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

April 13, 2017

Mr. J. J. Hutto
Regulatory Affairs Director
Southern Nuclear Operating Co., Inc.
P.O. Box 1295 / BIN B038
Birmingham, AL 35201-1295

SUBJECT: EDWIN I. HATCH NUCLEAR PLANT, UNITS 1 AND 2 – FLOOD HAZARD MITIGATION STRATEGIES ASSESSMENT (CAC NOS. MF7932 AND MF7933)

Dear Mr. Hutto:

By letter dated March 12, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12053A340), the U.S. Nuclear Regulatory Commission (NRC) issued a request for information to all power reactor licensees and holders of construction permits in active or deferred status, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.54(f), "Conditions of Licenses" (hereafter referred to as the "50.54(f) letter"). The request was issued in connection with implementing lessons learned from the 2011 accident at the Fukushima Dai-ichi nuclear power plant, as documented in the NRC's Near-Term Task Force (NTTF) report (ADAMS Accession No. ML111861807).

Enclosure 2 to the 50.54(f) letter requested that licensees reevaluate flood hazards for their sites using present-day methods and regulatory guidance used by the NRC staff when reviewing applications for early site permits and combined licenses (ADAMS Accession No. ML12056A046). Concurrent with the reevaluation of flood hazards, licensees were required to develop and implement mitigating strategies in accordance with NRC Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events" (ADAMS Accession No. ML12054A735). In order to proceed with implementation of Order EA-12-049, licensees used the current licensing basis flood hazard or the most recent flood hazard information, which may not be based on present-day methodologies and guidance, in the development of their mitigating strategies.

By letter dated December 16, 2016 (ADAMS Accession No. ML16351A087, non-public Security Related Info), Southern Nuclear Operating Company, Inc. (SNC, the licensee), submitted its mitigation strategies assessment (MSA) for Edwin I. Hatch Nuclear Plant, Units 1 and 2 (Hatch). The MSAs are intended to confirm that licensees have adequately addressed the reevaluated flooding hazards within their mitigating strategies for beyond-design-basis external events. The purpose of this letter is to provide the NRC's assessment of the Hatch MSA.

The NRC staff has concluded that the Hatch MSA was performed consistent with the guidance described in Appendix G of Nuclear Energy Institute 12-06, Revision 2, as endorsed by Japan Lessons-Learned Division (JLD) interim staff guidance (ISG) JLD-ISG-2012-01, Revision 1, and that the licensee has demonstrated that the mitigation strategies appear to be reasonably protected from reevaluated flood hazards conditions for beyond-design-basis external events. This closes out the NRC's efforts associated with CAC No. MF7992.

If you have any questions, please contact me at 301-415-1056 or at Lauren.Gibson@nrc.gov.

Sincerely,

Lauren Kate Gibson

Lauren K. Gibson, Project Manager
Hazards Management Branch
Japan Lessons-Learned Division
Office of Nuclear Reactor Regulation

Enclosures:
1. Staff Assessment Related to the Mitigating Strategies for Hatch (non-public)
2: Staff Assessment Related to the Mitigating Strategies for Hatch (redacted)

Docket Nos. 50-321 and 50-366

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# STAFF ASSESSMENT BY THE OFFICE OF NUCLEAR REACTOR REGULATION RELATED TO MITIGATION STRATEGIES FOR EDWIN I. HATCH NUCLEAR PLANT, AS A RESULT OF THE REEVALUATED FLOODING HAZARD NEAR-TERM TASK FORCE RECOMMENDATION 2.1- FLOODING

CAC NOS. MF7932 AND MF7933

## 1.0 INTRODUCTION

By letter dated March 12, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12053A340), the U.S. Nuclear Regulatory Commission (NRC) issued a request for information to all power reactor licensees and holders of construction permits in active or deferred status, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.54(f), "Conditions of Licenses" (hereafter referred to as the "50.54(f) letter"). The request was issued in connection with implementing lessons learned from the 2011 accident at the Fukushima Dai-ichi nuclear power plant, as documented in the NRC's Near-Term Task Force (NTTF) report (ADAMS Accession No. ML111861807).

Enclosure 2 to the 50.54(f) letter requested that licensees reevaluate flood hazards for their sites using present-day methods and regulatory guidance used by the NRC staff when reviewing applications for early site permits and combined licenses (ADAMS Accession No. ML12056A046). Concurrent with the reevaluation of flood hazards, licensees were required to develop and implement mitigating strategies in accordance with NRC Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events" (ADAMS Accession No. ML12054A735). That order requires holders of operating reactor licenses and construction permits issued under 10 CFR Part 50 to modify the plants to provide additional capabilities and defense-in-depth for responding to beyond-design-basis external events, and to submit to the NRC for review a final integrated plan (FIP) that describes how compliance with the requirements of Attachment 2 of the order was achieved. In order to proceed with implementation of Order EA-12-049, licensees used the current licensing basis (CLB) flood hazard or the most recent flood hazard information, which may not be based on present-day methodologies and guidance, in the development of their mitigating strategies.

The NRC staff and industry recognized the difficulty in developing and implementing mitigating strategies before completing the reevaluation of flood hazards. The NRC staff described this issue and provided recommendations to the Commission on integrating these related activities in COMSECY-14-0037, "Integration of Mitigating Strategies for Beyond-Design-Basis External Events and the Reevaluation of Flood Hazards," dated November 21, 2014 (ADAMS Accession No. ML14309A256). The Commission issued a staff requirements memorandum on March 30, 2015 (ADAMS Accession No. ML15089A236), affirming that the Commission expects licensees for operating nuclear power plants to address the reevaluated flood hazards, which are considered beyond-design-basis external events, within their mitigating strategies.

Nuclear Energy Institute (NEI) 12-06, Revision 2, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide" (ADAMS Accession No. ML16005A625), has been endorsed by the NRC as an appropriate methodology for licensees to perform assessments of the mitigating strategies against the reevaluated flood hazards developed in response to the March 12, 2012. 50.54(f) letter. The guidance in NEI 12-06, Revision 2, and Appendix G in particular, supports the proposed Mitigation of Beyond-Design-Basis Events rulemaking. The NRC's endorsement of NEI 12-06, including exceptions, clarifications, and additions, is described in NRC 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. ML15357A163). Therefore, Appendix G of NEI 12-06, Revision 2, describes acceptable methods for demonstrating that the reevaluated flooding hazard is addressed within the Edwin I. Hatch Nuclear Plant, Units 1 and 2 (Hatch) mitigating strategies for beyond-design-basis external events.

## 2.0 BACKGROUND

By letter dated March 6, 2014 (ADAMS Accession No. ML14069A054), as supplemented by letters dated August 6, 2014, June 3, 2015, and March 7, 2016 (ADAMS Accession Nos. ML14219A570 (non-public), ML15154B601 (non-public), and ML16069A088 (non-public), respectively), Southern Nuclear Operating Company, Inc. (SNC, the licensee) submitted its flood hazard reevaluation report (FHRR) for Hatch. By letter dated December 4, 2015 (ADAMS Accession No. ML15329A135), the NRC issued an interim staff response (ISR) letter for Hatch. The ISR letter provided the reevaluated flood hazard mechanisms that exceeded the current design basis (CDB) for Hatch and flood parameters that are suitable input for the mitigating strategies assessment (MSA). For Hatch, the mechanisms listed as not bounded by the CDB in the ISR letter are local intense precipitation (LIP), streams and rivers, and failure of dams and onsite water control structures.

By letter dated December 16, 2016 (ADAMS Accession No. ML16351A087), SNC submitted the Hatch MSA for review by the NRC staff.

## 3.0 TECHNICAL EVALUATION

### 3.1 Hatch's FLEX Strategies

Hatch's FLEX strategy is described in the document, "Final Integrated Plan (FIP) U.S. Nuclear Regulatory Commission Order EA-12-049, Strategies for Beyond Design Basis External Events, Hatch Nuclear Plant, Units 1 and 2," Revision 0, February 2017, which was submitted by letter dated February 13, 2017 (ADAMS Accession No ML17045A597). The NRC staff is evaluating the strategies in the plan and will document the review in a safety evaluation. The intent of the safety evaluation is to inform the licensee whether or not its integrated plans, if implemented as described, appear to adequately address the requirements of Order EA-12-049. An inspection will confirm compliance with the order.

The licensee's FLEX strategies, as described in its FIP, consider the site to be a dry site, which is consistent with their CDB flood level, which is below both the site grade and the elevation for the intake structure. However, several flooding mechanisms were identified in the FHRR as not bounded by the CDB; therefore, the licensee has considered them in its MSA, as discussed in Section 3.2.

The licensee stated in its MSA that the existing FLEX strategy can be successfully implemented and deployed as designed for all applicable flood-causing mechanisms.

A brief summary of the licensee's FLEX strategies is as follows:

- For Phase 1, the Reactor Core Isolation Cooling (RCIC) system is initiated at the beginning of the extended loss of alternating current power (ELAP) event and is normally aligned to take suction from the condensate storage tank (CST). The licensee plans to swap RCIC suction from the CST to the suppression pool prior to the CST depleting, which would occur after approximately 6.8 hours. At approximately 4 hours after the initiation of the ELAP event, the licensee will initiate use of the hardened containment vent in order to maintain the suppression pool temperatures within acceptable parameters.

  Station batteries and the Class 1E 125 Vdc [volts direct current (dc)] distribution systems provide power to the RCIC system and instrumentation. The dc load shedding is accomplished within 75 minutes of event initiation to extend the battery capacity to power the Phase 1 systems and instrumentation. After load shedding, the installed batteries can maintain the necessary voltage for over 14 hours.

- For Phase 2, Hatch relies on FLEX components that include two 600V FLEX diesel generators (DG), a FLEX pump package, and portable FLEX fans for cooling. The equipment is stored in a FLEX storage building.

  The licensee will continue to cool the reactor using RCIC. During the time that the suction source is the suppression pool, the licensee will begin replenishing the CST with water from the Altamaha River, the ultimate heat sink, using a FLEX pump. Phase 2 will begin when RCIC switches to taking suction from the replenished CST.

  600V FLEX DG (one per unit) will be used to power both divisions of Class 1E emergency 600 VAC busses C and D in order to power the battery chargers, RCIC controls, certain instrumentation, and other selected loads. The battery chargers may also be directly powered from the FLEX DGs using temporary cables.

- For Phase 3, the equipment from the national SAFER [Strategic Alliance of FLEX Emergency Response] response center (NSRC) will be transported to on-site staging area B for interim staging prior to being transported to the final location in the plant.

### 3.2 Evaluation of Flood Protection Features

The following flooding mechanisms from the FHRR were not bounded by the CDB: LIP; flooding in rivers and streams (all season probable maximum flood (PMF) with a ½ PMF antecedent storm); seismic upstream dam failure; PMF with upstream overtopping dam failure; and combined effects flooding (PMF with upstream dam failure with wind-induced waves). In its MSA, the licensee states that three of these mechanisms have maximum flooding elevations that are below the elevation of the intake structure and are therefore not required to be further evaluated in the MSA. The NRC agrees with this assessment for flooding in rivers and streams (all season PMF with a ½ PMF antecedent storm), seismic upstream dam failure, and PMF with upstream overtopping dam failure. Further evaluation of the LIP and combined effects flood protection features follow below.

LIP Flood

Section 5.1 of the MSA described the reevaluated LIP as a maximum flood height of 130.5 feet (ft) National Geodetic Vertical Datum of 1929 (NGVD29) around the power block. The plant design basis probable maximum flood with wave run-up is 108.3 ft NGVD29. The MSA indicated 10 doors in the Reactor and the Turbine and Control buildings at which the flood elevation would be higher than the finished floor elevation. Water would ingress; however, the resulting flood levels inside the rooms would not affect the structures, systems, or components (SSCs) necessary for the FLEX strategies.

The licensee calculated that the resulting flood depth in the reactor building would be 0.03 ft. The lowest SSC is at 0.33 ft (approximately 4 inches) and would therefore not be affected.

The licensee calculated that the resulting flood depth inside the Turbine and Control building at the 130 ft NGVD29 elevation would be 0.05 ft (0.64 inches). This depth is below the level of the key SSCs or the credited flex equipment, which is 3 inches off the floor. Therefore, there is a margin of over 2 inches. At elevation 112 ft NGVD29 of the Turbine and Control building, the resulting interior flood depth was calculated to be 0.04 ft (0.47 inches). This is approximately a half inch below a cable tray that has cables required for the FLEX strategy.

The LIP water surface elevation also exceeds the Main Stack flood elevation of 120 ft NGVD29 by approximately 0.6 inches. Should all the floodwater pass through the closed exterior doors, the licensee calculated that the resulting interior flooding depth would be approximately 1 ft (12 inches). Although this is at or slightly below the minimum penetration in the mixing chamber, it is well below the stand-by vents; therefore, the mixing chambers venting capabilities are not expected to be affected.

The NRC staff reviewed the licensee's assessment of the reevaluated LIP event as compared to the existing FLEX strategies in the Hatch FIP. The NRC staff concludes that there appears to be sufficient time for the LIP flood event and eventual recession before the Phase 2 FLEX equipment is required to be deployed.

The NRC staff concludes that the licensee appears to have adequately assessed the MFSHI for the LIP flood event and that the applicable FLEX strategies can be implemented as described in the FIP.

Combined Effects Flooding

MSA Section 5.2 describes the combined effects flooding, which is the combination of the probable maximum flood, the upstream overtopping dam breach, and 2-year wind-driven wave action. The maximum water surface elevation [redacted] exceeds the minimum ground elevation at the intake structure (109.99 ft NGVD29).

During Phase 2, a FLEX pump package with two submersible pumps will be staged at the intake structure. They will be lifted by crane into the river. The primary pump staging location is below the maximum water surface elevation for the combined effects flooding. However, the alternate staging location [redacted] for the pump remains available and unaffected.

The NRC concludes that the licensee appears to have adequately assessed the combined effects flooding for the impact on the FLEX strategies and that the applicable FLEX strategies can be implemented as currently designed.

Conclusion

The NRC staff has reviewed the information provided in the Hatch MSA related to the original FLEX strategies, as evaluated against the reevaluated hazards described in Section 3.2.3 of this Staff Assessment, and concludes that the licensee appears to have adequately assessed the MFSHI for the reevaluated LIP and the combined effects flood events to determine that the FLEX Strategy can be implemented as currently designed. The NRC staff made its determination based upon:

- The available physical margin between the expected interior flood levels and the key SSCs or credited FLEX equipment;
- The existence of an alternate and unaffected staging location for the Phase 2 pump near the intake structure; and
- Flood levels not reaching site grade for flooding in rivers and streams (all season probable maximum flood (PMF) with a ½ PMF antecedent storm), seismic upstream dam failure, and PMF with upstream overtopping dam failure.

Therefore, the NRC staff concludes that the licensee has demonstrated the capability to deploy FLEX strategies, against a postulated beyond-design-basis event for the above flood events, as described in Appendix G of NEI 12-06, Revision 2 and ISG-2012-01, Revision 1.

3.3 Confirmation of Flood Hazard Evaluations in the MSA

The NRC staff reviewed the flood hazard elevations reported in the MSA, and confirmed the flood elevations for the LIP flood-causing mechanism are slightly changed from the values reported in the NRC staff's Interim Staff Response (ISR) letter (mitigating strategies flood hazard information Table 2: ADAMS Accession No. ML15327A249, non-public, security related information) as discussed below. For all other flood-causing mechanisms that are not bounded by the CDB, including streams and rivers and failure of dams flood-causing mechanisms, the elevation values in the MSA match those reported in the ISR letter. The licensee presented the combined-effects flooding event as part of the upstream dam breach flood-causing mechanism. The combined-effects flooding elevation is a combination of the PMF, upstream dam breach, and 2-year wind-driven wave height along the critical fetch.

For the LIP flood-causing mechanism, NRC staff noted flood elevations were reported at different locations between the MSA and the FHRR. The staff determined that these variations are not from changes in the FLO-2D model setup, input conditions, or boundary conditions, which was reviewed as part of the FHRR. The licensee states in its MSA report that the FLO-2D reference grid numbers in Table 5-1 of the MSA correspond to doors D-166, R-30A, T-16, 2T-17, and the Freight Elevator. These locations are different from those presented in the FHRR and more closely reflect the locations of these access doors. The NRC staff reviewed the licensee-provided LIP FLO-2D input and output files and confirmed that the MSA's grid cells reflect the locations of the doors and Freight Elevator. The NRC staff conclude that the new reporting locations and maximum water elevations summarized in Table 3.3-1 are reasonable and appropriate for use in the MSA.

3.4 Evaluation of Flood Event Duration

The staff reviewed information provided by the licensee in the FHRR and its supplements and in the MSA regarding the flood event duration (FED) parameters needed to perform the MSA for flood-causing mechanisms not bounded by the CDB. The FED parameters for these flood-causing mechanisms are summarized in Table 3.4-1.

For the LIP flooding, the licensee used results from a 2-dimentional numerical modeling method, as described in the FHRR, to determine the inundation duration and period of recession parameters. The staff confirmed that the licensee's reevaluation of the inundation periods for LIP and associated drainage uses present-day methodologies and regulatory guidance.

For the LIP flooding event, the licensee stated that the water surface elevation exceeds the Main Stack floor elevation of 120 ft NGVD29 for approximately 1.1 hours. The period of site inundation is reported to be about 1.0 hour and the period of recession from the site is estimated to be about 7 hours.

For the combined-effects flooding event, which is a combination of PMF, upstream dam breach, and 2-year wind-driven wave heights along the critical fetch, the maximum water surface elevation is [redacted] This flood level is above the ground elevation and the intake structure, with the site grade elevation at the intake structure being 110 ft NGVD29. The licensee reported that the period of inundation for combined-effects flooding event was computed as the time duration wherein the flood water elevation remains above the minimum surveyed door sill elevation at the three doors at the Intake Structure (110.12 ft North American Vertical Datum of 1988 = 110.91 ft NGVD29). In its MSA, the licensee reported that the resulting duration of inundation is 6.2 days (149 hours).

In summary, the staff agrees with the licensee's conclusion related to determining the FED parameters is consistent with the guideline provided by Appendix G of NEI 12-06, Revision 2 (NEI, 2015). Based on this review, the staff determined that the licensee's FED parameters summarized in Table 3.4-1 are reasonable and acceptable for use in the MSA.

3.5 Evaluation of Associated Effects

The staff reviewed information provided by the licensee in the FHRR, its supplements, and the MSA regarding the reevaluated associated effects (AE) parameters for flood hazards not bounded by the CDB. The AE parameters related to water surface elevation (i.e., stillwater elevation with wind waves and runup effects) were previously reviewed by staff, and were transmitted to the licensee via the ISR letter. The AE parameters not directly associated with water surface elevation are discussed below and are summarized in Table 3.5-1.

For the LIP flood-causing mechanism, the licensee provided estimates of hydrostatic and hydrodynamic loads in the FHRR. The estimates are based on the results of a 2-dimensional numerical model that was used to analyze LIP flooding and is described in the FHRR. The licensee states in its MSA and FHRR that the potential debris generation caused by the LIP event will be from unsecured materials located inside the Power Block Area. The licensee also states that there are control procedures implemented to minimize the amount of material/debris transported by LIP runoff. The water depths and velocities inside the Power Block Area are low, thus making the hazard from waterborne projectiles minimal. The licensee states that areas with higher velocities associated with the LIP flood-causing mechanism occur only on asphalt and/or paved areas, and as a result any adverse erosion and sedimentation impacts are minimal.

For the combined effects flood-causing mechanisms, the licensee provided estimates of maximum hydrostatic and hydrodynamic pressure on the intake structure walls which were compared with the concrete strength. It is reported in the MSA that the maximum hydrostatic pressure on the Intake Structure walls is 874 $lb/ft^2$, the maximum hydrodynamic pressure and force on the Intake Structure walls due to the river current is 3 $lb/ft^2$, and the maximum hydrodynamic pressure on the Intake Structure walls due to a breaking wave is 4,312 $lb/ft^2$. It is also reported in the MSA that the maximum debris impact load for a 1,000 lb wood log on the Intake Structure walls is 1,387 lb. The intake structure concrete has a strength of 576,000 $lb/ft^2$. The results of this comparison show that the walls contain sufficient capacity to handle any demands due to hydrostatic, hydrodynamic, and breaking wave-induced pressures as well as any debris loads.

The licensee states that the stillwater elevation associated with combined effects flood-causing mechanism does not flood the site, and as a result the site is not susceptible to debris loads or barge strike. The licensee also stated that the location of the Intake Structure Doors D-130 and D-131 would also make any impact with debris and barges highly unlikely. In addition, the licensee stated that for the combined effects flood-causing mechanism, any sediment deposition or erosion would be negligible.

For the streams and rivers flood-causing mechanism, the resulting flood does not inundate the site. As a result the licensee did not provide associated effects parameters. Similarly for seismic and overtopping dam breach flood-causing mechanisms, the resulting flood levels do not inundate the site. Therefore, the licensee did not provide associated effects parameters for these mechanisms, and the staff agrees with the licensee's approach and analyses.

The staff confirmed the licensee's statements by reviewing the licensee-provided documents and model input and output files for the LIP and combined effects flood-causing mechanisms. The staff verified that inundation depths and flow velocities are reasonable and acceptable for use as part of the MSA. As a result, the staff agrees with the licensee's assessment of the AE parameters for LIP and combined effects flood causing mechanisms. For the LIP flood hazard the licensee stated that the LIP associated effects are not included in the design basis flood.

In summary, the staff concludes the licensee's methods were appropriate and that AE parameters summarized in Table 3.5-1 are reasonable and acceptable for use in the MSA.

## 4.0 CONCLUSION

The NRC staff has reviewed the information provided in the Hatch MSA related to the FLEX strategies, as evaluated against the reevaluated hazard(s) described in Section 3 of this Staff Assessment, and found that:

- The FLEX strategies should not be affected by the impacts of the ISR flood levels (including impacts due to the environmental conditions created by the ISR flood levels):

- The deployment of the FLEX strategies, as described in the FIP (which is under review by the NRC staff) and subject to subsequent inspection, should not be affected by the impacts of the ISR flood levels; and

- Associated effects and FED are reasonable and acceptable for use in the Hatch MSA, and have been appropriately considered in the MSA.

Therefore, the NRC staff concludes that the licensee appears to have followed the guidance in Appendix G of NEI 12-06, Revision 2, and should be able to deploy the original FLEX strategies, as designed, against a postulated beyond-design-basis event for LIP and combined effects flooding, including associated effects and flood event duration.

**Table 3.3-1. Comparison of Maximum LIP Flood Elevations between the FHRR and MSA**

| Building | Door ID | FHRR & MSFHI | | MSA | |
|---|---|---|---|---|---|
| | | FLO-2D Grid Cell ID | Maximum Flood Elevation[1] (ft NGVD29) | FLO-2D Grid Cell ID | Maximum Flood Elevation (ft NGVD29) |
| Turbine and Reactor Building | Door R-30A | 84396 | 130.1 | 83979 | 130.1 |
| | Door R-23A | 84394 | 130.2 | 84394 | 130.2 |
| | Door T-15 | 73412 | 130.1 | 73412 | 130.1 |
| | Door T-16 | 73411 | 130.2 | 74316 | 130.2 |
| | Door 2T-17 | 73350 | 130.3 | 75167 | 130.3 |
| | Door 2T-18 | 73349 | 130.3 | 73349 | 130.3 |
| | Truck Bar Door | 82287 | 130.4 | 82287 | 130.4 |
| Unit 1 Control Building | Freight Elevator | 66156 | 131.2 | 66158 | 130.5 |

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

**Table 3.4-1. Flood Event Durations for Flood-Causing Mechanisms Not Bounded by the CDB**

| Flood-Causing Mechanism | Time Available for Preparation for Flood Event | Duration of Inundation of Site | Time for Water to Recede from Site |
|---|---|---|---|
| **Local Intense Precipitation and Associated Drainage** | Minimal | 1.0 h | 7 h |
| **Streams and Rivers** | Not Applicable | Not Applicable | Not Applicable |
| **Failure of Dams and Onsite Water Control/Storage Structures**<br><br>Combined Effects Flood (PMF with overtopping dam failure and wind-induced waves) | 24 h | 6.2 days (149 h) | 4 h |

**TABLE 3.5-1. ASSOCIATED EFFECTS PARAMETERS NOT DIRECTLY ASSOCIATED WITH TOTAL WATER HEIGHT FOR FLOOD-CAUSING MECHANISMS NOT BOUNDED BY THE CDB**

| Associated Effects Parameter | Local Intense Precipitation and Associated Drainage | Streams and Rivers[2] | Failure of Dams and Onsite Water Control/Storage Structures (Combined Effects)[1] |
|---|---|---|---|
| Hydrodynamic loading | 53.08 lb/ft (Intake Structure)<br><br>78.02 lb/ft (Power Block) | Not Applicable | 874 lb/ft$^2$ (Intake Structure with Hydrostatic Load)<br><br>3 lb/ft2 (Intake Structure with Hydrodynamic Load)<br><br>4,312 lb/ft$^2$ (Intake Structure with waves) |
| Debris loading | 0.72 lb/ft (Intake Structure)<br><br>35.10 lb/ft (Powerblock) | Not Applicable | 1,387 lb (Intake Structure with Wood Log) |
| Sediment loading at plant grade | Minimal | Not Applicable | Not Applicable |
| Sediment deposition and erosion at plant grade | Minimal | Not Applicable | Not Applicable |
| Concurrent conditions, including adverse weather - Winds | Minimal | Not Applicable | Not Applicable |
| Groundwater ingress at plant grade | Minimal | Not Applicable | Not Applicable |
| Other pertinent factors (e.g., waterborne projectiles) at plant grade | Minimal | Not Applicable | Not Applicable |

1. The Power Block Area grade elevation is at 129 ft NGVD29 therefore it will not be inundated by the combined effects flood causing mechanism. Also, for the intake structure which is at elevation 110 ft NGVD29, the secondary staging location of the Phase 2 Pump is at an elevation of 119.29 ft. NGVD29, which is 0.69 ft. above of the maximum water surface elevation associated with the combined effects hazard. Therefore, associated effects were not calculated at plant grade but for the intake structure which will be partially inundated.
2. The AE parameters for streams and rivers flood-causing mechanism are 'Not Applicable' because the plant site is not inundated by this flood-causing mechanism.

EDWIN I. HATCH NUCLEAR PLANT, UNITS 1 AND 2 – FLOOD HAZARD MITIGATION STRATEGIES ASSESSMENT DATED APRIL 13, 2017

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