



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

April 17, 2017

Mr. John Dent, Jr.  
Entergy Nuclear Operations, Inc.  
Pilgrim Nuclear Power Station  
600 Rocky Hill Road  
Plymouth, MA 02360-5508

SUBJECT: PILGRIM NUCLEAR POWER STATION – NRC RESPONSE TO REQUEST  
FOR DEFERRAL OF ACTIONS RELATED TO BEYOND-DESIGN-BASIS  
SEISMIC AND FLOODING HAZARD REEVALUATIONS

Dear Mr. Dent:

The purpose of this letter is to provide the U.S. Nuclear Regulatory Commission (NRC) staff's response to letters received from Entergy Nuclear Operations, Inc. (Entergy, the licensee) on August 18, 2016 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML16250A017 and ML16250A018), related to post-Fukushima seismic and flooding hazard reevaluations. These letters request deferral of actions related to these hazard reevaluations for Pilgrim Nuclear Power Station (Pilgrim) in anticipation of the planned permanent shutdown of Pilgrim in mid-2019. Entergy's letters also inform the NRC of certain commitment changes related to the hazard reevaluations. The NRC staff has determined that deferring action related to flooding and seismic hazard reevaluations as described below is acceptable.

#### 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 hazards on the plant (e.g., through a flooding integrated assessment or a seismic probabilistic risk assessment (SPRA)). The NRC staff would review the completed responses to these assessments to determine if there is a need for any additional regulatory actions, such as a plant-specific backfit.

Concurrent with the reevaluation of flooding and 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). 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.

In the staff requirements memorandum to COMSECY-14-0037, “Integration of Mitigating Strategies for Beyond-Design-Basis External Events and the Reevaluation of Flooding Hazards” (ADAMS Accession No. ML15089A236), the Commission affirmed that licensees for operating nuclear power plants need to address the reevaluated flooding hazards within their mitigating strategies for beyond-design-basis external events. The draft final Mitigation of Beyond-Design-Basis Events rule, which the NRC staff provided to the Commission in SECY-16-0142 (ADAMS Accession No. ML16301A005), includes a proposed requirement to address the Commission’s direction. If approved by the Commission, Pilgrim would have 3 years from the effective date of the rule to implement this requirement. The nuclear power industry has established guidance, which the NRC has endorsed, for the performance of mitigating strategies assessments (MSAs) to identify what adjustments, if any, are necessary to the strategies and guidelines developed under Order EA-12-049 for compliance with the proposed Mitigation of Beyond-Design-Basis Events rule found in SECY-16-0142.

As part of the flooding hazard reevaluation process, Pilgrim is expected to complete a flooding MSA by August 4, 2017, a focused evaluation by June 2017, and an integrated assessment, if necessary, by December 31, 2018. As part of the seismic hazard reevaluation process, Pilgrim is expected to complete an SPRA, which will also assess high frequency ground motion effects, and a limited-scope evaluation for the spent fuel pool (SFP). These seismic evaluations are expected to be submitted to the NRC by December 31, 2017. Because the SPRA results are used to develop the seismic MSA, the seismic MSA is also due at that time.

By letter dated November 10, 2015 (ADAMS Accession No. ML15328A053), Entergy informed the NRC of its intent to permanently shut down Pilgrim and cease operation no later than June 1, 2019. By letter dated August 18, 2016, the licensee requested deferral of the remaining 50.54(f) letter activities related to the reevaluation of seismic hazards for Pilgrim, including completion of a seismic MSA, until December 31, 2019. In a separate August 18, 2016, letter the licensee requested that the remaining 50.54(f) letter activities related to the reevaluation of flooding hazards for Pilgrim, including completion of the flooding MSA, be permanently deferred. The licensee stated that, based on the remaining operational time, there is insufficient time to implement potential changes identified by the remaining flooding and seismic reevaluations prior to permanently defueling the plant. This is because the remaining reevaluations would have to be completed, and if changes were identified that would result in a substantial safety increase, these changes would have to be designed, approved, and scheduled for installation. The licensee also informed the NRC of a change to a commitment made in its December 16, 2014, Expedited Seismic Evaluation Process (ESEP) report (ADAMS Accession No. ML14357A061).

## EVALUATION

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

- 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 seismic and flooding events, as a result of Pilgrim's compliance with Orders EA-12-049 and EA-12-051. NRC inspectors verified that the mitigation strategies have been appropriately implemented at Pilgrim as documented in a July 7, 2016, inspection report (ADAMS Accession No. ML16189A066).
- For seismic reevaluations, the staff considered: 1) the seismic design margin in nuclear plants, 2) the ability of Pilgrim to cope with earthquakes larger than the design basis earthquake as documented in a December 14, 2014, Expedited Seismic Evaluation Process (ESEP) report (ADAMS Accession No. ML14357A061), and 3) recent research on spent fuel pool safety.
  - Regarding seismic design margin, the staff considered NRC and industry studies summarized in a May 9, 2014 (ADAMS Accession No. ML14111A147), letter that cite a number of reasons for continued operation while seismic reevaluations were continuing. 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.
  - Regarding the ESEP, the staff's assessment can be found in a letter dated June 16, 2015 (ADAMS Accession No. ML15154A975). The staff's assessment concluded that Entergy 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 safe shut down earthquake for Pilgrim.
  - Regarding the spent fuel pool, the staff considered insights from NUREG-2161, "Consequence Study of a Beyond-Design-Basis Earthquake Affecting the Spent Fuel Pool for a U.S. Mark I Boiling Water Reactor" (ADAMS Accession No. ML14255A365). This NUREG concluded that SFPs are robust structures that are likely to withstand severe earthquakes without leaking, and that SFP accidents are a small contributor to overall risk.
- For flooding reevaluations, the staff reviewed the licensee submittals which indicated that the impact to the Pilgrim site from the reevaluated flooding hazards is limited and the site is able to cope with it. The licensee performed an interim evaluation to address the reevaluated hazards documented in the flooding hazard reevaluation report. A sample of the licensee's assumptions used to support its conclusion that the site is able to cope with the reevaluated hazard was inspected by the staff as documented in Inspection Report 05000293/2015003 (ADAMS Accession No. ML15317A030). The staff's inspections confirmed that the interim evaluation assumptions reflected actual plant conditions.
- Considering the remaining operational period, there is not sufficient time to implement potential changes identified by the remaining flooding and seismic reevaluations prior to permanently defueling the plant such that a meaningful, further safety improvement will

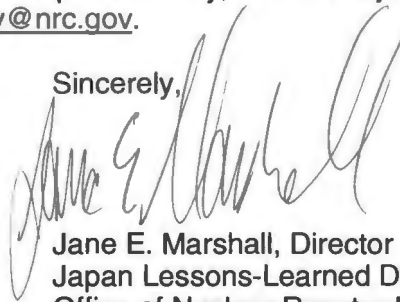
be achieved. This is because the remaining external hazard reevaluation work would have to be completed, and if changes were identified that would result in a substantial safety increase, these changes would have to be designed, approved, and scheduled for installation.

### CONCLUSION

Based on the evaluations in Enclosures 1 and 2, and after consultation with the Director of the NRC's Office of Nuclear Reactor Regulation, the NRC staff concludes that Entergy's proposals to defer the remaining activities related to the 50.54(f) letter request for information for flooding and seismic events, and the deferral of the flooding and seismic MSAs are acceptable. Accordingly, the required response dates for the remaining 50.54(f) letter activities and MSAs are deferred until December 31, 2019. If Pilgrim does permanently cease operations before this date, and should Entergy determine that the remaining 50.54(f) letter activities and the MSAs are no longer necessary based on the shutdown conditions of the plant, the staff expects that Entergy would document such a request in a letter, with the appropriate basis supporting the request, prior to December 31, 2019.

If you have any questions, please contact Joseph Sebrosky, Senior Project Manager, at (301) 415-1132 or via e-mail at [Joseph.Sebrosky@nrc.gov](mailto:Joseph.Sebrosky@nrc.gov).

Sincerely,



Jane E. Marshall, Director  
Japan Lessons-Learned Division  
Office of Nuclear Reactor Regulation

Docket No. 50-293

Enclosures:

1. Evaluation of Entergy's Seismic Deferral Request
2. Evaluation of Entergy's Flooding Deferral Request

cc: Distribution via Listserv

## Evaluation of Entergy's Seismic Deferral Request

By letter dated August 18, 2016 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML16250A017), Entergy Nuclear Operations, Inc. (Entergy, the licensee) requested deferral of the remaining activities related to the reevaluation of seismic hazards for the Pilgrim Nuclear Power Station (Pilgrim) until December 31, 2019. The licensee also informed the NRC of a change to commitments made in its December 16, 2014, Expedited Seismic Evaluation Process (ESEP) report (ADAMS Accession No. ML14357A061). The requested deferral of actions related to the hazard reevaluations is in anticipation of the planned permanent shutdown of Pilgrim by June 1, 2019. The licensee's deferral request is based on the limited remaining operational time for the plant and the existing capabilities to address beyond-design-basis seismic events. The staff's evaluation of the licensee's request is below.

### EVALUATION

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, Pilgrim is scheduled to perform and submit by December 31, 2017, a seismic probabilistic risk assessment (SPRA), a high-frequency evaluation (which is included as part of the SPRA), and a limited-scope seismic evaluation of the spent fuel pool (SFP).

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 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 Pilgrim, the SPRA results would be used to develop the seismic MSA.

By letter dated November 10, 2015 (ADAMS Accession No. ML15328A053), Entergy informed the NRC of its decision to permanently shutdown Pilgrim by June 1, 2019. In anticipation of the shutdown, in its August 2016 deferral letter, Entergy is requesting the deferral of the SPRA, high-frequency evaluation, SFP evaluation and MSA submittal dates to December 31, 2019. The staff's evaluation of this request is outlined below.

#### Deferral of Additional Seismic Activities

The licensee's March 14, 2014, seismic hazard and screening report (ADAMS Accession No. ML14092A023) states that Pilgrim screened in for an SPRA and limited-scope evaluations for high frequency seismic effects and SFP seismic robustness. As discussed above, these evaluations are to be used by the NRC in order to reach a decision as to the need for regulatory actions, beyond those associated with Order EA-12-049, to improve the seismic robustness of certain nuclear plants whose reevaluated seismic hazard is greater than their current design-basis seismic hazard. To assess the deferral request, the staff considered a number of factors including the plant's safety improvements due to the installation of mitigation strategies, the plant's capability to cope with loss of large areas of the plant due to explosion or fire, seismic design margin in nuclear plants, recent research on SFP safety, and the remaining operational period of the plant.

The mitigating 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 (ac) power (ELAP) and loss of normal access to the ultimate heat sink (LUHS) 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 surrounds each reactor. By letter dated July 17, 2015 (ADAMS Accession No. ML15202A415), Entergy notified the NRC that the mitigating strategies under Order EA-12-049 are fully in place at Pilgrim. Attachment 2 to that letter provided Pilgrim's Final Integrated Plan (FIP). The FIP describes the strategies to maintain or restore core cooling, containment, and SFP cooling capabilities in the event of a beyond-design-basis external event. The NRC safety evaluation regarding the acceptability of the licensee's strategies to address Order EA-12-049 was issued on March 3, 2016 (ADAMS Accession No. ML16008B077), and an onsite inspection to verify compliance with the order has been completed, as documented in a July 7, 2016, inspection report (ADAMS Accession No. ML16189A066). Therefore, the NRC staff notes that tangible safety benefits have been achieved for coping with an ELAP and LUHS due to external events as a result of Pilgrim's compliance with Order EA-12-049.

In addition to the safety benefits achieved for coping with beyond design basis events provided by compliance with Order EA-12-049, Pilgrim also is required to comply with the requirements of 10 CFR 50.54(hh)(2). Per this requirement, Pilgrim 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 Pilgrim, 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.

Entergy also assessed Pilgrim's ability to cope with an earthquake larger than the design basis earthquake as documented in Entergy's December 16, 2014, Expedited Seismic Evaluation Process (ESEP) report (ADAMS Accession No. ML14357A061). The staff's assessment of

Entergy's ESEP for Pilgrim can be found in a letter dated June 16, 2015 (ADAMS Accession No. ML15154A975). The staff's assessment concluded that Entergy 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 safe shut down earthquake for Pilgrim.

In addition to the seismic capabilities of the mitigations strategies equipment, the NRC staff also considered the seismic capabilities of other structures, systems, and components (SSCs) in the plant. NRC's May 9, 2014, letter (ADAMS Accession No. ML14111A147) documented the staff's initial review and screening results, identifying the additional evaluations necessary from licensees to complete the seismic portion of the 50.54(f) letter response. The letter also documented the staff's basis for allowing plants to operate while the additional assessments of plant response to the reevaluated hazard is conducted. The staff explained that plants can continue to operate because earthquake experience and margin studies have consistently demonstrated that nuclear plants' seismic designs have large margins of safety, which allow plants to cope with earthquakes larger than the design basis earthquake. An example of a seismic margin report that demonstrates robustness of nuclear plants' SSCs is an Electric Power Research Institute (EPRI) report titled, "EPRI-NP-6041-SL Revision 1: A Methodology for Assessment of Nuclear Power Plant Seismic Margin, Revision 1," dated August, 1991.<sup>1</sup>

The NRC staff also indicated that, based on its risk assessment for Generic Issue 199, "Implications of Updated Probabilistic Seismic Hazard Estimates in Central and Eastern United States on Existing Plants," (ADAMS Accession No. ML100270582), and using the reevaluated hazard, the fleet-wide seismic core damage risk estimates are at or below  $10^{-4}$ /year core damage frequency and, therefore, consistent with the Commission Safety Goal Policy Statement. The May 9<sup>th</sup> letter also references a March 12, 2014, NEI letter that provided perspectives on the seismic capacity of operating plants, which (1) assessed a number of qualitative reasons why the design of SSCs inherently contain margin beyond their design level; (2) discussed industrial seismic experience databases of performance of industry facility components similar to nuclear SSCs; and (3) discussed earthquake experience at operating plants.

The staff's assertions in the May 9<sup>th</sup> letter continue to be valid for the U.S. operating fleet, including Pilgrim, and indicate that the deferral of the remaining evaluations does not pose an unacceptable risk. Therefore, the basis for continued operation at Pilgrim remains unchanged, and applies throughout the requested deferral period. Further, the staff concludes that public health and safety will continue to be adequately protected during the deferral period based on: 1) the installation of the mitigation strategies and their seismic safety margin; 2) the inherent seismic margin in nuclear plant designs; and 3) the insights gained by the fleet-wide risk study due to the reevaluated hazard.

The staff notes that the Pilgrim reevaluated seismic hazard ground motion response spectrum (GMRS) provided in its letter dated March 14, 2014, exceeds the design basis safe shutdown earthquake. The licensee's Individual Plant Examination of External Events (IPEEE) previously

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<sup>1</sup> EPRI-NP-6041-SL Revision 1 is referenced in Nuclear Energy Institute 12-06, Revision 2, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide" (ADAMS Accession No. ML16005A625), which has been endorsed by the NRC.

analyzed seismic risk based on the design basis safe shutdown earthquake. As part of the IPEEE, the licensee performed a conservative analysis that concluded that the median seismic capacity of the plant is 0.48g peak ground acceleration. This value is comparable to the peak ground acceleration value found in the licensee's March 14, 2014, reevaluated seismic hazard. Although not a substitute for an SPRA, the staff notes that the IPEEE analysis provides insights into Pilgrim's inherent seismic margin and its ability to cope with earthquakes larger than the design basis earthquake.

Regarding spent fuel storage, the mitigating strategies implemented 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, "Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation" (ADAMS Accession No. ML12056A044). 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. The NRC staff documented its assessment of regulatory actions going beyond the issued orders in COMSECY-13-0030, "Staff Evaluation and Recommendations for Japan Lessons-Learned Tier 3 Issue on Expedited Transfer of Spent Fuel," dated November 12, 2013 (ADAMS Accession No. ML13329A918). The assessment was supported by detailed analyses documented in NUREG-2161, "Consequence Study of a Beyond-Design-Basis Earthquake Affecting the Spent Fuel Pool for a U.S. Mark I Boiling Water Reactor" (ADAMS Accession No. ML14255A365). These recent studies supported the findings in past evaluations that SFPs are robust structures that are likely to withstand severe earthquakes without leaking.

The NUREG-2161 study considered an earthquake at a representative BWR Mark 1 design with ground motion roughly four to eight times stronger, depending on the frequency, than that used in the plant design and predicted a liner failure likelihood of about two times in a million years. The study further noted that in the unlikely event of a failure of the fuel pool liner, releases from the SFP are considered very unlikely for several reasons including the capability of the mitigation strategies to cool the spent fuel. The structural integrity of SFPs combined with additional capabilities for monitoring conditions and adding water to the pools following a beyond-design-basis external event supported the staff's recommendation and subsequent Commission decision that further studies of potential regulatory actions were not warranted. Therefore, based on the insights gained by the NUREG-2161 study regarding the structural integrity and relatively low risk of spent fuel pools' susceptibility to seismic failures, the staff concludes that public health and safety will continue to be adequately protected during the deferral period.

In addition to the existing seismic coping capabilities of the plant, the NRC staff also considered the remaining period of operation for the plant and the practicality of submitting the remaining assessments on the current schedule. Pilgrim's submittal date for these assessments is December 31, 2017. Based on the final shutdown date of not later than June 1, 2019, the seismic assessments would be completed approximately 6 months into the final operating cycle and after the final refueling outage. The NRC staff would then begin its review of the assessments and its determination of whether the license for Pilgrim should be modified, suspended or revoked would take 6 to 9 months. Therefore, the NRC staff concludes that there would not be sufficient time to implement any required changes, assuming that any changes were identified that would result in a substantial safety increase consistent with the



requirements found in 10 CFR 50.109, "Backfitting". In other words, any meaningful, further improvement to safety will not be achieved prior to permanently defueling the plant.

The NRC staff is deferring additional seismic evaluations related to the 50.54(f) letter until December 31, 2019. Following shutdown of the plant in mid-2019, the staff expects the licensee to provide justification for not completing the remaining 50.54(f) activities. Such justification would consider the fact that the reactor vessel is permanently defueled. For a plant that is permanently defueled, the staff expects the licensee will provide information demonstrating that only capabilities to address beyond-design-basis external events leading to loss of large areas of the plant due to explosions and fire are necessary. Such information is expected to include a decay heat analysis of the fuel in the spent fuel pool demonstrating that the decay heat can be removed solely by heating and boiling of water within the spent fuel pool and that the associated boil-off period provides sufficient time for the licensee to obtain resources to sustain the spent fuel pool cooling function indefinitely.

#### Deferral of Mitigation Strategies Assessment

As stated above, the reevaluated seismic hazard information identified 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. For Pilgrim, the SPRA results would be used to develop the seismic MSA. The MSA is intended to confirm that licensees have adequately addressed the reevaluated seismic hazard within their mitigating strategies for beyond-design-basis events.

In SECY-16-0142, "Draft Final Rule – Mitigation of Beyond-Design Basis Events [MBDBE]," dated December 15, 2016 (ADAMS Accession No. ML16301A005), the staff proposes an implementation period of 3 years from the date the rule is issued for boiling water reactors such as Pilgrim to demonstrate that their mitigating strategies are capable of addressing the reevaluated hazard information. Assuming the Commission approves this proposed implementation requirement in 2017, Pilgrim would be obligated to meet the proposed MBDBE rule reevaluated hazard requirement in the 2020 timeframe. The proposed shutdown date of Pilgrim is before the proposed implementation date of the MBDBE rule. Under the current plans, by the mid-2020 timeframe, there will be no fuel in the Pilgrim reactor. Therefore, the staff concludes deferring the seismic MSA will not have an impact on the schedule for compliance with the proposed MBDBE rule.

#### ESEP Commitment Change

The licensee also reported that it would not be performing the ESEP commitment to modify vital MG set EG-23 anchorages. The licensee has determined that the vital MG set EG-23 modification is not required to perform Pilgrim's mitigating strategies required under Order EA-12-049. This MG set provides one of the paths for providing direct current power from batteries to alternating current buses that power key instrumentation. The licensee indicated, however, that during an ELAP, Pilgrim will enter emergency operating procedures and there will be other instrumentation, beyond that supported by vital MG set EG-23, which provide indications for plant operators to use without leaving the control room. These alternates are documented in Pilgrim's mitigating strategy procedures. As such, Entergy's deferral letter indicated that commitments to modify MG set EG-23 anchorages are being cancelled, as allowed by Pilgrim's Commitment Management Process. The NRC staff acknowledges the

commitment change and understands that if these indications were to be lost, the licensee would use other main control room indications to implement their mitigating strategies under Order EA-12-049. Specifically, the staff's March 3, 2016, mitigating strategies order safety evaluation notes that Entergy provides guidance in the FLEX Support Guidelines (FSGs) for obtaining critical plant parameters locally in the event that the vital direct current and alternating current bus infrastructure is damaged. The safety evaluation also notes that portable FLEX equipment is supplied with local instrumentation needed to operate the equipment and the FSGs include the use of the FLEX equipment and instrumentation.

### CONCLUSION

Based on the evaluation above, the NRC staff concludes that the public health and safety will continue to be adequately protected through the requested deferral period for Pilgrim without additional assessments of the reevaluated seismic hazard being performed during that time. Thus, the NRC concludes that Entergy's proposal to defer activities being performed under 50.54(f) request for information for seismic events is acceptable. The staff also concludes that deferring the Pilgrim seismic MSA is acceptable, because, under the current plans, the Pilgrim reactor will be defueled prior to the proposed implementation requirement for the seismic reevaluated hazard found in the draft MBDBE rule. Accordingly, the required response date for the remaining seismic assessments in response to the 50.54(f) letter, and the seismic MSA are deferred until December 31, 2019.

## **Evaluation of Entergy's Flooding Deferral Request**

By letter dated August 18, 2016 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML16250A018), Entergy Nuclear Operations, Inc. (Entergy, the licensee) requested deferral of the outstanding activities related to the reevaluation of flooding hazards for the Pilgrim Nuclear Power Station (Pilgrim). The licensee also informed the NRC that the site can cope with the reevaluated flood hazard as Entergy demonstrated in the Flood Hazard Reevaluation Report (FHRR) dated March 12, 2015 (ADAMS Accession No. ML15075A082), and the performance of the flooding mitigating strategies assessment (MSA) is, therefore, unnecessary. The requested deferral of actions related to the hazard reevaluations is in anticipation of the planned permanent shutdown of Pilgrim by June 1, 2019. The licensee's deferral request is based on the limited remaining operational time for the plant and the existing capabilities to address beyond-design-basis flooding events. The staff's evaluation of the licensee's request is below.

### **EVALUATION**

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, and a graded approach to determine the need for, and scope of, plant-specific integrated assessments. This letter also included a discussion of the anticipated timetables for completion of flooding activities. For those plants where a focused evaluation is needed they are anticipated to be complete by mid-2017 and for those plants warranting development of an integrated assessments they are expected to be completed by December 2018. The 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).

In its August 18, 2016, letter, the licensee cited its FHRR (ADAMS Accession No. ML15075A082), which found limited impact for the site from the reevaluated flooding hazard. The licensee also noted that walkdowns that were performed confirmed that inundation associated with local intense precipitation (LIP) or the combined effects flood, which are the only

flooding mechanisms exceeding Pilgrim's flooding design-basis, would not impact structures, systems, and components (SSCs) important to safety, nor would these revised hazard estimates result in either an extended loss of alternating current (ac) power (ELAP) or a loss of normal access to the ultimate heat sink (LUHS). Additionally, the plant's existing severe weather procedure includes measures for mitigating external flooding conditions. Other factors were also considered, and as a result, the licensee indicated that no additional flood mitigating actions are planned beyond those already in place. Based on the limited impact of the reevaluated flood hazard to the SSCs important to safety, the licensee concluded that the site can cope with the reevaluated flood hazard and a separate flooding MSA is not warranted.

In addition, the licensee requested that further flooding activities being performed under the 50.54(f) letter be deferred. To assess the deferral request, the staff considered a number of factors including the plant's safety improvements due to the installation of mitigation strategies, the plant's capability to cope with loss of large areas of the plan due to explosion or fire, the ability of the installed plant equipment to cope with the reevaluated hazard, and the remaining period of operation for the site. The staff's evaluation of this request is outlined below.

#### Deferral of Additional Flooding Activities

As indicated above, to complete Pilgrim's response to the 50.54(f) letter, the licensee is expected to complete a focused evaluation by mid-2017 or an integrated assessment by December 2018. The purpose of these additional evaluations is to demonstrate the plant's ability to cope with the reevaluated hazard and to identify further safety enhancements beyond the sites current protection and mitigation capabilities. In accordance with Nuclear Energy Institute (NEI) 16-05, Revision 1, "External Flooding Assessment Guidelines," (ADAMS Accession Nom. ML16165A178), which has been endorsed by the NRC, Entergy could submit either a focused evaluation or integrated assessment for Pilgrim. Whether a focused evaluation or an integrated assessment is submitted depends on the nature of the hazard and the site's ability to cope with the reevaluated hazard. Regardless of the option chosen by the licensee, if the licensee did submit either a focused evaluation or an integrated assessment the NRC staff would review the licensee's information and provide an assessment of whether or not it addressed the NRC information needs. In its August 18, 2016, letter, the licensee requested deferral of the remaining 50.54(f) flooding activities, which includes either a focused evaluation or integrated assessment. The staff's basis for deferring the development of a focused evaluation or integrated assessment is found below.

By letter dated March 12, 2015, Entergy submitted its FHRR for Pilgrim in response to Enclosure 2 of the 50.54(f) letter. In Section 4 of its FHRR, the licensee states that Pilgrim has two flood-causing scenarios that are not bounded and/or not fully evaluated in the current design basis. The scenarios are flooding due to a LIP event and flooding due to the combined effects of storm surge and wind-wave activity off the Atlantic Ocean. Therefore, under the process laid out in the 50.54(f) letter, the licensee included an interim evaluation to address these scenarios in the FHRR, while the additional flood evaluations are underway. This interim evaluation, which is discussed below in more detail, describes protective or mitigative measures in place for any reevaluated hazards that exceed the current design basis.

The NRC staff reviewed the licensee's reevaluated hazard and by letter dated August 4, 2016 (ADAMS Accession No. ML16215A076), the NRC staff provided a summary of the reevaluated flood-causing mechanisms described in Pilgrim's FHRR. The NRC staff's assessment is consistent with the licensee's March 12, 2015, assessment. 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.

With regard to the reevaluated flood interim evaluation, in Section 5 of its FHRR, the licensee describes that walkdowns confirmed that existing plant design margin, installed doors, and plant physical layout can effectively deal with the effects of both reevaluated flood-causing mechanisms without additional actions. Therefore, the existing water-tight doors, installed water-oil barriers, elevated equipment, and site layout constitute the interim actions taken by the licensee. The licensee concludes that because the inundation associated with the LIP or the combined event flood will not impact SSCs important to safety such that additional interim flood mitigating measures are not warranted. The NRC staff inspected the licensee's basis that interim actions are not necessary based on the interim evaluation found in the March 12, 2015, FHRR. As documented in Inspection Report 05000293/2015003 (ADAMS Accession No. ML15317A030) inspector independently verified that samples of Entergy's assumptions used in the FHRR interim evaluation reflected actual plant conditions. Visual inspections of the installed flood protection features was performed for the relevant flood protection features.

The licensee documented the plant's ability to cope with the reevaluated flood hazard in the FHRR. In Section 5.1 of the FHRR the licensee indicated that, in the case of the LIP event, the north side of the plant would see maximum flood levels of 23.5 feet mean sea level (MSL), exceeding the current design basis level of 22.5 feet MSL. The grade level at the plant averages about 20 feet MSL. Three door locations would potentially be affected by the reevaluated flood heights. All three of these doors were included in the post-Fukushima flooding walkdowns. Flood depth at these three doors are less than 1 foot. An analysis of these doors confirmed that they will not fail for flood heights up to 1.5 feet. The south side of the plant would see a maximum flood height of 25.2 feet MSL, while having a current design basis flood elevation of 24.5 feet MSL. The licensee described that the areas threatened by the LIP-induced flooding on the south side of the plant do not have direct paths to any SSCs important to safety. In addition, the licensee confirmed that at-risk doors are able to withstand the hydrostatic loading from the floodwaters. The licensee concluded that no additional actions are necessary because SSCs important to safety are either elevated or located in an area that is beyond a "tortuous path" from the at-risk locations. What this means is that flooding water would not reach SSCs important to safety or would need to pass through multiple doors and/or corridors, such that the barriers and intervening volumes would only allow small amounts of leakage where these SSCs are located.

The second flood-causing mechanism addressed by the licensee in the FHRR is the combined effects of storm surge and wind wave. The stillwater elevation of the reevaluated storm surge presented in the FHRR is 15.1 feet MSL. This results in a combined effect flood of storm surge and wind-wave activity of 22.1 feet MSL.<sup>2</sup> This combined effect flood, which includes wave heights, exceeds the current design basis flood elevation for storm surge of 13.5 feet MSL. This reevaluated flood height affects two buildings which house SSCs important to safety: the emergency diesel generator (EDG) building and the intake structure. At the EDG building, all openings, including doors, are at an elevation of 23 feet MSL or higher. Therefore, SSCs important to safety within the EDG building are not adversely affected and no additional actions are necessary in response to the reevaluated flood hazard. As for the intake structure, the intake structure consists of a Class I (safety-related) structure inside of a Class II (non-safety-related) structure. The entrance into the Class I structure is at an elevation of 25.5 feet MSL, and so water from the reevaluated combined effect flood would not enter the Class I structure. Moreover, the salt water service pumps and their motors comprise the SSCs important to safety within the intake structure, and are located at elevation 25.6 feet MSL, which is above the revised flood level. In summary, although water from the 22.1 foot MSL reevaluated combined effect flood can enter the Class II structure, it will not enter the Class I structure nor impact the safety-related salt water service pumps and motors.

In addition to the installed plant equipment's ability to cope with the reevaluated flood, the NRC staff considered the added safety margin gained from installing the mitigation strategies. The mitigating strategies that are being put into place in response to Order EA-12-049, "Order Modifying Licenses with Regard to Requirement for Mitigation Strategies for Beyond-Design-Basis External Events" (ADAMS Accession No. ML12054A736), require that licensees develop strategies to cope with an ELAP and LUHS 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 surrounds each reactor. By letter dated July 17, 2015 (ADAMS Accession No. ML15202A415), Entergy notified the NRC that the mitigating strategies are fully in place at Pilgrim. Attachment 2 to that letter provided Pilgrim's Final Integrated Plan (FIP). The FIP describes the strategies to maintain or restore core cooling, containment, and spent fuel pool (SFP) cooling capabilities in the event of a beyond-design-basis external event. The NRC safety evaluation regarding the acceptability of the licensee's strategies to address Order EA-12-049 was issued on March 3, 2016 (ADAMS Accession No. ML16008B077), and an onsite inspection to verify compliance with the order has been completed, as documented in a July 7, 2016, inspection report (ADAMS Accession No. ML16189A066).

In its FIP, the licensee stated that flooding due to LIP and the combined effect flood are the only flood mechanisms which could cause inundation of the Pilgrim site in the vicinity of SSCs important to safety. The results of the licensee's evaluation determined that there are no impacts to equipment important to safety as a result of the reevaluated flood elevations.

In addition to the safety benefits achieved for coping with beyond design basis events provided by compliance with Order EA-12-049, Pilgrim also is required to comply with the requirements of 10 CFR 50.54(hh)(2). Per this requirement Pilgrim is required to implement guidance and

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<sup>2</sup> The staff's August 4, 2016, letter also notes a separate combined effect flood of wind storm and wind wave effects of 22.4 ft MSL that is based on information provided by the licensee after the FHRR was submitted. However, the staff finds that the discussion of the 22.1 ft MSL scenario bounds this 22.4 ft MSL scenario. Therefore, the 22.4 ft MSL scenario is not discussed further in this evaluation.

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 Pilgrim, 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.

The NRC staff also considered the remaining period of operation for the plant and the practicality of submitting the remaining assessments on the current schedule. Pilgrim's submittal date for a focused evaluation is mid-2017 and for an integrated assessment (if needed) is December 31, 2018. Based on the final shutdown date of not later than June 1, 2019, these assessments would be completed well into the final operating cycle and after the final refueling outage. The NRC staff would then begin its review of the assessments and its determination of whether the license for Pilgrim should be modified, suspended or revoked.

If the licensee determines that only a focused evaluation is necessary and provides the information in mid-2017, the staff would expect its review to be completed by early 2018. Plants that perform a focused evaluation have demonstrated that their sites can address the reevaluated flooding hazards through existing capabilities or regulatory commitments associated with enhanced capabilities<sup>3</sup>. Based on the staff's discussion of Pilgrim's ability to cope with the reevaluated hazard that is provided above, the staff believes additional regulatory commitments, if any were identified, would have a limited safety benefit. Further, due to the limited operational time for Pilgrim, such benefits would only be implemented for a short amount of time prior to shutdown of the plant.

If the licensee determines that an integrated assessment is needed to address the reevaluated flooding hazard, the licensee is expected to submit this information by December 31, 2018. The staff expects its review of the integrated assessment to take 6 to 9 months which is past the June 1, 2019, proposed shutdown date for the plant. Therefore, the NRC staff concludes that there would not be sufficient time to implement any required changes, assuming that any changes were identified that would result in a substantial safety increase consistent with the requirements found in 10 CFR 50.109, "Backfitting". In other words, any meaningful, further improvement to safety will not be achieved prior to permanently defueling the plant.

Based on the ability of plant equipment to cope with the reevaluated flood hazard, the added safety margin as a result of instituting the mitigation strategies and their ability to cope with the reevaluated hazard, and the limited period of operation remaining for Pilgrim, the staff concludes that the licensee has provided sufficient information to ensure public health and safety are maintained throughout the deferral time that was requested for the 50.54(f) activities.

#### Deferral of Mitigation Strategies Assessment

As stated above, the reevaluated flood hazard information identified in response to the 50.54(f) letter is used by licensees to ensure their mitigating strategies for beyond-design-basis

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<sup>3</sup> Detailed guidance regarding flooding focused evaluations and integrated assessments can be found in in NEI 16-05, and COMSECY-15-0019, "Closure Plan for the Reevaluation of Flooding Hazards for Operating Nuclear Power Plants," (ADAMS Accession No. ML15153A104).

events are capable of addressing the reevaluated hazard information. The MSA is intended to confirm that licensees have adequately addressed the reevaluated flood hazard within their mitigating strategies for beyond-design-basis events.

In SECY-16-0142, "Draft Final Rule – Mitigation of Beyond-Design Basis Events [MBDBE]," dated December 15, 2016 (ADAMS Accession No. ML16301A005), the staff proposes an implementation period of 3 years from the date the rule is issued for plants such as Pilgrim to demonstrate that their mitigating strategies are capable of addressing the reevaluated hazard information. Assuming the Commission approves this proposed implementation requirement in 2017, Pilgrim would be obligated to meet the proposed MBDBE reevaluated hazard requirement in the 2020 timeframe. The proposed shutdown date of Pilgrim is before the proposed implementation date of the MBDBE rule. Under the current plans by the mid-2020 time frame there will be no fuel in the Pilgrim reactor. Therefore, the staff concludes deferring the flooding MSA until December 31, 2019, will not have an impact on the schedule for compliance with the proposed MBDBE rule.

Although the NRC staff finds the deferral of the MSA acceptable, the staff continues to expect Entergy to submit a flooding MSA should the plant continues to operate beyond June 1, 2019. In addition to demonstrating the site's ability to cope with the reevaluated hazard, the MSA should document various attributes of the mitigation strategies including the list of equipment relied on to implement the strategies. Nuclear Energy Institute (NEI) 12-06, Revision 2, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide (ADAMS Accession No. ML16005A635), has been endorsed by the NRC as an appropriate methodology for licensees to perform MSAs against the reevaluated flood hazard. Appendix G of NEI 12-06 provides guidance on performing and documenting the MSA. Section G.4.3 provides guidance on the use of plant equipment as an alternative to modifying the FLEX strategies, which is the approach described by Entergy in its deferral letter. As such, although the licensee discussed the ability of plant equipment to cope with the reevaluated flood hazard in its deferral letter, this does not remove the need for the licensee to provide a detailed MSA in accordance with NEI 12-06, Appendix G guidance should the plant continue to operate beyond June 1, 2019. Accordingly, the staff is deferring the flooding MSA until December 31, 2019.

## CONCLUSION

Based on the evaluation above, the NRC staff concludes that the public health and safety will continue to be adequately protected through the requested deferral period for Pilgrim without the need for additional assessments of the reevaluated flooding hazards during that time. Thus, the NRC concludes that Entergy's proposal to defer activities being performed to meet the 50.54(f) request for information for flooding events is acceptable. The staff also concludes that deferring the Pilgrim flooding MSA is acceptable, because, under the current plans, the Pilgrim reactor will be defueled prior to the proposed implementation requirement for the flooding reevaluated hazard found in the draft MBDBE rule. Accordingly, the required response date for the remaining flood assessments in response to the 50.54(f) letter and the MSA are deferred until December 31, 2019.



PILGRIM NUCLEAR POWER STATION – NRC RESPONSE TO REQUEST FOR DEFERRAL OF ACTIONS RELATED TO BEYOND-DESIGN-BASIS SEISMIC AND FLOODING HAZARD REEVALUATIONS DATED APRIL 17, 2017

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