PSEG Nuclear LLC
P.O. Box 236, Hancocks Bridge, NJ 08038-0236

PSEG
Nuclear LLC

10 CFR 50.4

LR-N16-0112

DEC 29 2016

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

Hope Creek Generating Station
Renewed Facility Operating License No.NPF-57
NRC Docket No. 50-354

Subject: Hope Creek Generating Station's Flood Hazards Mitigating Strategies Assessment (MSA) Report Submittal

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. PSEG Letter LR-N14-0041, "PSEG Nuclear LLC's Response to Request for Information Regarding Flooding Aspects of Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident – Hope Creek Generating Station Flood Hazard Reevaluation," dated March 12, 2014.

3. PSEG Letter LR-N14-0170, "PSEG Nuclear LLC's 30-day Response to Request for Additional Information Regarding Flooding Aspects of Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident," dated July 28, 2014.

4. NRC Letter, "Nuclear Regulatory Commission Report for the Audit of PSEG Nuclear LLC's Flood Hazard Reevaluation Report Submittals Relating to the Near-Term Task Force Recommendation 2.1 - Flooding for Hope Creek Generating Station (CAC NO. MF3789)," dated January 8, 2016.

5. NRC Memorandum to COMSECY-14-0037, "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.

6. Nuclear Energy Institute (NEI), Report NEI 12-06, Revision 2, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," dated December 2015.

7. NRC Interim Staff Guidance 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.

8. NRC Letter, "Hope Creek Generating Station – Interim Staff Response to Reevaluated Flood Hazards Submitted in Response to 10 CFR 50.54(f) Information Request – Flood-Causing Mechanism Reevaluation (TAC No. MF3789)," dated September 10, 2015.

9. 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.

10. NRC Letter, "Hope Creek Generating Station – Staff Assessment of Response to 10 CFR 50.54(f) Information Request – Flood-Causing Mechanism Reevaluation (CAC NO. MF 3789)," dated October 25, 2016.

11. PSEG Letter LR-N14-0207, "PSEG Nuclear LLC's 90-day Response to Request for Additional Information Regarding Flooding Aspects of Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident," dated September 23, 2014.

12. PSEG Letter LR-N15-0100, "Hope Creek Generating Station's Response to Request for Additional Information Regarding Flooding Aspects of Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident," dated May 7, 2015.

13. PSEG Letter LR-N12-0369, "Hope Creek Generating Station Response to Recommendation 2.3: Flooding Walkdown of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident," dated November 26, 2012.

The purpose of this letter is to provide the Hope Creek Generating Station (HCGS) mitigating strategies assessment (MSA) for reevaluated external flood hazards.

On March 12, 2012, the NRC issued Reference 1 to request information associated with Near-Term Task Force (NTTF) Recommendation 2.1 for Flooding. One of the Required Responses in Reference 1 directed licensees to submit a Flood Hazard Reevaluation Report (FHRR). For HCGS, the FHRR was submitted on March 12, 2014 (Reference 2). The reevaluated flood hazard was further developed in response to requests for additional information and a regulatory audit (References 3, 4, 11 and 12). Per Reference 9, the NRC considers the reevaluated flood hazard to be "beyond the current design/licensing basis of operating plants."

Concurrent with the flood hazard reevaluation, HCGS developed and implemented mitigating strategies in accordance with NRC Order EA-12-049, "Requirements for Mitigation Strategies for Beyond-Design-Basis External Events." In Reference 5, the Commission affirmed that licensees need to address the reevaluated flooding hazards within their mitigating strategies for beyond-design-basis (BDB) external events. Guidance for performing flood hazard MSAs is contained in Appendix G of Reference 6, endorsed by the NRC (with conditions) in Reference 7. For the purpose of the MSAs, the NRC has termed the reevaluated flood hazard, summarized in Reference 8, as the "Mitigating Strategies Flood Hazard Information" (MSFHI). Reference 6, Appendix G, describes the MSA for flooding as containing the following elements:

- Section G.2 – Characterization of the MSFHI
- Section G.3 – Comparison of the MSFHI and FLEX Design Basis (DB) Flood
- 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 Alternative Mitigating Strategies (if necessary)
- Section G.4.4 – Assessment of Targeted Hazard Mitigating Strategies (if necessary)

The following provides the MSA results for the Hope Creek Generating Station.

<u>Reference 6, Section G.2 – Characterization of the MSFHI</u>

Characterization of the Mitigating Strategies Flood Hazard Information (MSFHI) is summarized in Reference 8; the NRC's interim response to the flood hazard reevaluation submittal (Reference 2) and related submittals (References 3, 4, 11 and 12). A more detailed description of the MSFHI, along with the basis for inputs, assumptions, methodologies, and models, is provided in the following references:

- Local Intense Precipitation (LIP): See Section 2.1 of Reference 2, Enclosure 1.
- Flooding in Streams and Rivers: See Section 2.2 of Reference 2, Enclosure 1.
- Dam Breaches and Failures: See Section 2.3 of Reference 2, Enclosure 1.

- Storm Surge: See Section 2.4 of Reference 2, Enclosure 1.
- Seiche: See Section 2.5 of Reference 2, Enclosure 1.
- Tsunami: See Section 2.6 of Reference 2, Enclosure 1.
- Ice-Induced Flooding: See Section 2.7 of Reference 2, Enclosure 1.
- Channel Migration or Diversion: See Section 2.8 of Reference 2, Enclosure 1.
- Combined Effects (including wind-waves and runup effects): See Section 2.9 of Reference 2, Enclosure 1.
- Other Associated Effects (i.e., hydrodynamic loading, including debris; effects caused by sediment deposition and erosion; concurrent site conditions; and groundwater ingress): See Sections 2.10 and 3.10 of Reference 2, Enclosure 1.
- Flood Event Duration Parameters (i.e. warning time, period of site preparation, period of inundation, and period of recession): See Section 2.10.6 of Reference 2, Enclosure 1.

As discussed in Reference 2, the flood hazard reevaluation showed that the Flooding in Streams and Rivers (including combined effects provided in NUREG/CR-7046, Appendix H, H.1), Dam Breaches and Failures (including combined effects provided in NUREG/CR-7046, Appendix H, H.2), Seiche, Tsunami (including combined effects provided in NUREG/CR-7046, Appendix H, H.5), Ice-Induced Flooding, and Channel Migration or Diversion flood-causing mechanisms were either determined to be implausible or completely bounded by other mechanisms. Storm Surge (including combined effects provided in NUREG/CR-7046, Appendix H, H.3) is the primary flood-causing mechanism at Hope Creek Generating Station; however, the reevaluated flood hazard, including combined and associated effects, and flood event duration parameters, remain bounded by the current design basis. Only LIP was determined to be an applicable flood-causing mechanism at Hope Creek Generating Station that exceeded the current design basis. Parameters for this flood-causing mechanism, including associated effects and flood event duration parameters, are described in detail in Reference 2 and summarized in Attachment 1 to this letter.

In Reference 8, the NRC concluded that the "reevaluated flood hazards information, as summarized in the Enclosure, is suitable for the assessment of mitigating strategies developed in response to Order EA-12-049 for Hope Creek." Table 2 of Reference 8 describes the reevaluated flood hazards that exceed the current design-basis for use in the MSA (i.e., LIP with associated effects and flood duration parameters).

As discussed in Reference 2, the reevaluated LIP event could produce flood levels that are above the watertight door thresholds, but significantly below the plant's minimum flood-protected elevation of 121 ft. Public Service Datum (PSD);e.g., the maximum LIP flood level at critical door locations is 102.6 ft. PSD. Protection of safety related SSCs can be ensured by implementing operating procedure HC.OP-AB.MISC-0001, which instructs operators to close all watertight doors. Following submittal of Reference 2, PSEG revised HC.OP-AB.MISC-0001 to include actions to close watertight doors if the National Weather Service Probabilistic Quantitative Precipitation Forecast (PQPF) predicts Local Intense Precipitation (LIP) to exceed 6 inches over the next 24 hours.

The process for closure of the March 12, 2012 Request for Information, Recommendation 2.1: Flooding has evolved with NRC and the industry reaching a common ground with the development of the MSA process, and subsequently with issuance of NEI 16-05, "External Flooding Assessment Guidelines," as endorsed in JLD-ISG-2016-01, "Interim Staff Guidance for Activities Related to Near-Term Task Force Recommendation 2.1, Flooding Hazard Reevaluation; Focused Evaluation and Integrated Assessment." One area in the MSA process that is not clearly discussed pertains to flood mechanisms which exceed the current licensing basis for that mechanism and therefore are included in the MSFHI, but still have significant available physical margin (APM) to the plant's design basis flood protection level. In the case of HCGS, the plant's design basis flood protection features are established to mitigate the effects of a hurricane storm surge event, with the minimum flood protection elevation at 121 ft. PSD.

A LIP event alone cannot produce a water surface elevation across the site to challenge HCGS's flood protection elevation. Only events where Delaware River water is pushed onto the site from a storm surge could challenge HCGS's installed flood protection features' design elevation. Due to the APM during a LIP event, an extended loss of AC power and loss of ultimate heat sink are not credible outcomes of a BDB LIP event. Therefore, HCGS does not consider LIP an event that can challenge key safety functions, and only considers LIP flooding elevations and associated effects in the protection of FLEX connections and equipment during storage.

Reference 6, Section G.3 – Basis for Mitigating Strategies Assessment (FLEX Design Basis Comparison)

At HCGS, the FLEX design basis (FLEX DB) flood is primarily based on the plant's current design basis (CDB) flood but also incorporates aspects of the reevaluated flood hazard (i.e., MSFHI), including LIP, Flooding in Streams and Rivers, Dam Breaches and Failures, and Tsunami. The FLEX DB flood and associated mitigating strategies is bounded by the Storm Surge event. LIP is the only flood hazard at HCGS for which the reevaluated maximum water surface elevation (WSEL) exceeds its CDB WSEL; therefore, a comparison of the CDB, FLEX DB, and MSFHI for LIP is provided in Attachment 1.

Comparison of the FLEX DB and reevaluated flood hazards (i.e. MSFHI) shows that the FLEX DB flood bound the MSFHI for all applicable flood-causing mechanisms, including associated effects and flood event duration parameters. Therefore, HCGS considers the requirement to address the reevaluated flooding hazards within its BDB mitigating strategies as being satisfied with no further action required.

10 CFR 50.4

There are no regulatory commitments contained in this letter. If you have any questions or require additional information, please do not hesitate to contact Mr. Brian J. Thomas at 856-339-2022.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on 12/22/2016
(Date)

Sincerely,

Eric Carr
Site Vice President
Hope Creek Generating Station

Attachment 1: HCGS FLEX DB and MSFHI – Flood Parameter Comparison Tables

cc: Mr. Daniel Dorman, Administrator, Region I, NRC
Mr. Justin Hawkins, NRC Senior Resident Inspector, Hope Creek
Ms. Carleen J. Parker, Project Manager, NRC/NRR/DORL
Mr. John Boska, Senior Project Manager, NRC/NRR/JLD
Mr. Patrick Mulligan, Chief, NJBNE
Mr. Thomas MacEwen, Hope Creek Commitment Tracking Coordinator
Mr. Lee Marabella, PSEG Corporate Commitment Coordinator

ATTACHMENT 1

HCGS FLEX DB AND MSFHI – FLOOD PARAMETER COMPARISON TABLES

Table 1 – Local Intense Precipitation Flood Parameter Comparison

	Flood Scenario Parameter	Plant's Current Design Basis	FLEX Design Basis	MSFHI	Bounded (B) or Not Bounded (NB)
Flood Level and Associated Effects	1. Max Stillwater Elevation (ft. NAVD88)	12.1	12.8	12.8	B
	2. Max Wave Run-up Elevation (ft. NAVD88)	N/A	N/A	N/A	N/A
	3. Max Hydrodynamic (lb/ft)/Debris Loading (lb)	N/I	See note	See note	B
	4. Effects of Sediment Deposition/Erosion	N/I	See note	See note	B
	5. Other associated effects (identify each effect)	N/A	N/A	N/A	N/A
	6. Concurrent Site Conditions	N/I	See note	See note	B
	7. Effects on Groundwater	N/I	See note	See note	N/A
Flood Event Duration	8. Warning Time (hours)	N/I	See note	See note	N/A
	9. Period of Site Preparation (hours)	N/I	See note	See note	N/A
	10. Period of Inundation (hours)	N/I	1	1	B
	11. Period of Recession (hours)	N/I	<11	<11	B
Other	12. Plant Mode of Operations	Any	Any	Any	B
	13. Other Factors	N/A	N/A	N/A	N/A

N/A = Not Applicable N/I = Not Included

NOTES CORRESPONDING TO TABLE 1 LINE ITEMS:

1. Elevation varies around the site; this elevation represents the maximum flood elevation at critical door locations. The LIP maximum stillwater elevation is also considered in siting the Outdoor FLEX Storage Areas and HCGS FLEX Diesel Generator Location on the Unit 2 Reactor Building Roof. NAVD88 = North American Vertical Datum of 1988. 12.8 ft. NAVD88 is equivalent to 102.6 ft PSD.
2. Consideration of wind-wave action for the LIP event is not explicitly required by NUREG/CR-7046 and is judged to be negligible because of limited fetch lengths and water depths.
3. The hydrodynamic and hydrostatic loads during a LIP are negligible compared to the design basis loads on SSC due to the Storm Surge event. The debris load for the LIP event is assumed to be negligible due to low flow velocity and water depths. The water depths around the buildings due to LIP are relatively shallow. Also, tie-downs for FLEX equipment at Outdoor FLEX Storage Areas consider the effects of water-induced drag loads.
4. The flow velocities due to the LIP event are determined to be below the suggested velocities (FHRR Reference 2.1-4) for the ground cover type (asphalt, concrete and gravel) at the plant area. Therefore, significant erosion is not expected for the LIP flood. Similarly, the relatively low velocities and flow depths are not expected to have the power to transport sediment and cause significant deposition during the LIP flood. Refer to FHRR Section 2.1.4.2 for further discussion.
5. N/A
6. High winds could be generated concurrent to a LIP event. However, manual actions are not required to protect the plant during LIP flooding so this concurrent condition is not applicable. Closure of watertight doors around the plant takes place prior to the onset of the LIP event.
7. Below grade structures at HCGS are designed to mitigate the effects of the continuous presence of groundwater through the use of waterproofing and waterstops. Refer to FHRR Sections 2.10.5 and 3.10.5 for further discussion.
8. The reevaluated LIP event could produce flood levels that are above watertight door thresholds, but significantly below the plants flood protected elevation described in FHRR Section 1.5. Plant safety can be ensured by implementing operating procedure HC.OP-AB.MISC-0001, which instructs operators to close all watertight doors. PSEG updated HC.OP-AB.MISC-0001 to include guidance on accessing the National Weather Service's Probabilistic Quantitative Precipitation Forecast (NWS PQPF). If the NWS PQPF predicts greater than 6 inches of rainfall in the next 24 hours, operators are instructed to close the watertight doors.

9. SSC's important to safety are currently protected by means of permanent passive measures and permanent active features, i.e., watertight doors. Watertight door closure can be performed well within the warning time provided by the 24-hour PQPF trigger discussed above in Note 8, as shown by HCGS operating experience (e.g., the flooding walkdown report in Reference 13 documents actual closure in approximately one hour of exceeding a high river water level trigger). Therefore, the period of site preparation based on current procedures is adequate.
10. SSC's important to safety are currently protected by means of permanent measures. The LIP event is assumed to occur over a one hour period, then enter into a period of recession across the site.
11. Following a one hour LIP event, waters recede from critical door locations in less than two hours (See FHRR Table 2.1-3). FHRR Figure 2.1-9 shows the flood depths at 11 hours after the one hour LIP event concludes. Minor standing water is around the site, but Outdoor FLEX Storage Areas are accessible and critical FLEX deployment routes are passable. The FLEX Diesel Generators are permanently located on the roof of the Unit 2 Reactor Building and are not affected by LIP period of recession. The total time for flooding across the site is less than 12 hours, similar to the current assumptions for deployment of FLEX equipment following a storm surge flooding event. SSC's important to safety are currently protected by means of permanent measures. Therefore, FLEX equipment can be deployed from the Outdoor FLEX Storage Areas given the period of recession associated with a LIP flood.
12. Protection against the LIP flood causing mechanism can be implemented in any mode.
13. N/A