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FirstEnergy Nuclear Operating Company

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July 24, 2017
L-17-229

10 CFR 50.54(f)

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, MD 20852

SUBJECT:
Perry Nuclear Power Plant
Docket No. 50-440, License No. NPF-58
Mitigating Strategies Assessment (MSA) for Flooding (CAC No. MF6099)

On March 12, 2012, the Nuclear Regulatory Commission (NRC) issued a letter titled, "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," to all power reactor licensees and holders of construction permits in active or deferred status. Enclosure 2 of the 10 CFR 50.54(f) letter addresses Near-Term Task Force (NTTF) Recommendation 2.1 for flooding. One of the required responses is for licensees to submit a hazard reevaluation report (HRR) in accordance with the NRC's prioritization plan. By letter dated March 10, 2015, FirstEnergy Nuclear Operating Company (FENOC) submitted the flood HRR for Perry Nuclear Power Plant (PNPP). Additional information was provided by FENOC letters dated December 11, 2015 and March 24, 2016, which also included a revision to the flood HRR. As indicated in NRC letter dated March 1, 2013, the NRC staff considers the reevaluated flood hazard to be "beyond the current design/licensing basis of operating plants."

Concurrent to the flood hazard reevaluation, FENOC developed and implemented mitigating strategies in accordance with NRC Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events." By letter dated September 1, 2015, the NRC staff confirmed that licensees need to address the reevaluated flooding hazards within their mitigating strategies for beyond-design-basis (BDB) external events. Guidance for performing mitigating strategies assessments (MSAs) for reevaluated flooding hazards is contained in Appendix G of Nuclear Energy Institute 12-06, Revision 2, which was endorsed by

the NRC in JLD-ISG-2012-01, Revision 1. In the NRC interim staff assessment for PNPP, dated July 25, 2016, the NRC concluded that the "reevaluated flood hazards information, as summarized in the enclosure [Summary Tables of Reevaluated Flood Hazard Levels], is suitable for the assessment of mitigating strategies developed in response to Order EA-12-049" for PNPP.

The enclosure to this letter provides the MSA for flooding for PNPP. This assessment indicated that the FLEX strategies are adequate and can be implemented as written without impact from the local intense precipitation (LIP) flood, streams and rivers flooding (SRF), and the probable maximum storm surge (PMSS) flooding.

There are no new regulatory commitments contained in this letter. If there are any questions or if additional information is required, please contact Mr. Thomas A. Lentz, Manager – Fleet Licensing, at 330-315-6810.

I declare under penalty of perjury that the foregoing is true and correct. Executed on July 24, 2017.

Sincerely,

Frank R. Payne
General Plant Manager, Perry Nuclear Power Plant

Enclosure:
Mitigating Strategies Assessment for Flooding

cc: Director, Office of Nuclear Reactor Regulation (NRR)
NRC Region III Administrator
NRC Resident Inspector
NRR Project Manager

Enclosure
L-17-229

Mitigating Strategies Assessment for Flooding
(16 pages follow)

Perry Nuclear Power Plant
Mitigating Strategies Assessment for Flooding

Acronyms:

- BDBEE - Beyond Design Basis External Event
- DB - Design Basis
- ELAP - Extended Loss of AC Power
- FHRR - Flood Hazard Reevaluation Report
- FIP - Final Integrated Plan
- FLEX - Diverse and Flexible Coping Strategies
- LIP - Local Intense Precipitation
- LUHS - Loss of Normal Access to the Ultimate Heat Sink
- MSA - Mitigating Strategies Assessment
- MSFHI - Mitigating Strategies Flood Hazard Information (from the FHRR and MSFHI letter)
- NORM - Nuclear Operating Reference Material
- NSRC - National SAFER Response Center
- NGVD29 PLD - Perry Local Datum - NGVD 29 data corrected to local monument markers.
- PNPP - Perry Nuclear Power Plant
- PMF - Probable Maximum Flood
- PMSS - Probable Maximum Storm Surge
- PMWS - Probable Maximum Wind Storm
- RAI - Request for Additional Information
- SRF - Streams and Rivers Flooding
- USAR - Updated Safety Analysis Report

Definitions:

FLEX Design Basis Flood Hazard - The controlling flood parameters used to develop the FLEX flood strategies.

FLEX - Diverse & Flexible Coping Strategies

- **Phase 1** - Initially cope by relying on installed plant equipment.
- **Phase 2** - Transition from installed plant equipment to the on-site FLEX equipment.
- **Phase 3** - Obtain additional capability and redundancy from off-site equipment until power, water, and coolant injection systems are restored or commissioned.

FLEX N Equipment - Equipment used is protected from all BDBEE hazards and is the primary FLEX response equipment.

FLEX N+1 Equipment - Equipment used is NOT protected from all BDBEE hazards and is used as an alternate to FLEX N equipment.

FLEX NSRC Equipment - Equipment provided by the NSRC to support FLEX Phase 3 strategy.

Unit abbreviations:

ft – feet
lbs/ft2 – pounds per square foot
ft/sec – feet per second

1. Summary

The Mitigating Strategies Flood Hazard Information (MSFHI) provided in the Perry (PNPP) Flood Hazard Reevaluation Report (FHRR) concluded that the local intense precipitation (LIP), streams and river flooding (SRF) and probable maximum storm surge (PMSS), including wind generated waves, can potentially challenge implementation of the FLEX strategies. Based on the completed Mitigating Strategies Assessment (MSA), the existing FLEX strategies are shown to be adequate and can be implemented as written without impact from the identified MSFHI.

2. Documentation

2.1 NEI 12-06, Rev. 2, Section G.2 – Characterization of the MSFHI

The MSFHI to be evaluated in the MSA was determined in the Perry FHRR, Rev 1, and subsequently as Table 2 in NRC correspondence Letter ML 16202A348 / Enclosure ML 16202A417. This letter identifies the staff review and results of the audit of the FHRR (Rev 0 and Rev. 1), as well as any additional RAIs or additional data received. Additional analyses resulted in revision 2 of the FHRR, which provided new MSFHI data and is available for NRC review. Therefore, NRC Table 2 information has been updated to reflect the FHRR, Rev 2, results and is included with this summary as Attachment A.

The LIP, SRF and PMSS, including wind generated waves, exceed the current design basis. Other reevaluated flood hazard mechanisms (i.e. tsunami, channel migrations/diversions, etc.), are bounded by the plant design basis and have no impact on the site.

2.2 NEI 12-06, Rev. 2, Section G.3 – Comparison of the MSFHI and FLEX DB Flood

The original FLEX implementation was evaluated based on the Updated Safety Analysis Report (USAR) information:

- LIP - the plant site has been graded so that overland drainage will occur away from the plant site buildings and will not allow the accumulated storm water to exceed Elevation 620.5 feet.
- SRF – maximum water levels remain within the stream banks.
- PMSS
    - Wave runup – site is protected by the high bluff at the Lake Erie shoreline
    - Stillwater – Emergency Service Water Pumphouse floor elevation exceeds maximum stillwater elevation.

The LIP flooding of the powerblock area poses several challenges for FLEX due to flooding of deployment paths and staging areas, and water levels above critical doors needed for execution of the strategies. Based on forthcoming site modifications to install door flood barriers and alternatives available (deployment paths, equipment, etc), FLEX strategies can be implemented as written.

The reevaluated hazards for PMSS and SRF have minimal effects on FLEX since they do not impact the powerblock area. The PMSS includes a more severe low water level, which is below the original low water elevation design point for the FLEX lake water pumps. However, it has been shown that pump operation at the slightly lower suction source

elevation will have a negligible impact. The SRF will flood the site access road, which restricts off site resources for a short period. Sufficient margin in the FLEX timeline allows for the short delay (approximately 2.5 hours).

The following tables provide the comparison of the current design basis, FLEX design basis and the MSFHI for the various flood parameters, as applicable. The notes following the tables provide more explanation of each of the specific parameters listed in the tables.

Table 1: Local Intense Precipitation

Table 2: Streams and River Flooding

Table 3: Probable Maximum Storm Surge – This table includes the PMSS for the Lake stillwater elevations and the Combined Effects of the PMSS + Wind Generated Wave.

Table 1 – Flood Causing Mechanism: Local Intense Precipitation

	Flood Scenario Parameter *(The attached notes provide further discussion for each corresponding numbered parameter listed)*	Plant Design Basis Flood	FLEX Design Basis Flood Hazard	MSFHI	MSFHI Bounded (B) or Not Bounded (NB)
Flood Level and Associated Effects *	1. Max Stillwater Elevation	620.5 ft	620.5 ft	621.65 ft	NB
	2. Max Wave Run-Up Elevation	N/A	N/A	N/A	B
	3. Max Hydrodynamic/Debris Loading (lbs/ft^2)	N/A	N/A	Minimal increase	B
	4. Effects of Sediment Deposition/Erosion	N/A	N/A	Minimal	B
	5. Other Associated Effects (identify each effect)	N/A	N/A	N/A	B
	6. Concurrent Site Conditions	N/A	N/A	None identified	B
	7. Effects on Groundwater	N/A	N/A	Minimal	B
Flood Event Duration	8. Warning Time (hours)	N/A	N/A	>24 hrs	NB
	9. Period of Site Preparation (hours)	N/A	N/A	8 hrs (approx.)	NB
	10. Period of Inundation (hours)	N/A	N/A	1–2 hrs (approx.)	NB
	11. Period of Recession (hours)	N/A	N/A	2 hrs (approx.)	NB
Other	12. Plant Mode of Operations	N/A	N/A	N/A	B
	13. Other Factors	N/A	N/A	N/A	B

* All elevation values are in NGVD29 PLD, unless noted otherwise.

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. Since the MSFHI value is above the design basis it is considered not bounded. The reported value in the table is representative of the high water surface elevation at any of the doors of interest evaluated for impact on FLEX strategies. References: USAR Chapter 2, FHRR Rev 0 and 2, Calculation 50:66.000, 50:58.000.
2. There is no wave run-up associated with the LIP. Wind wave effect is not a factor based on the resulting shallow ponding depths, the short duration of flooding, and the building/barriers around the site areas of interest which would not allow sufficient fetch length to develop. The USAR does not address flooding from the LIP, specifically with regard to standing water, so no wave run-up discussion exists. Since neither the design basis nor the MSFHI identified this as an issue, these values are marked N/A. The MSFHI is considered bounded. References: USAR Chapter 2, FHRR Rev 0 and 2, Calculation 50:66.000.
3. Very little debris or sediment will be deposited based on the short duration of the event and the impermeable ground cover (concrete and/or asphalt material) surrounding the power block area, preventing debris and sediment from being entrained in flood waters. Based on the lack of free debris in the surrounding area and low velocities of water impinging on structures there is minimal loading expected from debris. Based on the short duration and small localized loads there is no effect on the structures as a result of a LIP event. These structures are evaluated for more significant loads than those presented by the LIP; therefore, no adverse consequences result from the LIP. The design basis does not discuss this issue and the MSFHI does; however, as noted above it is shown to have no effect and is therefore considered as bounded. References: USAR Chapter 2 & 3.4, FHRR Rev 0 and 2, Calculation 50:66.000.
4. Perry is located on relatively flat terrain. The average velocity of the flood waters at the peak of the LIP is relatively low in the vicinity of the power block. Very little debris or sediment will be deposited based on the short duration of the event and the impermeable ground cover (concrete and/or asphalt material) surrounding the power block area, preventing debris and sediment being entrained in flood waters. This hard material will also prevent scour, so it is not considered an issue. The design basis does not discuss this issue and the MSFHI does; however, as noted above it is shown to have no effect and is therefore considered as bounded. References: USAR Chapter 2, Calculation 50:66.000.
5. No additional associated effects were identified. Since neither the design basis nor the MSFHI identified this as an issue, these values are marked N/A. The MSFHI is considered bounded. References: USAR Chapter 2, FHRR Rev 0 and 2.

6.
There are no specific concurrent conditions identified during a LIP event. It is reasonable to assume there will be sufficient rain to cause flooding in the Major Stream as well as the Diversion Stream. The LIP calculation used the maximum flooding levels for adjacent flood hazards (lake and streams) as boundary conditions. Based on this, the item is considered N/A, and the MSFHI is considered bounded.

References: USAR Chapter 2, FHRR Rev 0 and 2, Calculation 50:66.000.

7.
There will be no adverse groundwater surcharge effects. The short duration of inundation and impermeable materials surrounding the power block area would prevent any significant change in the groundwater. Additionally, the underdrain system is designed to maintain groundwater less than 590 ft, while plant structures are designed for hydrostatic forces up to elevation 618 ft. This margin provides a margin of approximately 28 ft in which any groundwater inflow from the surface can be accommodated. Note that the underdrain system is designed for a groundwater inflow rate of 30,000 gpm (resulting from circulating water pipe failure) while the normal groundwater inflow is less than 80 gpm. Therefore, this item is considered bounded by the existing design basis.

References: USAR chapter 2.5, Calculations P72-006, 50:66.000.

8.
No specific warning time is identified for the design basis. As outlined in the PFA for continued operation the site has established a trigger point based on predicted rainfall rates. A similar trigger point/alarm will be provided for the beyond design basis LIP event. The warning time provided is an estimate to be validated to ensure it exceeds the site preparation time. These actions commence based on automatic notification from the fleet meteorologists, who constantly monitors environmental conditions. Since the design basis does not discuss this issue and the MSFHI does, it is considered not bounded.

References: FHRR Section 5, USAR Chapter 2, 50:66.000.

9.
As discussed in Item 8 above, an estimated warning time is provided. A warning time will be established that will provide sufficient time for the onsite personnel to ensure doors/hatches are closed and flood barriers installed to prevent water ingress. Since the design basis does not discuss this issue and the MSFHI does, it is considered not bounded.

References: FHRR Section 5, USAR Chapter 2, 50:66.000.

10.
The total site inundation period in the power block area can occur very rapidly. The timing of when this occurs is dependent on the timing of the peak intensity of the rain event. For example, inundation would be within an hour for the front loaded event. The value range provided is representative of the peak intensity of the LIP event. Since the design basis does not discuss this issue and the MSFHI does, it is considered not bounded.

References: FHRR Section 5, USAR Chapter 2, Calculation 50:66.000.

11.
The site drains rapidly after the LIP event except for several low areas where ponding occurs. The site remains accessible during and after the LIP event. The value provided is representative of the typical site recession time following the peak intensity of the LIP event. Since the design basis does not discuss this issue and the MSFHI does, it is considered not bounded.

References: USAR Chapter 2, Calculation 50:66.000

12.
Plant modes are not discussed in the USAR related to flooding events. The USAR did not identify any flooding impacts to the power block and/or safety-related equipment from a LIP event. The MSFHI does not discuss flooding with regard to plant modes. Since neither the design basis nor the MSFHI identified this as an issue, these values are marked N/A. The MSFHI is considered bounded.

References: USAR Chapter 2, FIP, FHRR Rev 0 and 2,

13.
No additional factors were identified associated with the LIP. The event is short duration and has low water velocity so waterborne projectiles are not expected. Since neither the design basis nor the MSFHI identified this as an issue, these values are marked N/A. The MSFHI is considered bounded.

References: USAR Chapter 2, FHRR Rev 0 and 2

Table 2 – Flood Causing Mechanism: Stream and River Flooding

Flood Scenario Parameter *(The attached notes provide further discussion for each corresponding numbered parameter listed)*		Plant Design Basis Flood	FLEX Design Basis Flood Hazard	MSFHI	MSFHI Bounded (B) or Not Bounded (NB)
Flood Level and Associated Effects *	1. Max Stillwater Elevation • Major Stream • Minor Stream • Diversion Stream	624.0 ft 619.5 ft N/A	624.0 ft 619.5 ft N/A	628.5 ft N/A 629.2 ft	NB
	2. Max Wave Run-Up Elevation	N/A	N/A	N/A	B
	3. Max Hydrodynamic/Debris Loading (lbs/ft^2)	N/A	N/A	N/A	B
	4. Effects of Sediment Deposition/Erosion	N/A	N/A	Negligible	B
	5. Other Associated Effects (identify each effect)	Site access flooded	Site access flooded	Site access flooded for several hours	NB
	6. Concurrent Site Conditions	N/A	N/A	None identified	B
	7. Effects on Groundwater	N/A	N/A	N/A	B
Flood	8. Warning Time (hours)	N/A	N/A	N/A	B
	9. Period of Site Preparation (hours)	N/A	N/A	N/A	B
	10. Period of Inundation (hours)	N/A	N/A	Site access road- 1 hr	NB
	11. Period of Recession (hours)	N/A	N/A	Site access road- 1.5 hr	NB
Other	12. Plant Mode of Operations	N/A	N/A	N/A	B
	13. Other Factors	N/A	N/A	N/A	B

* All elevation values are in NGVD29 PLD, unless noted otherwise.

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. The Diversion Stream has been installed to divert the Minor Stream directly to Lake Erie. The Remnant Minor Stream is now modeled as part of the LIP domain. The analyses show that the stream flooding does not impact the power block area. However, since the MSFHI values for the Major Stream exceeds the design basis, it is considered not bounded. References: FHRR Rev 0 and 2, USAR, Calculations 50:33.000, 50:62.000, 50:66.000.
2. The locations of the powerblock area and of the streams preclude any wind generated wave effects on the powerblock area. There will be no site flooding or wave runup concerns. This is not addressed in the design basis; however, based on the above discussion, this item is considered bounded. Reference: FHRR Rev 0 and 2, USAR, 50:33.000, 50:62.000.
3. No site flooding occurs, so there are no debris concerns. The Diversion Stream berm was assessed for failure and the potential for impact on the LIP domain results. Failure of the berm is assumed to occur during the peak water surface elevation in the Diversion Stream, at a location that maximizes the depth. The resulting failure flow hydrograph is then added to the FLO-2D model for the LIP domain. This is not addressed in the design basis; however, based on the above discussion, this item is considered bounded. Reference: FHRR Rev 0 and 2, USAR, 50:33.000, 50:66.000.
4. No site flooding occurs, so there are no scour or soil deposition concerns. The surficial geology map indicates the area in the immediate vicinity of PNPP is characterized by layers of sand, silt and clay, and till or clayey to silty till over shale bedrock. This characterization represents the entire watersheds of the Remnant Minor, Diversion Stream, and the majority of the Major Stream watershed. The upstream portion of Major Stream is characterized by additional areas of sand and gravel or clayey to silty till over shale bedrock. Alluvium or organic material, which are more susceptible to erosion, are not present in the Remnant Minor Stream, Diversion Stream, or the Major Stream watersheds. The design basis identified this as N/A. The site will implement preventive maintenance actions to ensure integrity of the streams, and therefore this is considered bounded. References: FHRR Rev 0 and 2, USAR
5. The SRF could prevent site access. The design basis identifies site access road flooding; however, the duration of the flooding is not addressed. The MSFHI identified this as an issue, and therefore this is considered not bounded. Reference: FHRR Rev 0 and 2, USAR, 50:62.000.
6. There are no specific concurrent conditions identified during a SRF event. The results of a PMSS are used as boundary conditions in the SRF analysis. As the appropriate boundary conditions have been utilized, this is considered bounded. References: FHRR Rev 0 and 2, USAR, Calculations 50:62.000 and 50:33.000.

7. There will be no groundwater surcharge effects. No site flooding occurs in the immediate vicinity of the power block or other safety-related structures due to a SRF event. Since neither the design basis nor the MSFHI identified this as an issue, these values are marked N/A. The MSFHI is considered bounded. References: FHRR Rev 0 and 2, USAR, Calculations 50:62.000 and 50:33.000.
8. No specific warning time is identified for a SRF event. Areas closer to the power block do not flood as a result of this mechanism as flood waters are confined to the channels or overbank areas of the adjacent streams. Since neither the design basis nor the MSFHI identified this as an issue, these values are marked N/A. The MSFHI is considered bounded. References: FHRR Rev 0 and 2, USAR, Calculations 50:62.000 and 50:33.000.
9. The SRF event does not flood the powerblock area. Since neither the design basis nor the MSFHI identified this as an issue, these values are marked N/A. The MSFHI is considered bounded. References: FHRR Rev 0 and 2, USAR, Calculations 50:62.000 and 50:33.000.
10. The SRF event does not flood the powerblock area; however, the site access roads are flooded during a SRF event (discussed further in Note 5). Total flood duration is 2.5 hours of which 1 hour represents the inundation from the start of the access road flooding to the peak of the flood elevation. The design basis does not identify this as an issue; however, the MSFHI does. Therefore, the MSFHI is not bounded. References: FHRR Rev 0 and 2, USAR, Calculations 50:62.000 and 50:33.000
11. The SRF does not flood the powerblock area; however, the outlying areas around the site, including the access roads, are flooded during a SRF event (discussed further in Note 5). Total flood duration is 2.5 hours of which 1.5 hours represents the access road flooding from the peak of the flood until the water subsides. The design basis does not identify this as an issue; however, the MSFHI does. Therefore, the MSFHI is not bounded. References: FHRR Rev 0 and 2, USAR, Calculations 50:62.000 and 50:33.000.
12. Plant modes are not discussed in the USAR related to flooding events. The MSFHI does not discuss flooding with regard to plant modes. Since neither the design basis nor the MSFHI identified this as an issue, these values are marked N/A. The MSFHI is considered bounded. References: FHRR Rev 0 and 2, USAR, Calculations 50:62.000 and 50:33.000.
13. No additional factors were identified associated with the SRF. Since neither the design basis nor the MSFHI identified this as an issue, these values are marked N/A. The MSFHI is considered bounded. References: FHRR Rev 0 and 2, USAR, Calculations 50:62.000 and 50:33.000.

Table 3 – Flood Causing Mechanism: PMSS, Including Wind Generated Waves

	Flood Scenario Parameter *(The attached notes provide further discussion for each corresponding numbered parameter listed)*	Plant Design Basis Flood	FLEX Design Basis Flood Hazard	MSFHI	MSFHI Bounded (B) or Not Bounded (NB)
Flood Level and Associated Effects *	1. Max Stillwater Elevation • High Water: West of the Power Block Along the Shoreline Bluff Slopes • Low Water	580.5 ft 565.26 ft	580.5 ft 565.26 ft	582.8 ft 563.2 ft	NB NB
	2. Max Wave Run-Up Elevation	607.9 ft	607.9 ft	609.5 ft	NB
	3. Max Hydrodynamic/Debris Loading (lbs/ft^2)	N/A	N/A	N/A	B
	4. Effects of Sediment Deposition/Erosion	N/A	N/A	N/A	B
	5. Other Associated Effects (identify each effect)	N/A	N/A	N/A	B
	6. Concurrent Site Conditions	N/A	N/A	N/A	B
	7. Effects on Groundwater	N/A	N/A	N/A	B
Flood Event Duration	8. Warning Time (hours)	N/A	N/A	0	B
	9. Period of Site Preparation (hours)	N/A	N/A	0	B
	10. Period of Inundation (hours)	N/A	N/A	0	B
	11. Period of Recession (hours)	N/A	N/A	0	B
Other	12. Plant Mode of Operations	N/A	N/A	N/A	B
	13. Other Factors	N/A	N/A	N/A	B

* All elevation values are in NGVD29 PLD, unless noted otherwise.

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. The maximum water surface elevation of 582.8 ft, is well below the site elevation of 620.5 ft and, also, below the ESWPH operating floor, which is at elevation 586.5 ft. The low water elevation of 563.2 ft does not have any adverse effects since the FLEX lake water pumps are designed to operate at a minimum lake level of 563.0 ft. Since the MSFHI value for both the High and Low water levels exceed the design basis, this is considered not bounded. References: FHRR Rev 0 and 2, USAR Chapter 2, Calculation 50:47.000.
2. The PMSS has no impact on the site due to the site location on a bluff overlooking Lake Erie at an elevation approximately 40 ft above the water surface. The maximum wave runup of 609.5 ft is well within the site elevation of 620.0 ft. However, since the maximum wave runup exceeds the design basis by 1.6 ft, this is considered not bounded. References: FHRR Rev 0 and 2, USAR Chapter 2, Calculation 50:55.000.
3. The PMSS has no impact on the site due to the site location on a bluff overlooking Lake Erie at an elevation approximately 40 ft above the water surface. Since neither the design basis nor the MSFHI identified this as an issue, these values are marked N/A. The MSFHI is considered bounded. References: FHRR Rev 0 and 2, USAR Chapter 2.
4. The PMSS has no impact on the site due to the site location on a bluff overlooking Lake Erie at an elevation approximately 40 ft above the water surface. Since neither the design basis nor the MSFHI identified this as an issue, these values are marked N/A. The MSFHI is considered bounded. References: FHRR Rev 0 and 2, USAR Chapter 2.
5. No additional associated effects were identified. The PMSS has no impact on the site due to the site location on a bluff overlooking Lake Erie at an elevation approximately 40 ft above the water surface. Since neither the design basis nor the MSFHI identified this as an issue, these values are marked N/A. The MSFHI is considered bounded. References: FHRR Rev 0 and 2, USAR Chapter 2.
6. There are no specific concurrent conditions identified during a PMSS event. The PMSS analytical results are not dependent on any LIP or SRF inputs. Since neither the design basis nor the MSFHI identified this as an issue, these values are marked N/A. The MSFHI is considered bounded. References: FHRR Rev 0 and 2, USAR Chapter 2, Calculation 50:66.000.
7. The PMSS has no impact on the site due to the site location on a bluff overlooking Lake Erie at an elevation approximately 40 ft above the water surface. Plant groundwater is passively addressed through the plant underdrain system. Lake Erie has a negligible, if any, effect on groundwater elevations. Since neither the design basis nor the MSFHI identified this as an issue, these values are marked N/A. The MSFHI is considered bounded. References: FHRR Rev 0 and 2, USAR Chapter 2.

8. No specific warning time is identified for a PMSS event. A trigger point is currently in place related to a LIP event. The PMSS has no impact on the site due to the site location on a bluff overlooking Lake Erie at an elevation approximately 40 ft above the water surface. Since neither the design basis nor the MSFHI identified this as an issue, these values are marked N/A. The MSFHI is considered bounded. References: FHRR Rev 0 and 2, USAR Chapter 2.
9. The PMSS has no impact on the site due to the site location on a bluff overlooking Lake Erie at an elevation approximately 40 ft above the water surface. Since neither the design basis nor the MSFHI identified this as an issue, these values are marked N/A. The MSFHI is considered bounded. References: FHRR Rev 0 and 2, USAR Chapter 2.
10. The PMSS has no impact on the site due to the site location on a bluff overlooking Lake Erie at an elevation approximately 40 ft above the water surface. Since neither the design basis nor the MSFHI identified this as an issue, these values are marked N/A. The MSFHI is considered bounded. References: FHRR Rev 0 and 2, USAR Chapter 2.
11. The PMSS has no impact on the site due to the site location on a bluff overlooking Lake Erie at an elevation approximately 40 ft above the water surface. Since neither the design basis nor the MSFHI identified this as an issue, these values are marked N/A. The MSFHI is considered bounded. References: FHRR Rev 0 and 2, USAR Chapter 2.
12. Plant modes are not discussed in the USAR or the MSFHI related to flooding events. Since neither the design basis nor the MSFHI identified this as an issue, these values are marked N/A. The MSFHI is considered bounded. References: FHRR Rev 0 and 2, FIP, USAR Chapter 2.
13. No additional factors were identified associated with the PMSS. Since neither the design basis nor the MSFHI identified this as an issue, these values are marked N/A. The MSFHI is considered bounded. References: FHRR Rev 0 and 2, FIP, USAR Chapter 2.

2.3 NEI 12-06, Rev. 2, Section G.4 – Evaluation of Mitigating Strategies for the MSFHI

2.3.1 NEI 12-06, Rev. 2, Section G.4.1 – Assessment of Current FLEX Strategies

The overall plant FLEX response strategies to an ELAP or LUHS event can be implemented as described in the Final Implementation Plan using current procedures, equipment and personnel.

The assessment concluded that the flood causing mechanisms would not initiate an ELAP or LUHS event, pending completion of flood hazards mitigation modifications (as listed below). FLEX activities would be initiated through existing plant procedures for abnormal or emergency event response. The individual flooding mechanisms were evaluated assuming they could occur at any point on the FLEX strategy timeline to ensure that the most severe flooding would be evaluated at a time, which would have the most adverse impact on FLEX implementation.

The assessment concluded that the MSFHI would not prevent FLEX implementation and included evaluation of FLEX equipment storage areas, operations and staging locations, deployment travel paths, and the working conditions for personnel and equipment in flooded areas. Perry is reconstituting the design basis, which is expected to utilize a time-based warning protection scheme in which incorporated barriers (such as flood panels) and specific trigger points will be required. The actions identified below are a subset of those planned for the design basis reconstitution effort. Once completed, the actions will also mitigate the effects of the beyond design basis flood event, and therefore, there will be no adverse effects on FLEX strategy implementation.

a. For all doors required for FLEX activities, install flood protection barriers that will prevent flood water from entering the buildings, provide a minimum WSE margin of 1 inch and capable of withstanding all hydrostatic loads.
b. Establish and implement a warning time and trigger point for the installation of flood barriers prior to a flooding event.
c. Develop a proceduralized plan and pre-stage materials for flood barriers that must be installed on powerblock doors and openings.
d. Complete powerblock building flood protection verification or modifications, as required.
e. Implement flood protection features for the diesel generator fuel tank flame arrestors.
f. Develop preventive maintenance documents for:
    - Diversion Stream berm inspection for degradation and repairs, as required.
    - Stream debris clearing and maintenance of ground cover overgrowth.
    - Inspection of the site storm sewer system, including cleaning and repair, as required.

The actions identified above will be tracked in the site corrective action program.

2.3.2 Conclusion

The MSA demonstrated that the existing FLEX strategies, as described in the FIP, are acceptable as designed.

- The boundary conditions and assumptions of the initial FLEX design are maintained.
- The sequence of events for the FLEX strategies is not affected by the impacts of the MSFHI (including impacts due to the environmental conditions created by the MSFHI) in such a way that the FLEX strategies cannot be implemented as currently developed.
- The validation performed for the deployment of the FLEX strategies is not affected by the impacts of the MSFHI.
- With the implementation of the items identified in Section 2.3.1, above, site flood protection features will mitigate the effects of a beyond design basis flood event.

2.4 References

- FHRR, Rev. 0, 2/24/2015 – 10 CFR 50.54(f), Regarding the Flooding Aspects of Recommendation 2.1 of the Near-Term Task Force (NTTF) Review of Insights from the Fukushima Dai-ichi Accident
- FHRR, Rev. 1, 3/4/2016 – 10 CFR 50.54(f), Regarding the Flooding Aspects of Recommendation 2.1 of the Near-Term Task Force (NTTF) Review of Insights from the Fukushima Dai-ichi Accident
- FHRR, Rev. 2, 6/27/2017 – 10 CFR 50.54(f), Regarding the Flooding Aspects of Recommendation 2.1 of the Near-Term Task Force (NTTF) Review of Insights from the Fukushima Dai-ichi Accident
- Staff Assessment – NRC correspondence Letter ML 16202A348, with Enclosure ML 16202A417 – Dated 7/25/2016, Interim Staff Response To Reevaluated Flood Hazards Submitted In Response To 10CFR50.54(f) Information Request-Flood Causing Mechanism Reevaluation.
- NORM-LP-7321, Perry Nuclear Power Plant Flooding Mitigating Strategy Assessment Support Document
- NORM-LP-7303, Perry Nuclear Power Plant FLEX Final Integrated Plan Report
- Perry Nuclear Power Plant, Updated Safety Analysis Report, Revision 17.
- Calculation 50:33.000 PNPP Stream Modification PMF
- Calculation 50:47.000 PNPP Surge and Seiche Analysis
- Calculation 50:55.000 PNPP Combined Events
- Calculation 50:58.000 PNPP Stream Modification Berm Failure Analysis
- Calculation 50:62.000 PNPP Major Stream Rail Modification PMF
- Calculation 50:66.000 PNPP LIP
- Calculation P72-006.000 Effect(s) of Underdrain System Manhole Modification
- PNPP Updated Safety Analysis Report, Rev 19.

ATTACHMENT A

(Revised Table 2 from NRC Letter ML 16202A348 with Enclosure ML 16202A417)

Revised Flood-Causing Mechanisms for Use in the MSA:

Mechanism	Stillwater Elevation	Waves/ Runup	Design Basis Hazard Elevation	Reference
Local Intense Precipitation				
Power Block	621.65 ft NGVD29	Not applicable	621.65 ft NGVD29	FHRR Rev 2 Section 3.2.9 & Table 8 (see note 1)
Streams and Rivers				
Major Stream	628.5 ft NGVD29	Not applicable	628.5 ft NGVD29	FHRR Rev 2 Section 3.2.2 & Table 8
Diversion Stream	629.2 ft NGVD29	Not applicable	629.2 ft NGVD29	FHRR Rev 2 Section 3.2.2 & Table 8
Storm Surge				
High Water: West of the Power Block Along the Shoreline Bluff Slopes	582.8 ft NGVD29	Not applicable	582.8 ft NGVD29	FHRR Rev 2 Section 3.2.6 & Table 8 (see note 2)
Low Water	563.2 ft NGVD29	Not applicable	563.2 ft NGVD29	FHRR Rev 2 Section 3.2.6 & Table 8
Combined Effect Flood				
East of the Power Block Along the Shoreline Bluff Slopes	581.9 NGVD29	27.5ft	609.5 NGVD29	FHRR Rev 2 Section 3.2.8 & Table 8 (see note 2)

Note 1: Maximum water surface elevation at the evaluated door is approximately 1.4 ft above the door threshold.

Note 2: Maximum water surface elevation is 582.8 ft occurs west of the power block along the shoreline bluff slopes. The maximum effects due to wind wave activity occur at a location just east of the power block along a section of shoreline with steeper bluff slopes. The PMSS maximum water surface elevation at this location is 581.9 ft. (Total of 609.5 ft conservatively rounded up).

* All elevation values are in NGVD29 PLD, unless noted otherwise.