



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

April 11, 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 - AUDIT REPORT  
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 staff (NRC) 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 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.

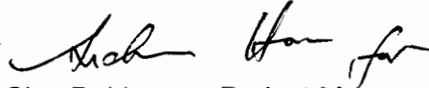
By letter dated November 27, 2012, Duke Energy Progress, Inc. (Duke Energy), formerly known as Carolina Power & Light Company, submitted a report documenting the flooding walkdowns as requested per Enclosure 4 of the 50.54(f) letter for Brunswick Steam Electric Plant, Units 1 and 2. On June 21, 2013, an NRC audit team completed the on-site audit to gain a better understanding of the methods and procedures used by Duke Energy to conduct the flooding walkdowns. The information gained during the audit will facilitate the NRC staff review of the walkdown report and allow for more concise requests for information. The NRC staff appreciates your support of the audit. The final audit report has been included as an enclosure to this letter.

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, appearing to read 'Siva P. Lingam' with a stylized flourish at the end.

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:  
Audit Report

cc w/encl: Distribution via Listserv

REPORT OF REGULATORY AUDIT FROM JUNE 18 TO JUNE 21, 2013

FLOODING WALKDOWNS

DUKE ENERGY PROGRESS, INC.

BRUNSWICK STEAM ELECTRIC PLANT, UNITS 1 AND 2

DOCKET NOS. 50-325 AND 50-324

1.0 INTRODUCTION

This document provides a summary of the U. S. Nuclear Regulatory Commission (NRC) audit of the flooding walkdowns performed by Brunswick Steam Electric Plant (BSEP), Units 1 and 2. The walkdowns were performed in response to NRC's request for information contained in the March 12, 2012, letter, Enclosure 4.

1.1 Background

By letter dated March 12, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12053A340), the 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*, 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 of the 50.54(f) letter requested that licensees plan and perform a flooding walkdown to identify degraded, nonconforming, or unanalyzed conditions related to the licensing bases of structures, systems, and components important to safety and to verify the adequacy of the monitoring and maintenance procedures.

By letter dated November 27, 2012 (ADAMS Accession No. ML12340A074), Duke Energy Progress, Inc. (Duke Energy or the licensee), 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 BSEP, Units 1 and 2.

1.2 Regulatory Audit Basis

The NRC staff conducted a regulatory audit to gain a better understanding of the methods and associated procedures used by Duke Energy to conduct the flooding walkdowns at BSEP, Units 1 and 2 and facilitate NRC staff assessment of the report documenting the site walkdowns.

The Nuclear Energy Institute (NEI) developed guidance for performing the flooding walkdowns with extensive review and input from NRC staff in numerous public meetings, webinars, and public conference calls. NEI submitted NEI 12-07, "Guidelines for Performing Verification Walkdowns of Plant Flood Protection Features" (ADAMS Accession No. ML12144A401) for endorsement. The NRC staff subsequently endorsed the walkdown guidance by letter dated May 31, 2012 (ADAMS Accession No. ML12144A142). By letter dated June 11, 2012 (ADAMS

Enclosure

Accession No. ML12171A199), Duke Energy indicated that they would follow the NRC endorsed guidance for the flooding walkdowns at BSEP, Units 1 and 2.

The 50.54(f) letter and NEI 12-07 were the basis documents upon which the regulatory audit was performed.

### 1.3 Audit Logistics

An audit plan was submitted to BSEP, on May 14, 2013 (ADAMS Accession No. ML13127A038). The audit plan included a list of information needs requested to be reviewed during the audit and a proposed audit schedule. The audit plan also requested that personnel (the licensee staff and contractors) be available for interviews.

The NRC staff performed an audit of BSEP, Units 1 and 2, from June 18 to 21, 2013. The audit was performed in accordance with the Nuclear Reactor Regulation (NRR) Office Instruction LIC-111, "Regulatory Audits" (ADAMS Accession No. ML082900195). Table 1 lists NRC staff and contractors who participated in the audit. An entrance meeting was held on June 18, 2013, to convey to the licensee background information and the audit purpose. An exit meeting was held on June 21, 2013, to convey to the licensee observations from the audit, including: (1) observations related to whether the walkdowns were performed in accordance with NEI 12-07 and (2) observations forwarded to the resident inspectors for additional action, if appropriate.

**Table 1: NRC audit team**

<b>Auditor</b>	<b>Affiliation</b>	<b>Audit Role</b>
Stephen Campbell	NRC/NRR/DIRS/IRIB	Audit lead
Peter Chaput	NRC/NRO/DSEA/RHMB	Flooding Technical Lead
Michelle Catts	NRC/RII	Resident Inspector
Nebiyu Tiruneh	NRC/NRO/DSEA/RHMB	Flooding Technical Support
Christopher Cook	NRC/NRO/DSEA/RHMB	Management Support
Scott Flanders	NRC/NRO/DSEA	Management Support
Kevin Stewart	ORNL	Flooding Technical Support

### 2.0 AUDIT SCOPE

The audit provides support for the ongoing NRC staff assessment of the licensee submitted walkdown report. To support the staff assessment, the audit was scoped to review information and documents available onsite, and interview the licensee staff and contractors to aid NRC staff understanding of: (1) how the licensee performed the flooding hazard walkdowns and (2) whether the walkdowns were performed in accordance with NEI 12-07. The audit also helped to identify additional information that will require docketing to support the staff conclusions related to the staff assessment. Observations made by the audit team that were not within the scope of the audit were transferred to the resident inspector for additional action, if appropriate.

### 3.0 AUDIT ACTIVITIES

The audit team reviewed documents related to the licensee's performance of the flooding walkdowns, including:

- Walkdown record forms, and other supplemental forms and worksheets generated by the licensee to document observations associated with the walkdowns.
- Flood-specific procedures that are part of flood protection and mitigation strategies or hazardous weather response that were reviewed or used by the licensee as part of the flood walkdowns.
- Listing of entries into the Corrective Action Program (CAP) resulting from the performance of the flood walkdowns.
- Brunswick Self-Assessment report that the licensee had performed after the walkdown and before the regulatory audit.
- Site plans and maps as well as relevant plant drawings.
- Relevant sections of the Final Safety Analysis Report (FSAR) and Design Basis Document for the site.

The audit team also interviewed site personnel and walkdown participants to inquire about how visual inspections were performed (e.g., criteria used to determine feature acceptability), calculation of available physical margin (APM), current licensing basis (CLB) interpretation, and flood protection features at each building. As necessary, the NRC staff observed areas of the site that are associated with plant flood response or were examined by the licensee as part of flooding walkdowns.

All audit team members participated in a site familiarization tour. As necessary, the NRC staff also requested and participated in additional field visits to the reactor building (RB), control building, and diesel generator building (DGB) based on information derived from the licensee walkdowns. The licensee also presented an overview of the site walkdowns, flood protection of the site, and the Brunswick Self-Assessment.

Audit review responsibilities associated with flood protection features were generally divided among team members based on plant building or area. In addition, at least one auditor focused on review of procedures and reasonable simulations, to determine whether all procedures were adequately simulated.

The audit team participated in a site familiarization tour of the service water building (SWB), fuel oil tank chamber (FOTC) (external only), and DGB. Audit team members visually reviewed flood protection features including penetration seals, flood doors (including roller doors), louvered ventilation panels, and sump systems. Audit team members also interviewed site personnel regarding the CLB flood elevations, and posted signage at every building indicating the elevations of the CLB stillwater, maximum wave, and wave runup height.

The site visits provided evidence that the control building did not require additional walkdowns based on the first floor elevation and no physical paths for wave action into the building. Audit team members noted that the external rollup door at the DGB had some visible gaps in the door seal and did not operate when site personnel performed a brief test. Later operation of the door

was successful, however, additional actions were required (i.e., obtaining and using a ladder to access a manual locking mechanism), which do not appear to be part of the normal operation of the door. The reasonable simulation walkdown record form did not state how the door was operated, but did state that the operation was successful.

Audit team members performed an audit of the following documents:

- Sample of walkdown record forms for all buildings inspected by the licensee including:
  - DGB,
  - RB,
  - Control Building,
  - SWB,
  - Auxiliary Off Gas Building, and
  - FOTC (diesel fuel storage)
- Brunswick Nuclear Plant Response to Severe Weather Warnings procedure
- Design Basis Documents for Brunswick Steam Electric Plant
- Quick Hit Self-Assessment

The audit team sampled walkdown record forms, specifically for Question 27 of NEI 12-07, which indicates whether a flood protection feature has a small margin and potential significant safety consequences. During the sample review, the audit team noted that several flood protection features had "Not Applicable" or "N/A" listed under Question 27, and the related Question 11 under the Visual Inspection portion of the record form. The features' walkdown record forms were incorrectly completed. The features did have small margins and should have been entered into the CAP, but due to filling the Question 27 "N/A," the features were not entered into the CAP. The audit team determined during the review of the Quick Hit Self-Assessment that BSEP noted this error as well.

The audit team noted during the review of the FSAR and Design Basis Documents that in-leakage is allowed at various doors, including the DGB, SWB, and RB. The interior sump pumps then operate to remove the in-leakage. The in-leakage rate and sump pump rating would be considered critical characteristics of the flood mitigation system, and should have been verified during the walkdown. The audit team requested either evidence that the verification was performed or that an analysis was completed to ensure the in-leakage and sump pump ratings are still valid. The licensee staff could not provide documentation that in-leakage was determined to still be within the licensing basis computed levels, and entered this issue into the CAP.

The audit team noted that sandbags are deployed behind the DGB roll-up door, as a defense in-depth measure. During the review of the walkdown record forms, severe weather procedure, and the licensee staff interviews, the audit team determined that the sandbags are not a licensing basis flood protection feature, and therefore, should not have been reasonably simulated during the walkdown.

Based on the audit team's reviews, NRC staff has several observations directly related to whether the licensee performed the audit in accordance with NEI 12-07. Those observations are described in Section 4.0 of this audit summary.

## 4.0 AUDIT SUMMARY

As described in Section 2.0, the goal of the audit was to support the development of the staff assessment of the licensee's walkdown report. The audit team made observations during the audit that were compiled and conveyed to the licensee during the exit meeting. These observations are neither findings nor regulatory issues, however they will be used to inform the NRC staff assessment of the licensee walkdown.

### 4.1 Observations Related to NEI 12-07

The audit team made observations directly related to the scope of the audit that are described below.

In-leakage through external doors (personnel, rollup, and track) is part of the CLB, and should have been considered a critical characteristic and part of the acceptance criteria, per NEI 12-07 Section 5.5.2(10), "Incorporated or Exterior Passive Flood Protection Features," and Section 6, "Acceptance Criteria." However, the 50.54(f) response Section 5.0, "Flood Protection Features Effectiveness, Part A, Acceptance Criteria, Credited Watertight Doors," does not discuss in-leakage rates. No documentation at any doors was provided to indicate in-leakage was analyzed or verified. During the audit, discussions between the audit team and the licensee led the audit team to conclude that at the DGB rollup door the in-leakage rate could not be verified. Only the in-leakage rate analysis for the auxiliary off gas building was provided. The licensee committed to entering the verification of the inleakage rate into the CAP.

During the flooding walkdown conducted by the licensee, APMs with small margins and possible significant consequences were not entered into the CAP as stipulated by NEI 12-07, Section 5.8, "Documentation of Available Physical Margins." However, the licensee identified this issue as part of their Quick Hit Self-Assessment (AR 602565) conducted during the week of May 20 - 23, 2013, where the licensee identified 15 flood protection features with potential APM deficiencies that were not entered into the CAP.

The audit team noted that there was confusion among BSEP staff regarding the CLB flood protection levels. Specifically, at the DGB the CLB includes an allowable leakage rate, yet the walkdown included installing sandbags that was not part of the CLB. Responses by BSEP staff during the site familiarization tour and during later interviews provided contradictory answers regarding this issue. The audit team was not certain that the CLB protection features were fully understood by BSEP staff, however, BSEP management appropriately verified the CLB protection features and discussed instructing all other licensee staff.

During the site familiarization tour, the audit team noted that the FOTC had label plates for the wave run up of 26.1 feet. Informal visual inspection indicated that the flood elevation was above the top of the smoke exhausters at the FOTC. The audit team questioned BSEP staff regarding whether this was a possible flooding flow path. BSEP staff responded in the field by discussing how the wave dissipation would occur at the FOTC, and therefore, not flood into the exhausters. However, during subsequent interviews, the audit team asked further clarifying questions, and the licensee provided wave heights of the exhausters listed in the FSAR close to the heights of the exhausters, which may have required an APM calculation and was not listed in the

walkdown report. The licensee discussed this issue in a post-audit discussion and committed to entering into the CAP.

#### 4.2 Observations communicated to resident inspectors

The audit team made observations related to the plant response to flooding hazards that were not directly related to the scope of the audit. These observations were forwarded to the site resident inspectors for additional action, if appropriate.

During a review of the walkdown record reports, the audit team identified several instances where functionality assessments were not available upon request for issues associated with two RB penetrations, RB2-557 for missing seal link and RB2-577 for a seal that has a 2-inch long gap.

In 2011, the licensee issued Engineering Change-0000080408R2, "Flood Protection Basis Update," to address the difficulty in demonstrating the 15 gallons per minute leakage rates past the roll-up door at the DGB. This engineering change described using sandbags to add significant confidence that leakage past the inner door is not excessive. The issuance of this Engineering Change made it difficult to determine exactly what the CLB is for this door. Additionally, the walkdown record form for flood protection feature ID URS-164, "Procedure for Temporary Barrier\Sandbags for 2-DG-DR-EL023-126" indicates that the sandbag wall procedure did not succeed and the procedure needed to be revised.

Service water (SW) valves SW-V-3 and SW-V-4, SW to turbine building component cooling water located in the Radwaste Pipe Tunnel and the pipe tunnel are not protected for external flood protection. These two normally open valves' safety functions are too close and may fail as-is (i.e., open) during an external flood event and could cause floodwaters to enter the Radwaste Pipe Tunnel.

#### 5.0 POTENTIAL REQUESTS FOR ADDITIONAL INFORMATION

To support the NRC staff assessments of the licensee walkdown reports, the NRC staff may require additional information from the licensee regarding the methodology used to evaluate APM and responses to Question 27 for the walkdown record form in Appendix B, "Walkdown Record Form," of NEI 12-07 for flood protection features with small or zero APM. In addition, the NRC staff may require additional information regarding the flood heights used to calculate APM for certain flood protection features.

#### 6.0 CONCLUSIONS

The audit provided the NRC staff and contractors with information that is relevant to the staff assessment of the licensee's walkdown report. This audit summary will be used as an input to the staff assessment.

G. Hamrick

- 2 -

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 by AHon for/***

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

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