



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

April 21, 2014

Mr. George T. Hamrick, Vice President  
Brunswick Steam Electric Plant  
Duke Energy Progress, Inc.  
Post Office Box 10429  
Southport, North Carolina 28461

**SUBJECT: BRUNSWICK STEAM ELECTRIC PLANT, UNITS 1 AND 2 – STAFF  
ASSESSMENT REGARDING FLOODING WALKDOWNS TO SUPPORT  
IMPLEMENTATION OF NEAR-TERM TASK FORCE RECOMMENDATION 2.3  
RELATED TO THE FUKUSHIMA DAI-ICHI NUCLEAR POWER PLANT  
ACCIDENT (TAC NOS. MF0203 AND MF0204)**

Dear Mr. Hamrick:

On March 12, 2012, the U.S. Nuclear Regulatory Commission (NRC) staff issued a request for information letter per Title 10 of the *Code of Federal Regulations*, Part 50, 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 to be taken in response to lessons learned from Japan's March 11, 2011, Great Tōhoku Earthquake and subsequent tsunami. The request addressed the methods and procedures for plants to conduct 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 27, 2012, Duke Energy Progress, Inc., formerly known as Carolina Power & Light Company, submitted a report documenting the flooding walkdowns as requested per Enclosure 4 of the 50.54(f) letter for Brunswick Steam Electric Plant, Units 1 and 2.

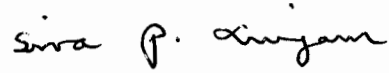
The NRC staff has reviewed the information provided and, as documented in the enclosed staff assessment, determined that you have provided sufficient information to be responsive to the 50.54(f) letter. This closes out the NRC's efforts associated with TAC Nos. MF0203 and MF0204.

G. Hamrick

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If you have any questions, please contact me at (301) 415-1564 or by e-mail at [Siva.Lingam@nrc.gov](mailto:Siva.Lingam@nrc.gov).

Sincerely,

A handwritten signature in black ink that reads "Siva P. Lingam". The signature is written in a cursive style with a distinct loop for the letter 'P'.

Siva P. Lingam, Project Manager  
Plant Licensing Branch II-2  
Division of Operating Reactor Regulation  
Office of Nuclear Reactor Regulation

Docket No. 50-325 and 50-324

Enclosure:  
Staff Assessment of Flooding Walkdown

cc w/encl: Distribution via Listserv

STAFF ASSESSMENT BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO FLOODING WALKDOWN REPORT

DUKE ENERGY PROGRESS, INC.

BRUNSWICK STEAM ELECTRIC PLANT, UNITS 1 AND 2

DOCKET NOS. 50-325 AND 50-324

1.0 INTRODUCTION

By letter dated March 12, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12053A340), the U.S. Nuclear Regulatory Commission (NRC) issued a request for information to all power reactor licensees and holders of construction permits in active or deferred status, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.54(f) (hence referred to as the 50.54(f) letter). The request was issued as a part of implementing lessons-learned from the accident at the Fukushima Dai-ichi, Japan, nuclear power plant. Enclosure 4 "Recommendation 2.3: Flooding," 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.

The 50.54(f) letter requests licensees to include the following:

- 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 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.
- 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 Park 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.

Enclosure

- 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 (ADAMS Accession No. ML12056A050), 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, 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 (ADAMS Accession Nos. ML12144A400, letter and ML12144A401, guidance). 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 of the 50.54(f) letter. By letter dated May 31, 2012 (ADAMS Accession No. ML12144A142), the NRC staff found that the performance and reporting of flooding protection walkdowns in accordance with the guidance would be responsive to the 50.54(f) letter. As a result, NEI 12-07, Revision 0-A was published (ADAMS Accession Nos. ML12173A215).

By letter dated November 27, 2012 (ADAMS Accession No. ML12340A074), Duke Energy Progress, Inc. (Duke Energy or the licensee) provided a response for the Brunswick Steam Electric Plant (BSEP), Units 1 and 2.

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 structures, systems, and components (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," and Appendix A to 10 CFR Part 100, "Reactor Site Criteria." 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, tsunamis, 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 that an SSC of a facility must perform, 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 is the set of NRC requirements applicable to a specific plant, including the licensee's docketed commitments for ensuring compliance with, and operation

within, applicable NRC requirements and the plant-specific design-basis, including all modifications and additions to such commitments over the life of the facility operating license.

### 3.0 TECHNICAL EVALUATION

#### 3.1 Design-Basis Flooding Hazard for Brunswick Steam Electric Plant

The design-basis flood hazard for the site is a Probable Maximum Hurricane (PMH) with flood hazard level at 22.0 feet (ft) main sea level (MSL) with wave run up reaching 26.1 ft MSL (note: due to its proximity, the service water intake structure wave run up elevation is 28.3 ft MSL). The effects of the PMH and the storm surge result in a flooded elevation of 22.0 ft MSL for a duration of 6 hours.

#### 3.2 Flood Protection and Mitigation

##### 3.2.1 Flood Protection and Mitigation Description

Flood protection consists of incorporated passive features such as wall penetration seals, floor drains, roof drains, and manhole covers. Incorporated active features include credited watertight doors, sump pumps, and check valves. Windows and doors are either located above the 22 ft elevation or have positive seals that will mitigate flooding inleakage rate. There are room warning systems located in the sumps of safety related buildings for identifying internal flooding only.

##### 3.2.2 Incorporated and Exterior Barriers

See section 3.2.1 above.

##### 3.2.3 Temporary Barriers and Other Manual Actions

The site has temporary barriers and other manual actions that require operator action, including closing or verifying closed flood doors and installing flood barriers. Sandbags are noted to be used within the procedure, but are considered an above-design-basis flood protection feature.

##### 3.2.4 Reasonable Simulation and Results

The licensee performed reasonable simulations for several activities, among them are:

- closing weather doors
- installing rattlespace (i.e., space between buildings provided for seismic isolation) contingency flood barriers
- constructing sandbag dike at diesel generator building rollup door
- checking railroad track door seals
- staging portable air sump pumps
- securing service water pump bay and a screenwash pump bay
- temporary penetration.

All reasonable simulations were performed and met the intent of the walkdown guidance.

### 3.3 Warning Systems

There are room water level warning systems located in the sumps of safety-related buildings for identifying internal flooding only.

There are off-site agreements with a meteorological provider for notification of National Oceanic and Atmospheric Administration hurricane watches and warnings. Additional notifications are used to trigger certain site-specific procedures and activities.

### 3.4 Effectiveness of Flood Protection Features

The licensee's walkdown report states that reasonable simulations performed for several flood related features demonstrated that the incorporated active features, temporary active features, and passive features are available, functional, and implementable. However, it should be noted that based on NRC's on-site walkdown audit, it was discovered that there were issues with the feasibility, availability, and performance of the temporary use of the sandbags (see Section 3.6.2).

### 3.5 Walkdown Methodology

By letter dated June 11, 2012 (ADAMS Accession No. ML12171A199), the licensee responded to the 50.54(f) letter that they intended to utilize the NRC-endorsed walkdown guidelines contained in NEI 12-07, Revision 0-A. The licensee's walkdown submittal dated November 27, 2012, indicated that the licensee implemented the walkdowns consistent with the intent of the guidance provided in NEI 12-07. The licensee did not state any exceptions from NEI 12-07.

### 3.6 Walkdown Results

#### 3.6.1 Walkdown scope

The licensee performed walkdowns of flood protection features including incorporated passive features such as wall penetration seals, floor drains, roof drains, and manhole covers. Also included were incorporated active features such as watertight doors, sump pumps, and check valves. The licensee also performed reasonable simulation of manual actions, including physical actions such as closing of severe weather doors, installing rattlepace contingency flood barriers in place of the steel plates at the seismic gap areas, constructing a sandbag dike at the diesel generator building rollup door, checking railroad track door seals, staging portable air sump pumps, and securing a service water pump bay and a screenwash pump bay temporary penetration.

There was no discussion regarding the specific operation of the plant or any concurrent environmental conditions for the walkdown.

### 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. See section 3.4 above for the licensee's summary of the effectiveness of the 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 identified deficiencies because of the flood walkdowns.

Of the several deficiencies identified, most are related to penetrations. The issues concerning the penetrations are associated mostly with poor, degraded, or missing seals. These were either repaired immediately or a work request (WR) was issued for future repair.

Other deficiencies related to findings associated with the reasonable simulations and procedures. The simulations and procedures performed for installation of sandbags and severe weather related activities revealed issues such as incorrectly identified sandbag weight, discrepancies related to different sandbag requirements among two different procedures, poor condition of the sandbags, lack of procedural guidance pertaining to staging areas and required support equipment, inappropriate contingencies associated with pumps, and incomplete and/or lack of detail in general.

NEI 12-07 requires licensees to identify observations in the CAP that were not yet dispositioned at the time the walkdown report was submitted. Duke Energy identified items that were entered into the CAP. Some of these had been repaired, whereas most had been issued a WR.

### 3.6.3 Flood Protection and Mitigation Enhancements

The licensee has implemented or planned the enhancements that improve or increase flood protection or mitigation as discussed below.

#### 3.6.4 Planned or Newly Installed Features

As a result of the flood walkdowns, the licensee improved portions of the site flood protection. These include replacing the steel plates at the seismic gap areas (rattlespaces) with flood barriers that slide in place via a track that can be sealed to prevent flooding between buildings.

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

The licensee noted the deficiencies and actions taken or planned to address the deficiencies. See section 3.6.2 above for a summary of these deficiencies. The licensee entered the deficiencies into the CAP.

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

##### 3.6.6.1 Restricted Access

There were 204 features that were not inspected due to restricted access. The licensee provided a justification for the delay in walkdowns of restricted access features. The restricted

access is due to several issues including the need for insulation removal, removal of plugs in backwater valves, or electrical cabinets that could not be opened at the time of the walkdown.

#### 3.6.6.2 Inaccessible Features

There were no flood protection features that were classified by the licensee as inaccessible.

#### 3.6.7 Staff Assessment of Walkdowns

The NRC staff reviewed the licensee's walkdown report dated November 27, 2012, and conducted a site audit of the walkdown report at the BSEP site in July 2013 (see section 3.8). There were two issues that were not fully documented in the report, but were deemed to be consistent with the walkdown guidance during the audit (see section 3.8). These two issues included the sandbag barrier at the emergency diesel building and the adequacy of the door seals.

Based on the review of the walkdown report and the site audit, the NRC staff concludes that the licensee did perform the walkdowns in accordance with NEI 12-07.

#### 3.6.8 Available Physical Margin

During the site audit discussed in section 3.8, the NRC staff reviewed the processes used to calculate and address the available physical margin (APM) at flood protection features. The NRC staff concluded that the licensee met the intent of the APM process.

### 3.7 Independent Verification

On June 27, 2012, the NRC issued Temporary Instruction (TI) 2515/187, "Inspection of Near-Term Task Force Recommendation 2.3 Flooding Walkdowns" (ADAMS Accession No. ML12129A108). The TI directed NRC inspectors to independently verify that licensees were implementing the flooding walkdowns in accordance with the NRC endorsed walkdown methodology by accompanying licensee personnel on a sample of walkdowns. Additionally, the TI directed the inspectors to independently perform walkdowns of a sample of flood protection features. In Inspection Report 050003554/2012005, dated February 11, 2013, the results of this inspection were documented. No findings of significance were identified.

### 3.8 Staff Audit

The NRC staff performed an audit of BSEP during the week of June 25, 2013. During the audit, the NRC staff gained an increased understanding of the process used by the licensee to perform the walkdowns, including the available physical margin determinations, the use of sandbags at the diesel generator building and the adequacy of the door seals. The NRC staff identified and conveyed to the licensee the specific issues to be addressed. The NRC staff also noted that the licensee discussed several self-identified issues. The audit report dated April 11, 2014 (ADAMS Accession No. ML14052A033) provides the results of this audit for BSEP.



### 3.9 SSCs to be Walked Down at a Later Date

The licensee inspected the features described as restricted prior to July 31, 2013. The licensee identified several restricted access features, which are mainly penetrations in reactor buildings 1 and 2, augmented off-gas building, diesel generator building, and the service water building.

### 4.0 CONCLUSION

The NRC staff concludes that the licensee's implementation of flooding walkdown methodology meets the intent of the walkdown guidance. The NRC 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 seismic conditions; and verified the adequacy of monitoring the maintenance programs for protective features. Furthermore, the NRC staff notes that no immediate safety concerns were identified. The NRC staff concludes that the licensee responded appropriately to Enclosure 4 of the 50.54(f) letter, dated March 12, 2012.

G. Hamrick

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If you have any questions, please contact me at (301) 415-1564 or by e-mail at [Siva.Lingam@nrc.gov](mailto:Siva.Lingam@nrc.gov).

Sincerely,

*/RA/*

Siva P. Lingam, Project Manager  
Plant Licensing Branch II-2  
Division of Operating Reactor Regulation  
Office of Nuclear Reactor Regulation

Docket No. 50-325 and 50-324

Enclosure:  
Staff Assessment of Flooding Walkdown

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