



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

October 4, 2017

Vice President, Operations  
Entergy Nuclear Operations, Inc.  
Indian Point Energy Center  
450 Broadway, GSB  
P.O. Box 249  
Buchanan, NY 10511-0249

**SUBJECT: INDIAN POINT NUCLEAR GENERATING UNIT NOS. 2 AND 3 – NRC  
RESPONSE TO REQUEST FOR DEFERRAL OF ACTIONS RELATED TO  
BEYOND-DESIGN-BASIS SEISMIC AND FLOODING HAZARD  
REEVALUATIONS**

Dear Sir or Madam:

The purpose of this letter is to provide the U.S. Nuclear Regulatory Commission (NRC) staff's response to the letters received from Entergy Nuclear Operations, Inc. (the licensee) on May 10, 2017, and July 24, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML17136A345, and ML17209A740, respectively). In these letters, the licensee requested deferral of actions related to post-Fukushima seismic and flooding hazard reevaluations until after the planned permanent shutdown of Indian Point Nuclear Generating Unit. Nos. 2 and 3 (IP2 and IP3) in 2020 and 2021, respectively.

The May 10, 2017, letter relates to commitments associated with post-Fukushima seismic hazard reevaluations and requests deferral of the completion dates of the seismic probabilistic risk assessments (SPRAs) and other actions associated with the seismic hazard reevaluations of IP2 and IP3 until August 1, 2020, and August 1, 2021, respectively. The July 24, 2017, letter relates to actions associated with post-Fukushima flooding reevaluations and requests deferral of the completion date for the flooding integrated assessment (IA) for both IP2 and IP3 until August 31, 2021. As described below, the NRC staff has determined that deferring these actions related to the seismic and flooding hazard reevaluations is acceptable and that the deferral poses no immediate safety concern.

#### **BACKGROUND**

By letter dated March 12, 2012, 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 (ADAMS Accession No. ML12053A340). Enclosures 1 and 2 of the 50.54(f) letter requested that licensees perform seismic and flooding hazard reevaluations using present-day methodologies and guidance, and then assess the impact of the reevaluated hazard on the plant (e.g., through an SPRA or a flooding IA). The NRC staff would then review the completed responses to these assessments to determine whether there is a need for any additional regulatory actions, such as a plant-specific backfit.

Concurrent with the reevaluation of seismic and 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 seismic and flood hazard or the most recent seismic and flood hazard information, which may not be based on present-day methodologies and guidance, in developing their mitigation strategies.

The licensee's requested seismic and flooding deferrals are based, in part, on the limited remaining operational period for IP2 and IP3.<sup>1</sup> By letter dated February 8, 2017 (ADAMS Accession No. ML17044A004), the licensee informed the NRC of its intention to shut down IP2 by April 30, 2020, and IP3 by April 30, 2021, subject to potential operating extensions unrelated to the NRC regulations through, but not beyond, 2024 and 2025, under very limited circumstances.

### *Seismic Deferral*

By letter dated October 27, 2015 (ADAMS Accession No. ML15194A015), the NRC made a determination of which licensees were to perform: (1) an SPRA; (2) limited scope evaluations; or (3) no further actions based on a comparison of the reevaluated seismic hazard and the site's design-basis earthquake. As documented in that letter, IP2 and IP3 are expected to complete SPRAs, which will also assess high frequency ground motion effects, and limited-scope evaluations for the spent fuel pools (SFPs). The SPRAs were expected to be submitted to the NRC for IP2 and IP3 by June 30, 2017, and June 30, 2018, respectively. The SFP evaluations were expected to be submitted by December 31, 2017. The SPRA results are used to develop the seismic Mitigation Strategies Assessments (MSAs) for each unit. All licensees submitting an SPRA in 2017, such as IP2, are expected to submit their seismic MSA by December 31, 2017. After 2017, all licensees, such as IP3, are expected to submit their seismic MSA to the NRC at the same time they submit their SPRA.

In its May 10, 2017, letter, the licensee requested deferral of the completion dates for the IP2 and IP3 SPRAs and associated commitments to August 1, 2020, for IP2 and August 1, 2021, for IP3. The letter also asserts that the SFP evaluations are not warranted given the February 8, 2017, letter notifying the NRC of the planned permanent cessation of power operations. In the May 2017 letter, the licensee informed the NRC that it had completed the IP2 SPRA, and that the evaluation was available at the site for NRC staff to evaluate or inspect if desired. The licensee also noted that the SPRA for IP3, while not completed, was progressing in a manner similar to the IP2 SPRA and would be expected to have similar results.

As discussed in Enclosure 1, the NRC staff audited the results and selected documents associated with the IP2 SPRA as a portion of the technical basis that supports the deferral. The NRC staff observed that the IP2 SPRA was peer reviewed in accordance with Nuclear Energy Institute (NEI) guidance document NEI 12-13, "External Hazards PRA Peer Review Process Guidelines" against the requirements of Section 5 of American Society of Mechanical Engineers (ASME)/American Nuclear Society (ANS) RA-Sb-2013, "Addenda to ASME/ANS RA-S-2008 Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear

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<sup>1</sup> In this letter, the NRC staff uses the phrase "limited remaining operational period" to describe the potential future operating period of IP2 and IP3. The two units are currently operating under the NRC's timely renewal regulation, 10 CFR 2.109. Under that regulation, if a licensee submits a sufficient application for renewal at least five years before expiration of its current license, the request is considered "timely" and the facility is allowed to continue to operate under its existing license until the NRC completes its review and reaches a decision on the license renewal request. Under the currently submitted license renewal application, if approved, the renewed license of IP2 and IP3 would not extend beyond 2024 and 2025, respectively.

Power Plant Applications.” The NRC staff audited the findings from the peer review along with the SPRA results. The NRC staff also audited the evaluations that had been prepared for IP3 and the licensee’s comparisons of the two units. The NRC staff used this information, along with the latest NRC Standardized Plant Analysis Risk (SPAR) model, which has been modified to incorporate the reevaluated seismic hazard, to glean additional risk insights as discussed in Enclosure 1.

### *Flooding Deferral*

As part of the flooding hazard reevaluation process, the licensee is expected to complete a flooding IA by December 31, 2018. In its July 24, 2017, letter, the licensee requested deferral of this assessment until August 31, 2021, for both IP2 and IP3.

### EVALUATION

The staff’s evaluation of the licensee’s request and commitment changes for the seismic and flooding reevaluations is contained in Enclosures 1 and 2, respectively. As described in the enclosures, the staff considered the following factors in its evaluations:

- IP2 and IP3 have achieved additional defense in depth 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 seismic and flooding events, as a result of the licensee’s compliance with Orders EA-12-049 and EA-12-051, “Reliable Spent Fuel Pool Instrumentation” (ADAMS Accession No. ML12056A044). The NRC will verify through inspection in Fall 2017 that the mitigation strategies have been appropriately implemented at IP2 and IP3. Any issues identified during the inspection will be processed in accordance with the Enforcement Policy and applicable Reactor Oversight Process procedures, appropriately documented, and provided to the licensee for corrective action.
- For the deferral of the seismic evaluations, the staff considered: (1) the results and pertinent risk insights of the current IP2 SPRA and the IP3 SPAR model; (2) the seismic design margin existing in nuclear power plants; (3) the documented ability of IP2 and IP3, specifically, to cope with earthquakes larger than their design-basis earthquakes; (4) the limited time frame for continued operations at IP2 and IP3; and (5) information regarding the seismic capacity of SFPs.
- For the IA deferral request, the staff reviewed the licensee submittals which indicated that the impact to the site from the reevaluated flooding hazards is within the site’s ability to cope with the hazards.
- Considering both the flooding and seismic coping capabilities and the available seismic risk insights, the information does not indicate any concern regarding adequate protection of public health and safety for either IP2 or IP3 due to the reevaluated seismic and flooding hazard. Furthermore, based on the information developed to date, the staff did not identify any substantial safety improvements that would be cost-justified to implement during the period of deferral.
- If the licensee decides to continue to operate the units beyond 2020 and 2021, respectively, the licensee would need to provide the SPRAs and the SFP assessments associated with the seismic hazard reevaluations at IP2 and IP3 by August 1, 2020, and August 1, 2021,

respectively. The seismic MSAs associated with the seismic hazard reevaluations at IP2 and IP3 would need to be provided by August 1, 2020, and August 1, 2021, respectively.<sup>2</sup> In addition, the licensee would need to provide the flooding IA for IP2 and IP3 by August 31, 2021.

The underlying purpose of the 50.54(f) letter is to gain information in order to enable the NRC to determine whether the IP2 or IP3 licenses should be modified, suspended, or revoked. The licensee has provided sufficient information, consistent with the intent of the 50.54(f) letter, to justify continued safe operation without undue risk to public health and safety during the limited period of deferral. Furthermore, based on IP2 and IP3's ability to cope with the reevaluated flood hazards and the demonstrated low seismic risk from the reevaluated hazard, the NRC staff does not anticipate that additional regulatory commitments or backfits would result in a cost-justified substantial safety enhancement before the scheduled shutdown of IP2 and IP3 (i.e., before 2020 or 2021). The staff has not identified any changes that have not yet been implemented but that would be expected to meet the NRC's criteria for imposing such changes through the backfit process. In the unlikely event that the completion of the analyses proposing to be deferred would yield information leading to a substantial safety enhancement, there would likely be insufficient time to implement the modification before the plant would shut down. The remaining external hazard reevaluation work (including NRC review) would have to be completed, and any necessary changes would have to be designed, approved, and scheduled for installation.

The staff notes that in SECY-16-0142, "Draft Final Rule—Mitigation of Beyond-Design-Basis Events," dated December 15, 2016 (ADAMS Accession No. ML16301A005), the staff proposed a requirement that licensees for operating nuclear power plants address the reevaluated seismic and flood hazards, which are considered beyond-design-basis events, within their mitigating strategies. The proposed implementation date of the MBDBE rule for pressurized water reactors like IP2 and IP3 is 2 years after the Commission approves the rule. Should the Commission decide to issue the MBDBE rule, the licensee would need to comply with any applicable requirements or seek an appropriate exemption.

Licensees are submitting seismic and flooding MSAs for staff review to demonstrate how they intend to comply with the MBDBE rule, should it come into effect. As discussed in Enclosure 2 of this document, the licensee provided its flooding MSA in a letter dated October 27, 2016 (ADAMS Accession No. ML16305A331). The staff's assessment of the flooding MSA can be found in a letter dated April 10, 2017 (ADAMS Accession No. ML17059C227). If the rule is issued, the licensee will have to comply by demonstrating that the mitigation strategies or an alternate mitigation strategy will also be effective against the reevaluated seismic hazard. If the licensee cannot demonstrate compliance with this proposed requirement by the implementation date (typically done via MSA submittal), the licensee will either have to provide a schedule relaxation request associated with the reevaluated seismic hazard in accordance with proposed rule Section 50.155(b)(2), if applicable, or submit an exemption request for the MBDBE rule.

## CONCLUSION

Based on the staff's evaluations in Enclosure 1 and 2, and after consultation with the Acting Director of the NRC's Office of Nuclear Reactor Regulation, the NRC is granting the licensee's request to defer the remaining activities related to the 50.54(f) letter request for information for

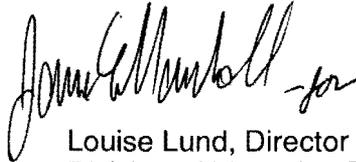
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<sup>2</sup> As discussed below, the Commission is considering a Mitigation of Beyond-Design-Basis Event (MBDBE) rulemaking. Should the Commission decide to issue the MBDBE rule, the licensee would need to comply with any applicable requirements or seek an appropriate exemption. This could include a requirement to provide the seismic MSAs prior to the scheduled shutdown of IP2 and IP3. Licensees are responsible for complying with any subsequently issued rules or seeking an appropriate exemption.

seismic and flooding events. Accordingly, the SPRA completions, and the SFP assessments associated with the seismic hazard reevaluations at IP2 and IP3 are deferred until August 1, 2020, and August 1, 2021, respectively. The seismic MSAs associated with the seismic hazard reevaluations at IP2 and IP3 are deferred until August 1, 2020, and August 1, 2021, respectively. In addition, the response date for the flooding IA for IP2 and IP3 is deferred until August 31, 2021. Licensees are responsible for complying with any subsequently issued rules or seeking an appropriate exemption.

If you have any questions, please contact Brett Titus, Senior Project Manager, at (301) 415-3075 or via e-mail at [Brett.Titus@nrc.gov](mailto:Brett.Titus@nrc.gov).

Sincerely,

A handwritten signature in black ink, appearing to read "Louise Lund" with a stylized flourish at the end.

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

Docket Nos. 50-247 and 50-286

Enclosures:

1. Evaluation of Entergy's Seismic Deferral Request for Indian Point Nuclear Generating Unit Nos. 2 and 3
2. Evaluation of Entergy's Flooding Deferral Request for Indian Point Nuclear Generating Unit Nos. 2 and 3

cc: Distribution via Listserv

Evaluation of Entergy's Seismic Deferral Request for  
Indian Point Nuclear Generating Unit Nos. 2 and 3

By letter dated May 10, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17136A345), Entergy Nuclear Operations, Inc. (Entergy, the licensee) requested deferral of actions related to commitments associated with post-Fukushima seismic hazard reevaluations for Indian Point Nuclear Generating Unit Nos. 2 and 3 (IP2 and IP3, Indian Point) until after the planned permanent shutdown of these units. The licensee requested deferral of the completion dates of the seismic probabilistic risk assessments (SPRAs) and other actions associated with the seismic hazard reevaluations for IP2 and IP3 until August 1, 2020, and August 1, 2021, respectively. The licensee's deferral request is based on the limited remaining operational period<sup>1</sup> for the plants and the existing capabilities to address beyond-design-basis events. The staff's evaluation of the licensee's request is below.

BACKGROUND

By letter dated March 12, 2012, the NRC issued a request for information under Title 10 of the Code of Federal Regulations, Section 50.54(f) (ADAMS Accession No. ML12053A340), (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. The 50.54(f) letter includes information requests related to the NRC's Near-Term Task Force report, "Near-Term Task Force Recommendations for Enhancing Reactor Safety in the 21st Century," issued July 12, 2011 (ADAMS Accession No. ML111861807). Enclosure 1 of the 50.54(f) letter requested that licensees perform seismic hazard reevaluations using present-day methodologies and guidance. Licensees would use the new hazard information to determine the need for, and scope of, plant specific assessments of the response to the reevaluated seismic hazards. The NRC staff would review the completed responses to these assessments to determine if there was a need for any additional regulatory actions, such as plant-specific backfits. The process for this regulatory review is described in a memorandum dated September 21, 2016 (ADAMS Accession No. ML16237A103).

By letter dated October 27, 2015 (ADAMS Accession No. ML15194A015), the NRC documented its final screening results and informed licensees of the remaining seismic evaluations to be performed. Based on that letter, IP2 and IP3 were scheduled to perform and submit by June 30, 2017, and June 30, 2018, respectively, SPRAs. A limited-scope seismic evaluation of the spent fuel pool (SFP) was due on December 31, 2017.

Concurrent with the reevaluation of the seismic 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). The reevaluated hazard information identified

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<sup>1</sup> In this letter, the NRC staff uses the phrase "limited remaining operational period" to describe the potential future operating period of IP2 and IP3. The two units are currently operating under the NRC's timely renewal regulation, 10 CFR 2.109. Under that regulation, if a licensee submits a sufficient application for renewal at least five years before expiration of its current license, the request is considered "timely" and the facility is allowed to continue to operate under its existing license until the NRC completes its review and reaches a decision on the license renewal request. Under the currently submitted license renewal application, if approved, the renewed license of IP2 and IP3 would not extend beyond 2024 and 2025, respectively. By letter dated February 8, 2017 (ADAMS Accession No. ML17044A004), the licensee informed the NRC of its intention to shut down IP2 by April 30, 2020, and IP3 by April 30, 2021, subject to potential operating extensions unrelated to the NRC regulations through, but not beyond, 2024 and 2025, under very limited circumstances.

in response to the 50.54(f) letter is used by licensees to ensure their mitigating strategies for beyond-design-basis events are capable of addressing the reevaluated hazard information (these assessments are referred to as “mitigating strategies assessments” or “MSAs”) in addition to being used to assess the need for plant-specific backfits. For IP2 and IP3, the SPRA results would be used to develop the seismic MSAs.

## EVALUATION

The staff’s evaluation of the licensee’s request for deferral of activities and commitments associated with the seismic reevaluations considered several factors including: (1) the results and pertinent risk insights of the current IP2 SPRA and the NRC staff’s Standardized Plant Analysis Risk (SPAR) model of IP3; (2) the additional defense-in-depth capabilities achieved through Order EA-12-049 and Order EA-12-051, “Reliable Spent Fuel Pool Instrumentation;” (3) the seismic design margin existing in nuclear power plants; (4) the documented ability of IP2 and IP3, specifically, to cope with earthquakes larger than their design-basis earthquakes; (5) the remaining operational lifetime of IP2 and IP3; and (6) information regarding the seismic capacity of the SFPs. Below is a brief description of each consideration.

### Seismic Probabilistic Risk Assessments

#### *Previous SPRAs*

Both IP2 and IP3 are Westinghouse four-loop pressurized water reactors (PWRs) with dry, ambient pressure containments that were initially licensed in 1973 and 1975, respectively. However, due to the number and significance of design and operational differences, probabilistic risk assessments have historically been performed for each unit individually in both the licensee and NRC models, and, therefore, the licensee determined that it was appropriate to develop a separate SPRA for each unit.

The SPRAs developed following the 50.54(f) letter and seismic hazard reevaluation were not the first seismic risk assessments conducted for IP2 and IP3. In 1998, the licensee performed a SPRA as part of the individual plant examination of external events (IPEEE). The licensee subsequently made changes to the plant to reduce the overall risk. For example, one of the main contributors to the IP2 seismic core damage frequency involved interactions between the decommissioned Indian Point Unit 1 (IP1) superheater stack and the IP2 control building. The licensee reduced the height of the IP1 superheater stack after the IPEEE SPRA was prepared. The failure of this stack during a seismic event is no longer a main contributor to the IP2 seismic core damage frequency. While it is difficult to fully compare the 1998 IPEEE analysis to the SPRA developed in response to the seismic hazard reevaluation, a significant reduction in risk resulted from the reduction in height of the IP1 superheater stack.

#### *SPRAs Considering Reevaluated Hazard*

By letter dated July 6, 2017 (ADAMS Accession No. ML17177A446), the NRC entered into the audit process described in Office Instruction LIC-111, “Regulatory Audits”, dated December 29, 2008 (ADAMS Accession No. ML082900195), to assist in the timely and efficient closure of activities associated with the March 12, 2012, request for information associated with reevaluation of the seismic hazard at nuclear power plants pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.54(f) (ADAMS Accession No. ML12053A340). Entergy’s IP2 and IP3 were included in the list of applicable licensees. The staff exercised the audit process through both an electronic reading room and a site visit that took place on August 29 and 30, 2017.

Prior to the decision to commit to a permanent plant shutdown, Entergy had developed an SPRA for IP2. However, following the shutdown decision, Entergy requested a deferral of the formal submittal date and made the SPRA in its current state of completion available to the staff at the site. During the audit, the staff reviewed the risk insights of the IP2 SPRA because those risk insights serve as a large portion of the licensee's technical basis for safe operation during the period of deferral. The staff observed that the IP2 SPRA was peer reviewed in accordance with Nuclear Energy Institute (NEI) 12-13, "External Hazards PRA Peer Review Process Guidelines" against the requirements of Section 5 of American Society of Mechanical Engineers (ASME)/American Nuclear Society (ANS) RA-Sb-2013, "Addenda to ASME/ANS RA-S-2008 Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications." The licensee dispositioned the findings of the peer review team and described the disposition to the staff during the audit.

The licensee stated that each finding either: resulted in a change to the model; supported a conservative analysis; or was not important to the SPRA's quantitative results (i.e., a documentation issue). The staff audited these dispositions as part of its consideration of the overall deferral request, and the staff did not note any issues that would change the response to the deferral request.

The licensee partially completed an SPRA of IP3 and presented information comparing both units at the site. The staff audited this information in combination with historical information about both units and the latest published NRC SPAR model, modified to incorporate the reevaluated seismic hazard, to glean risk insights.

#### *Assessment of SPRA Results and Risk Insights and Consideration of Adequate Protection*

The staff concluded that the current SPRA for IP2 appears to be sufficiently developed and provides risk insights supporting continued safe operation during the requested period of deferral. The IP3 SPRA, in its current state of completion, provided some safety insights for the staff to consider; however, the staff conducted additional analysis to supplement the licensee's justification for deferring completion of the SPRA. Neither of these sources of information revealed issues that would call into question the adequate protection of public health and safety. The staff noted that the Seismic Core Damage Frequency (SCDF) estimates for both units, when combined with current estimates from other hazards to develop the total CDF, are consistent with the Commission's Safety Goal Policy Statement.

#### *Additional Mitigation Equipment and Strategies*

The staff also considered the additional defense in depth that 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 seismic and flooding events, as a result of IP2's and IP3's compliance with Orders EA-12-049 and EA-12-051. The NRC staff issued a joint safety evaluation regarding implementation of these mitigating strategies and the reliable SFP instrumentation on March 27, 2017 (ADAMS Accession No. ML17065A171). The safety evaluation concluded that the licensee has developed guidance and proposed designs that if implemented appropriately adequately address the requirements of the Orders. The NRC will verify through inspection in Fall 2017 that the mitigation strategies have been appropriately implemented at IP2 and IP3. The completion of this work results in a safety benefit and an enhanced ability to mitigate beyond-design-basis events during the period of deferment.

In addition to the safety benefits achieved by compliance with Orders EA-12-049 and EA-12-051, IP2 and IP3 are also required to comply with the requirements of 10 CFR 50.54(hh)(2). Per this requirement, IP2 and IP3 are required to implement guidance and strategies intended to maintain or restore core cooling, containment, and SFP cooling

capabilities under the circumstances associated with loss of large areas of the plant due to explosions or fire. At IP2 and IP3, the 50.54(hh)(2) equipment is stored in different locations than the equipment used to demonstrate compliance with Order EA-12-049. Therefore, the 50.54(hh)(2) equipment represents an additional beyond-design-basis capability from that provided by the equipment associated with Order EA-12-049.

### *Seismic Design Margin*

Information regarding the seismic design margin in nuclear plants, including NRC and industry studies summarized in the NRC's May 9, 2014, letter (ADAMS Accession No. ML14111A147), outlines a number of reasons for continued operation while seismic reevaluations are performed. These reasons include a safety margin in the design such that plants can withstand potential earthquakes exceeding the original design-basis and that the fleet-wide seismic core damage risk as a result of the reevaluated hazard did not pose a concern regarding adequate protection of public health and safety.

The ability of IP2 and IP3, specifically, to cope with earthquakes larger than their design-basis earthquakes is documented in the Expedited Seismic Evaluation Process (ESEP) report submittals and additional clarifying information dated December 22, 2014 (ADAMS Accession No. ML15008A086), June 25, 2015 (ADAMS Accession No. ML15182A249), and April 21, 2015 (ADAMS Accession No. ML15118A570). The staff's assessment can be found in the letter dated September 15, 2015 (ADAMS Accession No. ML15232A667). The staff's assessment concluded that the licensee demonstrated that a set of mitigation strategies equipment, which could be used to maintain or restore core cooling and containment function, has additional safety margin such that this equipment can cope with an earthquake two times the design-basis earthquakes of IP2 and IP3.

### *Consideration of Potential Cost-Justified Substantial Safety Enhancements*

The underlying purpose of the 50.54(f) letter is to gain information in order to enable the NRC to determine whether the IP2 or IP3 licenses should be modified, suspended, or revoked. As documented in its letter dated February 8, 2017 (ADAMS Accession No. ML17044A004), the licensee has notified the NRC that IP2 and IP3 are to permanently cease power operations by April 30, 2020, and April 30, 2021, respectively. Based on the staff's audit of the current IP2 SPRA, the IP3 SPRA in its current state of completeness, and the staff's evaluation using the IP3 SPAR model, the staff did not identify any cost-justified substantial safety enhancements.

Specifically, in the aforementioned ESEP report, the licensee identified two potential modifications for IP2 and two potential modifications for IP3. The IP2 modifications were intended to improve the seismic capacity of the refueling water storage tank (RWST) and a fire water storage tank (FWST). The IP3 modifications were intended to improve the seismic capacity of two FWSTs. Subsequently, Entergy submitted a letter dated March 31, 2016 (ADAMS Accession No. ML16096A353), which notified the NRC that these modification commitments were being canceled, and that the risk insights from the SPRA results would be used to determine what modifications, if any were required, would provide the best safety improvement.

During the audit, the staff inquired as to the risk insights of the SPRAs concerning the modifications which were identified during the ESEP effort. The licensee provided information demonstrating that the IP2 RWST had a limited contribution (less than 5 percent) to the plant's SCDF. Furthermore, the licensee stated that the three FWSTs in question are not necessary for plant safe shutdown. The licensee also stated that, in the event that these preferred water sources were unavailable due to the beyond-design-basis event, they would use the site's ultimate heat sink, the Hudson River, as a water source to employ mitigating strategies.

The licensee did not view these modifications to be cost-beneficial to implement as a result of these insights. Furthermore, the staff considers these modifications not to be likely to provide a substantial safety enhancement for IP2 and IP3 such that they would be imposed as requirements.

In addition to the risk insights and the existing seismic coping capabilities of the plant, the NRC staff also considered whether potential modifications that may be identified by the analyses could be reasonably implemented during the limited potential for additional operations at IP2 and IP3. Based on the staff's audit of the current IP2 SPRA, and the IP3 SPRA in its current state of completeness as complemented by the staff's evaluation using the IP3 SPAR model, the risk insights do not indicate any concern regarding adequate protection of public health and safety for either IP2 or IP3 due to the reevaluated seismic hazard. Furthermore, the staff did not identify any cost-justified, substantial safety enhancements based on the available information. The NRC staff estimates that its review and determination of whether the license for IP3 should be modified, suspended, or revoked would take 6 to 9 months (e.g., by early 2019 for IP3). Assuming that any changes were identified that would result in a substantial safety enhancement, these results would then likely be communicated to the licensee in the first quarter of 2019. Additional time would then be needed to design, approve, and install these potential modifications. Major plant modifications of the sort that would be expected to provide a substantial safety enhancement would typically be expected to take up to two years to implement. In other words, any meaningful further improvement to safety would not be achieved prior to the current schedule for permanently defueling the plant.

#### *Potential Rule Compliance*

The staff notes that in SECY-16-0142, "Draft Final Rule—Mitigation of Beyond-Design-Basis Events," dated December 15, 2016 (ADAMS Accession No. ML16301A005), the staff proposed a requirement that licensees for operating nuclear power plants address the reevaluated seismic and flood hazards, which are considered beyond-design-basis events, within their mitigating strategies. The proposed implementation date of the MBDBE rule for pressurized water reactors like IP2 and IP3 is 2 years after the Commission approves the rule. Should the Commission decide to issue the MBDBE rule, the licensee would need to comply with any applicable requirements or seek an appropriate exemption.

Licensees are submitting seismic MSAs for staff review to demonstrate how they intend to comply with the MBDBE rule, should it come into effect. If the rule is issued, the licensee will have to comply by demonstrating that the mitigation strategies will also work against the reevaluated seismic hazard. If the licensee cannot demonstrate compliance with this proposed requirement by the implementation date (typically done via MSA submittal), the licensee will either have to provide a schedule relaxation request associated with the reevaluated seismic hazard in accordance with proposed rule Section 50.155(b)(2), if applicable, or submit an exemption request for the MBDBE rule.

#### Spent Fuel Pools

The licensee's May 10, 2017, deferral request letter also contained a section associated with delaying the performance of IP2 and IP3's seismic evaluations of the SFPs specified in the NRC's letter dated October 27, 2015.

Guidance document NEI 12-06, Revision 4, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide" (ADAMS Accession No. ML16354B421), describes methods for complying with NRC's Order EA-12-049. Table D-3, "Summary of Performance Attributes for SFP Cooling Functions," contains a provision for "...plants that have SFPs that are below ground and cannot be drained as determined during the implementation of B.5.b/10 CFR

50.54(hh)(2).” IP2 meets the requirements of this provision. Because IP2’s SFP has been found to meet the provision, the only postulated loss of SFP water inventory following a seismic event would be due to initial sloshing and decay heat boil-off. The mitigating strategies implemented at IP2 as part of Order EA-12-049 include capabilities beyond the installed plant systems to add cooling water to the SFP. The licensee has also installed additional SFP level instrumentation as required by NRC Order EA-12-051. These measures have improved the licensee’s ability to address a loss of SFP cooling resulting from either a loss of electrical power or a loss of water inventory from the pool. As described above in the section on “Additional Mitigation Equipment and Strategies,” at IP2, the 50.54(hh)(2) equipment is stored in a different location than the equipment used to demonstrate compliance with Order EA-12-049. Therefore, the 50.54(hh)(2) equipment represents an additional beyond-design-basis capability from that provided by the equipment associated with Order EA-12-049. For these reasons, the staff agrees that a seismic evaluation of the IP2 SFP can be deferred until August 1, 2020, without undue risk to public health and safety.

The IP3 SFP does not meet the aforementioned provision related to B.5.b/10 CFR 50.44(hh)(2). During the audit process, the licensee provided information regarding the design of the IP3 fuel handling building. The licensee stated that the fuel handling building structure is anchored directly to hard rock and constructed such that there is no further amplification of the ground motion above the foundation. As shown in the staff’s assessment of the IP3 reevaluated seismic hazard (ADAMS Accession No. ML15096A340), below 20 Hertz (Hz) (which is the frequency region of interest for the IP3 SFP), the spectral acceleration of the reevaluated seismic hazard does not exceed 0.8g. Additionally, the IP3 Final Safety Analysis Report (FSAR) states that the Spent Fuel Pool is a Class I structure that is designed to remain functional following a safe shutdown earthquake. The safe shutdown earthquake at IP3 has a maximum ground acceleration of 0.15g.

By letter dated February 28, 2017 (ADAMS Accession No. ML17034A408), the NRC endorsed the Electric Power Research Institute’s (EPRI’s) Report 3002009564, “Seismic Evaluation Guidance: Spent Fuel Pool Integrity Evaluation” (ADAMS Accession No. ML17031A176). This report provided guidance for conducting seismic evaluations of SFPs. The methodology of the EPRI report credits screening criteria and seismic capacity calculations based on the accepted methods of assessing seismic capacity shown in EPRI NP-6041<sup>2</sup>. The EPRI 6041 report forms the basis for the EPRI 3002009564 document’s conclusion that SFPs that were designed to a safe shutdown earthquake with a peak ground acceleration of at least 0.1g have a high confidence of a seismic capacity that exceeds 0.8g.

During the audit process, the licensee stated that the SFP does not have any intermediate floor or wall supports and that the geometry configurations meet the requirements of Section 4 of the EPRI 3002009564 guidance document. Furthermore, the licensee stated that the non-structural considerations of EPRI 3002009564 are also met as all locations of piping are well above the spent fuel and anti-siphoning measures are in place. As such, the only postulated loss of SFP water inventory following a seismic event would be due to initial sloshing and decay heat boil-off. Similar to IP2 as described above, the mitigating strategies implemented at IP3 as part of Order EA-12-049 include capabilities to add cooling water to the SFP. The licensee has also installed additional SFP level instrumentation as required by NRC Order EA-12-051. The IP3 50.54(hh)(2) equipment is also stored in a different location than the mitigation strategies equipment; therefore, the 50.54(hh)(2) equipment represents an additional beyond-design-basis capability from that provided by the equipment associated with Order EA-12-049.

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<sup>2</sup> A Methodology for Assessment of Nuclear Plant Seismic Margin, Revision 1. EPRI, Palo Alto, CA: 1991. NP-6041-SL.

The underlying purpose of the 50.54(f) letter is to gain information in order to enable the NRC to determine whether the IP2 or IP3 licenses should be modified, suspended, or revoked. The staff has concluded that deferral of the seismic evaluation of the IP3 SFP until August 1, 2021, poses no undue risk to public health and safety and adequate protection is maintained. This conclusion is based on the magnitude of the reevaluated seismic hazard in the frequency range of interest, the design basis earthquake for the IP3 SFP being at least 0.1g, the information the licensee provided regarding other areas of conformance with the EPRI 3002009564 document, and the diverse equipment that would be available to provide water to the SFP in the unlikely occurrence of a beyond-design-basis seismic event.

### AUDIT REPORT

The July 6, 2017, generic audit plan describes the NRC staff's intention to issue an audit report that summarizes and documents the NRC's regulatory audit of licensee's submittals associated with reevaluated seismic hazard analyses. The NRC staff's IP2 and IP3 audit was limited to the review of the information above. Because this staff assessment appropriately summarizes the results of the audit, the NRC staff concludes a separate audit report is not necessary, and that this document serves as the audit report described in the July 6, 2017, letter.

### CONCLUSION

In summary, the licensee's deferral request has a technical basis that is supported by the results of the IP2 and IP3 SPRAs in their respective states of completeness and complemented by the staff's SPAR model analysis. Compliance with NRC Orders EA-12-049 and EA-12-051 has provided a safety benefit and an enhanced ability to mitigate beyond-design-basis events during the period of deferment. The seismic capacity inherent in the design of nuclear power plants, and the site-specific evaluation of the seismic capacity of safe-shutdown equipment as documented by the ESEP provides additional assurance that IP2 and IP3 can cope with an earthquake larger than the design-basis earthquake during the period of deferral. A similar conclusion was made for all plants that are developing SPRAs to support continued operation during the period of development. Approval of the licensee's deferral request extends this period of operation.

The IP2 SFP meets the provision accepted by the NRC for a pool which cannot be drained, and the licensee provided information consistent with the guidance of EPRI 3002009564 for the IP3 SFP that gives a high confidence of its seismic capacity during the period of deferral. For these reasons, the staff finds that deferment of the SPRA completions, and the SFP assessments associated with the seismic hazard reevaluations at IP2 and IP3 until August 1, 2020, and August 1, 2021, respectively, is acceptable and does not pose undue risk to public health and safety. In addition, the staff finds the deferment of the seismic MSA associated with the seismic hazard reevaluations at IP2 and IP3 until August 1, 2020, and August 1, 2021, respectively to be acceptable and does not pose undue risk to public health and safety.

Licensees are responsible for complying with any subsequently issued rules or seeking an appropriate exemption.

## **Evaluation of Entergy's Flooding Deferral Request for Indian Point Nuclear Generating Unit Nos. 2 and 3**

By letter dated July 24, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17209A740), Entergy Nuclear Operations, Inc. (Entergy, the licensee) requested deferral of actions related to commitments associated with post-Fukushima flooding hazard reevaluations for Indian Point Nuclear Generating Unit Nos. 2 and 3 (IP2 and IP3, Indian Point) until after the planned permanent shutdown of these units. The licensee requested deferral of the completion dates of the flooding integrated assessment (IA) for both IP2 and IP3 until August 31, 2021. The licensee's deferral request is based on the limited remaining operational period<sup>1</sup> for the plants and the existing capabilities to address beyond-design-basis events. The staff's evaluation of the licensee's request is below.

### **BACKGROUND**

By letter dated March 12, 2012, the NRC issued a request for information under Title 10 of the *Code of Federal Regulations*, Section 50.54(f) (ADAMS Accession No. ML12053A340), (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. The 50.54(f) letter includes information requests related to the NRC's Near-Term Task Force report, "Near-Term Task Force Recommendations for Enhancing Reactor Safety in the 21st Century," issued July 12, 2011 (ADAMS Accession No. ML111861807). Enclosure 2 of the 50.54(f) letter requests that licensees perform flooding hazard reevaluations using present-day methodologies and guidance. Licensees would use the new hazard information to determine the need for, and scope of, plant specific assessments of the response to the reevaluated flooding hazards.

By letter dated September 1, 2015 (ADAMS Accession No. ML15174A257), the NRC informed power reactor licensees of changes in the NRC's approach to flood hazard reevaluations, and the coordination of activities related to the flooding hazard reevaluations and mitigating strategies. In this letter, the NRC described the primary elements of the revised plan, which include the need to address the reevaluated flood hazards within their mitigating strategies by performing a MSA,<sup>2</sup> and a graded approach to determine the need for, and scope of, plant-specific integrated assessments. The September 1, 2015, letter also included a discussion of the anticipated timetables for completion of flooding activities. For those plants where a focused evaluation (FE) is needed they are anticipated to be complete by mid-2017 and for those plants warranting development of an IA they are expected to be completed by December 2018. The

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<sup>1</sup> In this letter, the NRC staff uses the phrase "limited remaining operational period" to describe the potential future operating period of IP2 and IP3. The two units are currently operating under the NRC's timely renewal regulation, 10 CFR 2.109. Under that regulation, if a licensee submits a sufficient application for renewal at least five years before expiration of its current license, the request is considered "timely" and the facility is allowed to continue to operate under its existing license until the NRC completes its review and reaches a decision on the license renewal request. Under the currently submitted license renewal application, if approved, the renewed license of IP2 and IP3 would not extend beyond 2024 and 2025, respectively. By letter dated February 8, 2017 (ADAMS Accession No. ML17044A004), the licensee informed the NRC of its intention to shut down IP2 by April 30, 2020, and IP3 by April 30, 2021, subject to potential operating extensions unrelated to the NRC regulations through, but not beyond, 2024 and 2025, under very limited circumstances.

<sup>2</sup> The expectation that licensee for operating nuclear power plants address the reevaluated flood hazard within their mitigating strategies is reflected in SECY-16-0142, "Draft Final Rule—Mitigation of Beyond-Design Basis Events," dated December 15, 2016 (ADAMS Accession No. ML16301A005).

NRC staff will review the completed responses to these assessments to determine if there is a need for any additional regulatory actions, such as plant-specific backfits. This regulatory review process is described in a memorandum dated September 21, 2016 (ADAMS Accession No. ML16237A103).

An IA's overall goal is to demonstrate that for scenarios with consequential flooding with high frequencies of occurrence, the licensee has an effective flood strategy. For scenarios with lower frequencies, the goal is to demonstrate that a feasible response strategy is available to mitigate the effects of extreme flood conditions. The NRC staff will review the results of the IA to determine if licensees can address plant vulnerabilities (if any identified) appropriately or if a plant-specific backfit is required in accordance with MD 8.4, "Management of Facility Specific Backfitting and Information Collection," dated October 9, 2013. The NRC staff could identify these backfits over and beyond those mentioned in the draft MBDDBE rule found in SECY-16-0142.

Nuclear Energy Institute (NEI) 16-05, Revision 1, "External Flooding Assessment Guidelines" (ADAMS Accession No. ML16165A178), has been endorsed by the NRC as an appropriate methodology for licensees to perform the FE or IA in response to the 50.54(f) letter. The NRC's endorsement of NEI 16-05, including exceptions, clarifications, and additions, is described in NRC JLD-ISG-2016-01, "Guidance for Activities Related to Near-Term Task Force Recommendation 2.1, Flood Hazard Reevaluation" (ADAMS Accession No. ML16162A301).

#### Previous Staff Evaluations of Indian Point Associated with Flood Hazards

##### *Flood Hazard Reevaluation Report*

In response to the 50.54(f) letter, on December 23, 2013 (ADAMS Accession No. ML13364A006), Entergy submitted the flood hazard reevaluation report (FHRR) for IP2 and IP3. By letter dated December 9, 2014 (ADAMS Accession No. ML14357A052), the licensee provided its FHRR Revision 2. The licensee also provided supplemental information in letters dated August 18, 2014 (ADAMS Accession No. ML16116A060), December 10, 2015 (ADAMS Accession No. ML15351A068), and April 5, 2016 (ADAMS Accession No. ML16104A041). By letter dated April 25, 2016 (ADAMS Accession No. ML16112A172), the NRC issued an interim staff response (ISR) letter for IP2 and IP3 based on the licensee FHRR as supplemented by responses to staff questions. The ISR letter provided the reevaluated flood hazards that exceeded the current design basis (CDB) for Indian Point and were suitable input for the mitigating strategies assessment (MSA). For Indian Point, the mechanisms listed as not bounded by the CDB in the letter (ISR flood levels) are listed below:

- Local intense precipitation (LIP) – the ISR flood level is higher than the CDB level;
- Flooding in streams and rivers – the Hudson River probable maximum flood height ISR flood level exceeded the CDB;
- Dam breeches and failures – the ISR flood level for a dam failure combined with Hudson River probable maximum flood (PMF) exceeded the CDB; and
- Storm surge – the ISR flood level for a combined event coincident with the probable maximum storm surge exceeded the CDB.

##### *Mitigation Strategies Assessment for the Current Licensing Basis Flood*

The NRC staff evaluated the Indian Point strategies as developed and implemented under Order EA-12-049, as described in the "Final Integrated Plan Document, Indian Point Energy

Center, Units 2 and 3,” (Enclosure 2 to Entergy Letter NL-16-089, dated August 12, 2016 (ADAMS Accession No. ML16235A292)). The NRC staff’s safety evaluation is dated March 27, 2017 (ADAMS Accession No. ML17065A171). In its Final Integrated Plan (FIP), the licensee used the current licensing basis flood conditions to develop the mitigation strategies. The safety evaluation concluded that the licensee has developed guidance and proposed design that, if implemented appropriately, will adequately address the requirements of Order EA-12-049.

#### *Mitigation Strategies Assessment for the Reevaluated Flood*

By letter dated October 27, 2016 (ADAMS Accession No. ML16305A331), Entergy submitted the reevaluated flood MSA for IP2 and IP3. The reevaluated flood MSAs are intended to confirm that licensees have adequately addressed the reevaluated flooding hazards within their mitigation strategies for beyond-design-basis external events. By letter dated April 10, 2017 (ADAMS Accession No. ML17059C227), the NRC issued the IP2 and IP3 reevaluated flood MSA staff assessment. The NRC staff concluded that the IP2 and IP3 MSA was performed consistent with the guidance described in Appendix G of NEI 12-06, Revision 2, “Diverse and Flexible Coping Strategies (FLEX) Implementation Guide,” (ADAMS Accession No. ML16005A625). The NRC’s endorsement of NEI 12-06, Revision 2, is described in 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).

The licensee’s MSA found limited impact to the site FLEX strategy from the reevaluated flood hazard and described changes that the licensee had implemented, or was in the process of implementing, to the existing FLEX strategies such that they could be successfully implemented and deployed for the reevaluated flood hazards. The modifications included raising manholes, sealing conduits, and changes to procedures to implement temporary passive flood protection features. The MSA also included a commitment to raise the temporary flood protection features on two interior doors leading to the Unit 2 480 Volt switchgear room and exterior doors leading to both the auxiliary feedwater pump and control building from the IP2 and IP3 transformer yard during storm preparations. The NRC staff concluded that the licensee has demonstrated the mitigation strategies, if appropriately implemented, can reasonably be executed under the reevaluated flood hazard conditions for beyond-design-basis external events.

#### Deferral Request

##### *Focused Evaluation and Integrated Assessment*

As described above by letter dated July 24, 2017, the licensee requested deferral of the FE and IA for IP2 and IP3. The FEs are intended to confirm that licensees have adequately demonstrated, for unbounded mechanisms identified in the ISR letter, that: 1) a flood mechanism is bounded based on further reevaluation of flood mechanism parameters; 2) effective flood protection is provided for the unbounded mechanism; or 3) a feasible response is provided if the unbounded mechanism is LIP. The IAs are intended to confirm that licensees have adequately demonstrated for unbounded mechanisms identified in the ISR letter other than LIP, that: 4) effective flood mitigation is provided, or 5) effective flood protection is provided for higher frequency flood scenarios and for lower frequency scenarios a feasible response strategy has been provided. These 5 options associated with performing an FE or IA are referred to as Paths 1, 2, 3, 4, or 5 as described in NEI 16-05, Revision 1. The purpose of this staff assessment is to provide the results of the NRC’s evaluation of the deferral request for an FE or IA for IP2 and IP3.

## EVALUATION

Figure 1 shows the Indian Point site layout and topography. As stated in Entergy's July 24, 2017, letter, consequential impact to the IP2 and IP3 safety-related service water pumps occurs at 17.9 feet (ft.) National Geodetic Vertical Datum of 1929 (NGVD29). Because the storm surge combined event leads to water levels above 17.9 ft. NGVD29 at the location of the service water pumps, the licensee is expected to submit an IA by December 2018. The licensee's July 24, 2017, letter states that for the other three flood hazard mechanisms (LIP, dam failure, and streams and rivers) a Path 2 FE demonstrating effective flood protection for these mechanisms would be included with the IA for the combined storm surge event.

### Path 2 Focused Evaluation Flood Hazard Mechanisms

The purpose of a FE is to demonstrate protection from the flood hazard mechanisms other than LIP. For LIP events the purpose of the FE is to demonstrate either protection from the event or mitigation of the event. To this end, the staff assessed the ability of the Indian Point site to withstand the dam failure and streams and rivers flood mechanisms with their key safety functions intact.

The licensee's December 9, 2014, revised FHRR Section 5.1 states that the licensee has actions in place to protect vital SSCs located in the following areas up to 17.9 ft. NGVD29:

- Unit 2 intake structure (safety-related service water pumps);
- Unit 3 intake structure (safety-related service water pumps);
- Unit 2 480 volt switchgear room in the control building;
- Unit 3 480 volt switchgear room in the control building;
- Unit 2 turbine building for motor control center 24A;
- Unit 3 turbine building for motor control center 34;
- Unit 3 emergency diesel generator building ;
  - The Unit 2 emergency diesel generator building is at elevation 72 ft. NGVD29 and therefore has margin from the river floods
- Unit 2 service water valve pit; and
- Unit 3 service water valve pit.

The December 9, 2014, FHRR notes that the transformer yard and other key buildings to the east of the turbine building are shielded from wave run-up by the turbine building itself. The IP2 and IP3 switchgear rooms are away from the river front and their access points are located within the existing turbine buildings and in the transformer yards. Although the turbine buildings will be allowed to flood, the buildings will protect the access doors to the control buildings from the wave action. The IP2 and IP3 service water pumps are to the west of the turbine building and therefore, the turbine building does not shield the safety-related service water pumps from wave run-up.

The IP2 safety-related service water pumps are not housed within a building while the IP3 safety-related service water pumps are. The FHRR does note that the safety-related service water pumps and motors are protected from direct wave action due to large equipment (traveling screen system) located between them and the river. In addition, in the event of flooding the licensee has procedures in place to protect key safety functions. The staff audited licensee procedure 0-MET-402-GEN, Revision 5, "Location of Sandbags in Flood Warning Conditions," in accordance with an audit plan dated July 18, 2017 (ADAMS Accession No. ML17192A452). The procedure establishes the requirements for the stacking and proper location of mitigation systems and sandbags in order to protect the service water pumps, the turbine building, fuel storage building, control building, and the transformer yard doors at IP2 and IP3. The procedure is implemented in the event the Hudson River water elevation at either

intake structure reaches 11 ft. above mean sea level, or in preparation for a LIP event of 10 inches of rain or greater over a 6-hour period.

In the July 24, 2017, letter, the licensee stated that its preliminary assessment determined that the streams and rivers PMF has effective flood protection for key safety functions. The licensee's determination is based on the streams and rivers event being less than the temporary flood protection features implemented in the licensee's abnormal operating procedures. The streams and rivers event is based on cool season on the Hudson River, PMF with snow pack coincident with 25-year storm surge, and 10 percent exceedance high tide. This event results in a stillwater level of 16.5 ft. NGVD29.

The 16.5 ft. NGVD29 stillwater flood height is below the consequential flood height of 17.9 ft. NGVD29 for IP2 and IP3. The ISR includes a 2.1 ft. wave run-up for this event. As described in the licensee's December 10, 2015, submittal (ADAMS Accession No. ML15351A068 (nonpublic)), this maximum wave run-up of 2.1 ft. was calculated for vertical surfaces such as buildings in the area subject to wave action. The December 10, 2015, submittal notes that the maximum depth-limited wave height in the site area is 1.3 ft. Based on the protection provided by the IP2 and IP3 turbine building for key safety functions east of the turbine buildings and the motor control centers inside the turbine buildings, and the protection afforded the IP2 and IP3 safety-related service water pumps by a combination of structures and sandbags, the staff finds it reasonable to conclude that IP2 and IP3 key safety functions are protected from the streams and rivers flood mechanism. As such, additional regulatory actions associated with this reevaluated flood hazard, beyond those proposed as part of the mitigation strategies assessment, are likely not warranted for this flood hazard.

In its July 24, 2017, letter, the licensee stated that its preliminary assessment determined that the dam failure scenario has effective flood protection provided by the site grade. The stillwater flood height and the wave run-up from this event are lower than that from the streams and rivers flood hazard. Therefore, the staff finds it reasonable to conclude the IP2 and IP3 key safety functions are protected from the dam failure flood mechanism. As such, additional regulatory actions associated with this reevaluated flood hazard, beyond those proposed as part of the mitigation strategies assessment, are likely not warranted for this flood hazard.

In its July 24, 2017, letter, the licensee stated that its preliminary assessment determined that the LIP event has effective flood protection for permanent plant equipment based on information provided in the July 24, 2017, letter, and the information the licensee provided in its FHRR submittals dated December 23, 2013, and December 9, 2014, and in its MSA submittal dated October 27, 2016. Based on guidance provided in NEI 16-05, Revision 1, the licensee stated that it could demonstrate effective flood protection (i.e., Path 2 of NEI 16-05, Revision 1) for the LIP event. The staff notes that for a LIP event the licensee could also follow Path 3 of NEI 16-05, Revision 1 (i.e., demonstrate feasible response for a LIP event).

The licensee's July 24, 2017, letter states that modifications implemented to raise manholes, seal conduits, and modify procedures for implementation of temporary passive flood protection ensures that the FLEX strategy will not be impacted for the LIP flood hazard. The staff's assessment of the MSA for the LIP hazard can be found in a letter dated April 10, 2017. The staff concluded that for the LIP event, the licensee demonstrated the capability to deploy the original FLEX strategy as designed. Therefore, the staff finds it reasonable to conclude that IP2 and IP3 can meet Path 3 of NEI 16-05, Revision 1 for the LIP flood mechanism. As such, additional regulatory actions associated with this reevaluated flood hazard, beyond those proposed as part of mitigation strategies assessment, are likely not warranted for this flood hazard.

The staff also evaluated the licensee's preliminary assessment that it could meet the criteria found in Path 2 of NEI 16-05, Revision 1 for the LIP event. The LIP event leads to different water levels at different locations at the Indian Point site based on the topography of the site. The licensee's MSA evaluated the impact of the reevaluated LIP on FLEX strategies. However, in doing this evaluation, the licensee considered the impact on key safety functions.

The MSA discusses an engineering evaluation that was performed and changes that were made to the site and to site flood preparation procedures. Changes to the site included raising manholes 24 and 34 by 2.5 ft. above the transformer yard grade of 18 ft. NGVD29 to prevent flooding in the 480 volt switchgear rooms. This provides greater than 12 inches of margin above the LIP flood elevation of 19.5 ft. NGVD29 and 19.3 ft. NGVD29 for Units 2 and 3, respectively. The MSA also notes that conduits in manholes 23, 33, and manhole 37 were sealed. The licensee also describes in its MSA that a walkdown was performed around the transformer yards to evaluate any additional penetrations such as air intakes and louvers. There were no additional penetrations (other than doorways) identified that were below the 20 ft. NGVD29 elevation. The licensee's evaluation of doorways in the MSA stated that each door was evaluated against the current temporary flood protection levels. The licensee determined that the local ponding depths were below the temporary flood protection measures or below the sills for doors. The staff also reviewed the flood elevations at the location of the safety-related service water pumps and determined that they were below the consequential impact to the IP2 and IP3 safety-related service water pumps.

Therefore, based on information found in the licensee FHRR and MSA, the staff finds it reasonable to conclude the IP2 and IP3 key safety functions are protected from the LIP flood mechanism. As such, additional regulatory actions associated with this reevaluated flood hazard, beyond those proposed as part of the mitigation strategies assessment, are likely not warranted for this flood hazard; therefore, deferral of submittal of an FE over the period of concern is reasonable.

#### Integrated Assessment Flood Hazard Mechanism

The staff's assessment of the IP2 and IP3 IA deferral request is focused on the licensee's ability to demonstrate effective flood mitigation for the storm surge for the higher frequency storm surge events and to demonstrate a feasible response strategy for lower frequency storm surge events (i.e., Path 5 of NEI 16-05, Revision 1). The licensee's performance of an IA is focused on the safety-related service water pumps being inundated and their associated key safety function being rendered inoperable under certain storm surge conditions.

The ISR provides a reevaluated flood elevation of 18.9 ft. NGVD29 for locations east of the IP2 and IP3 turbine buildings due to a storm surge event. As described in the licensee's MSA, the licensee committed to perform an engineering evaluation to implement additional flood protection features, with margin, for Doors 213, 215, 234, and 235 based on this flood level. Doors 213 and 215 are located in the IP3 transformer yard and lead to the auxiliary boiler feed pump room. Door 234 and 235 are internal doors that lead into the IP2 switchgear room. The licensee stated in its July 24, 2017, letter that procedure 0-MET-402-GEN was revised to provide the additional temporary flood protection features necessary to comply with the MSA flood levels. As described above, the staff audited this procedure and determined that it provides protection, with margin, above the storm surge reevaluated flood levels for these doors.

The ISR also provides an 18.9 ft. NGVD29 stillwater flood height with a 4.7 ft. wind wave run-up for the west sides of the IP2 and IP3 intake structure. These levels are above the consequential impact to the IP2 and IP3 safety-related service water pumps of 17.9 ft. NGVD29. Because the licensee cannot demonstrate effective flood protection for this flood mechanism for these pumps

that perform a key safety function, the guidance in NEI 16-05, Revision 1 directs the licensee to perform an IA and either demonstrate effective flood mitigation (Path 4) or describe a blend of responses for the scenario (Path 5). The licensee's July 24, 2017, letter is consistent with the Path 5 process found in NEI 16-05, Revision 1.

Guidance Document NEI 16-05, Revision 1, Section 8.2.4 states that for a licensee following Path 5, the frequency of each specific scenario should be estimated as the frequency of a flood reaching or exceeding the water surface elevation for that scenario. The NEI guidance further states that for floods with a frequency of 1E-3 per year to 1E-4 per year, it is necessary to demonstrate that the site has an effective flood strategy as discussed in the SRM of COMSECY-15-0019.

To this end, the licensee's July 24, 2017, letter provides two scenarios: 1) a storm surge flood scenario that is below 17.7 ft. NGVD29 water surface elevation and 2) a storm surge flood scenario that is above the 17.7 ft. NGVD29 water surface elevation. The 17.7 ft. NGVD29 water surface elevation is below the 17.9 ft. NGVD29 consequential flood for the IP2 and IP3 site. As described above, the 17.9 ft. NGVD29 consequential flood evaluation is based on the safety-related service water pumps not being able to perform their intended function above this flood level without additional protection. The July 24, 2017, letter references the licensee's December 9, 2014, FHRR that demonstrates that the expected frequency of such a flood is below the 1E-4 per year threshold of concern.

As described above, the staff determined that it is reasonable to conclude that IP2 and IP3 key safety functions are protected from flood mechanisms below 17.9 ft. NGVD29. In addition, the staff has determined that it is reasonable to conclude that key safety functions that are provided by structures, systems, or components east of the IP2 and IP3 turbine buildings are protected to the storm surge reevaluated flood height of 18.9 ft. NGVD29 for this area. Further, the staff determined, as documented in the April 10, 2017, staff assessment, that the licensee's modified FLEX strategy for the reevaluated storm surge, if implemented appropriately, could be effectively deployed to mitigate the storm surge event at 18.9 ft NGVD29.<sup>3</sup>

In the July 24, 2017, letter, the licensee points to the licensee's December 9, 2014, FHRR that states that the annual exceedance probability for the storm surge combined event was determined to be on the order of 2E-5 per year frequency for the 17.7 ft. NGVD29 level. The staff agrees that the storm surge events that exceed 17.7 ft NGVD29 are rare and are unlikely to exceed the screening criteria of 1E-4 per year frequency found in NEI 16-05, Revision 1 guidance. In addition, the storm surge event should have sufficient warning time associated with it such that the plant is placed in the best possible condition to withstand the event. This includes IP2 and IP3 being shutdown well in advance of a storm surge flood thus reducing the decay heat that needs to be removed from the reactor. Other preparations would be enacted in accordance with the licensee's severe weather procedures.

Therefore, the staff finds it reasonable to conclude that IP2 and IP3 could develop an appropriate NEI 16-05, Revision 1, Path 5 IA for the storm surge flood mechanism. Based on the licensee's ability to provide protection for key safety functions below the consequential flood, and the low expected frequency of storm surge events exceeding the consequential flood combined with the licensee's ability to mitigate such a flood, the staff finds it reasonable to conclude that additional regulatory actions associated with this reevaluated flood hazard,

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<sup>3</sup> As described in the April 10, 2017, NRC staff's assessment of the ability of FLEX strategies to address a storm surge event of 18.9 ft NGVD29 is based on the turbine buildings shielding the transformer yards and the buildings credited for FLEX (located east of the turbine buildings) from wave run-up and debris. This is consistent with the ISR response letter, which identifies a wave run-up of 0.0 ft for the locations east of the IP2 and IP3 turbine buildings.

beyond those proposed as part of the mitigation strategies assessment, are likely not warranted for this flood hazard. Therefore, deferral of the submittal of an IA over the period of concern is acceptable.

### Additional Considerations

The staff's basis for deferring the FE and IA also includes: 1) the additional safety margin gained from installing mitigation strategies; 2) the licensee's compliance with the requirements found in 10 CFR 50.54(hh)(2) for loss of large areas of the plant due to fire or explosion; 3) changes to the FLEX strategies that are currently implanted to address the reevaluated flood hazard; and 4) the remaining period of operation for the plant. Those considerations are discussed below.

#### *Mitigation Strategies*

As stated above, the staff's evaluation of the licensee's mitigation strategies was issued on March 27, 2017, and an inspection of these strategies is scheduled for Fall 2017. The mitigation strategies that are being put into place in response to Order EA-12-049 require that licensees develop strategies to cope with an extended loss of alternating current power and loss of the ultimate heat sink for an indefinite period of time. These strategies must keep the reactor core and spent fuel cool, as well as protect the containment structure that surround each reactor.

#### *Loss of Large Areas of the Plant due to Fire or Explosion*

Per the requirement of 10 CFR 50.54(hh)(2) the licensee is required to implement guidance and strategies intended to maintain or restore core cooling, containment, and spent fuel pool cooling capabilities under the circumstances associated with loss of large areas of the plant due to explosions or fire. At IP2 and IP3 this equipment is stored in a different location than the equipment used to demonstrate compliance with Order EA-12-049. Therefore, the 50.54(hh)(2) equipment represents an additional beyond-design-basis capability from that provided by the equipment associated with Order EA-12-049.

#### *Changes to the Current FLEX Strategies to Address the Reevaluated Flood Hazard*

As described above, the expectation that licensee for operating nuclear power plants address the reevaluated flood hazard within their mitigating strategies is reflected in SECY-16-0142. The April 10, 2017, MSA staff assessment was issued with the intention that it would support the inspection of this requirement (if it is approved by the Commission). The licensee's July 24, 2017, letter notes that the licensee has implemented the changes described in its MSA such that the licensee's FLEX strategies can be implemented during flood hazards associated with the reevaluated flood levels. Therefore, the licensee has implemented changes to the plant that provide a safety improvement now as opposed to a future date that would be required if the MBDBE rule were approved by the Commission.

#### *Remaining Period of Operation of the Units*

The staff further finds that deferring the FE and IA is acceptable because any potential cost-justified substantial safety enhancements which may be identified by the flooding integrated assessment could not be reasonably implemented during the limited potential for additional operations at IP2 and IP3. The underlying purpose of the 50.54(f) letter is to gain information in order to enable the NRC to determine whether the IP2 or IP3 licenses should be modified, suspended, or revoked. Based on IP2 and IP3's ability to cope with the reevaluated flood hazards as discussed above, additional regulatory commitments or backfits, if any were

identified, would have a limited safety benefit. Further, due to the IP2 scheduled shutdown in mid-2020 and IP3 in mid-2021, such benefits would only be implemented for a short amount of time prior to shutdown of the units.

### AUDIT REPORT

The July 18, 2017, generic audit plan describes the NRC staff's intention to issue an audit report that summarizes and documents the NRC's regulatory audit of licensee's submittals associated with and FE or IA. The NRC staff's IP2 and IP3 audit was limited to the review of the procedure described above. Because this staff assessment appropriately summarizes the results of the audit, the NRC staff concludes a separate audit report is not necessary, and that this document serves as the audit report described in the July 18, 2017, letter.

### CONCLUSION

The NRC staff concludes that the public health and safety will continue to be adequately protected through the requested deferral period for IP2 and IP3 without the need for the FE or IA for the reevaluated flooding hazards during that time based on:

- 1) the ability of the IP2 and IP3 to cope with the reevaluated flood hazard;
- 2) the safety margin provided as a result of compliance with Order EA-12-049, and 10 CFR 50.54(hh)(2);
- 3) changes to the FLEX strategies that are currently implanted to address the reevaluated flood hazard; and
- 4) limited period of operation remaining for IP2 and IP3.

Thus, the NRC concludes that deferring activities being performed to meet the 50.54(f) request for information for flooding events is acceptable. Accordingly, the required response date for the FE or IA in response to the 50.54(f) letter is deferred until August 31, 2021.

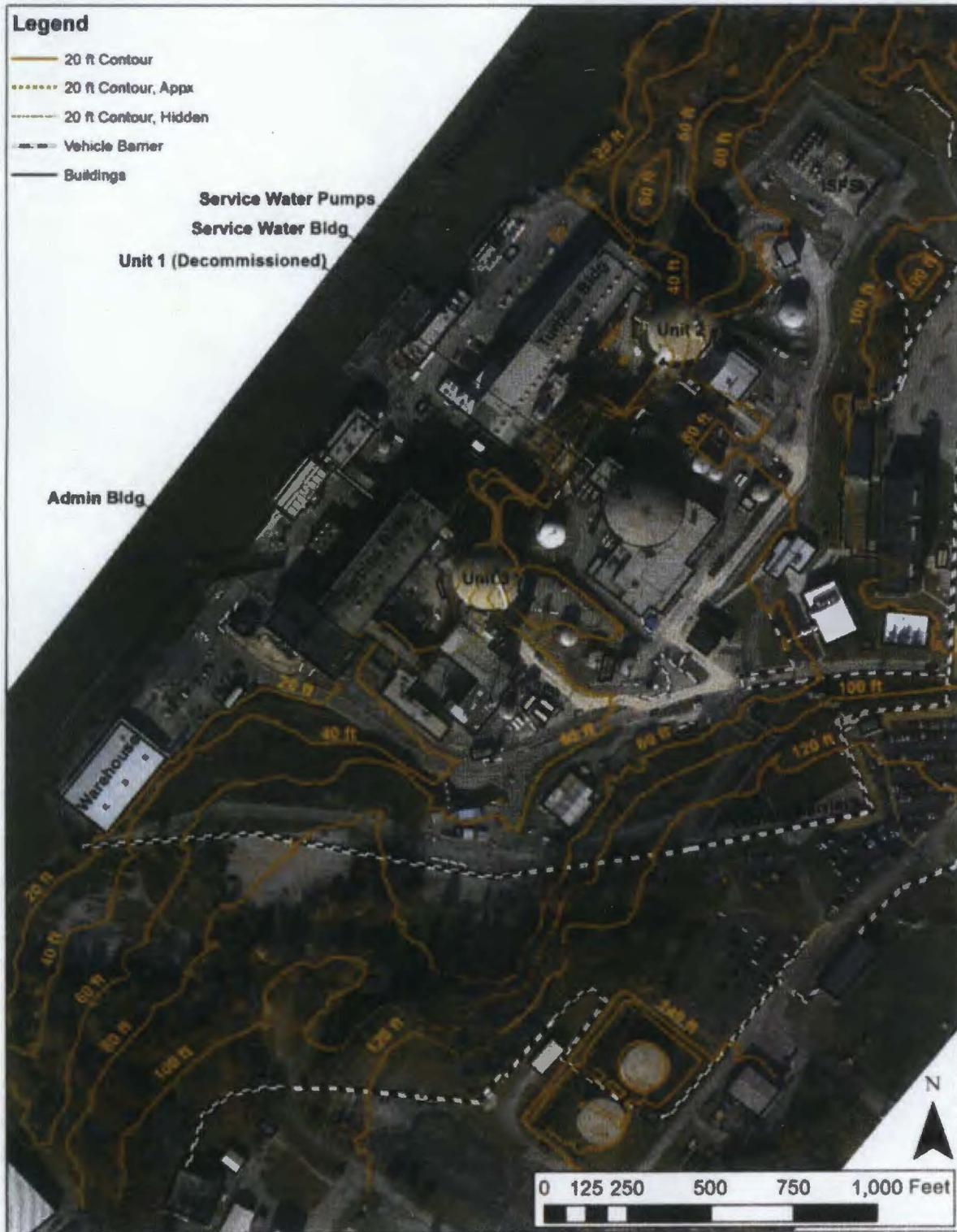


Figure 1 – Indian Point Site Topography and Layout (Adapted from Figure 2.1-2 of December 9, 2014, Entergy Supplemental Response (ADAMS Accession No. ML14357A052))

INDIAN POINT NUCLEAR GENERATING UNIT NOS. 2 AND 3 – NRC RESPONSE TO  
REQUEST FOR DEFERRAL OF ACTIONS RELATED TO BEYOND-DEISGN-BASIS  
EXTERNAL EVENT SEISMIC AND FLOODING REEVALUATIONS DATED October 4, 2017

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