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December 15, 2016

AEP-NRC-2016-87
10 CFR 50.4

Docket Nos.: 50-315
50-316

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

Subject: Donald C. Cook Nuclear Plant Unit 1 and Unit 2 Mitigating Strategies Flood Hazard Assessment

References:

1. Letter from E. J. Leeds, U. S. Nuclear Regulatory Commission (NRC), to All Power Reactor Licensees and Holders of Construction Permits in Active or Deferred Status, "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, Agencywide Documents Access and Management System (ADAMS) Accession No. ML12053A340.

2. Letter from J. P. Gebbie, Indiana Michigan Power Company (I&M), to the NRC, "Donald C. Cook Nuclear Plant Unit 1 and Unit 2, Response to March 12, 2012, Request for Information, Enclosure 2, 'Recommendation 2.1: Flooding,' Required Response 2, Hazard Reevaluation Report," dated March 6, 2015, AEP-NRC-2015-14, ADAMS Accession No. ML15069A334.

3. Letter from J. P. Gebbie, I&M, to the NRC, "Donald C. Cook Nuclear Plant Unit 1 and Unit 2, "Additional Information Regarding Flood Hazard Reevaluation Report," dated June 16, 2015, AEP-NRC-2015-56.

4. Letter from J. P. Gebbie, I&M, to the NRC, "Donald C. Cook Nuclear Plant Unit 1 and Unit 2, Additional Information for NRC Audit of Flood Hazard Reevaluation Conducted in Response to March 12, 2012, NRC Request for Information Regarding Fukushima Near-Term Task Force Recommendation 2.1: 'Flooding'," dated October 27, 2015, AEP-NRC-2015-105.

5. Letter from E. Leeds, NRC, to All Power Reactor Licensees and Holders of Construction Permits in Active or Deferred Status, "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, ADAMs Accession No. ML13044A561.

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6. NRC Memorandum "Staff Requirements - 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. Letter from W. M. Dean, NRC, to the listed Power Reactor Licensees, "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.

8. Nuclear Energy Institute (NEI), Report NEI 12-06, Revision 2, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," dated December 2015, ADAMS Accession No. ML16005A625.

9. U.S. Nuclear Regulatory Commission, JLD-ISG-2012-01, Revision 1, "Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigating Strategies for Beyond-Design-Basis External Events," dated January 22, 2016, ADAMS Accession No. ML15357A163.

10. Letter from T. V. Govan, NRC, "Donald C. Cook Nuclear Plant, Units 1 and 2 - Interim Staff Response to Reevaluated Flood Hazards Submitted in Response to 10 CFR 50.54(f) Information Request- Flood Causing Mechanism Reevaluation (TAC Nos. MF6096 and MF6097)," dated December 4, 2015, ADAMs Accession No. ML15334A424.

11. Letter from Q. S. Lies, I&M, to the NRC, "Donald C. Cook Nuclear Plant Unit 1 and Unit 2, Revision of Flood Hazards Reevaluation Report and Supporting Calculations, Re. March 12, 2012, Request for Information, Enclosure 2, Recommendation 2.1: Flooding," dated November 10, 2016, AEP-NRC-2016-89.

On March 12, 2012, the U. S. Nuclear Regulatory Commission (NRC) issued Reference 1 to request information associated with Near-Term Task Force Recommendation 2.1 for Flooding. One of the Required Responses specified in Reference 1 directed licensees to submit a Flood Hazard Reevaluation Report (FHRR). The FHRR for the Donald C. Cook Nuclear Plant (CNP) was submitted on March 6, 2015 (Reference 2). The reevaluated flood hazard was supplemented by responses to requests for additional information (References 3 and 4). Per Reference 5, the NRC considers the reevaluated flood hazard to be "beyond the current design/licensing basis of operating plants."

Concurrent with the flood hazard reevaluation, Indiana Michigan Power Company (I&M) developed and implemented mitigating strategies in accordance with NRC Order EA-12-049, "Requirements for Mitigation Strategies for Beyond-Design-Basis External Events." By Reference 6, the Commission affirmed that licensees need to address the reevaluated flooding hazards within their mitigating strategies for Beyond-Design-Basis external events, including the reevaluated flood hazards. This requirement was confirmed by the NRC in Reference 7. Guidance for performing mitigating strategies assessments (MSAs) is contained in Appendix G of Reference 8, endorsed by the NRC (with conditions) in Reference 9. For the purpose of the MSAs, the NRC has termed the reevaluated flood hazard, summarized in Reference 10, as the "Mitigating Strategies Flood Hazard

Information" (MSFHI). Reference 8, Appendix G, describes the MSA for flooding as containing the following elements:

- Section G.2, "Characterization of the MSFHI"
- Section G.3, "Basis for Mitigating Strategy Assessment"
- Section G.4.1, "Assessment of Current FLEX Strategies" (if necessary)
- Section G.4.2, "Assessment for Modifying FLEX Strategies" (if necessary)
- Section G.4.3, "Assessment of Alternate Mitigating Strategies" (if necessary)
- Section G.4.4, "Assessment of Targeted Hazard Mitigating Strategies" (if necessary)
- Section G.5, "Performance Criteria For Flood Protection Features"
- Section G.6, "Documentation"

Enclosures 2 through 4 to this letter provides the flood MSA results for CNP. As documented in these enclosures, the MSA determined that the design basis flood hazard upon which the EA-12-049 mitigation strategies are based does not bound the reevaluated flood hazard. Rather than modify the strategies, I&M has elected to install or modify flood protection features and modify mitigation equipment to provide assurance that the strategies can be implemented as originally designed.

Enclosure 1 to this letter provides an affirmation regarding the information contained herein. Enclosure 2 provides a description of compliance with Sections G.2 through G.4.2 of Reference 8. Enclosure 3 provides a description of compliance with Section 6 of Reference 8. Enclosure 4 provides a description of compliance with Section G.5 of Reference 8. Enclosure 5 provides a tabulation of the new regulatory commitments made in this letter.

If there are questions concerning the information provided by this letter, please contact Mr. Michael K. Scarpello, Manager, Nuclear Regulatory Affairs, at (269) 466-2649.

Sincerely,

Quinton S. Lies

Q. Shane Lies
Site Vice President

JRW/db

Enclosures:

1. Affirmation.
2. Donald C. Cook Nuclear Plant, Units 1 and 2, Flood Mitigating Strategies Assessment, Compliance with NEI 12-06, Revision 2, Sections G.2 through G.4.2.
3. Donald C. Cook Nuclear Plant, Units 1 and 2, Flood Mitigating Strategies Assessment, Compliance with NEI 12-06, Revision 2, Section 6.
4. Donald C. Cook Nuclear Plant, Units 1 and 2, Flood Mitigating Strategies Assessment, Compliance with NEI 12-06, Revision 2, Section G.5
5. Regulatory Commitments

c: R. J. Ancona, MPSC
A. W. Dietrich, NRC, Washington, D.C.
T. V. Govan, NRC, Washington DC
MDEQ - RMD/RPS
NRC Resident Inspector
C. D. Pederson, NRC, Region III
A. J. Williamson, AEP Ft. Wayne, w/o enclosures

Enclosure 1 to AEP-NRC-2016-87

AFFIRMATION

I, Q. Shane Lies, being duly sworn, state that I am the Site Vice President of Indiana Michigan Power Company (I&M), that I am authorized to sign and file this document with the U. S. Nuclear Regulatory Commission on behalf of I&M, and that the statements made and the matters set forth herein pertaining to I&M are true and correct to the best of my knowledge, information, and belief.

Indiana Michigan Power Company

Quinton A. Lies

Q. Shane Lies
Site Vice President, Indiana Michigan Power

SWORN TO AND SUBSCRIBED BEFORE ME

THIS 15 DAY OF December, 2016

Danielle Burgoyne
Notary Public

My Commission Expires 04-04-2018

DANIELLE BURGOYNE
Notary Public, State of Michigan
County of Berrien
My Commission Expires 04-04-2018
Acting in the County of Berrien

Enclosure 2 to AEP-NRC-2016-87

Donald C. Cook Nuclear Plant, Units 1 and 2, Flood Mitigating Strategies Assessment

Compliance with NEI 12-06, Revision 2,
Sections G.2 through G.4.2

Contents

1 Executive Summary

The design basis flood event used to develop the Donald C. Cook Nuclear Plant (CNP) FLEX mitigating strategies pursuant to U. S. Nuclear Regulatory Commission (NRC) Order EA-12-049 is a seiche occurring on Lake Michigan. The CNP Flood Hazards Reevaluation Report submitted in response to the NRC's March 2012 10 CFR 50.54(f) letter documented the determination that, for some locations, one potential external flood causing mechanism, a Local Intense Precipitation (LIP) event, could result in flood water levels at CNP that are not bounded by the design basis flood elevation. As required by the NRC, this Mitigating Strategies Assessment was performed to evaluate the impact of the postulated LIP event on the CNP FLEX strategies.

The Mitigating Strategies Assessment determined that the existing FLEX strategies can be implemented as designed provided the following actions are completed:

- Install, modify, or augment flood protection features for the Auxiliary Building and the Turbine Building to preclude or minimize flood water ingress through 16 pathways, and replace, qualify, or augment approximately 30 to 40 penetration seals.
- Modify several pieces of portable FLEX equipment to assure functionality at projected flood water levels in the deployment pathway and/or the pre-staged locations.
- Change several FLEX Support Guidelines to provide instructions for keeping portable electrical cable connections above flood waters.

The population of pathways that must be mitigated or FLEX portable equipment that must be modified to support the current FLEX strategies may change if supported by refinements in the associated evaluations.

These actions are to be completed by the required compliance date for the forthcoming regulation 10 CFR 50.155, "Mitigation of Beyond-Design-Basis Events."

2 List of Abbreviations and Acronyms

- AC - alternating current
- AMS - Alternate Mitigating Strategies
- BART - Boric Acid Reserve Tank
- BDB - Beyond Design Basis
- BDBEE - Beyond Design Basis External Event
- CCW - Component Cooling Water
- CL – Critical Location
- CNP - Donald C. Cook Nuclear Plant
- CST - Condensate Storage Tank
- CVCS – Chemical & Volume Control System
- DB - Design Basis
- DBFL - Design Basis Flood Level
- DC - direct current
- DG - Diesel Generator
- DIS - Distributed Ignition System

- EDG - Emergency Diesel Generator
- ELAP - Extended Loss of AC Power
- EOP - Emergency Operating Procedures
- FHRR - Flood Hazard Reevaluation Report
- FIP - Final Integrated Plan
- FLEX - Strategy response to an ELAP and LUHS, postulated from a BDBEE
- FLEX DB - FLEX Design Basis (flood hazard); the controlling flood parameters used to develop the FLEX flood strategies
- FSG - FLEX Support Guideline
- ft. - foot, feet
- gpm - gallons per minute
- HHA - Hierarchical Hazard Assessment
- hr. - hour
- I&M - Indiana Michigan Power Company
- in. - inch, inches
- kV - kilovolt
- kW - killowatt
- LIP- Local Intense Precipitation
- LUHS - Loss of Ultimate Heat Sink
- Max. - maximum
- Min. - minute/minutes
- MSA - Mitigation Strategy Assessment
- MSFHI - Mitigating Strategies Flood Hazard Information
- NRC- U. S. Nuclear Regulatory Commission
- NA -- not applicable
- NGVD29 - National Geodetic Vertical Datum of 1929
- NSRC - National SAFER Response Center
- PMF - Probable Maximum Flood
- PMP - Probable Maximum Precipitation
- PORV - power operated relief valve
- psig - pounds per square inch gage
- PWST - Primary Water Storage Tank
- RAI- Request for Additional Information
- RCP - Reactor Coolant Pump
- RCS - Reactor Coolant System
- RHR - Residual Heat Removal
- RWST - Refueling Water Storage Tank
- RV - Reactor Vessel
- sec. - second
- SFP - Spent Fuel Pool
- SG - steam generator
- SSC - structures, systems, and components
- TDAFW - Turbine Driven Auxiliary Feed Water
- TSA -Time Sensitive Action
- UFSAR - Updated Final Safety Analysis Report
- UHS – Ultimate Heat Sink

3 Background

Documents referenced in this enclosure are identified in Section 10.

On March 12, 2012, the NRC issued Reference 1 to request information associated with NTTF Recommendation 2.1 for Flooding. One of the Required Responses specified in Reference 1 directed licensees to submit an FHRR. The FHRR for CNP was submitted on March 6, 2015 (Reference 2). I&M provided additional information regarding the FHRR by letters dated June 16, and October 27, 2015 (Reference 3 and Reference 4). On December 4, 2015, the NRC transmitted (Reference 5) a summary of the staff's assessment of the re-evaluated flood-causing mechanisms described in the CNP FHRR. Reference 5 documented the NRC staff's conclusion that the reevaluated flood hazards information for CNP was suitable for an assessment of mitigating strategies developed in response to Order EA-12-049 (Reference 6). I&M subsequently transmitted (Reference 7) a minor revision to the FHRR that did not alter the overall conclusions documented in the FHRR.

The mitigating strategies for CNP, termed FLEX strategies, developed in response to Order EA-12-049, were documented in the FIP submitted by Reference 8. As documented in Reference 9, the NRC staff concluded that the CNP FLEX strategies, if implemented appropriately, would adequately address the requirements of Order EA-12-0-49.

By Reference 10, the NRC affirmed that licensees need to address the reevaluated flood hazards within their mitigating strategies for BDBEEs. This requirement was confirmed by the NRC in Reference 11. Guidance for performing flood hazards mitigating strategy assessments (flood MSAs) is contained in Appendix G, "Mitigating Strategies Assessment for New Flood Hazards Information," of Reference 12. NRC endorsement of Reference 12 is documented in Reference 13. Appendix G of Reference 12, defines the reevaluated flood hazard information from the FHRR as the MSFHI, and identifies the following Appendix G sections as the elements of the flood MSA:

- Section G.2, "Characterization of the MSFHI."

- Section G.3, "Basis for Mitigating Strategy Assessment." This section guides the comparison of the flood hazard used to develop the FLEX strategies with the MSFHI to determine if the MSFHI is bounded.

- Section G.4.1, "Assessment of Current FLEX Strategies." If the MSFHI is NOT bounded in all aspects as described in Section G.3 (i.e., flood height, associated effects, and flood event duration), this section provides guidance for evaluating the existing FLEX strategies against the impacts of the MSFHI to determine if the FLEX strategies can still be implemented without change.

- Section G.4.2, "Assessment for Modifying FLEX Strategies." If the FLEX strategies cannot be implemented without change, this section provides guidance to determine if the FLEX strategies can be modified to address the identified impacts from the MSFHI.

- Section G.4.3, "Assessment of Alternate Mitigating Strategies." As an alternative to modifying the FLEX strategies, this section provides guidance for the development of an alternate mitigating strategy. Unlike the FLEX strategies which assume specific event consequences (i.e., ELAP and LUHS) from an undefined external event, the Alternate Mitigating Strategy would be based specifically upon the MSFHI as the defined external event.

- Section G.4.4, "Assessment of Targeted Hazard Mitigating Strategies." As an alternative to modifying the FLEX strategies or developing an AMS, this section provides guidance for the development of a Targeted Hazard Mitigating Strategy that would consider other mitigative measures.

- Section G.5, "Performance Criteria for Flood Protection Features." This section provides guidance for demonstrating that flood protection features are robust for the MSFHI.

- Section G.6, "Documentation." This section provides guidance for documenting the results of the MSA.

The sections that are applicable to CNP are Sections G.2, G.3, G.4.1, G.4.2, G.5, and G.6. This enclosure provides the information required by those sections. Elevation data in this enclosure is based on Mean Sea Level NGVD29.

4 Site Description

The CNP site is located near the town of Bridgman, Michigan. The site encompasses approximately 650 acres along the eastern shore of Lake Michigan The site has approximately 4,350 ft. of lake frontage, and extends an average of about one and one quarter miles inland.

The plant is situated on a flat area among lakeshore sand dunes, with most of the Protected Area at an elevation of 609 ft. The site grade falls to about 594 ft. near the lake (west of the Screenhouse and Turbine Building). This grade is maintained by a sheet pile wall at the west edge of the Protected Area. The beach level west of the sheet pile wall is between the elevations of approximately 584 and 577 ft. To the north and south of the Protected Area are sand dunes with elevations up to about 650 ft.

5 Overview of FLEX Strategies

The objective of the FLEX strategies is to establish an indefinite coping capability in order to satisfy the following key safety functions in the event of a BDBEE which results in an ELAP and LUHS:

- Prevent damage to the fuel in the reactors,
- Maintain the Containment function, and
- Maintain cooling and prevent damage to fuel in the spent fuel pool using installed equipment, on-site portable equipment, and off-site resources.

Consistent with Reference 12, the following three-phase approach is used for FLEX strategies to mitigate such a BDBEE:

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

Following such a BDBEE, if personnel determine that AC power cannot be restored within a reasonable period of time, a branch out of the EOPs to the FSGs would be made. The FSGs determine which strategy would have the most likelihood of success, based on damage assessment and equipment availability. The FSGs control the restoration of core cooling, RCS boration/inventory makeup, SFP cooling, Containment, and electric power as described below.

Core Cooling Strategies:

The reactor would trip at the start of an ELAP if the unit was in Mode 1 or 2. The EOPs would provide directions to stabilize the plant, attempt restoration of AC power, and initiate RCS cooldown. With SGs available, core cooling would be accomplished by natural circulation. SG inventory make up would be supplied by the TDAFW pump taking suction from the CST. Local manual SG PORV operation is credited. A DC load shed would be completed within one hour, ensuring that battery power would be available for a minimum of 12 hrs. The 12 hr. period would allow FLEX Phase 2 equipment deployment while maintaining necessary instrumentation and control power. If the CST inventory becomes depleted a diesel driven FLEX Lift Pump would be deployed to draw Lake Michigan water from the Circulating Water System forebay area.

Core cooling in Mode 5 with SGs unavailable, Mode 6 with the refueling cavity not flooded, or Mode 6 with the RV internals installed, would be accomplished using an RCS feed and bleed strategy described below under "RCS Boration/Inventory Strategies." In Mode 6 with the refueling cavity flooded and the RV internals removed, approximately 49 hrs. would be available before unacceptable boil-off occurred. Therefore no makeup would be needed prior to the arrival of Phase 3 equipment from the NSRC.

Restoration of 4kV power would occur in Phase 3 allowing operation of equipment necessary for RHR system cooling. The LUHS would necessitate use of NSRC supplied large raw water pumps to provide cooling water flow to the CCW system. This equipment would allow completion of an RCS cooldown below 200°F and depressurization to atmospheric pressure.

RCS Boration/Inventory Strategies:

With a unit initially in Mode 1 or 2, RCS boration and make up would not be needed during the initial Phase 1 cooldown. Borated water would be added in Phase 2 to compensate for positive reactivity added as a result of the cooldown and the decay of xenon. This makeup would also compensate for RCS inventory contraction and RCP seal leakage. A portable FLEX BART Lift Pump and a portable FLEX Boric Acid Pump powered by a FLEX DG would be used to inject borated makeup into the RCS. The Boric Acid Reserve Tank would be available as the source of borated makeup.

With a unit initially in Mode 5 without SGs available or in Mode 6 with the RV cavity not flooded, RCS makeup may initially be available by gravity flow from the RWST to the RCS. If the RCS was initially pressurized, Pressurizer PORVs could be opened to reduce RCS pressure to allow the RCS make up using gravity feed from the RWST. In Mode 5 without SGs available, or in Mode 6 with the RV cavity not flooded, a FLEX DG and supporting equipment are pre-staged to enable operation of the Safety Injection Accumulator outlet isolation valves which would allow sufficient time to establish RCS feed and bleed.

RCS Inventory Control in Phase 3 would use the same inventory control methods as used in Phase 2.

SFP Cooling Strategies:

The normal SFP inventory is adequate to preclude the need for makeup for at least 24 hrs. Cooling is provided by maintaining adequate SFP inventory. Moisture caused by evaporation or boiling would be removed from the Auxiliary Building by opening the Auxiliary Building Crane Bay door and opening the Auxiliary Building roof fire dampers. When needed, SFP make up would be provided by a diesel driven FLEX Lift Pump drawing Lake Michigan water from the Circulating Water System forebay area.

Containment Strategies:

A site-specific analysis has determined that no actions are needed in Phases 1 and 2 to maintain acceptable Containment temperature and pressure following an ELAP and LUHS. With a unit initially in Modes 1 through 4, the Containment pressure would not reach the 12 psig maximum design pressure for over 72 hrs. In Phase 3 initial Containment cooling and depressurization would be accomplished by operation of a Containment Hydrogen Skimmer Fan establishing flow through the Ice Condenser, cooling and depressurizing the Containment. Since less heat would be added in Mode 5, the Mode 1 through 4 analysis bounds Mode 5.

In the RCS bleed and feed strategy described above under "RCS Boration/Inventory Strategies," Containment over-pressurization would be precluded by maintaining a vent path from the RCS to the upper Containment volume venting through the personnel access door which is secured in the open position in Modes 5 and 6.

The containment DIS would be powered from either a 500 kW "N" portable DG, or a 350 kW "N+1" portable DG to provide hydrogen control.

The Phase 3 Containment cooling strategy involves restoration of RHR cooling of the RCS, thereby eliminating the major heat source and allowing the Containment to cool through ambient losses.

Electrical Power Strategies:

Electrical Power in support of the above Phase 2 strategies would be provided by portable FLEX generators that are deployed from the FLEX Storage Building. For Phase 3, NSRC supplied generators would be used to restore 4kV vital bus in support of RHR long term RCS cooling.

6 Characterization of MSFHI (NEI 12-06, Revision 2, Section G.2)

The FHRR (Reference 2) addressed the following flood mechanisms:

- LIP
- Flooding of Streams and Rivers
- Failure of Dams and Onsite Water Control/Storage Structures
- Storm Surge
- Seiche
- Tsunami
- Ice Induced Flooding
- Channel Migrations/Diversions
- Groundwater Intrusion
- Combined Effect Flood
- Failure of an On-site Pond (Infiltration Pond)

The LIP was determined to be the controlling external flood mechanism. The controlling flood parameters specified in NEI 12-06, Revision 2, Section G.2 are provided below for the LIP event.

6.1 Flood Height

As documented in the FHRR, the flood heights from a LIP event vary at different CNP plant locations due to the site-specific terrain and watershed pathways. A LIP event could result in water levels for some locations that are not bounded by the current DB basis flood elevation. The CNP LIP event is characterized by 1 hr., 1 square mile PMP event distribution. The LIP parameters for the HHA Case 2 were defined using input from a site-specific calculation as prescribed in NUREG/CR-7046, "Design-Basis Flood Estimation for Site Characterization at Nuclear Power Plants in the United States of America." A cumulative depth of 20.2 inches (which includes the peak one hr. rainfall) was computed for a 6-hr., 1-square mile PMP. Based on this rainfall model, flooding depths were computed for ten CLs where the watershed could negatively impact SSCs based on the general site and plant configuration, and on specific attributes observed in plant walkdowns. Table 6-1 below lists the MSFHI parameters (specifically still-water elevation and wind-wave run-up elevation) for the LIP event which are not bounded by the current design basis hazard and are used in the MSA.

Table 6-1 Reevaluated Flood Hazards for LIP External Flood Mechanism				
CL Number and Description	**Stillwater elevation**	**Waves/ Runup**	**Reevaluated Hazard elevation**	**Source**
CL1: 1-DR-TUR201 (Turbine Building Unit 1 West Rollup Door)	594.8 ft.	Minimal	594.8 ft.	Reference 2, FHRR, Table 3-2
CL2: 2-DR-TUR220 (Turbine Building Unit 2 West Rollup Door)	596.0 ft.	Minimal	596.0 ft.	
CL3: 2-DR-TUR260 (Turbine Building Unit 2 East Rollup Door)	609.2 ft.	Minimal	609.2 ft.	
CL4: Valve-Shed RWST 1-TK-33	609.9 ft.	Minimal	609.9 ft.	
CL5: Valve-Shed PWST/CST 1	609.9 ft.	Minimal	609.9 ft.	
CL6: Valve-Shed RWST 2-TK-33	609.5 ft.	Minimal	609.5 ft.	
CL7: Valve-Shed PWST/CST 2	609.6 ft.	Minimal	609.6 ft.	
CL8: Supplemental DGs (See Note 1)	609.6 ft.	Minimal	609.6 ft.	
CL9: 1-DR-TUR253 (Turbine Building Unit 1 East Rollup Door)	609.8 ft.	Minimal	609.8 ft.	
CL10: 12-DR-AUX381 (Auxiliary Building North Rollup Door)	609.9 ft.	Minimal	609.9 ft.	
Note 1: The Supplemental DGs at CL8 are not credited by the FLEX strategies. The data for that location is provided for information only.				

6.2 Flood Event Duration

Inundation of many of the ten CLs begins to occur in less than 30 minutes as shown in Reference 2, FHRR Figures B-1 through B-10. Based on the variations in site topography and water pathways, the inundation period for these ten CLs varies from near the time of event initiation (T=0), to over 14 hrs. as shown in Table 6-2 below.

Table 6-2 Inundation Period at CLs				
CL	**Location**	**Reevaluated Hazard elevation**	**Max. Inundation Level**	**Duration**
CL1	1-DR-TUR201 (Turbine Building Unit 1 West Rollup Door)	594.8 ft.	0.0 ft.	NA

Table 6-2
Inundation Period at CLs

CL	Location	Reevaluated Hazard elevation	Max. Inundation Level	Duration
CL2	2-DR-TUR220 (Turbine Building Unit 2 West Rollup Door)	596.0 ft.	0.8 ft.	7.5 hr.
CL3	2-DR-TUR260 (Turbine Building Unit 2 East Rollup Door)	609.2 ft.	0.2 ft.	2.5 hr.
CL4	Valve-Shed RWST 1-TK-33	609.9 ft.	1.5 ft.	> 14 hr.
CL5	Valve-Shed PWST/CST 1	609.9 ft.	1.5 ft.	> 14 hr.
CL6	Valve-Shed RWST-2-TK-33	609.5 ft.	0.6 ft.	11.5 hr.
CL7	Valve-Shed PWST/CST 2	609.6 ft.	1.2 ft.	> 14 hr.
CL8	Supplemental DGs (Note 1)	609.6 ft.	0.6 ft.	7.5 hr.
CL9	1-DR-TUR253 (Turbine Building Unit 1 East Rollup Door)	609.8 ft.	0.8 ft.	7 hr.
CL10	12-DR-AUX381 (Auxiliary Building North Rollup Door)	609.9 ft.	1.0 ft.	>14 hr.

Note 1: The Supplemental DGs at CL8 are not credited by the FLEX strategies. The data for that location is provided for information only.

6.3 Relevant Associated Effects

The associated effects identified in NEI 12-06, Revision 2, Section G.2 that are potentially applicable to CNP are dispositioned as follows:

- Wave Run-up - Included in Table 6-1 above.

- Hydrodynamic Loading – The ten CLs, which are all in areas of about 0.5 to 1.0 ft./second maximum storm water runoff velocity, are not subject to significant hydrodynamic loading.

- Debris Loading - The flood water velocity would be low in equipment staging areas near the Protected Area and near Protected Area entrances. In addition, there would be very little debris located in these areas due to the small watershed which is located entirely within the owner controlled area. Any debris flowing from the access road northeast of the Protected Area would be routed north of the Protected Area from the primary plant access road. Thus, debris loading and transportation during a LIP event is not considered a hazard for SSCs important to safety.

- Sediment Deposition - The sand dunes to the east of the CNP Protected Area are covered with established trees, brush, and grasses. While vegetation cover helps to limit potential sediment production, these dunes may experience some degree of erosion. High storm water runoff velocity along the primary plant access road could convey eroded sediment from the upper watershed toward the Protected Area entrance. Some sediment would settle out in areas of decreased velocity. However, much of the material would be conveyed through high velocity zones within the roadway to the area north of the Turbine Building, and ultimately to the northwest corner of the Protected Area. Sediment coming from the access road would be deposited in the low velocity zone to the east of the Turbine Building door 1-DR-TUR253 (Turbine Building Unit 1 East Rollup Door), or travel north of the Turbine Building to the beach, or settle in the northwest corner of the Protected Area. Turbine Building door 1-DR-TUR253 is hydraulically separated from upper watershed sediment by flow patterns.

CLs, including the Turbine Building doors 2-DR-TUR220 (Turbine Building Unit 2 West Rollup Door) and 2-DR-TUR260 (Turbine Building Unit 2 East Rollup Door), are hydraulically isolated from upper watershed sediment inflow. The storm drain system, for HHA Case 2, is assumed to be operating at 25% of capacity to account for potential blockage due to sediment.

Sedimentation is not expected to increase water surface elevations, within the Protected Area.

- Concurrent Site Conditions – As documented in the FHRR, CNP is not susceptible to combined effect flooding hazard as the combined effect flood is lower than both the lowest site grade and the current DB for seiche flooding. In addition, CNP is not susceptible to the site-specific flooding hazard resulting from overflow or slope failure of the natural pond used for infiltration at the south side of the CNP site.

- Effects on Groundwater Intrusion – As detailed in the FHRR, the safety-related structures at CNP have a minimum margin of 0.8 ft. of protection (provided by the membrane waterproofing) above the potential ground water level resulting from the LIP event. Although there has been minor leakage into the Turbine Building and Auxiliary Building lower levels at normal groundwater elevations, this leakage is not consequential with respect to building flooding and it is judged that the increase in groundwater elevation of less than 5 feet resulting from the postulated LIP event would not significantly increase the leakage rate.

6.4 Warning Time and Flood Event Transient Water Surface elevations

The CNP response to a LIP event does not credit warning time. Entrance into the FSGs is based on loss of all AC power and other equipment and/or system conditions, and is not based on potential weather conditions.

7 Basis for Mitigating Strategy Assessment (NEI 12-06, Revision 2, Section G.3)

FLO-2D Model Update

In order to more accurately assess the impacts of the LIP event on the FLEX strategies, the FLO-2D model use for the FHRR was updated to reflect changes in the watershed, and eight additional grid locations inside the protected area were evaluated when the model was re-run.

The same methodology and LIP rainfall inputs used to derive the ten CLs identified in the FHRR were used when the model was re-run.

The FLO-2D model update accounts for recent changes in the watershed which were not reflected in the FHRR. These changes involved areas along the primary plant access road, and are listed below in order of increasing distance from the Protected Area.

- Removal of a warehouse and addition of a new Security Access Building in its place.
- Minor expansion of an existing parking lot
- Removal of a temporary office complex previously designated as the "TSOC."
- Addition of the FLEX Storage Building
- Addition of a permanent new building designated as the NEST, including sidewalks, parking, and minor topography changes.

The eight additional FLO-2D model locations are listed below in Table 7-1.

Table 7-1
Inundation at Additional Locations

Monitoring Location (ML)	Location	Reevaluated Hazard elevation	Max. Inundation Level	Approx. Duration
ML11	Service Building Extension Northwest	606.4 ft.	0.4 ft.	7 hrs.
ML12	Service Building Annex Northeast	609.0 ft.	1.1 ft.	14 hrs.
ML13	Service Building Annex Southeast	609.7 ft.	0.9ft.	7.5 hrs.
ML14	Top of Ramp for CL2, 2-DR-TUR220 (Turbine Building Unit 2 West Rollup Door)	595.9 ft.	0.6 ft.	7 hrs.
ML15	Bottom of Ramp for CL2, 2-DR-TUR220 (Turbine Building Unit 2 West Rollup Door)	596.0 ft.	4.0 ft.	15.5 hrs.
ML16	Low Point in Primary Plant Access Road used for FLEX Deployment	610.8 ft.	3.1 ft.	19 hrs.
ML17	Service Building Extension Northeast Corner	608.0 ft.	1.0 ft.	13 hrs.
ML18	Auxiliary Building Track Bay East Wall	609.8 ft.	0.6 ft.	7 hrs.

The inundation information at the ten CLs documented in the FHRR and presented in Table 6-2 above was not affected by the FLO-2D model update. The results of the FLO-2D model update are used as the MSFHI in this Mitigating Strategy Assessment. Note that an Interim Report was submitted pursuant to 10 CFR 21.21 regarding FLO-2D software errors. The reportability evaluation of this condition by the reporting corporation is expected to be complete by February 10, 2017. I&M is tracking the results of this evaluation and will take actions needed to address the condition if it is found to impact the CNP FLO-2D analyses.

DB and MSFHI Comparison

The current DB external flood mechanism for CNP is a Lake Michigan seiche coincident with the highest recorded lake level. This is the flood hazard for which the FLEX strategies were designed, i.e., the FLEX DB. The maximum flood elevation for the FLEX DB is 594.6 ft. above mean sea level. A comparison of the MSFHI flood heights to the DB flood height are provided in Table 7-2.

Table 7-2
Flood elevation Comparison between DB and MSFHI for Various External Flood Mechanisms

External Flood Mechanism	DB Flood Height (FLEX DB)	Reevaluated Flood elevation (MSFHI)	Difference
Local Intense Precipitation	Not evaluated for DB	See Table 6-1	Above DB (See Table 6-1)
PMF on Rivers and Streams	Not evaluated for DB	Screened Out	Not Applicable
Dam Breaches and Failures	Not evaluated for DB	588.6 ft.	6 ft. below DB
Storm Surges	Not evaluated for DB	590.3 ft.	4.3 ft. below DB
Seiche	594.6 ft.	590.3 ft.	4.3 ft. below DB
Tsunami	Not evaluated for DB	593.7 ft.	0.9 ft. below DB
Ice-Induced Flooding	Not evaluated for DB	<Storm Surge of 590.3 ft.	>4.3 ft. below DB
Channel Migration or Diversion	Not evaluated for DB	Screened Out	Not Applicable

Table 7-2 Flood elevation Comparison between DB and MSFHI for Various External Flood Mechanisms			
External Flood Mechanism	**DB Flood Height (FLEX DB)**	**Reevaluated Flood elevation (MSFHI)**	**Difference**
Combined Effect Flood:			
• Stability and flood potential for site's natural pond	Not evaluated for DB	Screened Out	Not Applicable
• Storm surge, with wave run-up and set-up (i.e., wind-wave activity)	Not evaluated for DB	593.3 ft.	1.3 ft. below DB

As shown in Table 7-2, the MSFHI flood height exceeds the FLEX DB flood height for the LIP. Therefore, the FLEX DB is not bounding and an assessment of the effects of the new external flood mechanism (LIP) is required. The comparison of the flood parameters of the FLEX DB (seiche) and the MSFHI for the LIP are provided in Table 7-3.

Table 7-3 Flood Parameter Comparison between the FLEX DB (Seiche) and the MSFHI for the LIP			
Flood Scenario Parameter		**FLEX DB (Seiche)**	**MSFHI (LIP)**
Flood Level and Associated Effect	1. Max. Stillwater elevation	594.6 ft.	See Table 6-1.
	2. Max. Wave Run-up elevation	Not explicitly determined (Note 1)	Minimal
	3. Max. Hydrodynamic /Debris Loading	Not determined	Note 2
	4. Effects of Sediment Deposition/Erosion	Not determined	Note 3
	5. Concurrent Site Conditions	Not determined	Note 4
	6. Effects on Groundwater	Not determined	Note 5
Flood Event	7. Warning Time (hrs.)	None	Note 6

Table 7-3
Flood Parameter Comparison between the FLEX DB (Seiche) and the MSFHI for the LIP

Flood Scenario Parameter		FLEX DB (Seiche)	MSFHI (LIP)
Duration	8. Period of Site Preparation	None	Note 7
	9. Period of Inundation	Not determined	Note 8
	10. Period of Recession	Not determined	Note 8
Other	11. Plant Mode of Operations	All modes	All modes
Notes:	1. The coincident occurrence of maximum wave and maximum seiche has been evaluated in the UFSAR and determined not to be a credible event. 2. The flood water velocity is low in equipment staging areas near the Protected Area and near Protected Area entrances. In addition, there would be very little debris located in these areas. Any debris flowing from the access road northeast of the Protected Area would be routed north of the Protected Area from the primary plant access road. Thus, debris loading and transportation during the LIP scenario is not considered a hazard for SSCs important to safety. 3. The dunes to the east of the CNP Protected Area are covered with established trees, brush, and grasses. While vegetation cover helps to limit potential sediment production, the sandy dunes to the east of the Protected Area may experience some degree of erosion from an LIP event. The high storm water runoff velocity along the primary plant access road could convey eroded sediment from the upper watershed toward the Protected Area entrance. Some sediment would settle out in areas of decreased velocity. Much of the material would continue through high velocity zones on the roadway north of the Turbine Building and ultimately to the northwest corner of the Protected Area. Sediment coming from the primary plant access road would be deposited in the low velocity zone to the east of the Turbine Building door 1-DR-TUR253 (Turbine Building Unit 1 East Rollup Door) or travel along the north of the Turbine Building to the beach or settle out in the northwest corner of the Protected Area. The Turbine Building door 1-DR-TUR253 (Turbine Building Unit 1 East Rollup Door) is hydraulically separated from upper watershed sediment by flow patterns		

Table 7-3
Flood Parameter Comparison between the FLEX DB (Seiche) and the MSFHI for the LIP

Flood Scenario Parameter	FLEX DB (Seiche)	MSFHI (LIP)
Stormwater velocity and sediment deposition patterns through the southern part of the Protected Area CLs including Turbine Building Rollup doors 2-DR-TUR220 (Turbine Building Unit 2 West Rollup Door) and 2-DR-TUR260 (Turbine Building Unit 2 East Rollup Door), are also hydraulically isolated from upper watershed sediment inflow. The storm drain system, for HHA Case 2, is assumed to be operating at 25% of capacity to account for potential blockage to sediment. Sedimentation is not expected to increase water surface elevations within the Protected Area. 4. As defined in the FHRR, CNP is not susceptible to the combined effect flooding hazard as the combined effect flood is lower than both the lowest site grade and the current design basis for seiche flooding. In addition, CNP is not susceptible to the site-specific flooding hazard resulting from overflow or slope failure of the natural pond used for infiltration at the south side of the CNP site. 5. As detailed in the FHRR, the safety-related structures at CNP have a minimum margin of 0.8 ft. of protection (provided by the membrane waterproofing) above the potential ground water level resulting from the LIP event. Although there has been minor leakage into the Turbine Building and Auxiliary Building lower levels at normal groundwater elevations, this leakage is not consequential with respect to building flooding and it is judged that the increase in groundwater elevation of less than 5 feet resulting from the postulated LIP event would not significantly increase the leakage rate. 6. The CNP response to a LIP event does not credit warning time. Entrance into the FSGs is based on loss of all AC power and other equipment/system conditions and not based on potential weather conditions. 7. There is no preparation period required before the beginning of the LIP event. All flood barriers are in place during normal operation and FLEX portable equipment is prepositioned in its normal storage location. 8. The duration of the highest flood elevations would vary for each of the critical locations. The Turbine Building Unit 1 West Rollup Door would be slightly inundated for the first 5 minutes. The inundation periods for the rest of the Turbine Building entrances range from 2 hrs. to 7 hrs. The Auxiliary Building roll up entrance door would remain slightly inundated (about 0.1 ft.) after 8 hrs. The valve shed CLs would remain inundated for at least 3 days,		

Table 7-3 Flood Parameter Comparison between the FLEX DB (Seiche) and the MSFHI for the LIP		
Flood Scenario Parameter	FLEX DB (Seiche)	MSFHI (LIP)
	except for CL 6 which would drain after approximately 9 hrs. of inundation. The Supplemental DG CL would remain inundated for about 7 hrs. However the Supplemental DGs are not credited by the FLEX strategies. The valve sheds are located within relatively flat and low spots in the Protected Area which may not drain in a timely manner.	

Table 6-1 and 7-1 above provide the MSFHI flood elevation values used for compliance with Sections G.4.1 and G.4.2 of NEI 12-06, Revision 2, as described below in Section 8 of this enclosure.

8 Assessment of Current FLEX Strategy (NEI 12-06, Revision 2, Section G.4.1)

The updated FLO-2D model indicated that the postulated LIP event would result in flood water entry into the Auxiliary Building and the Turbine Building that could adversely impact credited plant components and FLEX equipment. Therefore I&M will install, replace, or augment flood protection features so as to preclude such adverse impacts. The specific flood water pathways involved are listed in Table 8-1.

Table 8-1 Pathways Requiring Protection Features to be Installed, Replaced or Augmented	
Pathway Location and elevation	**Description**
Auxiliary Building elevation 609 ft.	Door 1-DR-AUX380
Auxiliary Building elevation 609 ft.	Door 12-DR-AUX381
Auxiliary Building elevation 609 ft.	Door 2-DR-AUX383
Auxiliary Building North elevation 596 ft. – 3 1/2 in.	Unit 1 CD EDG combustion air intake pipe penetration
Auxiliary Building North elevation 596 ft. – 3 1/2 in.	Unit 1 CD EDG exhaust penetration
Auxiliary Building North elevation 596 ft. – 3 1/2 in.	Manhole cover in front of Unit 1 CD EDG vent stack duct penetration
Auxiliary Building South elevation 596 ft. – 3 1/2 in.	Unit 2 AB EDG Exhaust Penetration

Table 8-1
Pathways Requiring Protection Features to be Installed, Replaced or Augmented

Pathway Location and elevation	Description
Auxiliary Building South elevation 596 ft. – 3 1/2 in.	Manhole cover in front of Unit 2 AB EDG vent stack duct penetration
Unit 1 Turbine Building East elevation 609 ft.	Door 1-DR-TUR253
Unit 1 Turbine Building East elevation 609 ft.	Door 1-DR-TUR254
Unit 1 Turbine Building North, elevations 595 ft. to 609 ft.	Doors 12-DR-SRV540, 12-DR-OFF-1, 12-DR-OFF-25, 12-DR-SRV163, 12-DRSRV164
Unit 1 Turbine Building West elevation 591 ft.	Door 1-DR-TUR201
Unit 1 Turbine Building West elevation 591 ft.	Door 1-DR-TUR200
Unit 2 Turbine Building East elevation 609 ft.	Door 2-DR-TUR260
Unit 2 Turbine Building West elevation 591 ft.	Door 2-DR-TUR220
Unit 2 Turbine Building West elevation 591 ft.	Door 2-DR-TUR221
Additionally, there are multiple conduit penetrations for which the seals will be qualified, replaced, or augmented with seals qualified for the applicable flood water level.	

In the following assessment per NEI 12-06, Revision 2, Section G.4.1, it is assumed that protection features for the above pathways are in place and will prevent significant leakage. NEI 12-06, Revision 2, Section G.4.1 is reproduced below with descriptions of CNP compliance inserted as outlined text following each specific requirement.

G.4.1 ASSESSMENT OF THE CURRENT FLEX STRATEGIES

This section provides guidance for evaluating the existing FLEX strategies to determine if they can be implemented as designed given the impacts of the MSFHI.

The following process should be applied to determine whether the FLEX strategies will be sufficient as currently developed given the impacts of the MSFHI:

- In the sequence of events for the FLEX strategies, if the reevaluated flood hazard does not cause the ELAP/LUHS, then the time when the ELAP/LUHS is assumed to occur should be specified and a basis provided (e.g., the ELAP/LUHS occurs at the peak of the flood).

> CNP Compliance
>
> The ELAP/LUHS is assumed to occur at the initiation of rainfall for the LIP event. This is a conservative assumption. There is no technical basis for how the LIP would cause an ELAP/LUHS. Assuming the ELAP/LUHS occurs at the beginning of rainfall is the most conservative approach since it maximizes duration of the AC power loss. If a loss of AC Power is postulated later in the LIP event, the FLEX equipment deployment would be needed later in the LIP event time line, beyond the time of peak rainfall and time of peak inundation.
>
> The majority of the postulated LIP rainfall would occur in the first 65 minutes of the event. After the 65 minute peak rainfall period, rainfall would be nominal and would not impact operational limitations of the FLEX equipment. Deployment of FLEX equipment can start as early as 2.5 hrs. after the start of the LIP event.

- The impacts of the MSFHI should be used in place of the FLEX DB flood to perform the screening and evaluation per Section 6.

> CNP Compliance
>
> See Enclosure 3 of this letter, which addresses the impacts of the MSFFHI in place of the FLEX DB on the screening and evaluation requirements of NEI 12-06, Revision 2, Section 6.

- The equipment storage guidance of Section 11.3 should be reassessed based on the impacts of the MSFHI.

CNP Compliance

The responses to NEI 12-06, Revision 2, Sections 6.2.3.1 and 6.2.3.2 in Enclosure 3 to this letter provide an evaluation of impact of the postulated LIP on the storage and deployment of the portable FLEX equipment. Additionally, redundant debris removal equipment is stored in two locations, neither of which would be impacted by the postulated LIP event. The capability to deploy FLEX equipment and debris removal equipment without off-site power or on-site emergency AC power would not be impacted by the postulated LIP event.

- The impacts of the MSFHI should be used in place of the FLEX DB flood in the consideration of robustness of plant equipment as defined in Appendix A. For determining robustness only the MSFHI should be used as the applicable hazard.

CNP Compliance

The plant equipment credited in the FLEX strategies is located in the Auxiliary Building and the Turbine Building. The potential impact of the flood water from the LIP event on the credited plant equipment in these buildings, assuming protection features are in place for the pathways identified in Table 8-1, is described below.

Auxiliary Building

The total flood water potentially entering the Auxiliary Building for the LIP event would be 4,306 gallons. This flood water would enter through the elevation 609 ft. Auxiliary Building Crane Bay. The water would exit the Crane Bay through floor drains and gaps around floor hatches.

Flood water entering the floor drains would flow to the Dirty Waste Holdup Tank which has a capacity of 24,700 gallons. This far exceeds the expected total influx of water.

Flood water falling through gaps around floor hatches would enter elevation 587 ft. in the Drum Storage Room. This room is open to the bulk of the Auxiliary Building at this elevation. Therefore, the water level would not accumulate to any appreciable depth.

Water on elevation 587 ft. or overflow from the Dirty Waste Holdup Tank (if already near capacity at the start of the event) would accumulate on the lowest elevation of the Auxiliary Building. The Auxiliary Building sump, CVCS hold-up tank area, and hold-up tank area sump have a capacity of 192,674 gallons below elevation 573 ft. This capacity is adequate to contain the 4,306 gallons entering the Auxiliary Building, and preventing flood water from reaching elevation 573 ft.

The limiting credited plant equipment in the Auxiliary Building are the RHR pumps which are located in the Auxiliary Building at elevation 573 ft. These pumps can be operated with flood water levels up to elevation 576 ft. – 6 in. The potential flood water level of less than 573 ft. in the Auxiliary Building is acceptable because it is less than RHR pump operational limit.

Turbine Building

Three scenarios were evaluated to determine impact of the potential LIP event on the Turbine Building. In all three scenarios, water could enter the west side of the Turbine Building through leakage around two rollup doors (one on the Unit 1 side and one on the Unit 2 side of the Turbine Building) on the floor at 591 ft. elevation and their associated flood barriers. The majority of the water entering in these locations is from direct rainfall on the open area between the flood barriers on the entry ramps and the rollup doors. Water could also enter the east side of the Turbine Building through leakage around two rollup doors and two access doors (one each on the Unit 1 side and one each on the Unit 2 side of the Turbine Building) at elevation 609 ft. That water would flow to the 591 ft. elevation floor via open areas and staircases, etc. Additional leakage would enter the Unit 1 side of the Turbine Building through doors between the Turbine Building and the Service Building at elevation 609 ft.

The total Turbine Building in-leakage from the postulated LIP event would be 10,458 gallons for the Unit 1 side, and 7,847 gallons for the Unit 2 side.

Scenario 1

This scenario addresses a condition in which all floor drains on the 591 ft. elevation floor are plugged, and flow paths to condenser pits, sumps, and stairwells on this elevation are obstructed. Water would accumulate on the 591 ft. elevation floor and would not flow to the Turbine Room Sump or the Main Condenser Pit for either unit. For this scenario, it is also assumed that the rollup doors that separate the Unit 1 and Unit 2 sides of the Turbine Building are closed and do not allow water to pass from one side of the building to the other. Since the volume of water entering the Unit 1 side of the Turbine Building would be greater than that entering the Unit 2 side, the flood water accumulating on the Unit 1 elevation 591 ft. floor would be the most limiting condition. The maximum water level on the 591 ft. floor of the Unit 1 Turbine Building would be 0.5 in.

Scenario 2

This scenario addresses a condition in which all drains to the Turbine Room Sump are blocked and the water on the 591 ft. elevation floor can only drain to the condenser pit sumps or the condenser pits. Since the volume of water entering the Unit 1 side of the Turbine Building is greater than that entering the Unit 2 side, Unit 1 represents the most limiting condition. The flood water would accumulate in the Unit 1 condenser pit to a level of less than 3.5 in. above elevation 579 ft.

Scenario 3

This scenario addresses a condition in which all drains flowing to the condenser pit sumps are blocked and water on the 591 ft. elevation floor can only drain to the Turbine Room Sump. The combined volume of water entering both sides of the Turbine building is used for this scenario because the Turbine Room Sump is common to both Unit 1 and Unit 2. The Turbine Room Sump has a capacity of 94,000 gallons before reaching the high water alarm. This is greater than the total in-leakage to the Unit 1 and Unit 2 sides of the Turbine Building of 18,305 gallons.

The limiting scenario is Scenario 1 which could result in a water level of 0.5 in. on the elevation 591 ft. floor.

The limiting credited plant equipment in the Turbine Building is as follows:

- The plant power supplies for the DIS located on elevation 587 ft. of the Auxiliary Building in the EDG room would be vulnerable to Turbine Building flooding that exceeded elevation 591 ft. – 7 in. which would overflow the curb protecting the EDG room corridor. The potential 0.5 in. of flood water on elevation 591 ft. floor is acceptable because it would not overflow the curb.

- The TDAFW pump rooms for both Unit 1 and Unit 2 are connected to the Turbine Building on the elevation 591 ft. floor. The elevation of the pump's concrete pedestals is 591 ft. - 4.5 in. The base of the Auxiliary Feed Water Pumps is an additional 8 in. high. Therefore, the critical elevation for the TDAFW pumps is 592 ft. – 1/2 in. The potential 0.5 in. of flood water on elevation 591 ft. floor is acceptable because it is less that the TDAFW pump critical elevation.

Since the credited plant equipment would not be impacted by the MSFHI, it is robust with respect to the MSFHI.

- The impacts of the MSFHI should be used to evaluate the location of connection points in accordance with Section 3.2.2.17.

CNP Compliance

The existing FLEX strategies provide primary and alternate connection points that comply with NEI 12-06 Section 3.2.2.17. The connection points located in areas potentially subject to inundation are the connection points for the 350 kW "N+1" DG, which are located on the outside east walls of the Unit 1 and Unit 2 switchgear areas of the Auxiliary Building.

> For Unit 1, the maximum inundation level in this area would be elevation 609.9 ft. The critical components for this connection point are located at the 611 ft. – 10 in. elevation, which is above the 609.9 ft. inundation level.
>
> For Unit 2, the maximum inundation level in this area would be elevation 609.3 ft. The critical components for this connection are located at the 612 ft. – 1 in. elevation, which is above the 609.3 ft. inundation level.

- Any flood protection features credited in the FLEX strategies meet the performance criteria in Section G.5.

> <u>CNP Compliance</u>
>
> See Enclosure 4 of this letter, which addresses application of the performance criteria provided in Section G.5. to the flood protection features that support FLEX strategies with respect to the MSFHI.

This evaluation should confirm the following:

- The boundary conditions and assumptions of the initial FLEX design are maintained.

> <u>CNP Compliance</u>
>
> The boundary conditions and assumptions of the initial FLEX design are in accordance with NEI 12-06, Revision 2, Sections 2 and 3, and are not impacted by the MSFHI.

- 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.

> <u>CNP Compliance</u>
>
> Table 8-2 below table addresses the potential impact of the LIP event inundation levels on the sequence of events actions for which Time Constraints have been established as documented in the CNP FLEX TSA Validation Report. As documented in this table, these actions would not be impacted by LIP event inundation levels.

Table 8-2
Sequence of Events Timeline and LIP Impacts

TSA No.	**Current Elapsed Time** (Note 1)	**Time Constraint** (Note 1)	**Action**	**LIP Impact**
TSA 1	34 min.	1 hr.	Declare ELAP and complete DC bus load shed	No impact - Local actions would be required in the Control Room and switchgear areas that are not impacted by a LIP event
TSA 2	50 min.	8 hrs.	Commence RCS Cooldown	No impact - Local actions may be required in the Main Steam Stop Valve Enclosures which are not impacted by a LIP event
TSA 3	1 hr. 21 min.	10 hrs.	Complete RCS Cooldown	No impact - Local actions may be required in the Main Steam Stop Valve Enclosures which are not impacted by a LIP event
TSA 4	7 hrs. 20 min.	10 hrs.	Stage SFP makeup equipment	No Impact - Local actions would be required in the Auxiliary Building Crane Bay, outside areas in vicinity of the Turbine and Auxiliary Buildings. Inundation levels at this time of the LIP event would be within the capability of the deployed FLEX equipment, and less than 6 in. in the applicable deployment areas.

Table 8-2 Sequence of Events Timeline and LIP Impacts				
TSA No.	**Current Elapsed Time** (Note 1)	**Time Constraint** (Note 1)	**Action**	**LIP Impact**
TSA 5	9 hrs. 37 min.	12 hrs.	Energize Bus 11D (21D) and 11B (21B), battery chargers and hydrogen igniters	No impact - Local actions would be required on the east side of the Turbine Bldg. Inundation levels at this time of the LIP event would be within the capability of the deployed FLEX equipment modified as described in the discussion of compliance with NEI 12-06, Revision 2, Section 6.2.3.1.1.a presented in Enclosure 3 to this letter.
TSA 6	8 hrs. 3 min.	12 hrs.	Ready to establish lake feed to TDAFW Pump from Lift pump, if necessary	No impact – As described in the response to NEI 12-06, Revision 2, Section 6.2.3.2.3, presented in Enclosure 3 to this letter, this action would not be required for a LIP event because the total CST volume would remain available since there would be no wind or seismic damage to the CST
TSA 7	10 hrs. 16 min.	12 hrs.	Ready to establish low pressure feed to all SGs, if necessary	No impact – As described in the response to NEI 12-06, Revision 2, Section 6.2.3.2.3, presented in Enclosure 3 to this letter, this action would not be required for a LIP event because the total CST volume would remain available since there would be no wind or seismic damage to the CST.

Table 8-2
Sequence of Events Timeline and LIP Impacts

TSA No.	**Current Elapsed Time** (Note 1)	**Time Constraint** (Note 1)	**Action**	**LIP Impact**
TSA 8	14 hrs. 32 min.	16 hrs.	Commence RCS boration	No impact - Local actions would be required in areas around the Turbine Building and the Auxiliary Building. Inundation levels in these areas at this time of the LIP event would be less than 6 in. Inundation levels in the deployment pathway would be within the capability of the deployed FLEX equipment.
TSA 9	Unit 1 – 20 hrs. 5 min. Unit 2 – 21 hrs. 5 min.	24 hrs.	Complete RCS boration	No impact - Local actions would be required in areas around the Turbine Building and the Auxiliary Building. Inundation levels in these areas at this time of the LIP event would be less than 6 in. Inundation levels in the deployment pathway would be within the capability of the deployed FLEX equipment.
TSA 10	2 hrs. 18 min.	4 hrs.	Establish TDAFW pump room and Control Room portable ventilation	No impact - Local actions would be required in the control room, TDAFW pump room, and 591 ft. elevation where portable equipment is stored. These areas would not be impacted by a LIP event.

Note 1: These times begin at the ELAP and LUHS start.

- The validation performed for the deployment of the FLEX strategies is not affected by the impacts of the MSFHI.

> <u>CNP Compliance</u>
>
> Although the FLEX strategies will not be changed, changes may be necessary to some deployment FSGs with respect to activities such as routing of temporary power cables. FSG validations will be re-performed as necessary to reflect any such changes.

If the evaluation demonstrates that the existing FLEX strategies can be deployed as designed, then the MSA is considered complete and should be documented per Section G.6.

If the evaluation demonstrates that the existing FLEX strategies cannot be implemented as designed, those aspects of the FLEX strategies that could not be implemented are documented. The outcome of this evaluation will be used to identify the most effective strategy for mitigating the flood hazard. The results of this evaluation should be documented in accordance with G.6 and provide the basis of the selected strategy.

> <u>CNP Compliance</u>
>
> The preceding evaluation per NEI 12-06, Revision 2, Section G.4.1 has determined that the existing FLEX strategies can be implemented as designed, assuming 1) plant flood protection features are installed, replaced, or augmented as necessary to satisfactorily mitigate the ingress of flood water via the Auxiliary Building and Turbine Building pathways identified in Table 8-1, and 2) FLEX portable equipment is modified as identified in the Enclosure 3 discussion of compliance with NEI 12-06, Revision 2, Section 6.2.3.1.1.a. Note that the population of pathways that must be mitigated or FLEX portable equipment that must be modified to support the current FLEX strategies may change if supported by refinements in the associated evaluations.
>
> I&M will complete the necessary changes to plant flood protection features and modifications of FLEX portable equipment by the required compliance date of the forthcoming regulation 10 CFR 50.155, "Mitigation of Beyond-Design-Basis Events."

9 Assessment for Modifying FLEX Strategies (NEI 12-06, Revision 2, Section G.4.2)

NEI 12-06, Revision 2, Section G.4.2 is reproduced below with descriptions of CNP compliance inserted as outlined text following each specific requirement

G.4.2 ASSESSMENT FOR MODIFYING FLEX STRATEGIES

If FLEX strategies cannot be implemented as designed due to the impact of the MSFHI, this section provides guidance for modifying the FLEX strategies to address the impacts of the MSFHI.

The process to modify the FLEX strategies should be the same as that used to develop the original FLEX strategies but will use the modified sequence of events developed under the evaluation performed in G.4.1. The impacts of the MSFHI to the original sequence of events may be addressed through alternatives such as early deployment, modifications to the flood protection features or equipment deployment locations, procedures or operator actions.

CNP Compliance

The preceding evaluation per NEI 12-06, Revision 2, Section G.4.1, determined that the existing FLEX strategies can be implemented as designed, provided that plant flood protection features are changed as necessary to mitigate the ingress of flood water via the Auxiliary Building and Turbine Building, and FLEX portable equipment is modified as necessary to preclude unacceptable flood water impacts to equipment storage, deployment, or pre-staging. Since the above definition of the scope of NEI 12-06, Revision 2, Section G.4.2 includes "modifications to the flood protection features or equipment deployment locations, procedures or operator actions," descriptions of compliance with the specific requirements of Section G.4.2 are provided below.

Documentation of the changes to the FLEX strategies should be performed in accordance with Section 11.8 Configuration Control to ensure the required baseline capabilities of FLEX to cope with an ELAP and LUHS continue to be maintained for all other screened-in hazards.

CNP Compliance

Although the above noted changes are not considered to be strategy changes, any changes that affect the FSGs or the FLEX FIP would be processed in accordance with the CNP procedure that implements the requirements of Section 11.8.

In addition to meeting the original FLEX guidance, the modification of the FLEX strategies should also address the following:

- If deployment locations of FLEX equipment are changed as a result of the evaluation per Section 6, the design considerations for the strategy should be reevaluated per Section 11.2.1.

CNP Compliance
No changes to FLEX equipment deployment locations are needed.

- New or modified actions required for the strategy or existing actions that are impacted by the environmental conditions created by the MSFHI should be validated in accordance with Appendix E.

CNP Compliance
As stated in Section 8 above, although the FLEX strategies will not be changed, changes may be necessary to some deployment FSGs with respect to activities such as routing of temporary power cables. FSG validations will be re-performed as necessary to reflect any such changes. The validations will be performed in accordance with NRC accepted guidance for compliance with the forthcoming regulation 10 CFR 50.155, "Mitigation of Beyond-Design-Basis Events."

- The flood protection features that support the modified FLEX strategies should meet the performance criteria provided in Section G.5.

CNP Compliance
See Enclosure 4 of this letter, which addresses application of the performance criteria provided in Section G.5. to the flood protection features that support FLEX strategies with respect to the MSFHI.

Document the MSA per Section G.6.

CNP Compliance
This letter and its enclosures provide the documentation required by Section G.6.

10 References

1. Letter from E. J. Leeds, NRC, to All Power Reactor Licensees and Holders of Construction Permits in Active or Deferred Status, "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, Agencywide Documents Access and Management System (ADAMS) Accession No. ML12053A340.

2. Letter from J. P. Gebbie, I&M, to the NRC, "Donald C. Cook Nuclear Plant Unit 1 and Unit 2, Response to March 12, 2012, Request for Information, Enclosure 2, 'Recommendation 2.1: Flooding,' Required Response 2, Hazard Reevaluation Report," dated March 6, 2015, AEP-NRC-2015-14, ADAMS Accession No. ML15069A334.

3. Letter from J. P. Gebbie, I&M, to the NRC, "Donald C. Cook Nuclear Plant Unit 1 and Unit 2, "Additional Information Regarding Flood Hazard Reevaluation Report," dated June 16, 2015, AEP-NRC-2015-56.

4. Letter from J. P. Gebbie, I&M, to the NRC, "Donald C. Cook Nuclear Plant Unit 1 and Unit 2, Additional Information for NRC Audit of Flood Hazard Reevaluation Conducted in Response to March 12, 2012, NRC Request for Information Regarding Fukushima Near-Term Task Force Recommendation 2.1: 'Flooding'," dated October 27, 2015, AEP-NRC-2015-105.

5. Letter from T. V. Govan, NRC, "Donald C. Cook Nuclear Plant, Units 1 and 2 - Interim Staff Response to Reevaluated Flood Hazards Submitted in Response to 10 CFR 50.54(f) Information Request - Flood Causing Mechanism Reevaluation (TAC Nos. MF6096 and MF6097)," dated December 4, 2015, ADAMs Accession No. ML15334A424.

6. NRC Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," March 12, 2012, (ADAMS Accession No. ML12054A736).

7. Letter from Q. S. Lies, I&M, to the NRC, "Donald C. Cook Nuclear Plant Unit 1 and Unit 2, Revision of Flood Hazards Reevaluation Report and Supporting Calculations, Re. March 12, 2012, Request for Information, Enclosure 2, Recommendation 2.1: Flooding," dated November 10, 2016, AEP-NRC-2016-89.

8. Letter from J. P. Gebbie, I&M, to the NRC, "Donald C. Cook Nuclear Plant Unit 1 and Unit 2, Revision 1 of Final Integrated Plan Regarding March 12, 2012, U. S. Nuclear Regulatory Commission Order Regarding Mitigation Strategies for Beyond-Design-Basis External Events (Order Number EA-12-049)" dated October 1, 2015, AEP-NRC-2015-83, ADAMS Accession No. ML15280A023).

9. Letter from M. Halter, NRC to L. J. Weber, I&M, Donald C. Cook Nuclear Plant, Units 1 and 2 – Safety Evaluation Regarding Implementation of Mitigating Strategies and Reliable Spent Fuel Instrumentation Related to Orders EA-12-049 and EA-12-051 (TAC Nos. MF0766, MF0767, MF0761, and MF0762), dated November 9, 2015, ADAMS Accession No. ML15264A851.

10. NRC Memorandum "Staff Requirements - 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.

11. Letter from W. M. Dean, NRC, to the listed Power Reactor Licensees, "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.

12. Nuclear Energy Institute (NEI), Report NEI 12-06, Revision 2, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," dated December 2015, ADAMS Accession No. ML16005A625.

13. U.S. Nuclear Regulatory Commission, JLD-ISG-2012-01, Revision 1, "Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigating Strategies for Beyond-Design-Basis External Events," dated January 22, 2016, ADAMS Accession No. ML15357A163.

Enclosure 3 to AEP-NRC-2016-87

Donald C. Cook Nuclear Plant, Units 1 and 2, Flood Mitigating Strategies Assessment

Compliance with NEI 12-06, Revision 2, Section 6

See Section 2 of Enclosure 2 to this letter for definitions of abbreviations and acronyms.

NEI 12-06, Revision 2, Section 6 is reproduced below with descriptions of CNP compliance with respect to the MSFHI inserted as outlined text following each specific requirement.

6 STEP 2B: ASSESS EXTERNAL FLOODING IMPACT

The potential challenge presented by external flooding is very site-specific and is a function of the site layout, plant design, and potential external flooding hazards present. Typically, plant design bases address the following hazards:

- local intense precipitation
- flooding from nearby rivers, lakes, and reservoirs
- high tides
- seiche
- hurricane and storm surge
- tsunami events

CNP Compliance

For CNP, the current DB flood hazard results from a postulated seiche on Lake Michigan, coincident with the highest recorded lake level.

There are large uncertainties in predicting the magnitude of beyond-design-basis flooding events. Consequently, it is necessary to evaluate the FLEX deployment strategies for sites where there is potential for such extreme flooding.

6.1 RELATIONSHIP TO LOSS OF AC POWER & LOSS OF UHS

A beyond-design-basis external flooding event can create a significant challenge to plant safety. This could include the following:

- loss of off-site power
- loss of UHS and/or
- impact on safe shutdown equipment.

In addition, severe flooding events can present a challenge to both on-site and off-site resources relied upon for coping.

6.2 APPROACH TO EXTERNAL FLOOD-INDUCED CHALLENGES

The evaluation of external flood-induced challenges has three parts. The first part is determining whether the site is susceptible to external flooding. The second part is the characterization of the applicable external flooding threat. The third part is the application of the flooding characterization to the protection and deployment of FLEX strategies.

6.2.1 Susceptibility to External Flooding

Susceptibility to external flooding is based on whether the site is a "dry" site, i.e., the plant is built above the design basis flood level (DBFL) [Ref. 10]. For sites that are not "dry", water intrusion is prevented by barriers and there could be a potential for those barriers to be exceeded or compromised. Such sites would include those that are kept "dry" by permanently installed barriers, e.g., seawall, levees, etc., and those that install temporary barriers or rely on watertight doors to keep the design basis flood from impacting safe shutdown equipment.

Plants that are not dry sites will perform the next two steps of the flood-induced challenge evaluation.

CNP Compliance
CNP is not categorized as a "dry site."

6.2.2 Characterization of the Applicable Flood Hazard

Most external flooding hazards differ from seismic and other events in that the event may provide the plant with considerable warning time to take action and the flood condition may exist for a considerable length of time. Table 6-1 summarizes some of these considerations for various flood sources.

Table 6-1
Flood Warning and Persistence Considerations

Flood Source	Warning	Persistence
Regional precipitation (PMF)	Days	Many Hours to Months
Upstream dam failures	Hours to Days	Hours to Months
High tides	Days	Hours
Seiche	None	Short
Hurricane and storm surge	Days	Hours
Tsunami events	Limited	Short

Each site that has identified that external flooding is an applicable hazard should review the current design basis flood analyses to determine which external floods are limiting. In general, a site will have one flood source that has been identified as the limiting condition, with respect to DBFL. However, in some cases, there can be multiple sources that yield similar DBFLs, e.g., various river flood scenarios involving combinations of dam failures and other input conditions. The limiting hazards should be characterized in terms of warning time and persistence following the creation of a flood condition. Such information is generally available in UFSARs and supporting analyses. It is not the intention to define precise time windows, simply to gauge the timing so that plant response actions can be considered. If warning time is credited, the evaluation of the adequacy of warning time includes review of the flooding event and warning time triggers needed to implement any flood protection or mitigating strategies. Multiple triggers or a single trigger can be established for milestones if the response to a flood hazard is done in graduated steps (e.g. stage equipment, assemble equipment, and complete implementation).

CNP Compliance
The flood hazard from a postulated LIP would exceed the DBFL, which would result from a seiche. No other credible flood mechanism would exceed the DBFL. Warning time for a postulated LIP is not being credited in the CNP FLEX strategies.

6.2.3 Protection and Deployment of FLEX Strategies

In view of the characterization of the applicable flood hazard, the site should consider means to reasonably assure the success of deployment of FLEX strategies such as flood protection of FLEX equipment, relocation of FLEX connection points, etc.

6.2.3.1 Protection of FLEX Equipment

These considerations apply to the protection of FLEX equipment from external flood hazards:

1. The equipment should be stored in one or more of the following configurations such that no one external event can reasonably fail the site FLEX capability (N):

    a. Stored above the flood elevation from the most recent design basis site flood analysis. The evaluation to determine the elevation for storage should be informed by flood analysis applicable to the site from early site permits, combined license applications, and/or contiguous licensed sites.

CNP Compliance

The majority of the FLEX equipment is stored in the FLEX Storage Building, with some FLEX equipment stored in the Auxiliary Building and the Turbine Building. Additionally, certain FLEX equipment is removed from its stored location in the FLEX Storage Building and pre-staged inside the Protected Area during unit outages.

FLEX Storage Building

The maximum flood level due to the MSFHI near the FLEX Storage Building would be 623 ft. – 6 in. The FLEX Storage Building would not be flooded by the LIP event because the top of the slab of the FLEX Storage Building is elevation 625 ft. - 6 in. and there are no penetrations below the flood level.

Auxiliary Building Storage

As documented in the Enclosure 2 description of CNP compliance with the requirements of NEI 12-06 Revision 2, Section G.4.1, regarding robustness of plant equipment, the flood water from the postulated LIP would reach an elevation of less than 573 ft. in the Auxiliary Building. The limiting items of FLEX equipment stored in the Auxiliary Building are the FLEX BART Lift Pumps which are stored on elevation 562 ft. of the Auxiliary Building. A flood water level of 573 ft. in the Auxiliary Building is acceptable because flood water would have to overflow a curb at elevation of 574 ft. – 3 in. to enter the room in which the FLEX BART Lift Pumps are stored.

Turbine Building Storage

As documented in the Enclosure 2 description of CNP compliance with the requirements of NEI 12-06 Revision 2, Section G.4.1, regarding robustness of plant equipment, flood water from the postulated LIP could result in a water level of 0.5 in. on the elevation 591 ft. floor. The limiting items of FLEX equipment stored in the Turbine Building are the 26 kW generators, the e-Cart Transformer, the Power Mover for the 26 kW generators, and the associated power cords and electric cables stored in their deployed location in the Unit 2 side of the Turbine Building on the elevation 591 ft. floor. The potential 0.5 in. of flood water on elevation 591 floor is acceptable because these components are mounted on trailers, wheeled frames, or tool storage boxes, that have clearances in excess of 0.5 in.

FLEX Equipment Pre-staged During Outages

During outages in which a unit is placed in Mode 5 with SG cooling unavailable, or in MODE 6, certain FLEX equipment is removed from the FLEX Storage Building and pre-staged at locations inside the Protected Area. As described below, this equipment has been evaluated with respect to the potential LIP flood water elevation at the deployed location. For this evaluation the worst (highest) flood level at any time is assumed. This is a conservative assumption since during most of the LIP event the flood waters would be below the peak elevations and receding.

- A FLEX Blended RCS Makeup pump is pre-staged near the Unit 1 RWST. The top of the pump trailer platform is 2.1 ft. above ground level. Ground elevation in the deployment area is 607.7 ft., placing the top of the trailer platform at 609.8 ft. The maximum flood elevation in this area would be 609.9 ft. This is 0.1 ft. above the top of the trailer platform. The pumps and/or trailers will be modified as necessary to assure the pumps would remain functional at the maximum flood level.

- A FLEX Blended RCS Makeup pump is pre-staged near the Unit 2 RWST. The top of the pump trailer platform is 2.1 ft. above ground level. Ground elevation in the deployment area is 608.5 ft., placing the top of the trailer platform at 610.6 ft. The maximum flood elevation in this area would be 609.5 ft. This is 1.1 ft. below the top of the trailer platform.

- A FLEX 480V/600V "N+1" Transformer Trailer is pre-staged at the Unit 1 northeast staging location. The top of the transformer trailer platform is 1.3 ft. above ground level. Ground elevation in the deployment area is 607.9 ft., placing the top of the trailer platform at 609.2 ft. The maximum flood elevation in this area would be 609.9 ft. This is 0.7 ft. above the top of the trailer platform. The transformer and/or trailer will be modified as necessary to assure the transformers would remain functional at the maximum flood level.

- A FLEX 350 kW "N+1" DG is pre-staged outside the Unit 1 Auxiliary Building. The top of the DG trailer platform is 2.2 ft. above ground level. Ground elevation in the deployment area is 608.2 ft., placing the top of the trailer platform at 610.4 ft. above the ground level. The maximum flood elevation in this area would be 609.9 ft. This is 0.5 ft. below the top of the trailer platform.

- A FLEX 480V/600V "N+1" Transformer Trailer is pre-staged at the Unit 2 southeast staging location. The top of the transformer trailer platform is 1.3 ft. above ground level. Ground elevation in the deployment area is 608.5 ft., placing the top of the trailer platform at 609.8 ft. The maximum flood elevation in this area would be 609.5 ft. This is 0.3 ft. below the top of the trailer platform.

- A FLEX 350 kW "N+1" DG is pre-staged outside the Unit 2 Auxiliary Building. The top of the DG trailer platform is 2.2 ft. above ground level. Ground elevation in the deployment area is 608.5 ft., placing the top of the trailer platform at 610.7 ft. The maximum flood elevation in this area is 609.5 ft. This is 1.2 ft. below the top of the trailer platform.

b. Stored in a structure designed to protect the equipment from the flood.

CNP Compliance

As described above regarding CNP Compliance with Section 6.2.3.1.1.a, the FLEX building floor slab is above the maximum expected LIP flood level, and new or modified protection features will preclude unacceptable flood water ingress into Auxiliary Building and the Turbine Building.

c. FLEX equipment can be stored below flood level if time is available and plant procedures/guidance address the needed actions to relocate the equipment. Based on the timing of the limiting flood scenario(s), the FLEX equipment can be relocated to a position that is protected from the flood, either by barriers or by elevation, prior to the arrival of the potentially damaging flood levels. This should also consider the conditions on-site during the increasing flood levels and whether movement of the FLEX equipment will be possible before potential inundation occurs, not just the ultimate flood height.

CNP Compliance

The FLEX strategies do not rely on equipment relocation to a protected position.

2. Storage areas that are potentially impacted by a rapid rise of water should be avoided.

> CNP Compliance
>
> As described above regarding CNP Compliance with Section 6.2.3.1.1.a, the FLEX building floor slab is above the maximum expected LIP flood level, and new or modified protection features will preclude unacceptable flood water ingress into Auxiliary Building and the Turbine Building regardless of the rapidity of the level rise.

6.2.3.2 Deployment of FLEX Equipment

There are a number of considerations which apply to the deployment of FLEX equipment for external flood hazards:

1. For external floods with warning time, the plant may not be at power. In fact, the plant may have been shut down for a considerable time and the plant configuration could be established to optimize FLEX deployment. For example, the FLEX pump could be connected, tested, and readied for use prior to the arrival of the critical flood level. Further, protective actions can be taken to reduce the potential for flooding impacts, including cooldown, borating the RCS, isolating accumulators, isolating RCP seal leak off, obtaining dewatering pumps, creating temporary flood barriers, etc. These factors can be credited in considering how the baseline capability is deployed.

> CNP Compliance
>
> Warning time for a postulated LIP is not credited in the CNP FLEX strategies.

2. The ability to move equipment and restock supplies may be hampered during a flood, especially a flood with long persistence. Accommodations along these lines may be necessary to support successful long-term FLEX deployment.

> CNP Compliance
>
> The Phase 2 portable FLEX equipment in the FLEX Storage Building would be deployed to the Protected Area via the primary plant access road. The deployment pathways and deployed locations for this FLEX equipment were evaluated for the potential impacts of the LIP flood

waters that might prevent equipment from reaching its deployed location or prevent equipment operation.

The highest flood level during the first 24 hrs. of the LIP event was assumed for all points in the travel path. It was determined that within 30 minutes following the postulated LIP event, this flood water level could exceed the capability of the FLEX trucks used to pull the FLEX equipment trailers, and some of the portable FLEX equipment. The limiting section of the deployment pathway (ML16) could peak at a water level of 3.1 ft., decreasing to 2.4 ft. after approximately 2 hrs.

While deployment of equipment through ML16 would be precluded by a flood water level of 3.1 ft., the FLEX trucks are capable of fording the 2.4 ft. water level, and FLEX equipment will be modified as necessary to allow deployment through a 2.4 ft. water level. This will allow deployment of the FLEX portable equipment within the identified Time Constraints. Additionally, The 2.4 ft. level also bounds the expected flood level at all deployed locations. The FLEX equipment that will be modified is the FLEX 480V/600V "N+1" Transformer Trailer.

The Phase 3 strategies would commence at approximately 24 hrs. after the event. By that time, the flood waters would have largely receded along the deployment paths and in the Phase 3 equipment staging areas. Therefore, the Phase 3 strategies can be implemented during a LIP flood event as designed.

3. Depending on plant layout, the ultimate heat sink may be one of the first functions affected by a flooding condition. Consequently, the deployment of the FLEX equipment should address the effects of LUHS, as well as ELAP.

<u>CNP Compliance</u>

Prior to Phase 3, the UHS would only be needed as a source of water for the TDAFW pump if the CST became depleted. For a postulated LIP event, the CSTs would remain undamaged since wind or seismic damage need not be assumed. The administratively controlled minimum CST water volume will be changed as necessary to assure that access to the UHS would not be needed during the period in which LIP flood water precluded deployment of FLEX equipment needed to supply UHS water to the TDAFW pump.

4. FLEX equipment will require fuel that would normally be obtained from fuel oil storage tanks that could be inundated by the flood or above ground tanks that could be damaged by the flood. Steps should be considered to protect or provide alternate sources of fuel oil for flood

conditions. Potential flooding impacts on access and egress should also be considered.

<u>CNP Compliance</u>

The general coping strategy for refueling the diesel powered FLEX equipment, i.e., pumps and generators, is to draw fuel oil from the installed safety- related Train A and Train B, Fuel Oil Storage Tanks. The Technical Specifications require that each of these tanks contain a minimum of 46,000 gallons of fuel oil. The Fuel Oil Storage Tanks are below grade tanks with atmospheric vent lines that terminate above grade at an elevation of approximately 621 ft. For the postulated LIP event, the maximum inundation level at the closest CL to the Train A Fuel Oil Storage Tank vent line, CL9, is 609.8 ft. The maximum inundation level at the closest location to the Train B Fuel Oil Storage Tank vent line, CL3, is, 609.2 ft. These inundation elevations levels are well below the 621 ft. elevation of the Fuel Oil Storage Tank vents.

The Fuel Oil Storage Tank fill line piping would be used to access the diesel fuel using the portable FLEX Fuel Transfer Pumps. The Train A Fuel Oil Storage Tank fill line cap, located near the Unit 1 East Turbine Building rollup door (CL9), is at least 16 inches (1.3 ft.) above ground level. Ground level in this area is 609.0 ft. placing the cap at an elevation of 610.3 ft. The maximum inundation elevation in this area would be approximately 609.8 ft., occurring at one hr. from the start of the LIP event. This provides adequate margin to ensure the fill piping can be accessed and used to refill the portable FLEX Fuel Trailer when necessary.

5. Connection points for FLEX equipment should be reviewed to ensure that they remain viable for the flooded condition.

<u>CNP Compliance</u>

The connection points located in areas subject to inundation are those for the 350 kW "N+1" DG connection point located on the outside east wall of the Unit 1 and Unit 2 switchgear areas of the Auxiliary Building.

For Unit 1, the maximum inundation level in this area would be at elevation 609.9 ft. The critical components for this connection point are located at the 611 ft. – 10 in. elevation, which is above the 609.9 ft. inundation level.

For Unit 2, the maximum inundation level in this area would be at elevation 609.3 ft. The critical components for this connection are located at the 612 ft. – 1 in. elevation, which is above the 609.3 inundation level.

6. For plants that are limited by storm-driven flooding, such as Probable Maximum Surge or Probable Maximum Hurricane (PMH), expected storm conditions should be considered in evaluating the adequacy of the baseline deployment strategies.

> CNP Compliance
>
> The limiting flood mechanism for CNP is the LIP. The majority of the postulated LIP rainfall would occur in the first 65 minutes of the event. No FLEX equipment would be used during this period. After the 65 minute peak rainfall period, rainfall would be nominal and would not impact operational limitations of the FLEX equipment.

7. Since installed sump pumps will not be available for dewatering due to the ELAP, plants should consider the need to provide water extraction pumps capable of operating in an ELAP and hoses for rejecting accumulated water for structures required for deployment of FLEX strategies.

> CNP Compliance
>
> The CNP FLEX strategies do not credit sump pumps or extraction pumps.

8. Plants relying on temporary flood barriers should assure that the storage location for barriers and related material provides reasonable assurance that the barriers could be deployed to provide the required protection.

> CNP Compliance
>
> The CNP strategies do not credit temporary flood barriers.

9. A means to move FLEX equipment should be provided that is also reasonably protected from the event.

> CNP Compliance
>
> The CNP FLEX strategies rely on portable trailer mounted equipment. Redundant FLEX trucks for towing the trailers are stored in the FLEX Storage Building. As described in the description of CNP compliance with NEI 12-06, Revision 2, Section 6.2.3.1.1.a, the FLEX Storage Building provides adequate protection from the flood water resulting from the postulated LIP event.

6.2.3.3 Procedural Interfaces

The following procedural interface considerations that should be addressed:

1. Many sites have external flooding procedures. The actions necessary to support the deployment considerations identified above should be incorporated into those procedures.

> <u>CNP Compliance</u>
>
> The FSGs identify the storage locations, deployment paths and deployment locations for FLEX equipment. Although changes to the FLEX strategies will not be needed, minor changes to the FSGs may be needed to facilitate routing of cables, etc. to assure protection of electrical junctions.
>
> The CNP site severe weather procedure and the flood protection program procedure may be changed to recognize the necessary changes to flood protection features as described in Enclosure 2 to this letter.
>
> All such procedure changes would be implemented in accordance with the established CNP procedure control process and FSG control process.

2. Additional guidance may be required to address the deployment of FLEX for flooded conditions (i.e., connection points may be different for flooded vs. non-flooded conditions).

> <u>CNP Compliance</u>
>
> The CNP FLEX strategies do not credit different connection points for flooded conditions.

3. FLEX guidance should describe the deployment of temporary flood barriers and extraction pumps necessary to support FLEX deployment.

> <u>CNP Compliance</u>
>
> The CNP FLEX strategies do not credit temporary flood barriers or extraction pumps.

6.2.3.4 Considerations in Utilizing Off-site Resources

Extreme external floods can have regional impacts that could have a significant impact on the transportation of off-site resources.

1. Sites should review site access routes to determine the best means to obtain resources from off-site following a flood.

CNP Compliance The limiting revaluated flood hazard for CNP is a LIP event, which would not have a regional impact. The local impact of a LIP event would not affect the Phase 3 strategies due to the later timeframe (24 hrs.) at which the NSRC equipment would be deployed. The LIP flooding is a short lived event (a few hrs.) and access roads would be available by 24 hrs. after the beginning of the LIP flood event.

2. Sites impacted by persistent floods should consider where equipment delivered from off-site could be staged for use on-site.

CNP Compliance The limiting flood hazard for CNP is a LIP event, which is not considered to be a persistent flood.

Enclosure 4 to AEP-NRC-2016-87

Donald C. Cook Nuclear Plant, Units 1 and 2, Flood Mitigating Strategies Assessment

Compliance with NEI 12-06, Revision 2, Section G.5

See Section 2 of Enclosure 2 to this letter for definitions of abbreviations and acronyms.

NEI 12-06, Appendix G, Section G.5 is reproduced below with descriptions of CNP compliance with respect to the MSFHI inserted as outlined text following each specific requirement.

G.5 PERFORMANCE CRITERIA FOR FLOOD PROTECTION FEATURES

This section provides guidance for demonstrating that flood protection features are robust for the MSFHI. Throughout Section G.4 above, it is necessary to evaluate flood protection features if they are relied on in the strategy. This evaluation is required to demonstrate that the flood protection features can accommodate the flood scenario parameters from the MSFHI defined in Section G.2.

Flood protection evaluations should consider the following for any flood protection feature relied on to protect equipment or actions in a mitigating strategy:

- The equipment quality attributes and design guidance in Sections 11.1 and 11.2 (as applicable) are met for flood protection features used as FLEX equipment.

> <u>CNP Compliance</u>
>
> There are no existing flood protection features used as FLEX equipment and no new or newly modified flood protection features will be used as FLEX equipment.

- The individual flood protection features will perform the intended function under any new loads (i.e., flood height, associated effects, and flood event duration including warning time and period of inundation) due to the revised flood scenario parameters.

> <u>CNP Compliance</u>
>
> As shown in Table 7-2 in Enclosure 2 to this letter, the design of the existing seiche protection feature facing Lake Michigan is based on a water level that is higher than the LIP event flood level. The seiche protection feature would continue to provide protection for the duration of the LIP flood event. No other existing flood protection features are credited for protection against a LIP flood event.
>
> Any new or modified flood protection features will be designed to perform the intended function under any new loads (i.e., flood height, associated effects, and flood event duration) due to the revised flood scenario parameters, i.e. the LIP event.

- The assessment of plant flood protection features is performed using the appropriate codes and standards (current flooding design basis if it exists or others as applicable) and accepted engineering practices.

> CNP Compliance
>
> New or newly modified flood protection features would be assessed using the appropriate codes and standards (based on a LIP event) and accepted engineering practices.

- The capacity of pumping or drainage systems is sufficient to handle any inflow through flood protection features for the entire flood event duration.

> CNP Compliance
>
> As described in the "G.4.1 Assessment of the Current Flex Strategies" presented in Enclosure 2 to this letter, Auxiliary Building drains were assumed to be unblocked because that would be the worst case condition. The Turbine Building evaluation consisted of various drain blockage scenarios in which the Turbine Room Sump could not be credited for containing the flood water. Therefore, drainage system capacities were not credited in the assessment.

- Necessary support systems and consumables are available.

> CNP Compliance
>
> The credited flood protection features do not need support systems or consumables.

The following flood protection features, both installed and temporary, should be considered in the evaluation:

Passive Features

Passive flood protection features may be incorporated, exterior, or temporary and do not require a change in a component's state in order for it to perform as intended. Passive features would include:

- earthen embankments (e.g., earth dams, levees and dikes)

> CNP Compliance
>
> Earthen embankments (e.g., earth dams, levees and dikes) are not credited for mitigating the impact of the postulated LIP event.

- floodwalls

<u>CNP Compliance</u>

The walls in the Auxiliary Building and Turbine Building are not considered to be floodwalls. There are no floodwalls credited for mitigation of the postulated LIP event.

- seawalls

<u>CNP Compliance</u>

The existing sheet pile wall facing Lake Michigan is not considered to be a seawall. Nevertheless, as shown in Table 7-2 in Enclosure 2 to this letter, the design of the sheet pile wall is based on a water level that is higher than the LIP event flood level.

- concrete barriers

<u>CNP Compliance</u>

Existing concrete walls credited in the Auxiliary Building and Turbine Building would be subjected to minimal loads. No new concrete barriers will be needed.

- plugs and penetration seals

<u>CNP Compliance</u>

Existing plugs and penetration seals would be subjected to minimal loads. Any new or newly modified plugs and penetration seals would be evaluated against expected loads.

- storm drainage systems

<u>CNP Compliance</u>

The applicable Hierarchical Hazard Assessment assumed the storm drains to be operating at 25% of capacity to account for potential blockage due to sediment.

Active Features

Note: Flood protection features that are normally considered active (e.g. valves, flood gates, doors and hatches) that are administratively controlled to remain closed could be evaluated as passive flood features.

Active flood protection features may be incorporated, exterior or temporary features that requires the change in a component's state in order for it to perform as intended. Active features would include:

- Rotating equipment (e.g. pumps, generators)
- Valves
- Flood Gates
- Doors
- Hatches

CNP Compliance
Actuation of rotating equipment, valves, flood gates, doors, and hatches is not credited for mitigation of the postulated LIP event.

Enclosure 5 to AEP-NRC-2016-87

REGULATORY COMMITMENTS

The following table identifies those actions committed to by Indiana Michigan Power Company (I&M) in this document. Any other actions discussed in this submittal represent intended or planned actions by I&M. They are described to the U. S. Nuclear Regulatory Commission (NRC) for the NRC's information and are not regulatory commitments.

Commitment	Date
Plant flood protection features will be installed, replaced, augmented, or qualified as necessary to satisfactorily mitigate the ingress of flood water via the Auxiliary Building and Turbine Building pathways identified in Table 8-1 of Enclosure 2 to this letter. See note at bottom of this table.	By the required compliance date of the forthcoming regulation 10 CFR 50.155, "Mitigation of Beyond-Design-Basis Events."
New or modified flood protection features will be designed to perform the intended function under any new loads (i.e., flood height, associated effects, and flood event duration) due to the revised flood scenario parameters, i.e. the Local Intense Precipitation event.	By the required compliance date of the forthcoming regulation 10 CFR 50.155, "Mitigation of Beyond-Design-Basis Events."
The FLEX Reactor Coolant System Blended Reactor Coolant System Makeup pumps and/or trailers will be modified as necessary to assure the pumps would remain functional at the maximum flood level at their deployed location. See note at bottom of this table.	By the required compliance date of the forthcoming regulation 10 CFR 50.155, "Mitigation of Beyond-Design-Basis Events."
The FLEX 480V/600V "N+1" Transformer and/or trailer will be modified as necessary to assure the transformers would remain functional at the maximum flood level in its deployment path and deployed location. See note at bottom of this table.	By the required compliance date of the forthcoming regulation 10 CFR 50.155, "Mitigation of Beyond-Design-Basis Events."
FSGs will be changed as needed, and validations will be re-performed as necessary. The validations will be performed in accordance with NRC accepted guidance for compliance with the forthcoming regulation 10 CFR 50.155, "Mitigation of Beyond-Design-Basis Events."	By the required compliance date of the forthcoming regulation 10 CFR 50.155, "Mitigation of Beyond-Design-Basis Events."
The administratively controlled minimum CST water volume will be changed as necessary to assure that access to the Ultimate Heat Sink would not be needed during the period in which LIP flood water precluded deployment of FLEX equipment needed to supply Ultimate Heat Sink water to the TDAFW pump.	By the required compliance date of the forthcoming regulation 10 CFR 50.155, "Mitigation of Beyond-Design-Basis Events."

Commitment	Date
I&M will take actions needed to address the FLO-2D software errors reported pursuant to 10 CFR 21.21 if the errors are found to impact the CNP FLO-2D analyses.	Consistent with the impact of the errors on the CNP FLO-2D analyses.
Note that the population of pathways that must be mitigated or FLEX portable equipment that must be modified to support the current FLEX strategies may change if supported by refinements in the associated evaluations.	