



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

May 16, 2019

Mr. David B. Hamilton  
Site Vice President - Nuclear  
FirstEnergy Nuclear Operating Company  
Perry Nuclear Power Plant  
P.O. Box 97  
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Perry, OH 44081-0097

**SUBJECT: NRC RESPONSE TO REQUEST FOR DEFERRAL OF ACTIONS RELATED TO BEYOND-DESIGN-BASIS FLOODING HAZARD REEVALUATIONS FOR PERRY NUCLEAR POWER PLANT, UNIT 1 (EPID NO. L-2018-JLD-0176).**

Dear Mr. Hamilton:

The purpose of this letter is to provide the U.S. Nuclear Regulatory Commission (NRC) staff's response to the letter received from FirstEnergy Nuclear Operating Company (FENOC, the licensee) on December 7, 2018 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML18341A046), related to post-Fukushima flooding hazard reevaluations at Perry Nuclear Power Plant, Unit 1 (Perry). The letter requested a deferral of the flooding focused evaluation (FE) associated with the flooding hazard activities in anticipation of the planned permanent shutdown of Perry on May 31, 2021.

The NRC staff has determined that deferring actions related to flooding hazard reevaluations is acceptable for Perry. This determination is based on the NRC staff's assessment that:

- The licensee has demonstrated that additional defense-in-depth has been achieved for coping with an extended loss of alternating current power and loss of normal access to the ultimate heat sink due to external events as a result of the site's 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. ML12054A735),
- Reasonable protection of systems, structures, and components that provide key safety functions has been demonstrated, if implemented as described, by relying on existing site protection, or reasonable protection of mitigating strategies against the unbounded mechanisms. In addition, these capabilities will continue to be maintained until permanent shutdown, and
- Considering the remaining operational period, the FE review period, and the time to implement any potential changes, it is unlikely that further meaningful safety improvements would be achieved prior to permanently defueling the plant.

Based on the evaluation found in the Enclosure to this letter, and after consultation with the Director of the NRC's Office of Nuclear Reactor Regulation, the NRC staff concludes that the NRC staff's review of the remaining activities associated with the March 12, 2012, request for information under Title 10 of the Code of Federal Regulations, Section 50.54(f) are considered deferred for Perry until May 31, 2021. If Perry does permanently cease operations on or before this date, and should FENOC determine that the remaining 50.54(f) letter activities are no longer necessary based on the shutdown conditions of the plant, the staff expects that FENOC would document such a request in a letter, with the appropriate basis supporting the request, prior to May 31, 2021. Alternatively, if Perry does not permanently cease operations by May 31, 2021, the staff also expects that FENOC would document such a decision in a timely letter prior to this date accompanied by a completion schedule for the submittal of the FE, which is the final submittal as part of the 50.54(f) letter activities.

If you have any questions, please contact Juan Uribe, Project Manager, at (301) 415-3809 or via e-mail at [Juan.Uribe@nrc.gov](mailto:Juan.Uribe@nrc.gov).

Sincerely,



Louise Lund, Director  
Division of Licensing Projects  
Office of Nuclear Reactor Regulation

Docket No. 50-440

Enclosure:  
Evaluation of Perry's Flooding Deferral Request

cc: Distribution via Listserv

NRC RESPONSE TO REQUEST FOR DEFERRAL OF ACTIONS RELATED TO  
BEYOND-DESIGN-BASIS FLOODING HAZARD REEVALUATIONS  
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1. INTRODUCTION

By letter dated March 12, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12053A340), the NRC issued a request for information under Title 10 of the *Code of Federal Regulations*, Section 50.54(f) (hereafter referred to as the 50.54(f) letter), to all nuclear power reactor licensees and construction permit holders in response to lessons learned from the March 2011 accident at Japan's Fukushima Dai-ichi nuclear power plant. Enclosure 2 of the 50.54(f) letter requested that licensees perform flooding hazard reevaluations using present-day methodologies and guidance, and then assess the impact of the reevaluated hazards on the plant.

By letters dated September 1, 2015 (ADAMS Accession No. ML15174A257), "Coordination of Requests for Information Regarding Flooding Hazard Reevaluations and Mitigating Strategies for Beyond-Design-Basis External Events", and September 21, 2016 (ADAMS Accession No. ML16237A108), "Regulatory Decision-Making for Reevaluated Flooding and Seismic Hazards for Operating Nuclear Power Plants", the NRC described changes in the regulatory process to address the flooding reevaluated hazards using a graded approach commensurate with the safety significance of the reevaluated flooding hazard at each site (e.g., focused evaluations, and revised integrated assessments), and its plan for completing and closing actions which included guidance on further regulatory decisions for sites submitting a revised integrated assessment. The NRC staff would then review the completed responses to these assessments in order to determine if there is a need for any additional regulatory actions, such as a plant-specific backfit.

Concurrent with the reevaluation of flooding hazards, licensees were required to develop and implement mitigating strategies under 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 the implementation of Order EA-12-049, licensees used the current design basis flood and seismic hazard or the most recent flood and seismic hazard information, which may not be based on present-day methodologies and guidance, in developing their mitigation strategies.

2. BACKGROUND

As part of the flooding hazard reevaluation process described in the 50.54(f) letter, Perry submitted a Flooding Walkdown Report by letter dated November 27, 2012 (ADAMS Accession No. ML12335A341), as supplemented by letter dated January 30, 2014 (ADAMS Accession No. ML14030A559). The flooding walkdowns were intended to identify and address degraded, nonconforming, or unanalyzed conditions through the corrective action program, and to verify the adequacy of the monitoring and maintenance procedures. By letter dated June 30, 2014 (ADAMS Accession No. ML14141A460), the NRC staff documented its review of the Flooding Walkdown Report and concluded that the licensee, through the implementation of the walkdown

guidance activities, and in accordance with plant processes and procedures, verified the plant configuration with the current flooding licensing basis; addressed degraded, nonconforming, or unanalyzed flooding conditions; and verified the adequacy of monitoring and maintenance programs for protective features.

Also, as part of the flooding hazard reevaluation process described in the 50.54(f) letter, Perry submitted its flood hazard reevaluation report (FHRR) by letter dated March 10, 2015 (ADAMS Accession No. ML15069A056), as supplemented by letter dated March 24, 2016 (ADAMS Accession No. ML16084A871). As part of its FHRR activities, FENOC identified and implemented several physical changes at the site (referred to as interim actions) that were intended to reduce and/or eliminate the impact of the unbounded reevaluated hazards at the site. The NRC staff performed an inspection at Perry following NRC Temporary Instruction (TI) 2515/190, "Inspection of the Licensee's Proposed Interim Actions as a Result of the Near-Term Task Force Recommendation 2.1 Flooding Reevaluation," and documented its results by letter dated February 11, 2016, "Perry Nuclear Power Plant NRC Integrated Inspection Report 05000440/2015004" (ADAMS Accession No. ML16042A640). No findings were identified in this report.

The NRC staff provided a summary of its review of the FHRR via an Interim Staff Response (ISR) letter issued on July 25, 2016 (ADAMS Accession No. ML16202A350). For Perry, the flood-causing mechanisms considered that exceeded the current design basis were local intense precipitation (LIP), streams and rivers, and probable maximum storm surge (PMSS). The NRC's letter concludes that the licensee's reevaluated flood hazard information is suitable for assessment of mitigating strategies developed in response to Order EA-12-049 and for completion of the other flooding assessments being performed as part of the 50.54(f) letter. A detailed FHRR staff assessment documenting the results of the staff's review was issued by letter dated January 24, 2018 (ADAMS Accession No. ML18002A555).

By letter dated July 24, 2017 (ADAMS Accession No. ML17205A336), FENOC submitted the Mitigation Strategies Assessment (MSA) for Perry. By letter dated May 03, 2018 (ADAMS Accession No. ML18108A694), the NRC staff issued a staff assessment to the MSA and concluded that the licensee has demonstrated that the mitigation strategies, if implemented as described, appear to be reasonably protected from the unbounded reevaluated flood hazards conditions described in the ISR letter. Overall, the licensee determined in its evaluation that the revised streams and rivers and storm surge flooding mechanisms do not impact the site and therefore, the current FLEX strategies can be deployed with no substantial modifications in order to account for the reevaluated hazards. For the LIP event, the licensee planned modifications to address the hazard exceedances. By letter dated April 2, 2018 (ADAMS Accession No. ML18094A661), the licensee notified the NRC that it had filed a voluntary petition for bankruptcy relief under Chapter 11 of Title 11 of the United States Code in the U.S Bankruptcy Court, Northern District of Ohio. By letter dated April 25, 2018 (ADAMS Accession No. ML18115A007), FENOC notified the NRC of its intention to permanently cease operations at Perry by May 31, 2021.

In order to complete the 50.54(f) response, the remaining submittal for Perry was the focused evaluation (FE). The licensee did not submit the FE and instead submitted the October 30, 2018, letter (ADAMS Accession No. ML18303A092) requesting a deferral of ongoing actions related to the remaining flood hazard reevaluations in anticipation of the planned permanent shutdown of Perry on May 31, 2021.

### 3. EVALUATION

As stated above, the licensee requested deferral of the FE submittal by letter dated October 30, 2018. The licensee stated that, based on the existing site physical modifications that have already been implemented and the planned shutdown on May 31, 2021, the planned FE review effort would not result in any additional, appreciable safety benefit at the site that could be realized during the remaining operational period of the plant. The licensee supported this conclusion by stating that:

- The site is currently protected from external flooding hazards, relative to the current design-basis, via a combination of topographic and geologic features, and temporary flood barriers (such as sandbags or panels) that will remain in place until permanent shutdown.
- Compliance with Order EA-12-049, which provides the ability to establish an indefinite coping capability to prevent damage to the fuel in the reactor and spent fuel pools and to maintain the containment function under extended loss of alternating current power or loss of normal access to the ultimate heat sink events, has been achieved. The staff's safety evaluation related to Order EA-12-049 was issued by letter dated May 16, 2016 (ADAMS Accession No. ML16056A560), and a subsequent inspection was performed at the site, as documented by Inspection Report dated September 14, 2016 (ADAMS Accession No. ML16258A452).
- FENOC demonstrated the capability to deploy the existing FLEX strategies against a postulated beyond-design-basis event for streams and rivers, and storm surge.

The NRC staff notes that for LIP, FENOC described changes and modifications to the site in the MSA that once implemented, appeared to be reasonable and were expected to allow FLEX strategies to be implemented, as designed. Subsequently, based on the anticipated plant shutdown and the information described in the deferral letter, the licensee stated that the proposed actions in the MSA would not be implemented. However, subsequent discussions with FENOC after receipt of the deferral request resulted in the licensee developing a plan to analyze and implement the installation of temporary and permanent flood protection features at the site. These protective measures are focused on addressing the LIP hazard exceedances at certain locations of interest associated with systems structures, and components (SSCs) that provide key safety functions (KSFs) of core cooling, spent fuel cooling, and/or containment integrity. Additional details are described below.

#### Deferral of Flooding Activities

As described in the ISR letter issued July 25, 2016 (ADAMS Accession No. ML16202A350), the flood-causing mechanisms considered to exceed the current design basis were LIP, streams and rivers, and PMSS. As part of the 50.54(f) response, the remaining submittal from FENOC was the FE. The purpose of the FE is to demonstrate the plant's ability to cope with the reevaluated hazards identified in the ISR letter, and to identify if further safety enhancements (beyond the sites current protection and mitigation capabilities) are needed.

Absent the submittal of the FE, the NRC staff evaluated the plant's current flood protection capabilities, the availability of mitigation strategies against the reevaluated hazards, and the impact that the reevaluated hazards may have on the SSCs that provide the three KSFs of

preventing damage to the fuel in the reactor, spent fuel pool, and to maintain the containment integrity.

With respect to PMSS, the total reevaluated hazard level listed in the ISR letter is 609.5 feet (ft.)<sup>1</sup>. The Perry site grade is located at 620 ft. As a result, the reevaluated PMSS hazard is well below the site grade and is not expected to impact the site based on the considerable margin.

With respect to streams and rivers, the reevaluated hazard levels listed in the ISR letter are 628.5 ft (Major Stream) and 619.7 ft. (Minor Stream). As stated in the MSA, the streams and rivers event is expected to cause flooding in the access road but minimal impact to the implementation of FLEX strategies given that the Powerblock area is not inundated and there is sufficient margin in the deployment and implementation of strategies to allow the 2.5 hours needed for the floodwaters to recede. In addition to the above, the NRC staff also notes that several key conservatisms were included as part of the analysis. For example, as described in Section 3.3.2 of the FHRR staff assessment, the following key assumptions were made in the models: a) the runoff infiltration loss was assumed to be zero, and b) Minor Stream Lockwood Road crossing and culvert at the outfall of the diversion channel are assumed to be completely blocked in the models. Therefore, it is reasonable to assume that there is considerable margin embedded within the analysis such that the Streams and Rivers flood-causing mechanism is not expected to impact SSCs or FLEX equipment that support KSFs. As a result of the above, no further analysis is needed for this flood hazard mechanism.

On May 3, 2018, the NRC staff transmitted its assessment of the adequacy of the licensee's mitigating strategies. Consistent with that evaluation, the licensee's mitigating strategies provide appropriate compensatory measures with respect to the reevaluated hazards of PMSS and streams and rivers to support deferral of the FE.

With respect to LIP, the reevaluated hazard levels listed in the ISR letter are 621.3 ft. at the Powerblock and 620.5 ft. North of Powerblock at the Service Water Pumphouse Building and the ESWPH Building. Waves and runup at both locations are minimal and are therefore negligible. The NRC staff agrees that it is reasonable to expect that current site flooding protection in the ESWPH (a building entry elevation of 620.5 ft.) will address the expected LIP levels of 620.5 ft. at the ESWPH. This determination was made because of the conservative assumptions that are inherently embedded in the reevaluated LIP analysis, the infrequent nature of the event, and the forecast predictions typically available for an event of this magnitude which allow for the staging of any protective strategies.

With regard to the reevaluated LIP event at the Powerblock, the NRC staff notes that the expected LIP level of 621.3 ft exceeds the Perry site grade at 620 ft. by approximately 1.3 ft. of water. During its review of the deferral request, the NRC staff identified the need for additional information with regard to the site response and plant capabilities available to address this flooding event.

By letter dated February 19, 2019 (ADAMS Accession No. ML19035A655), the NRC staff issued a request for additional information (RAI) that noted the potential impacts to the Powerblock, and the lack of remedial measures to address LIP, as described in the deferral letter. Specifically, the NRC staff sought to understand if there were any additional capabilities,

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<sup>1</sup> The NRC staff notes that all elevations are given relative to the National Geodetic Vertical Datum (NGVD) from 1929 (NGVD 29) unless stated otherwise.

temporary or permanent, that were readily available (or planned under the licensee commitment program) at the site that would potentially address the reevaluated LIP hazard until the planned permanent shutdown of Perry on May 31, 2021.

In its response to the RAI by letter dated March 20, 2019 (ADAMS Accession No. ML19080A005), FENOC stated that it will perform the following two actions, considered to be Regulatory Commitments, in order to address the RAI. The actions are:

- Re-perform the flooding analyses for the current site configuration and reevaluated LIP hazard in order to verify current water levels at locations of interest, and
- Once the LIP exceedances at SSCs that perform KSFs have been identified, temporary measures (such as flood barriers or sand bags) will be implemented at locations that allow gross in-leakage paths into Unit 1 or Unit 2 structures. Primary areas of concern include doors, gross openings in building exteriors (such as, penetrations below flood level), and miscellaneous yard equipment. Based on conditions at the specific location, the temporary measures may be pre-staged or stored barrier material and installed upon receipt of a meteorological event warning contained in current site operating instructions. These protective measures will be implemented by September 20, 2019.

The NRC staff considers the response adequate based on the planned analysis and identification of the availability of protective measures at the site that would allow SSCs to perform their intended KSFs. In its determination, the NRC staff also considered the infrequent nature of the reevaluated LIP hazard event, and the limited period of operation remaining for Perry.

#### 4. CONCLUSION

The NRC staff has completed its review of the December 7, 2018, deferral request letter for Perry. The staff has evaluated the licensee's request and considered the following factors in its evaluation:

- A flooding walkdown that verified the plant's configuration with the current flooding licensing basis; addressed degraded, nonconforming, or unanalyzed flooding conditions; and verified the adequacy of monitoring and maintenance programs for protective features has been completed. The licensee's walkdowns, as verified by staff inspection, identified no immediate safety concerns.
- Additional defense-in-depth has been achieved for coping with an extended loss of alternating current power and loss of normal access to the ultimate heat sink due to external events, including those caused by flooding events, as a result of Perry's compliance with Order EA-12-049, as described in Section 3 of this assessment.
- For reevaluated hazards other than LIP, FENOC has demonstrated the availability of effective site protection or addressed the hazard exceedances within their mitigating strategies for beyond-design-basis external events, and has implemented the necessary changes at the site that would reasonably ensure that the defense-in-depth capabilities are available, if needed.

- For LIP, the licensee has addressed the hazard exceedances using a combination of existing site flooding protection capabilities, or planned activities to enhance temporary flooding measures at certain locations at the site (tracked as Regulatory Commitments) that if appropriately implemented, are reasonably expected to provide defense in depth capabilities to those SSCs that provide KSFs.

The NRC staff expects that FENOC will maintain the commitment to have mitigating strategies against the beyond-design-basis external events at Perry until plant shutdown (expected to occur by May 31, 2021), as described in the RAI response letter; or until completion of the NRC staff's review of the FE if the plant does not shut down as anticipated.

In addition to the above, the NRC staff also considered the infrequent nature of the reevaluated hazard events, and the limited period of operation remaining for Perry. As a result, the NRC staff concludes that the licensee has provided sufficient information to ensure that public health and safety are maintained throughout the deferral period for Perry without the need for the completion of the FE review during that time. Furthermore, the NRC staff also concludes that FENOC's proposal to defer the remaining activities associated with the March 12, 2012, 50.54(f) letter is acceptable and are considered deferred until May 31, 2021.

If Perry does permanently cease operations on or before this date, and should FENOC determine that the remaining 50.54(f) letter activities are no longer necessary based on the shutdown conditions of the plant, the staff expects that FENOC would document such a request in a letter prior to May 31, 2021. Alternatively, if Perry does not permanently cease operations by May 31, 2021, the staff also expects that FENOC would document such a decision in a timely letter prior to this date accompanied by a completion schedule for the submittal of the FE, which is the final submittal as part of the 50.54(f) letter activities.



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 DATED: MAY 16, 2019

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