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July 11, 2017
L-17-176

10 CFR 50.54(f)

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

SUBJECT:
Davis-Besse Nuclear Power Station
Docket No. 50-346, License No. NPF-3
Focused Evaluation Regarding Near-Term Task Force Recommendation 2.1 for Flooding (CAC No. MF3721)

On March 12, 2012, the Nuclear Regulatory Commission (NRC) issued a letter titled, "Request for Information Pursuant to Title 10 of the *Code of Federal Regulations* 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3, of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident," to all power reactor licensees and holders of construction permits in active or deferred status. Enclosure 2 of the 10 CFR 50.54(f) letter addresses Near-Term Task Force (NTTF) Recommendation 2.1 for flooding and requires two responses. The first response is for licensees to submit a hazard reevaluation report (HRR) in accordance with the NRC's prioritization plan. As indicated in NRC letter dated March 1, 2013, the NRC staff considers the reevaluated flood hazard to be "beyond the current design/licensing basis of operating plants." By letter dated March 11, 2014, FirstEnergy Nuclear Operating Company (FENOC) submitted the flood HRR for Davis-Besse Nuclear Power Station (DBNPS). Additional information was provided by FENOC letters dated August 25, 2014, December 10, 2014, February 25, 2015, and August 11, 2015.

The second required response from the 10 CFR 50.54(f) letter regarding NTTF Recommendation 2.1 is for licensees to submit an integrated assessment report. By letter dated September 1, 2015, the NRC staff described changes in the NRC's approach to flood hazard reevaluations, including its use in evaluating mitigating strategies for beyond-design-basis external events, and the expected interactions and additional information needed to complete these activities. The NRC staff developed a graded approach for determining the need for, and scope of, plant-specific integrated assessments. One step is to perform a mitigating strategies assessment (MSA).

Guidance for performing MSAs for reevaluated flooding hazards is contained in Appendix G of Nuclear Energy Institute (NEI) 12-06, Revision 2, which was endorsed by the NRC in JLD-ISG-2012-01, Revision 1. FENOC submitted the MSA for flooding for DBNPS by letter dated December 12, 2016.

Another step in the graded approach is to screen the reevaluated flooding hazards results to determine the need for, and scope of, the integrated assessment. Guidance for performing this screening is contained in NEI 16-05, Revision 1, which was endorsed by the NRC in JLD-ISG-2016-01, Revision 1. The screening results for DBNPS are provided in the enclosed focused evaluation. The unbounded reevaluated flood mechanisms previously submitted in the flood HRR, local intense precipitation flood and probable maximum storm surge flooding, do not impact key structures, systems, or components or challenge key safety functions at DBNPS. Based on this focused evaluation, an integrated assessment is not needed. The actions related to the 10 CFR 50.54(f) request for information regarding NTTF Recommendation 2.1 for flooding are now complete for DBNPS.

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

I declare under penalty of perjury that the foregoing is true and correct. Executed on July 11, 2017.

Sincerely,

Brian D. Boles

Enclosure:
Davis-Besse Nuclear Power Station Flooding Focused Evaluation Summary

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

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DAVIS-BESSE NUCLEAR POWER STATION FLOODING FOCUSED EVALUATION SUMMARY

MAY 5, 2017

LETTER L-17-176

Enclosure

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DAVIS-BESSE FLOODING FOCUSED EVALUATION SUMMARY

1 EXECUTIVE SUMMARY

The Davis-Besse Nuclear Power Station (DBNPS) has reevaluated its flooding hazard in accordance with the NRC's March 12, 2012 10CFR50.54(f) Request for Information (RFI) (Reference 1). The RFI was issued as part of implementing lessons learned from the Fukushima Dai-ichi accident; specifically, to address Recommendation 2.1 of the NRC's Near-Term Task Force (NTTF) report. This information was submitted to NRC in a Flood Hazard Reevaluation Report (FHRR) on 2/25/2015 and is provided in the Mitigating Strategies Flood Hazard Information (MSFHI) documented in NRC's "Interim Staff Response to Reevaluated Flood Hazards" letter dated 9/3/2015 (Reference 12). Additionally, DBNPS has received the "Staff Assessment of Response to Request for Information Pursuant to 10CFR50.54(f) – Flood-Causing Mechanisms Reevaluation" letter dated 12/14/2016 (Reference 13). Additional flooding analyses have been performed since the FHRR submittal and were not evaluated in the MSFHI and Staff Assessment letters. These additional flooding analyses will serve as the input to this Focused Evaluation (FE). Open items identified in the Staff Assessment will also be addressed. Two mechanisms, described below, were found to exceed the design basis at DBNPS.

Probable Maximum Storm Surge

Associated Effects (AE) and Flood Event Duration (FED) parameters were assessed and submitted as a part of the Mitigating Strategies Assessment (MSA) (Reference 15). The FE concludes that the Probable Maximum Storm Surge (PMSS) does not affect any Key Safety Function (KSF) as the refined analysis removed all flooding in the power block area. No safety-related structures are subject to flooding from a PMSS event. The PMSS FE followed Path 1 of NEI 16-05, Rev. 1 and utilized revised analysis to improve the realism of the evaluated storm. This FE provides basis for the new flood parameters as well as documenting the resolution of open Staff Assessment items associated with the PMSS.

Local Intense Precipitation

AE and FED parameters were assessed and submitted as a part of the MSA (Reference 15). The FE concludes that the Local Intense Precipitation (LIP) does not affect any KSF as the site-specific analysis removed all flooding at critical doors in the power block area. No safety-related structures are subject to flooding from a LIP event. The LIP FE followed Path 2 of NEI 16-05, Rev. 1 and utilized a site-specific analysis to improve the realism of the evaluated storm. This FE provides basis for the new flood parameters as well as documenting the resolution of open Staff Assessment items associated with the LIP.

This submittal completes the actions related to External Flooding required by the March 12, 2012, 10CFR50.54(f) letter.

2 BACKGROUND

On March 12, 2012, the NRC issued Reference 1 to request information associated with Near-Term Task Force (NTTF) Recommendation 2.1 for flooding. The NRC RFI directed licensees, in part, to submit a FHRR to reevaluate the flood hazards for their sites using present-day methods and guidance used for early site permits and combined operating licenses. The DBNPS FHRR, Revision 2 was submitted on 2/25/2015 (Reference 3) with supplemental information provided in Reference 4.

Following the Commission's directive to the NRC Staff (Reference 6), the NRC issued a letter to the industry (Reference 9) indicating that new guidance is being prepared to replace instructions in Reference 6 and provide for a "graded approach to flooding reevaluations" and "more focused evaluations of local intense precipitation and available physical margin in lieu of proceeding to an integrated assessment." The Nuclear Energy Institute (NEI) prepared the new External Flooding Assessment Guidelines in NEI 16-05, Rev 1 (Reference 7), which was endorsed by the NRC (Reference 8). NEI 16-05 indicates that each flood-causing mechanism not bounded by the design basis (using stillwater and/or wind-wave runup level) should follow one of the following five assessment paths:

Path 1: Demonstrate Flood Mechanism is Bounded Through Improved Realism
Path 2: Demonstrate Effective Flood Protection
Path 3: Demonstrate a Feasible Response to LIP
Path 4: Demonstrate Effective Mitigation
Path 5: Scenario Based Approach

Non-bounded flood-causing mechanisms in Paths 1, 2, or 3 would only require a FE to complete the actions related to external flooding required by the March 12, 2012 10CFR50.54(f) letter. Mechanisms in Paths 4 or 5 require an Integrated Assessment.

3 REFERENCES

1. NRC Letter, Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3, of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident; dated March 12, 2012.
2. FENOC Letter to USNRC, Davis-Besse Nuclear Power Station, FHRR Rev 1, Response to NRC Request for Information Pursuant to 10CFR50.54(f), Regarding the Flooding Aspects of Recommendation 2.1 of the Near Term Task Force (NTTF) Review of Insights from the Fukushima Dai-ichi Accident, dated 3/11/2014 (ML14070A108).
3. FENOC Letter to USNRC, Davis-Besse Nuclear Power Station, FHRR Rev 2, Revision to Flood Hazard Reevaluation Report in Response to Near Term Task Force Recommendation 2.1 (TAC No. MF3721), dated 2/25/2015 (ML15750A023).
4. FENOC Letter to USNRC, Davis-Besse Nuclear Power Station, Supplement to Flood Hazard Reevaluations Report in Response to Near Term Task Force Recommendation 2.1, dated 7/17/2014 (ML14198A400).
5. NRC Letter, Supplemental Information Related to Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) regarding Flooding Hazard Reevaluations for Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, dated March 1, 2013.
6. NRC Staff Requirements Memoranda to COMSECY-14-0037, "Integration of Mitigating Strategies for Beyond-Design-Basis External Events and the Reevaluation of Flooding Hazards", dated March 30, 2015.
7. Nuclear Energy Institute, Report NEI 16-05, Rev 1, External Flooding Assessment Guidelines, dated June 2016.
8. U.S. Nuclear Regulatory Commission, JLD-ISG-2016-01, Guidance for Activities Related to Near-Term Task Force Recommendation 2.1, Flood Hazard Reevaluation; Focused Evaluation and Integrated Assessment, Revision 0, dated July 11, 2016.
9. NRC Letter, Coordination of Requests for Information Regarding Flooding Hazard Reevaluations and Mitigating Strategies for Beyond-Design-Basis External Events, dated September 1, 2015.
10. Nuclear Energy Institute, Report NEI 12-06 [Rev 2], Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, dated December 2015.
11. 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.
12. NRC Letter, Davis-Besse Nuclear Power Station, – Interim Staff Response to Reevaluated Flood Hazards Submitted in Response to 10CFR50.54(f) Information Request – Flood-Causing Mechanism Reevaluation (TAC NO. MF3721), dated 9/3/2015 (ML 15239B212).
13. NRC Letter, Davis-Besse Nuclear Power Station, – Staff Assessment of Response to Request for Information Pursuant to 10CFR50.54(f) – Flood-Causing Mechanisms Reevaluation (CAC NO. MF3721), dated 12/14/16 (ML16323A236).
14. FENOC Letter to USNRC, Davis-Besse Nuclear Power Station, Completion of Required Action by NRC Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation

Strategies for Beyond-Design-Basis External Events (TAC No. MF0961), dated 9/23/16 (ML16267A471).
15. FENOC Letter to USNRC, Davis-Besse Nuclear Power Station, Mitigating Strategies Assessment (MSA) for Flooding (CAC NO. MF3721), dated 12/12/16 (ML16348A010).
16. NRC Letter, Davis-Besse Nuclear Power Station, Unit 1 - Staff Assessment of the Flooding Walkdown Report Supporting Implementation of Near-Term Task Force Recommendation 2.3 Related to the Fukushima Dai-Ichi Nuclear Power Plant Accident (TAC NO.MF0220), dated 6/30/2014 (ML 14141A525).
17. FENOC Letter to USNRC, FENOC Response to NRC Request for Information Pursuant to 10CFR50.54(f) Regarding the Flooding Aspects of Recommendation 2.3 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident, dated 11/27/2012 (ML 12335A341).
18. NORM-LP-7221, Davis-Besse Flooding Mitigating Strategy Assessment Support Document.
19. Calculation C-CSS-020.13-017 Rev 1, Surge and Seiche Analysis for Davis-Besse Nuclear Power Station.
20. Calculation C-CSS-020.13-021 Rev 1, Surge and Seiche Calibration for Davis-Besse Nuclear Power Station.
21. Calculation C-CSS-020.13-015 Rev 1, Site-specific Wind and Pressure Field Analysis for Davis-Besse Nuclear Power Station.
22. Calculation C-CSS-020.13-022 Rev 1, Combined Event including Wind Wave Analysis for Davis-Besse Nuclear Power Station.
23. Calculation C-CSS-020.13-024 Rev 0, Site-Specific LIP Analysis for Davis-Besse Nuclear Power Station.
24. Calculation C-CSS-020.13-014 Rev 2, Effects of Local Probable Maximum Precipitation Analysis for Davis-Besse Nuclear Power Station.

4 TERMS AND DEFINITIONS

AE - Associated Effects
APM - Available Physical Margin
AIMs - Assumptions, Inputs, and Methods
BWST - Borated Water Storage Tank
CLB - Current Licensing Basis
DBNPS - Davis-Besse Nuclear Power Station
FE - Focused Evaluation
FED - Flood Event Duration
FHRR - Flood Hazard Reevaluation Report
FLEX - Diverse and flexible coping strategies covered by NRC order EA-12-049
FIAP - Flood Impact Assessment Process
Key SSC - A System, Structure or Component relied upon to fulfill a Key Safety Function
KSF - Key Safety Function, i.e. core cooling, spent fuel pool cooling, or containment function.
LIP - Local Intense Precipitation
MSA - Mitigating Strategies Assessment as described in NEI 12-06 Rev 2, App G
MSFHI - Mitigating Strategies Flood Hazard Information
NEI - Nuclear Energy Institute
NTTF - Near Term Task Force commissioned by the NRC to recommend actions following the Fukushima Dai-ichi accidents
PMSS - Probable Maximum Storm Surge
PMWS - Probable Maximum Windstorm
RFI - Request for Information
SWT - Service Water Tunnel
VBS - Vehicle Barrier System
WSE - Water Surface Elevation

All elevation values in this report will be in the Site Datum, IGLD55 (International Great Lakes Datum 1955).

5 FLOOD HAZARD PARAMETERS FOR UNBOUNDED MECHANISMS

The NRC has completed the "Interim Staff Response to Reevaluated Flood Hazards" (Reference 12) which contains the MSFHI related to the DBNPS FHRR (Reference 3). Additionally, DBNPS has received the "Staff Assessment of Response to Request for Information Pursuant to 10CFR50.54(f) – Flood-Causing Mechanisms Reevaluation" letter dated 12/14/2016 (Reference 13).

In Reference 12, the NRC states that the "staff has concluded that the licensee's reevaluated flood hazards information is suitable for the assessment of mitigation strategies developed in response to Order EA-12-049 (i.e., defines the mitigating strategies flood hazard information described in NEI guidance document NEI 12-06, 'Diverse and Flexible Coping Strategies (FLEX) Implementation Guide' for DBNPS. Further, the NRC staff concluded that the licensee's reevaluated flood hazard information is suitable input for the focused evaluation associated with NTTF Recommendation 2.1, Flooding. The enclosure to Reference 12 includes a summary of the current design basis and reevaluated flood hazard parameters, respectively. In Table 1 of the enclosure to Reference 12, the NRC lists the following flood-causing mechanisms for the design basis flood:

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

In Table 2 of the enclosure to Reference 12, the NRC lists flood hazard information (specifically stillwater elevation and wind-wave runup elevation) for the following flood-causing mechanisms that are not bounded by the design basis:

- Storm Surge
- Local Intense Precipitation

These are the reevaluated flood-causing mechanisms that are addressed in the external flooding assessment. The two non-bounded flood mechanisms for DBNPS are described in detail in References 2 and 3 (the FHRR submittals). The following table summarizes how each of these unbounded mechanisms was addressed in this external flooding assessment.

	Flood Mechanism	Summary of Assessment
1	Probable Maximum Storm Surge	The Storm Surge is evaluated using Path 1 of the Flood Impact Assessment Process (FIAP) Path Determination Table, Section 6.3.3 of NEI 16-05. The FHRR Storm Surge calculation was refined in 2015 but not included in the FHRR submittal (Reference 3).
2	Local Intense Precipitation	The LIP is evaluated using Path 2 of FIAP Path Determination Table, Section 6.3.3 of NEI 16-05. The FHRR Effects of Local Intense Precipitation calculation was refined in 2015 but not included in the FHRR submittal (Reference 3).

In Reference 13, the NRC states that the "staff confirms that the reevaluated flood hazards information defined in Section 4.1 of Reference 13 is appropriate input to the additional assessments of plant response as described in the 50.54(f) letter and COMSECY-15-0019, Mitigating Strategies and Flooding Hazard Reevaluation Action Plan." The staff also noted some AEs and FEDs were not reported in Reference 3 and were expected to be provided in subsequent flooding evaluations. The missing AE and FED items were provided in the MSA for Flooding, dated 12/12/2016 (Reference 15).

The refined analyses are used as the basis for this FE and were also referenced in the MSA, but were not used as the basis of the MSA evaluation.

5.1 Revised Probable Maximum Storm Surge (PMSS)

The PMSS calculation, C-CSS-020.13-017, Surge and Seiche Analysis for Davis-Besse Nuclear Power Station, was revised in January 2015. Calculations C-CSS-020.13-021, Surge and Sieche Calibration for Davis-Besse Nuclear Power Station, and C-CSS-020.13-015, Site-specific Wind and Pressure Field Analysis for Davis-Besse Nuclear Power Station, were also revised as they are inputs to the Surge and Seiche Analysis. Calculation C-CSS-020.13-022, Combined Event including Wind Wave Analysis for Davis-Besse Nuclear Power Station, was also revised as it receives input from the Surge and Seiche analysis.

To develop more realistic conditions, the refined analysis includes: (1) revision of the calibration model parameters based on the statistical evaluations for determining parameter selection, and (2) refinement of the wind events containing the candidate PMWS to exclude certain wind events based on transpositionability.

The Assumptions, Inputs, and Methods (AIMs) discussed below will be addressed for each calculation with justification for each change. The changes to the input calculations for the PMSS analysis will be discussed first. The Combined Event calculation will be discussed last as it receives input from the PMSS Analysis.

Discussion of Revised AIMs

Item	Description of Revised AIM	Justification of Reduced Conservatism
1	Model Parameters in Calculation C-CSS-020.13-021 Rev 0 were revised based on statistical evaluations for determining parameter selection. Only the wind drag coefficient changed in the revised calculation. Wind Drag Coefficient Breakpoint B at 30 m/s Original: 0.0030 Revised: 0.0028	Revision 1 of the calculation selected the best fit parameters such as wind drag coefficient, Manning's roughness and JONSWAP bottom friction coefficient (for WAVE model) by performing a statistical analysis in terms of Root Mean Square Error (RMSE), Nash Sutcliffe Efficiency (NSE) and coefficient of determination (R^2). These changes allowed for better model to data verification and resulted in only one change to the wind drag coefficient to be used subsequent calculations.
2	Wind events containing the candidate Probable Maximum Windstorm (PMWS) used in C-CSS-020.13-015 Rev 0 were refined to exclude certain wind events based on transpositionability. Revision 1 of the calculation removed data from storms occurring east of the Appalachians due to affects the mountains have on the storm characteristics. Storm locations greater than 6^0 latitude distance north or south of the site were also eliminated. This was to account for the change in Coriolis parameters and hence the effect on the vorticity of a given storm.	The refined domain of applicable storms includes only those storms that are physically capable of occurring over DBNPS. Original storm parameters were unrealistic as they did not account for the Appalachian Mountains or other geographical considerations. The revised transposition limitations follow Hydrometeorological Report HMR 51 and HMR 57 guidelines and provide a realistic storm selection for transposition to the DBNPS site.

Discussion of Revised AIMs		
Item	**Description of Revised AIM**	**Justification of Reduced Conservatism**
3	PMSS analysis C-CSS-020.13-017 original calculation used transpositioned storms including those described in Item 2. Revision 1 of this calculation is based on inputs from revisions of the calculations discussed in Items 1 and 2, which removed storms that were unrealistic for DBNPS and improved model inputs.	The major input for a PMSS analysis is the PMWS. The removal of the conservatisms, discussed in Item 2, is applicable here.
4	C-CSS-020.13-022, Combined Event including Wind Wave Analysis, was revised to incorporate the PMSS values discussed in Item 2.	The changes to the input values for the Combined Event are a direct result of the changes discussed in Item 3. Therefore, the justifications for Item 3 apply here.

The following table documents the revised parameters for the PMSS based on calculations C-CSS-020.13-017, Surge and Seiche Analysis for Davis-Besse Nuclear Power Station and C-CSS-020.13-022, Combined Event including Wind Wave Analysis for Davis-Besse Nuclear Power Station.

PMSS Flood Mechanism Parameters		
Item	**Parameter Description**	**Values/Discussion**
1	Max Stillwater Elevation	583.8 ft
2	Max Wave Run-up Elevation (at wave protection dike)	587.2 ft

5.2 Revised Local Intense Precipitation (LIP)

The LIP calculation, C-CSS-020.13-014, Effects of Local Intense Probable Maximum Precipitation Analysis for Davis-Besse Nuclear Power Station, provided in Reference 3 was revised in January 2015. Calculation C-CSS-020.13-024, Site-Specific LIP Analysis for Davis-Besse Nuclear Power Station, was created in December 2016 to provide site specific inputs to the revised LIP analysis. The revised LIP calculation also included some additional doors but none of these doors lead directly to Key System, Structure or Components (SSCs).

Discussion of Revised AIMs		
Item	**Description of Revised AIM**	**Justification of Reduced Conservatism**
1	The original LIP calculation used general HMR guidelines. The revised calculation uses a site-specific LIP analysis developed in Calculation C-CSS-020.13-024.	Use of a site-specific LIP analysis is an accepted industry practice and yields a more realistic LIP analysis. This conservatism is identified in Table A-1 of NEI 16-05 as a potential conservative assumption.
2	The original calculation considered various temporal distributions. The revised calculation only considers a frontal temporal distribution.	Considering only a front temporal distribution is consistent with the case study example provided in Appendix B of NUREG/CR-7046.
3	The original calculation used depth-variable roughness parameters. The revised calculation uses constant roughness surface parameters based on land surface cover.	This change is incorporated because the flooding depths are very shallow for most of the flooding event and a full flow condition (i.e. 3 ft water depth) is not reached.
4	The original calculation surface detention parameter was reduced from 0.05 ft to 0.03 ft in the revised calculation.	The use of 0.05 ft was overly conservative because it is the maximum value of the suggested range of values for rain runoff model. 0.03 ft is a more realistic value and is within the provided acceptable range for the model. This conservatism is identified in Table A-1 of NEI 16-05 as a potential conservative assumption.
5	The revised calculations set the Floodplain Limiting Froude number to 0.99 to assure subcritical flow regime. The original calculation did not contain this limitation.	Subcritical flow regime is a typical condition for overland flow. Limiting Froude number helps with model stability for very shallow water depths.

The following table documents the revised parameters for the LIP based on calculation C-CSS-020.13-014, Effects of Local Intense Probable Maximum Precipitation Analysis for Davis-Besse Nuclear Power Station.

LIP Flood Mechanism Parameters		
Item	**Parameter Description**	**Values/Discussion**
1	Max Stillwater Elevation	585.1 ft
2	Max Wave Run-up Elevation	N/A. Due to the short duration, shallow depths and inadequate fetch lengths there is no wave run due to a LIP.
3	Max Hydrodynamic/Debris Loading	Debris loading was accounted for in the Vehicle Barrier System (VBS) opening by reducing the space between the barriers due to debris thereby increasing water retention on the site. No debris loading was considered on the plant structures due to the area being mostly paved. As a conservatism, all storm drains and culverts are considered non-functional for the LIP analysis. Hydrodynamic and hydrostatic loading was calculated for each structure and determined to be well below building design loads.
4	Effects of Sediment Deposition/Erosion	N/A. The LIP is a short duration low velocity event. Areas surrounding the power block are concrete and macadam and not subject to scour. Sediment deposition is not considered credible due to the low velocities and short duration of the event.
5	Other Associated Effects	N/A. No other associated effects were identified.
6	Concurrent Site Conditions	N/A. No concurrent site conditions were identified.
7	Effects on Ground Water	Groundwater effects were not deemed credible due to the impermeable materials surrounding the power block and the short duration of the event. Additionally, critical structures are designed for a 250 psf surcharge load which would bound any potential groundwater surcharge if it were to occur.
8	Warning Time	No specific warning time is identified. Existing site procedures rely on weather reports as well as notification from external agencies of impending

LIP Flood Mechanism Parameters		
Item	**Parameter Description**	**Values/Discussion**
		severe weather. Once notified the Shift Manager directs action based on the environmental threat. No doors leading to Key SSC's are flooded in the revised calculation. Site actions in the event of severe weather include closing exterior doors and hatches. Sufficient time exists to execute these actions. Additionally, the MSA has identified a trigger point based on storm predictions which provides adequate warning time.
9	Period of Site Preparation	Adequate preparation time exists as discussed above in Item 8. The revised calculation has removed flooding from the power block area except for one Turbine Building door (Door 334) and three Water Treatment Building doors. None of these doors lead directly to Key SSC's and all would be closed prior to the onset of flooding. Sufficient time exists for these actions to be completed.
10	Period of Inundation	The revised calculation has removed flooding in the power block area except for the doors mentioned in Item 9. Door 334 is flooded for 12 minutes. The Water Treatment Building doors are flooded less than 30 minutes. The inundation period above the power block finish floor elevation of 585 ft is less than 30 minutes.
11	Period of Recession	Based on the hydrographs (in the new calculation) for the doors mentioned above, water levels peaks at approximately 1 hour after the onset of the storm. Water level recedes to below site grade approximately 30 minutes later. Low lying areas will remain flooded for a longer period but pose no threat to Key SSC's.
12	Plant Mode of Operation	N/A. Plant response to a LIP event is not Mode dependent.
13	Other Factors	N/A. No other factors were identified.

It was noted that the conclusion of the Staff Assessment for the FHRR agreed with the sites determination that the associated effects are minimal. As the revised LIP has reduced the previously reported flooding in the power block area, and removed flooding for all but one power block door (which is subject to flooding for 12 minutes), the associated effects are reduced below those values previously evaluated by the Staff.

The above parameters are discussed in detail in "Mitigating Strategies Assessment (MSA) for Flooding", dated 12/12/2016 (Reference 15).

6 OVERALL SITE FLOODING RESPONSE

6.1 DESCRIPTION OF OVERALL SITE FLOODING RESPONSE

6.1.1 Response to PMSS

The PMSS is evaluated using Path 1 and is bounded by the Current Licensing Basis (CLB) flooding protection. It is recognized that the maximum stillwater elevation in the revised calculation is slightly greater than the existing CLB value of 583.7 ft. However, the revised elevation, 583.8 ft, is below the power block finish floor elevation of 585 ft and causes no power block area flooding. The maximum wave run-up elevation (at the wave protection dike) is 587.2 ft which is below the CLB of 590.3 ft. Site flooding occurs in the outlying areas, but no structures containing Key SSC's are impacted by the PMSS. The Intake Structure, which contains Key SSC's, is designed for a wave run-up elevation of 590.3 ft, which is above the revised wave run-up elevation of 587.2 ft.

The existing site Emergency Plan Off Normal Occurrence Procedure RA-EP-02830 - Flooding contains actions required to respond to rising lake levels. The procedure recognizes that outlying areas and site access roads can be affected at lake level greater than or equal to 578 ft. The procedure also directs entry into Emergency Plan Off Normal Occurrence Procedure RA-EP-02870 - Station Isolation. This procedure ensures adequate personnel and resources are available for continued safe operation in the event flooding could impair site access.

6.1.2 Response to LIP

The LIP is evaluated using Path 2. The revised calculation reduced the LIP water level to 585.1 ft. The LIP level is above the CLB value of 584.5 ft but is at, or below, all critical doors previously evaluated in the FHRR, except Turbine Building Door 334. Three additional doors included in the revised calculation were identified to have flood levels above 585 ft. These doors are all associated with the Water Treatment Facility and do not lead directly to Key SSC's. These doors would all be closed in the event of a LIP.

Door 334 is flooded for approximately 12 minutes. Leakage through this door would not impact Key SSC's. The door would be closed during a LIP event, but the door is not designed with flood prevention features. Any leakage through the door would remain in the Turbine Building. No accumulation is expected due to the short duration of time the door is flooded. In the unlikely event that water accumulates in the Turbine Building, safety-related SSC's are not affected due to the low flood water level and the passive barriers in place, such as concrete curbing. Flooding into the Service Water Tunnel is discussed below. Based on this there is no impact to Key SSCs.

The Water Treatment Building doors would all be closed during a LIP event. The doors are not designed with flood protection features and are flooded for less than 30 minutes. Water leakage past these doors would migrate from the floor elevation at grade (585') to the lower

elevations of the Water Treatment Building. As the water accumulates in the lower elevations of the Water Treatment Building, the Intake Structure Valve Room would be exposed to this flood water through a non-water tight door. A louver, located 2' 6" above the floor, provides a direct communication path into the Intake Structure Valve Room from the Water Treatment Building. However, it is not anticipated that water would accumulate to the louver height due to the short duration (30 minutes) of the flood and the limited leakage past the doors.

The Intake Structure Valve Room is open to the Service Water Tunnel (SWT) which extends to the Turbine Building. Calculations 054.022, C-ME-021.02-003 and C-CCS-099.16-134 evaluate various flooding scenarios in the SWT. Of these, the most severe evaluates a Circulating System Water line break in the Turbine Building causing flooding of the SWT through an open pipe chase between the SWT and the Turbine Building. The valves of concern are located 52 inches above the SWT floor. The input flooding flows to the SWT in this calculation are in excess 20,000 gpm. Based on engineering judgment (including a review of Beaver Valley Calculation DSC-0368, which estimated water leakage past closed doors during a flood event) the incoming flows from the Water Treatment Building due to the LIP, for a flood duration of 30 minutes, will not approach the flooding values previously evaluated. Based on this, there is no impact to Key SSC's from flooding through the Water Treatment Building doors.

Only permanent passive features are relied upon during the revised site specific LIP event. No Key SSC's are impacted by the revised LIP, thus no additional actions or strategies are required.

The existing site Emergency Plan Off Normal Occurrence Procedure RA-EP-02810 - Tornado or High Winds contains actions required to respond to severe weather notifications. This procedure uses various external agency inputs for determining the potential for severe weather. The "Hazardous Weather Outlook" is produced daily and identifies any potential significant weather in the next seven days. The procedure contains actions based on the nature of the weather threat. Additionally, a trigger point has been developed which provides sufficient warning time for the site to prepare in the event of excessive rainfall prediction.

6.2 Summary of Plant Modifications and Changes

Based on the results of the revised PMSS and LIP evaluations, no site actions are required, procedure upgrades are not necessary and no modifications are needed.

7 FLOOD IMPACT ASSESSMENT

7.1 FLOOD MECHANISM PMSS (PATH 1 ASSESSMENT)

7.1.1 Comparison of New Flood Levels to the Design Basis

PMSS Flood Mechanism Parameters				
	Parameter Description	**Plant Design or Licensing Basis Flood Levels**	**Revised Levels**	**Bounded (B) or Not Bounded (NB)**
1	Max Stillwater Elevation	583.7 ft	583.8 ft	NB
2	Max Wave Run-up Elevation (at wave protection dike)	590.3 ft	587.2 ft	B

Although the Max Stillwater Elevation is not bounded, the area of inundation in the revised calculation shows there is no flooding in the power block area. Based on this, no safety-related structures containing Key SSC's are impacted by flooding during a PMSS event. The reduction in the Max Wave Run-up Elevation results in a bounded condition and precludes power block area flooding. Outlying area flooding (non-power block area) has no impact on KSFs or Key SSC's.

7.2 FLOOD MECHANISM LIP (PATH 2 ASSESSMENT)

7.2.1 Description of LIP Flood Impact

Available Physical Margin (APM) calculations were performed to the new LIP calculation flood height (585.1 ft) to support the MSA. The calculations are included in the MSA support document NORM-LP-7221. All features were identified as part of the 50.54(f) 2.3 Flooding Walkdown and subsequent RAI response. The results of the APM Calculation identified 10 seals with a small margin and one seal with negative margin. Small margin at DBNPS has been defined as less than 7.2 inches per CR 2014-00373.

The 10 seals with small margin have a positive margin at the new LIP value. The seals are below grade and are for prevention of groundwater ingress. It has been determined that the LIP event does not cause a groundwater surcharge due to its short duration and the impermeable materials surrounding the power block. The seals are not subject to any other associated effects from the LIP. The seals were walked down and determined to be adequate in accordance with NEI 12-07 guidance used to perform the 2.3 Flooding walkdowns (Reference 17).

The seal with negative margin is subject to groundwater only and will not experience any additional pressure during a LIP event. This seal was evaluated in the MSA as not posing a flooding risk during a LIP as the existing groundwater pressure on the seal does not change. Based on the flooding walkdown, the seal is not showing indications of any leakage and therefore determined to be sound. The seal, located in the Borated Water Storage Tank (BWST) pipe tunnel, is not subject to any other associated effects from the LIP, was walked down and determined to be adequate in accordance with NEI 12-07 guidance used to perform the 2.3 Flooding walkdowns (Reference 17).

Other flood protection features have APM exceeding 10 inches. No above grade flood protection features are subject to the LIP (i.e., Intake Structure water tight doors).

Since the LIP WSE is at the site design elevation for flood protections features, and no grade level protection features are subject to any associated effects there are no additional APM calculations to perform.

All Key SSC's have been determined to be adequately protected by the existing flood protection features.

7.2.2 Adequate APM Justification and Reliability Flood Protection

The adequacy of the flood protection features was discussed in the previous section. Reference 17 identified the sites flood protection features and determined all were subject to periodic maintenance to insure there is continued functionality. The revised LIP analysis does not affect the previously submitted information. This was reviewed by the Staff in Reference 16, and found to be acceptable.

7.2.3 Adequate Overall Site Response

This section is not applicable to DBNPS as no manual actions are required to implement the flood protection strategy. No flood mitigation equipment is required. Site flooding response discussed in Reference 17 remains unchanged. This was reviewed by the Staff in Reference 16, and found to be acceptable.

The MSA for Flooding (Reference 15) addressed actions related to FLEX implementation. No actions were related to protecting Key SSC's from flooding. No actions were considered Time Sensitive Actions relating to flooding.

8 CONCLUSION

This evaluation has determined that the unbounded flood mechanisms, PMSS and LIP, previously submitted in the FHRR, do not impact any Key SSC's or challenge any KSFs at DBNPS.

The revised PMSS calculation has removed all flooding in the power block area. Outlying areas still susceptible to flooding pose no threat to continued safe operation of DBNPS. No modifications to plant structures or flood protection features are required. Also, no changes to existing site flooding response procedures are required. Existing site procedures adequately address potential flooding of outlying areas.

The revised LIP calculation has removed flooding from critical doors that lead directly to Key SSC's. Non-critical doors that see minimal flooding are not designated as flood protection features. Leakage through these doors does not impact Key SSC's or present any potential impact to KSFs. No modifications to plant structures or flood protection barriers and no changes to existing site flooding response procedures are required.

This submittal completes the actions related to external flooding required by the March 12, 2012 10CFR50.54(f) letter.