



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

June 17, 2014

Mr. Michael J. Pacilio  
President and Chief Nuclear Office  
Exelon Nuclear  
4300 Winfield Road  
Warrenville, IL 60555

**SUBJECT: PEACH BOTTOM ATOMIC POWER STATION, UNITS 2 AND 3 - STAFF ASSESSMENT OF THE FLOODING WALKDOWN REPORT SUPPORTING IMPLEMENTATION OF NEAR-TERM TASK FORCE RECOMMENDATION 2.3 RELATED TO THE FUKUSHIMA DAI-ICHI NUCLEAR POWER PLANT ACCIDENT (TAC NOS. MF0261 AND MF0262)**

Dear Mr. Pacilio:

On March 12, 2012, the U.S. Nuclear Regulatory Commission (NRC) issued a request for information letter per Title 10 of the *Code of Federal Regulations*, Section 50.54(f) (50.54(f) letter). The 50.54(f) letter was issued to power reactor licensees and holders of construction permits requesting addressees to provide further information to support the NRC staff's evaluation of regulatory actions that may be taken in response to lessons learned from Japan's March 11, 2011, Great Tōhoku Earthquake, resultant tsunami, and subsequent accident at the Fukushima Dai-ichi nuclear power plant. The request addressed the methods and procedures for nuclear power plant licensees to conduct seismic and flooding hazard walkdowns to identify and address degraded, nonconforming, or unanalyzed conditions through the corrective action program, and to verify the adequacy of the monitoring and maintenance procedures.

By letter dated November 19, 2012, Exelon Generation Company, LLC (Exelon) submitted a Flooding Walkdown Report as requested in Enclosure 4 of the 50.54(f) letter for Peach Bottom Atomic Power Station (PBAPS), Units 2 and 3. By letter dated January 31, 2014, Exelon provided a response to the NRC request for additional information for the staff to complete its assessments.

The NRC staff acknowledges that the licensee will complete the delayed walkdown items during the PBAPS, Unit 3 P3R20 refueling outage, currently scheduled for fall 2015, consistent with a regulatory commitment. The NRC staff has reviewed the information provided and, as documented in the enclosed staff assessment, determined that sufficient information has been provided to be responsive to Enclosure 4 of the 50.54(f) letter. This closes out the NRC's efforts associated with TAC Nos. MF0261 and MF0262.

M. Pacilio

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If you have any questions, please contact me at 301-415-1420 or by e-mail at Rick.Ennis@nrc.gov.

Sincerely,

A handwritten signature in black ink, appearing to read "R B Ennis". The signature is fluid and cursive, with the first letters of the first and last names being capitalized and prominent.

Richard B. Ennis, Senior Project Manager  
Plant Licensing Branch I-2  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket Nos. 50-277 and 50-278

Enclosure:  
Staff Assessment of Flooding Walkdown  
Report

cc w/encl: Distribution via Listserv

STAFF ASSESSMENT OF FLOODING WALKDOWN REPORT  
NEAR-TERM TASK FORCE RECOMMENDATION 2.3 RELATED TO  
THE FUKUSHIMA DAI-ICHI NUCLEAR POWER PLANT ACCIDENT  
EXELON GENERATION COMPANY, LLC  
PEACH BOTTOM NUCLEAR POWER STATION, UNITS 2 AND 3  
DOCKET NOS. 50-277 AND 50-278

1.0 INTRODUCTION

On March 12, 2012,<sup>1</sup> the U.S. Nuclear Regulatory Commission (NRC) issued a request for information per Title 10 of the *Code of Federal Regulations*, Section 50.54(f) (50.54(f) letter) to all power reactor licensees and holders of construction permits in active or deferred status. The request was part of the implementation of lessons learned from the accident at the Fukushima Dai-ichi nuclear power plant. Enclosure 4, "Recommendation 2.3: Flooding,"<sup>2</sup> to the 50.54(f) letter requested licensees to conduct flooding walkdowns to identify and address degraded, nonconforming, or unanalyzed conditions using the corrective action program (CAP), verify the adequacy of monitoring and maintenance procedures, and report the results to the NRC.

Enclosure 4 of the 50.54(f) letter requested licensees to respond with the following information:

- a. Describe the design basis flood hazard level(s) for all flood-causing mechanisms, including groundwater ingress.
- b. Describe protection and migration features that are considered in the licensing basis evaluation to protect against external ingress of water into SSCs [systems, structures, and components] important to safety.
- c. Describe any warning systems to detect the presence of water in rooms important to safety.
- d. Discuss the effectiveness of flood protection systems and exterior, incorporated, and temporary flood barriers. Discuss how these systems and barriers were evaluated using the acceptance criteria developed as part of Requested Information item 1.h.
- e. Present information related to the implementation of the walkdown process (e.g., details of selection of the walkdown team and procedures) using the documentation template discussed in Requested Information item 1.j, including actions taken in response to the peer review.

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<sup>1</sup> Agencywide Documents Access and Management System (ADAMS) Accession No. ML12053A340.

<sup>2</sup> ADAMS Accession No. ML12056A050.

- f. Results of the walkdown including key findings and identified degraded, nonconforming, or unanalyzed conditions. Include a detailed description of the actions taken or planned to address these conditions using guidance in Regulatory Issues Summary 2005-20, Revision 1, Revision to the NRC Inspection Manual Part 9900 Technical Guidance, "Operability Conditions Adverse to Quality or Safety," including entering the condition in the corrective action program.
- g. Document any cliff-edge effects identified and the associated basis. Indicate those that were entered into the corrective action program. Also include a detailed description of the actions taken or planned to address these effects.
- h. Describe any other planned or newly installed flood protection systems or flood mitigation measures including flood barriers that further enhance the flood protection. Identify results and any subsequent actions taken in response to the peer review.

In accordance with the 50.54(f) letter, Enclosure 4, Required Response Item 2, licensees were required to submit a response within 180 days of the NRC's endorsement of the flooding walkdown guidance. By letter dated May 21, 2012,<sup>3</sup> the Nuclear Energy Institute (NEI) staff submitted NEI 12-07, Revision 0, "Guidelines for Performing Verification Walkdowns of Plant Flood Protection Features," to the NRC staff to consider for endorsement. NEI 12-07 describes a methodology for performing walkdowns in a manner that will address requested information items 1.a through 1.j of Enclosure 4 to the 50.54(f) letter. By letter dated May 31, 2012,<sup>4</sup> the NRC staff endorsed the walkdown guidance.

By letter dated November 19, 2012,<sup>5</sup> Exelon Generation Company, LLC (the licensee), provided a response to Enclosure 4 of the 50.54(f) letter, Required Response Item 2, for Peach Bottom Atomic Power Station (PBAPS), Units 2 and 3. The NRC staff issued a request for additional information (RAI) to the licensee regarding the available physical margin (APM) dated December 23, 2013.<sup>6</sup> The licensee responded by letter dated January 31, 2014.<sup>7</sup>

The NRC staff evaluated the licensee's submittals to determine if the information provided in the walkdown report met the intent of the walkdown guidance and if the licensee responded appropriately to Enclosure 4 of the 50.54(f) letter.

## 2.0 REGULATORY EVALUATION

The SSCs important to safety in operating nuclear power plants are designed either in accordance with, or meet the intent of Appendix A to 10 CFR Part 50, "General Design Criteria for Nuclear Power Plants," Criterion 2: "Design Bases for Protection Against Natural Phenomena;"

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<sup>3</sup> ADAMS Package Accession No. ML121440522.

<sup>4</sup> ADAMS Accession No. ML12144A142.

<sup>5</sup> ADAMS Accession No. ML123250714.

<sup>6</sup> ADAMS Accession No. ML13325A891.

<sup>7</sup> ADAMS Accession No. ML14031A443.

and Appendix A to 10 CFR Part 100, "Seismic and Geological Siting Criteria for Nuclear Plants." Criterion 2 states that SSCs important to safety at nuclear power plants shall be designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches without loss of capability to perform their safety functions.

For initial licensing, each licensee was required to develop and maintain design bases that, as defined by 10 CFR 50.2, identify the specific functions to be performed by an SSC, and the specific values or ranges of values chosen for controlling parameters as reference bounds for the design.

The design bases for the SSCs reflect appropriate consideration of the most severe natural phenomena that have been historically reported for the site and surrounding area. The design bases also reflect sufficient margin to account for the limited accuracy, quantity, and period of time in which the historical data have been accumulated.

The current licensing basis (CLB), as defined in 10 CFR 54.3(a), is the set of NRC requirements applicable to a specific plant, and a licensee's written commitments for ensuring compliance with, and operation within, applicable NRC requirements and the plant-specific design basis that are in effect.

### 3.0 TECHNICAL EVALUATION

All elevations in the licensee's flood walkdown report (FWR) are referenced to the Conowingo Datum (CD), which is 0.7 feet above mean sea level.

#### 3.1 Design Basis Flooding Hazard for PBAPS

The licensee stated that the design basis flood at the PBAPS site is a probable maximum flood (PMF) based on an analysis of the six greatest floods of record for the Susquehanna River at Harrisburg, Pennsylvania, and the probable maximum precipitation (PMP) over the watershed. Based on these data and analysis, the PMF at PBAPS is estimated as 131.5 feet (ft) CD. Combined with a transient upstream due to dam failure, the maximum still water elevation is 132.0 ft CD at PBAPS. PBAPS structures required for safe shutdown are flood protected to elevation 135 ft CD. Adding maximum wave runup to the PMF level results in an elevation of 136.9 ft CD. By comparison, the design plant grade elevation for PBAPS is 115 ft CD in the Turbine Building area and 134 ft CD in the Reactor Building area.

The licensee stated groundwater ingress and local intense precipitation are not specifically discussed in the CLB. The licensee also stated that the CLB does not define the flood duration.

Based on the NRC staff's review, the licensee appears to have sufficiently described the design basis flood hazard level(s) as requested in the 50.54(f) letter and consistent with the walkdown guidance.

## 3.2 Flood Protection and Mitigation

### 3.2.1 Flood Protection and Mitigation Description

The licensee stated that the CLB flood protection level and mitigation is 135 ft CD. The flood protection features are designed to protect the plant safety-related SSCs during all modes of operation. The flood protection and mitigation feature implementations are initiated when the river surface water level reaches an elevation of 109.5 ft CD per PBAPS Procedure AO 28.2. The Reactor Building and Radwaste Building are sealed to an elevation of 135 ft CD for minimal leakage. Although the Reactor Building doors above elevation 135 ft CD have weather stripping, the licensee stated that small amounts of flood water might leak through. However, the licensee stated that this small amount of water would not threaten operation of equipment credited in the CLB.

The licensee stated that the Emergency Cooling Tower Structure, Diesel Generator Building, and Emergency Pump Structure are flood protected to 137.5 ft CD. Valves in the Emergency Pump Structure prevent flood water from reaching its roof and another valve in the Diesel Generator Building prevents backflow via the sump overflow drain. The service water intake sluice gates are closed when the water-surface elevation in the Susquehanna River reaches 113 ft CD and the water supply to the service water system is switched from the river to an onsite emergency water reservoir.

The licensee stated that PBAPS Special Event Flood Procedure (SE-4) contains the flood protection and mitigation actions. The licensee stated that neither the CLB nor the procedure defines a credited time for the actions required for flood protection. However, to assess whether the flood protection actions could be completed without being impeded by flood, the licensee compared the time required to complete the actions with an assumed rate of river water-surface elevation rise of 1 ft per hour beginning when an elevation of 111 ft CD is exceeded and ending at 113 ft CD (i.e., 120 minutes).

The licensee stated that flood warning arrives at PBAPS in one of two ways: (1) a high river surface water elevation alarm in the control room monitored by sensors at the intake canal; or (2) an offsite federal agency notification. If the Susquehanna River water-surface elevation is greater than or equal to 111 ft CD and the river discharge is greater than 600,000 cubic feet per second (cfs), PBAPS initiates Flood Procedure SE-4. The licensee stated that, at this point, the reactors would be shut down using normal shutdown procedures. If the river water-surface elevation reaches 112 ft CD, the reactors are shut down using manual scrams. When the river water-surface elevation reaches 113 ft CD, the Emergency Cooling Water System is started.

### 3.2.2 Incorporated and Exterior Barriers

The licensee stated that the site has incorporated passive interior/exterior barriers including walls, floors, penetration seals, and internal conduit seals permanently in place requiring no operator manual actions. Active features include watertight doors, river water-surface level indicator switches, valves, and sluice gates. The licensee included all of these features in the flooding walkdowns.

### 3.2.3 Temporary Barriers and Other Manual Actions

The licensee stated that the PBAPS site has flood protection features consisting of temporary barriers and features that require manual action. The actions include protecting the Emergency Pump Structure, confirming that watertight doors are closed and secure, sealing a Turbine Building drain that flows to the Radwaste Building, opening the Turbine Building sump pump breakers to protect the Radwaste Building from flood waters, preventing backflow from the Diesel Generator Building sump overflow drain, and activating the Emergency Cooling Water System. Action on each feature is dependent on exceedence of a river surface water level trigger with response preparation initiated when river surface water levels are at or above 109.5 ft CD per PBAPS Procedure AO 28.2.

The NRC staff noted that the licensee's final flooding walkdown report describes that some flood protection barriers could be temporarily removed. The report states that Flood Procedure SE-4 contains instructions to replace these barriers if a flood is imminent.

### 3.2.4 Reasonable Simulation and Results

The licensee conducted reasonable simulations as part of its flooding walkdown, which included walking through the flood protection procedure steps to: (1) reposition valves in the Emergency Pump Structure when river levels exceed 111 ft CD; (2) activate the Emergency Cooling Water System when levels exceed 113 ft CD; and (3) confirm watertight doors are secured, seal Turbine Building floor drains, and close and plug the Diesel Generator Building oily waste valve when river levels exceed 115 ft.

The licensee's reasonable simulation initially was 156 minutes for the steps that were necessary to perform within the targeted available time of 120 minutes. Therefore, the procedures were entered into the PBAPS CAP. The licensee subsequently revised the procedures to optimize steps in the performance of the procedures such that the actual performance time would be 110 minutes and fall within the targeted available time of 120 minutes.

### 3.2.5 Conclusion

Based on the NRC staff's review, the licensee appears to have described protection and mitigation features as requested in the 50.54(f) letter and consistent with the walkdown guidance.

### 3.3 Warning Systems

The licensee stated that the CLB does not credit room water level warning systems for protection from external flooding.

Based on the NRC staff's review, the licensee appears to have provided information to describe any warning systems as requested in the 50.54(f) letter and consistent with the walkdown guidance.

### 3.4 Effectiveness of Flood Protection Features

The licensee's statements concluding that the credited flood protection features are effective are based on observations made during the walkdown, and reasonable simulations performed by the licensee. All features inspected not immediately acceptable were entered into the PBAPS CAP.

The licensee used acceptance criteria consistent with the walkdown guidance. Based on the NRC staff's review, the licensee appears to have discussed the effectiveness of flood protection features as requested in the 50.54(f) letter and is consistent with the walkdown guidance.

### 3.5 Walkdown Methodology

By letter dated June 11, 2012,<sup>8</sup> the licensee responded to the 50.54(f) letter indicating that it intended to utilize the NRC-endorsed walkdown guidance contained in NEI 12-07, Rev. 0-A, "Guidelines for Performing Verification Walkdowns of Plant Flood Protection Features."<sup>9</sup>

The licensee's walkdown submittal dated November 19, 2012, indicated that the licensee implemented the walkdowns consistent with the intent of the guidance provided in NEI 12-07. The licensee did not identify any exceptions from NEI 12-07.

Based on the NRC staff's review, the licensee appears to have presented information related to the implementation of the walkdown process as requested in the 50.54(f) letter, and is consistent with the walkdown guidance.

### 3.6 Walkdown Results

#### 3.6.1 Walkdown Scope

The licensee performed walkdowns of relevant flood protection features at the Reactor Building, Emergency Pump Structure, Diesel Generator Building, Emergency Cooling Tower, and Radwaste Building. In addition, the licensee performed reasonable simulations of actions and stated that all operator actions to install flood mitigation features could be completed within 120 minutes following the revisions to procedures described in Section 3.2.4, above.

The licensee used acceptance criteria consistent with the intent of NEI 12-07, supplemented with plant-specific procedures for periodic inspections of features.

#### 3.6.2 Licensee Evaluation of Flood Protection Effectiveness, Key Findings, and Identified Deficiencies

The licensee performed an evaluation of the overall effectiveness of the plant's flood protection features. NEI 12-07 defines a deficiency as follows: "a deficiency exists when a flood protection feature is unable to perform its intended function when subject to a design basis flooding hazard." The licensee did not identify deficiencies because of the flood walkdowns. The licensee identified 27 items that did not meet acceptance criteria, but determined those items remain

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<sup>8</sup> ADAMS Accession No. ML12164A570.

<sup>9</sup> ADAMS Accession No. ML12173A215.



operable. These items were entered into the CAP, and the licensee identified the actions planned to resolve the identified conditions.

NEI 12-07 requires licensees to identify observations in the CAP that were not yet dispositioned at the time the walkdown report was submitted. The licensee did not identify observations awaiting disposition.

### 3.6.3 Flood Protection and Mitigation Enhancements

The licensee disclosed enhancements to the flood protection and mitigation enhancements in the FWR that include optimizing procedures (SE-4 and SO 48.1.B) to enhance the station's response to a flood, including reducing performance times for the procedures. The licensee also discussed a plan to have the equipment operator curriculum review committee consider adding training on the SE-4 procedure to continuing training.

### 3.6.4 Planned or Newly Installed Features

The licensee identified no planned or newly installed features.

### 3.6.5 Deficiencies Noted and Actions Taken or Planned to Address

The licensee identified no deficiencies.

### 3.6.6 NRC Staff Analysis of Walkdowns

The NRC staff reviewed the licensee's walkdown report<sup>10</sup> dated November 19, 2012. The licensee provided an evaluation of flood protection procedures in the walkdown report. The staff found that the reasonable simulations conducted for these procedures were adequately described and met the intent of the walkdown guidance. The licensee provided detail related to its determination that all flood protection features that were immediately acceptable were performing their credited functions effectively. The licensee also confirmed that all flood protection features that were not immediately acceptable were entered into the CAP and verified to be operable.

Based on the above assessment, the licensee appears to have provided results of the walkdown and described any other planned or newly installed flood protection systems or flood mitigation measures as requested in the 50.54(f) letter and consistent with the walkdown guidance. Based on the information provided in the licensee's submittal, the NRC staff concludes that the licensee's implementation of the walkdown process meets the intent of the walkdown guidance.

### 3.6.7 Available Physical Margin

The NRC staff submitted an RAI to the licensee regarding the available physical margin (APM) dated December 23, 2013.<sup>11</sup> The licensee responded with a letter dated January 31, 2014.<sup>12</sup>

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<sup>10</sup> ADAMS Accession No. ML12335A341.

<sup>11</sup> ADAMS Accession No. ML13325A891.

<sup>12</sup> ADAMS Accession No. ML14031A443.

The licensee has reviewed their APM determination process, and entered any unknown APMs into their CAP.

Based on the NRC staff's review, the licensee appears to have documented the information requested for any cliff-edge effects, as requested in the 50.54(f) letter and consistent with the walkdown guidance. Further, the NRC staff reviewed the response, and concluded that the licensee met the intent of the APM determination per NEI 12-07.

### 3.7 NRC Oversight

#### 3.7.1 Independent Verification by Resident Inspectors

On June 27, 2012, the NRC issued Temporary Instruction (TI) 2515/187, "Inspection of Near-Term Task Force Recommendation 2.3 Flooding Walkdowns."<sup>13</sup> In accordance with the TI, NRC inspectors independently verified that the licensee for PBAPS, Units 2 and 3, implemented the flooding walkdowns consistent with the intent of the walkdown guidance. Additionally, the inspectors independently performed walkdowns of a sample of flood protection features. Inspection Reports 05000277/2012005, dated January 29, 2013,<sup>14</sup> document the results of this inspection. No findings of significance were identified.

#### 4.0 Walkdowns Not Performed for Flood Protection Features

##### 4.1 Restricted Access

The licensee identified restricted access features consisting of two blockouts and multiple internal conduit seals. The licensee stated that a review of the Component Record List showed that all internal conduit seals were installed as shown in design drawings and external flood seals are installed and inspected. The licensee stated that features in restricted access areas will be inspected when conditions allow during the PBAPS, Unit 3, P3R20 refueling outage scheduled for fall 2015.

##### 4.2 Inaccessible Features

The licensee identified inaccessible features in the Radwaste Building, Reactor Building, Turbine wall, Diesel Generator Building and Emergency Cooling Tower. The licensee provided a justification for reasonable assurance that these features are available based on design drawings, spot checks of three locations, issue reports and inspections of similar features.

### 5.0 CONCLUSION

The NRC staff concludes that the licensee's implementation of the flooding walkdown methodology meets the intent of the walkdown guidance. The staff concludes that the licensee, through the implementation of the walkdown guidance activities and in accordance with plant processes and procedures, verified the plant configuration with the current flooding licensing basis; addressed degraded, nonconforming, or unanalyzed flooding conditions; and verified the

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<sup>13</sup> ADAMS Accession No. ML12129A108.

<sup>14</sup> ADAMS Accession No. ML13029A013.

adequacy of monitoring and maintenance programs for protective features. Furthermore, the licensee's walkdown results, which were verified by the staff's inspection, identified no immediate safety concerns. The staff acknowledges that the licensee will complete the delayed walkdown items during the P3R20 refueling outage, currently scheduled for fall 2015, consistent with a regulatory commitment. The NRC staff concludes that the licensee responded appropriately to Enclosure 4 of the 50.54(f) letter, dated March 12, 2012.

M. Pacilio

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If you have any questions, please contact me at 301-415-1420 or by e-mail at Rick.Ennis@nrc.gov.

Sincerely,

*/RA/*

Richard B. Ennis, Senior Project Manager  
Plant Licensing Branch I-2  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket Nos. 50-277 and 50-278

Enclosure:  
Staff Assessment of Flooding Walkdown  
Report

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