll-up doors were identified to be degraded and/or missing during a walkdown with the resident NRC Inspector. In response, a new walkdown was performed to inspect all weather stripping on doors identified in the FHRR. Work orders on a total of five (5) doors were generated to repair the weather stripping. Additionally, Seasonal Weather Preparations procedure AP-12.04 (Reference 13) now includes yearly inspections of the door weather stripping to identify degradation or gaps greater than 1/8 inch, which is consistent with the doorway gap size assumption in JAF-RPT-14-00035 (Reference 10).

Furthermore, since the LIP flooding depths of approximately 0.8 ft (272.8 ft USLS35 – 272 ft USLS35) are small, hydrodynamic, hydrostatic, and debris impact forces on exterior features are judged to be enveloped by other design basis loadings and do not impact the functionality of these doors.

Therefore, the external features for the LIP flood were judged to be reliable, per Appendix B or NEI 16-05, based on:

- Conservative leakage rates used to estimate margin;
- Observations made during the walkdowns;
- Inclusion of inspections of the exterior features into the procedure; and
- Negligible flood loads relative to design basis loads.

The Key SSC identified as having the least available margin is the Standby Gas Treatment system, which sits on 1 foot high pedestals and is protected from the maximum flood depth of 0.5 ft. The 0.5-foot of APM is adequate since the AIMs used in the LIP analysis (Reference 11) and JAF-RPT-14-00035 were conservative. The following are several of the conservatisms used in these evaluations:

1. The site drainage network was assumed to be non-functional in accordance with Case 3 as described in Appendix B of NUREG/CR-7046 (Reference 8). Culverts were assumed blocked and storm sewers not considered.

2. Roof drains and parapet walls on buildings were conservatively not modeled at JAF as these structures would likely attenuate peak flows and levels near door locations. Runoff from rooftops is assumed to drain directly to the adjacent cell at site grade.

3. The VBS that would re-direct overland flow away from the site was conservatively not considered.

4. A door gap of 1/8 inch is used when calculating inflow leakage for standard and rollup doors, which is conservative given the weather stripping reduces this gap to close to zero and these doors are now procedurally inspected for degradation.

5. Conservative HMR-51/52 was used for the LIP input. A site-specific study would have likely reduced LIP results substantially, possibly to a level below all study doorways.

6.1.3 Adequate Overall Site Response

Significant plant preparation or actions are not required to provide LIP flood protection. The only plant action assumed in the FHRR is to close the exterior doors during periods of intense precipitation per Severe Weather procedure AOP-13 (Reference 14), the advance warning to close these doors is negligible. Per Information Need 8 submitted on 7/21/15 to support NRC review of the FHRR, only two exterior doors could potentially be left open and unattended; both would be closed per AOP-13. Therefore, no time sensitive manual actions are required for this flood mechanism at JAF.

6.2 STREAMS AND RIVERS – PATH 2

6.2.1 Description of Flood Impact

Similar to the LIP event, the PMF of the Unnamed Stream reaches the same maximum elevation of 272.8 ft USLS35 and does not impact any structures that contain Key SSCs. Other than potentially closing two exterior doors, there are no manual actions or active components credited in the FHRR. As discussed in Section 6.1.1, leakage through exterior features is evaluated in JAF-RPT-14-00035 (Reference 10). A similar (but smaller) minimum reported physical margin of 0.4 for the Standby Gas Treatment system is also applicable to the PMF.

6.2.2 Adequate APM Justification and Reliability of Flood Protection

The same justification for reliability as discussed in Section 6.1.2 for a LIP is used for the PMF of the Unnamed Stream. Exterior features not previously credited as part of the design basis for flood protection were evaluated further in JAF-RPT-14-00035 (Reference 10) to demonstrate that they can be credited for protecting against the reevaluated PMF flood (Type 2 features in accordance with NEI 16-05). Water infiltration evaluation JAF-RPT-14-00035 (Reference 10) summarizes the walkdown and inspection performed on exterior features and calculates a conservative leakage rate through them. The conclusion, which is summarized in Sections 5.1 and 5.2 of the FHRR, is that no Key SSCs are impacted. Given the relatively small flooding heights that are approximately 0.8 ft (272.8 ft USLS35 – 272 ft USLS35), hydrodynamic, hydrostatic, and debris impact forces on exterior features are judged to be negligible and do not impact the functionality of these doors. This demonstrates reliability per Appendix B of NEI 16-05.

Same as for a LIP event, the APM is considered 0.4 ft because the evaluation in JAF-RPT-14-00035 (Reference 10) uses the maximum height of the PMF. This is adequate since the AIMs used in the PMF analysis (Reference 12) and JAF-RPT-14-00035 were conservative. The following are several of the conservatisms used in these evaluations:

1. Per NUREG/CR-7046, an antecedent storm of 40-percent of the PMP during the first 72-hours of simulation, followed by a 72-hour dry period, and finally followed by the full 72-hour PMP storm is used for the PMF simulation.

2. The conservative antecedent rainfall condition (ARC) III curve number (relative to ARC II), which describes runoff potential of the watershed, was used for the PMF simulation.

3. The Runoff Curve Number method is known to produce potentially lower (more conservative) loss rates when an antecedent storm is being evaluated. See EPRI Report 3002008113 (Reference 18).

4. The water surface elevation on Lake Ontario was set to be the 100-year water level, equal to 249.0 feet USLS35. This is more conservative than the maximum allowable Lake Ontario elevation of 248.0 ft USLS35 per Section 6.2.2 of calculation JAF-CALC-15-00014 (Reference 11).

5. A door gap of 1/8 is used when calculating inflow leakage for standard and rollup doors, which is conservative given the weather stripping reduces this gap to close to zero and these doors are now procedurally inspected for degradation.

6. Conservative HMR-51/52 was used for the PMF input. A site-specific study would have likely reduced PMF results substantially, possibly to a level below all doorways.

6.2.3 Adequate Overall Site Response

There are no required manual actions and, therefore, an evaluation of the overall site response is not necessary. Significant plant preparation or actions are not required to provide PMF flood protection. The only plant action assumed in the FHRR is to close the exterior doors during periods of intense precipitation per Severe Weather procedure AOP-13 (Reference 14), the advance warning to close these doors is negligible. Per Information Need 8 submitted on 7/21/15 to support NRC review of the FHRR, only two exterior doors could potentially be left open and unattended; both would be closed per AOP-13. Therefore, no time sensitive manual actions are required for this flood mechanism at JAF.

6.3 STORM SURGE – PATH 2

6.3.1 Description of Flood Impact

The primary feature protecting the site from the Combined Effects flood (PMSS + PMP + Waves) is 'site topography and grading', which is a Type 1 feature per NEI 16-05 Appendix B Section B.1. Table 1 provides site grade and APM for buildings housing safety-related SSCs.

Table 1 – Combined Effects Flood Elevations

Wave Run-Up Elevation	Site Grade	APM
268.0 ft USLS35	272.0 ft USLS35	4.0 ft

The associated effects due to this flood were determined to have no impact on the site since the maximum water elevation does not reach site grade nor impact any Key SSCs. All FED parameters, including warning time, period of site preparation, period of

inundation, and period of recession, are not applicable since the protection feature (site grade and topography) is permanent and passive; requiring no manual actions.

6.3.2 Adequate APM Justification and Reliability of Flood Protection

As demonstrated in Section 6.3.1, site grade and topography, with a nominal grade elevation of 272.0 ft USLS35, is reliable in protecting the plant from the Combined Effects flood. The APM of 4.0 ft was determined to be adequate; the analysis used conservative inputs, assumptions, and/or methods. The following justifications are examples of conservatisms used in the Combined Effects flood analysis (Reference 9):

1. It was conservatively assumed that the waves resulting from the PMWS are coincident, in time, with the peak of the PMSS.

2. For the purpose of calculating wind generated waves at JAF, a storm forward speed of 20 mph was conservatively selected to optimize wind-generated wave growth during the probable maximum wind storm (PMWS). A speed of 20 mph conservatively results in a fully-developed, fetch-limited wave height (not duration-limited wave height) during the periods of very high wind speeds.

3. The bedrock shoreline at JAF is conservatively considered to be a smooth vertical slope for the purpose of calculating wind wave effects based on the JAF Flooding Walkdown Report.

As was briefly discussed in Section 4 regarding new orders contained in IJC's Lake Ontario-St. Lawrence Plan 2014 (Reference 17), Section H4 of the Plan indicates that the regulated monthly mean level of Lake Ontario shall not exceed the following elevations (IGLD85):

Lake Ontario Level (IGLD85)

Month	Meters	Feet
January	75.26	246.92
February	75.37	247.28
March	75.33	247.15
April	75.60	248.03
May	75.73	**248.46**
June	75.69	248.33
July	75.63	248.13
August	75.49	247.67
September	75.24	246.85
October	75.25	246.88
November	75.18	246.65
December	75.23	246.82

Upon review, the maximum and governing controlled mean lake level in the Plan 2014 is 248.46 ft. (IGLD85) for May; when converted to USLS35 datum, it is 248.46 + 0.709 = 249.17 ft. or slightly above the 100-year water level (249.0 ft. USLS35) and 1ft. - 2in. above the 248 ft. initial/antecedent lake elevation used in the FHRR's Combined Effects calculation. Whereas, since NUREG/CR-7046 specifies that the initial/antecedent water surface elevation should be "the lesser of the 100-year or the maximum controlled water level in the enclosed body of water", a lake elevation of 249.0 ft. would be appropriate today. While this is slightly less conservative, the change is inconsequential given there is 4 ft. of margin before reaching site grade. Furthermore, as discussed in Section 3.4.2.4 of the FHRR, the "Combined Effects" storm surge, generated by the PMWS, is "an extra-tropical storm which would occur during the winter months when the regulated level is not exceeded". The FHRR's initial lake elevation (248.0 ft. USLS35 or 247.3 ft. IGLD85) is exceeded by the Plan 2014 regulated levels only during non-winter months. Therefore, the conclusion that APM is adequate and protection features are reliable remains valid.

6.3.3 Adequate Overall Site Response

There are no required manual actions and, therefore, an evaluation of the overall site response is not necessary.

7 CONCLUSION

The FHRR showed that three (3) flooding mechanisms were not bounded by the CDB and were required to be evaluated in this FE. For all mechanisms, there are no manual actions (other than potentially closing 2 exterior doors for LIP and the PMF of the Unnamed Stream) or active components credited as part of the flood protection strategy and a FIAP Path 2 evaluation is used.

The first two mechanisms, LIP and PMF of the Unnamed Stream, were calculated to generate a maximum flood elevation of 272.8 ft USLS35, which is greater than the existing CDB controlling flood elevation of 262 ft USLS35. The maximum flood elevation is also above site grade, which is taken to be 272 ft USLS35. Since building exterior features were not previously credited in the design basis for flood protection, they are classified as Type 2 features per NEI 16-05. Therefore, JAF performed an evaluation of leakage through exterior features, which is summarized in Sections 5.1 and 5.2 of the FHRR (Reference 2). It was determined that no Key SSCs are impacted by this infiltration. Furthermore, all exterior doors are now inspected by procedure for possible gaps and weather stripping degradation. Adequate APM and reliability of protection features was demonstrated via Appendix B of NEI 16-05.

The third mechanism, Combined Effect flood, reaches a maximum height of 268.0 ft USLS35, which is below grade (272 ft USLS35). Site topography and grading is a Type 1 passive protection feature and the APM was found to be adequate.

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

8 REFERENCES

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3. 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 (ADAMS Accession No. ML15089A236).

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12. JAF-CALC-15-00015, Rev. 000, James A. Fitzpatrick Flooding Hazard Re-Evaluation – Probable Maximum Flood on Streams.

13. AP-12.04, Rev. 25 (Including changes recommended in EC52736), Seasonal Weather Preparations.

14. AOP-13, Rev. 25, Severe Weather.

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17. Regulation Plan 2014 for the Joint International Commission (JIC) Lake Ontario and the St. Lawrence River- Compendium Document, December 2016

18. EPRI Report 3002008113 - Evaluation of Deterministic Approaches to Characterizing Flood Hazards, Final Report, November 2016