



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

March 16, 2017

Mr. William R. Gideon  
Site Vice President  
Brunswick Steam Electric Plant  
8470 River Rd. SE (M/C BNP001)  
Southport, NC 28461

SUBJECT: BRUNSWICK STEAM ELECTRIC 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 (CAC NOS. MF6104 AND MF6105)

Dear Mr. Gideon:

The purpose of this letter is to provide a summary of the U.S. Nuclear Regulatory Commission (NRC) staff's assessment of the reevaluated flood-causing mechanisms described in the March 11, 2015, flood hazard reevaluation report (FHRR) submitted by Duke Energy Progress, LLC (Duke, the licensee) for Brunswick Steam Electric Plant, Units 1 and 2 (Brunswick) (Agencywide Documents Access and Management System (ADAMS) Accession No. ML15079A385), as well as supplemental information resulting from audits.

By letter dated March 12, 2012, the NRC issued a request for information pursuant to Title 10 of the *Code of Federal Regulations*, Section 50.54(f) (hereafter referred to as the 50.54(f) letter) (ADAMS Accession No. ML12053A340). The request was issued as part of implementing lessons learned from the accident at the Fukushima Dai-ichi nuclear power plant. Enclosure 2 to the 50.54(f) letter requested licensees to reevaluate flood-causing mechanisms using present-day methodologies and guidance. Concurrent with the reevaluation of flooding hazards, licensees were required to develop and implement mitigating strategies in accordance with NRC Order EA-12-049, "Requirements for Mitigation Strategies for Beyond-Design-Basis External Events" (ADAMS Accession No. ML12054A735). On March 30, 2015, the Commission provided staff requirements memorandum (SRM) (ADAMS Accession No. ML15089A236) to COMSECY-14-0037, "Integration of Mitigating Strategies for Beyond-Design-Basis External Events and the Reevaluation of Flooding Hazards," dated November 21, 2014 (ADAMS Accession No. ML14309A256), affirming that licensees need to address the reevaluated flooding hazards within their mitigating strategies for beyond-design-basis external events. Revision 2 of Nuclear Energy Institute (NEI) guidance document NEI 12-06, dated December 2015, includes a methodology for performing a mitigating strategies assessment (MSA) with respect to the reevaluated flood hazards.

**Enclosure 2 transmitted herewith contains Security-Related Information. When separated from the Enclosure, this document is decontrolled.**

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On February 29, 2016, the NRC staff published Japan Lessons-Learned Division (JLD) Interim Staff Guidance (ISG) JLD-ISG-2012-01, Revision 1, "Compliance with Order EA-12-049, 'Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events'" (ADAMS Accession No. ML15357A142), in the *Federal Register* (81 FR 10283). This ISG endorses Revision 2 of NEI 12-06 (ADAMS Accession No. ML16005A625). Based on the guidance provided in Revision 2 of NEI 12-06, any flood event duration parameters and applicable flood associated effects that were not provided in the FHRR should be considered as part of the Brunswick MSA. The NRC staff will evaluate the flood event duration parameters (including warning time and period of inundation) and flood-related associated effects developed by the licensee during the NRC staff's review of the MSA.

In addition to the MSA, in order to complete its response to the information requested by Enclosure 2 to the 50.54(f) letter, the licensee is expected to submit an integrated assessment or a focused evaluation, as appropriate, to address the reevaluated flood hazards that exceed the current design basis, as described in the NRC letter, "Coordination of Request for Information Regarding Flooding Hazard Reevaluation and Mitigating Strategies for Beyond-Design-Basis External Events" (ADAMS Accession No. ML15174A257). This letter describes the changes in the NRC's approach to the flood hazard reevaluations that were approved by the Commission in its SRM to COMSECY-15-0019, "Closure Plan for the Reevaluation of Flooding Hazards for Operating Nuclear Power Plants" (ADAMS Accession No. ML15209A682).

The NRC staff has reviewed the information submitted by the licensee in its FHRR and the associated regulatory audit (ADAMS Accession No. ML15148A762), and has summarized the results of the review in the tables provided as an enclosure to this letter. Table 1 provides the current design-basis flood hazard mechanisms. Table 2 provides the reevaluated flood hazard mechanisms; however, the reevaluated flood hazard mechanisms bounded by the current design basis (Table 1) are not included.

The NRC staff performed a confirmatory analysis of the information provided in the FHRR to independently evaluate the sensitivity of the reevaluated hazards to input parameters. The confirmatory analysis indicated that the storm surge flood-causing mechanism is sensitive to the input parameters and methodology used. The sensitivities identified have been discussed with the licensee. As a measure of conservatism, the licensee agreed to provide margin above the FHRR stillwater elevations for storm surge for the subsequent flood evaluations addressing flooding due to storm surge. The water elevations summarized in Table 2 reflect this commitment.

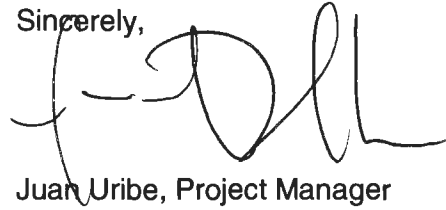
Based on the information provided by the licensee and the staff's confirmatory analysis, the NRC staff has concluded that the reevaluated flood hazard information, as summarized in Table 2 of the enclosure, is suitable for the assessment of mitigating strategies developed in response to Order EA-12-049 (i.e., defines the mitigating strategies flood hazard information described in NEI guidance document NEI 12 06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide") for Brunswick. Further, the NRC staff has concluded that the enclosed reevaluated flood hazard information is suitable input for other flooding assessments associated with the 50.54(f) letter. The NRC staff plans to issue a staff assessment documenting the basis for these conclusions at a later time.

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If you have any questions, please contact me at (301) 415-3809 or e-mail at Juan.Uribe@nrc.gov.

Sincerely,

A handwritten signature in black ink, appearing to read 'J. Uribe', written in a cursive style.

Juan Uribe, Project Manager  
Hazards Management Branch  
Japan Lessons-Learned Division  
Office of Nuclear Reactor Regulation

Docket Nos. 50-325 and 50-324

Enclosures:

1. Summary of Results of Flooding  
Hazard Re-Evaluation Report (Redacted Version)
2. Summary of Results of Flooding  
Hazard Re-Evaluation Report (Non-Public Version)

cc w/encl: Distribution via Listserv

**Table 1. Current Design Basis Flood Hazards for Use in the MSA**

<b>Mechanism</b>	<b>Stillwater Elevation</b>	<b>Waves/Runup</b>	<b>Design Basis Hazard Elevation</b>	<b>Reference</b>
<b>Local Intense Precipitation</b>	Not included in DB	Not included in DB	Not included in DB	FHRR Section 3b.1 and Table 5-1
<b>Streams and Rivers</b>	Not included in DB	Not included in DB	Not included in DB	FHRR Section 3b.2 & Table 5-1
<b>Failure of Dams and Onsite Water Control/Storage Structures</b>	Not included in DB	Not included in DB	Not included in DB	FHRR Section 3b.3 and Table 5-1
<b>Storm Surge</b>				
At Site Safety Related Buildings	22.0 ft NGVD29	3.6 ft	25.6 ft NGVD29	FHRR Section 3b.4 and Table 5-1 FHRR Section 3b.7 and Table 5-1
At Site Safety Related Buildings with Margin Added	Not applicable	Not applicable	26.1 ft NGVD29	FHRR Section 3b.7
At Intake Structure	25.3 ft NGVD29	3.0 ft	28.3 ft NGVD29	FHRR Section 3b.7
<b>Seiche</b>	Not included in DB	Not included in DB	Not included in DB	FHRR Section 3b.4 and Table 5-1
<b>Tsunami</b>	Not included in DB	Not included in DB	Not included in DB	FHRR Section 3b.5 and Table 5-1

**Table 1. Current Design Basis Flood Hazards for Use in the MSA**

<b>Mechanism</b>	<b>Stillwater Elevation</b>	<b>Waves/Runup</b>	<b>Design Basis Hazard Elevation</b>	<b>Reference</b>
<b>Ice-Induced Flooding</b>	Not included in DB	Not included in DB	Not included in DB	FHRR Section 3b.6 and Table 5-1
<b>Channel Migrations/Diversions</b>	Not included in DB	Not included in DB	Not included in DB	FHRR Table 5-1

Note 1: Reported values are rounded to the nearest one-tenth of a foot.

Note 2: Storm Surge Flood-Causing Mechanism includes a combined analysis of both surge and seiche.

**Table 2. Reevaluated Flood Hazards for Flood-Causing Mechanisms for Use in the MSA**

<b>Mechanism</b>	<b>Stillwater Elevation</b>	<b>Waves/Runup</b>	<b>Reevaluated Hazard Elevation</b>	<b>Reference</b>
<b>Local Intense Precipitation</b>				
Reactor Building (Door D-3)	21.1 ft NGVD29	Minimal	21.1 ft NGVD29	FHRR Section 4a and Tables 4-2 & 5-1
Turbine Building (Door D-24)	21.7 ft NGVD29	Minimal	21.7 ft NGVD29	FHRR Tables 4-3 & 5-1
Reactor Building (Door D-2)	20.8 ft NGVD29	Minimal	20.8 ft NGVD29	FHRR Section 4a and Tables 4-2 & 5-1
<b>Streams and Rivers</b>				
Cape Fear River	11.9 ft NGVD29	4.4 ft	16.3 ft NGVD29	FHRR Section 4b & Table 5-1 FHRR Section 4b, Table 4-18, & Table 5-1
Nancy's Creek	15.5 ft NGVD29	Minimal	15.5 ft NGVD29	FHRR Section 4b & Table 5-1
<b>Failure of Dams and Onsite Water Control/Storage Structures</b>				
REDACTED	REDACTED	REDACTED	REDACTED	REDACTED
REDACTED	REDACTED	REDACTED	REDACTED	REDACTED
<b>Storm Surge</b>				
Reactor Building	26.5 ft NGVD29	7.0 ft	33.5 ft NGVD29	See Note 5
Diesel Generator Building	26.5 ft NGVD29	7.1 ft	33.6 ft NGVD29	See Note 5

**Table 2. Reevaluated Flood Hazards for Flood-Causing Mechanisms for Use in the MSA**

Mechanism	Stillwater Elevation	Waves/Runup	Reevaluated Hazard Elevation	Reference
Service Water Building/Intake Structure	26.4 ft NGVD29	7.1 ft	33.5 ft NGVD29	See Note 5
AOG Building	26.4 ft NGVD29	7.2 ft	33.6 ft NGVD29	See Note 5
Radwaste Building	26.5 ft NGVD29	7.2 ft	33.7 ft NGVD29	See Note 5
Turbine Building	26.7 ft NGVD29	7.1 ft	33.8 ft NGVD29	See Note 5
<b>Tsunami</b>				
At the Intake Canal	10.2 ft NGVD29	Not applicable	10.2 ft NGVD29	FHRR Section 4E & Table 5-1

Note 1: The licensee is expected to develop flood event duration parameters and applicable flood associated effects to conduct the MSA. The staff will evaluate the flood event duration parameters (including warning time and period of inundation) and flood associated effects during its review of the MSA.

Note 2: Reevaluated hazard mechanisms bounded by the current design basis (see Table 1) are not included in this table.

Note 3: Reported values are rounded to the nearest one-tenth of a foot.

Note 4: Wind/Wave effects for streams and rivers flood-causing mechanism were determined using combined effects PMH based wind/wave effects noted in Rev. 0 of the FHRR.

Note 5: For the storm surge hazard, the elevations presented in this table include adjustments (relative to results presented in the FHRR) to account for (1) sensitivity and uncertainty associated with the wind drag functions used in numerical storm surge models and (2) the calculation of the tidal component of the antecedent water level.

Note 6: Storm Surge Flood-Causing Mechanism includes a combined analysis of both surge and seiche.

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BRUNSWICK STEAM ELECTRIC 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 DATED MARCH 16, 2017

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**ADAMS Accession Nos.: Pkg; ML17072A350; Non-Public Letter: ML17072A355; Public Letter: ML17072A364; Enclosure 1: ML17072A420; Enclosure 2: ML17072A452**  
**\*via email**

<b>OFFICE</b>	NRR/JLD/JHMB/PM*	NRR/JLD/LA	NRR/JLD/JHMB/BC(A)	NRR/JLD/JHMB/PM
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<b>DATE</b>	3/15/2017	3/15/2017	3/16/2017	3/16/2017

**OFFICIAL AGENCY RECORD**