



William R. Gideon
Vice President
Brunswick Nuclear Plant
P.O. Box 10429
Southport, NC 28461

o: 910.457.3698

December 15, 2016

Serial: BSEP 16-0104

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

Subject: Brunswick Steam Electric Plant (BSEP), Unit Nos. 1 and 2
Renewed Facility Operating License Nos. DPR-71 and DPR-62
NRC Docket Nos. 50-325 and 50-324
Spent Fuel Pool Evaluation Supplemental Report, Response to NRC Request for
Information Pursuant to 10 CFR 50.54(f) Regarding Recommendation 2.1 of the
Near-Term Task Force Review of Insights from the Fukushima Dai-Ichi Accident

References:

1. Nuclear Regulatory Commission (NRC) Letter, *Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3, of the Near-Term Task Force Review of Insights from the Fukushima Dai-Ichi Accident*, dated March 12, 2012, Agencywide Documents Access and Management System (ADAMS) Accession Number ML12053A340
2. NRC Letter, *Final Determination of Licensee Seismic Probabilistic Risk Assessments Under the Request for Information Pursuant to Title 10 of the Code of Federal Regulations 50.54(f) Regarding Recommendation 2.1 "Seismic" of the Near-Term Task Force Review of Insights from the Fukushima Dai-Ichi Accident*, dated October 27, 2015, ADAMS Accession Number ML15194A015
3. Nuclear Energy Institute (NEI) Letter, *Request for Endorsement of Seismic Evaluation Guidance: Spent Fuel Pool Integrity Evaluation (EPRI 3002007148)*, dated February 23, 2016, ADAMS Accession Number ML16055A017
4. Electric Power Research Institute (EPRI), *Seismic Evaluation Guidance Spent Fuel Pool Integrity Evaluation (EPRI 3002007148)*, ADAMS Accession Number ML16055A021
5. NRC Letter, *Endorsement of Electric Power Research Institute Report 3002007148, Seismic Evaluation Guidance: Spent Fuel Pool Integrity Evaluation*, dated March 17, 2016, ADAMS Accession Number ML15350A158
6. Duke Energy Letter, *Seismic Hazard and Screening Report (CEUS Sites), Response to NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding the Seismic Aspects of Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-Ichi Accident*, dated March 31, 2014, ADAMS Accession Number ML14106A461
7. Duke Energy Letter, *Response to Request for Additional Information Associated with Near-Term Task Force Recommendation 2.1, Seismic Hazard and Screening Report*, dated August 14, 2014, ADAMS Accession Number ML14241A432

AD10
NRK

8. NRC Letter, *Brunswick Steam Electric Plant, Units 1 and 2 - Staff Assessment of Information Provided Pursuant to Title 10 of the Code of Federal Regulations Part 50, Section 50.54(f), Seismic Hazard Reevaluations for Recommendation 2.1 of the Near-Term Task Force Review of Insights from the Fukushima Dai-Ichi Accident (CAC Nos. MF3824 and MF3825)*, dated March 1, 2016, ADAMS Accession Number ML16041A435
9. EPRI 1025287, *Seismic Evaluation Guidance, Screening, Prioritization and Implementation Details (SPID) for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic*, dated November 2012, ADAMS Accession Number ML12333A170

Ladies and Gentlemen,

On March 12, 2012, the Nuclear Regulatory Commission (NRC) issued a Request for Information per 10 CFR 50.54(f) (i.e., Reference 1) to all power reactor licensees. Enclosure 1, Requested Information Item (9) of the 50.54(f) letter, requested addressees to provide limited scope spent fuel pool (SFP) evaluations. By letter dated October 27, 2015 (i.e., Reference 2), the NRC transmitted final seismic information request tables which identified that Brunswick Steam Electric Plant (BSEP), Unit Nos. 1 and 2, is to conduct a spent fuel pool (SFP) Limited-Scope Evaluation. By Reference 3, Nuclear Energy Institute (NEI) submitted an Electric Power Research Institute (EPRI) report entitled, *Seismic Evaluation Guidance Spent Fuel Pool Integrity Evaluation (EPRI 3002007148)* (i.e., Reference 4) for NRC review and endorsement. NRC endorsement was provided by Reference 5.

EPRI 3002007148 provides criteria for evaluating the seismic adequacy of a SFP to the reevaluated ground motion response spectrum (GMRS) hazard levels. This report supplements the guidance in the *Seismic Evaluation Guidance, Screening, Prioritization and Implementation Details (SPID)* (i.e., Reference 9), for plants where the GMRS peak spectral acceleration is less than or equal to 0.8g. Section 3.3 of EPRI 3002007148 lists the parameters to be verified to confirm that the results of the report are applicable to BSEP, Unit Nos. 1 and 2, and that the BSEP, Unit Nos. 1 and 2 SFP are seismically adequate in accordance with NTF 2.1 Seismic evaluation criteria.

The enclosure to this letter provides the data for BSEP, Unit Nos. 1 and 2, that confirms applicability of the EPRI 3002007148 criteria, confirms that the SFPs are seismically adequate, and provides the requested information in response to Requested Information Item (9) of the 50.54(f) letter associated with NTF Recommendation 2.1 Seismic evaluation criteria.

Reference 2 final seismic information request tables also identified that BSEP, Unit Nos. 1 and 2, is to conduct a High Frequency Limited-Scope Evaluation, and a Relay Chatter IPEEE Screening Evaluation. These evaluations are not provided in this correspondence, and are submitted under separate cover.

This letter contains no new regulatory commitments.

If you have any questions regarding this submittal, please contact Mr. Lee Grzeck, Manager - Regulatory Affairs, at (910) 457-2487.

I declare under penalty of perjury that the foregoing is true and correct. Executed on
December 15, 2016.

Sincerely,

A handwritten signature in black ink, appearing to read 'W. Gideon', written in a cursive style.

William R. Gideon

Enclosure:

Brunswick Steam Electric Plant (BSEP), Unit Nos. 1 and 2, Site-Specific Spent Fuel Pool
Criteria

U.S. Nuclear Regulatory Commission
Page 4 of 4

cc (with enclosure):

U.S. Nuclear Regulatory Commission, Region II
ATTN: Ms. Catherine Haney, Regional Administrator
245 Peachtree Center Ave, NE, Suite 1200
Atlanta, GA 30303-1257

U.S. Nuclear Regulatory Commission
ATTN: Mr. Andrew Hon (Mail Stop OWFN 8G9A) **(Electronic Copy Only)**
11555 Rockville Pike
Rockville, MD 20852-2738

U.S. Nuclear Regulatory Commission
ATTN: Mr. Peter Bamford (Mail Stop OWFN 8B3) **(Electronic Copy Only)**
11555 Rockville Pike
Rockville, MD 20852-2738

U.S. Nuclear Regulatory Commission
ATTN: Ms. Michelle P. Catts, NRC Senior Resident Inspector
8470 River Road
Southport, NC 28461-8869

Chair - North Carolina Utilities Commission **(Electronic Copy Only)**
P.O. Box 29510
Raleigh, NC 27626-0510

Enclosure

Brunswick Steam Electric Plant (BSEP), Unit Nos. 1 and 2

Site-Specific Spent Fuel Pool Criteria

Enclosure

Brunswick Steam Electric Plant (BSEP), Unit Nos. 1 and 2
Site-Specific Spent Fuel Pool Criteria

For references in this enclosure, refer to the cover letter references.

The 50.54(f) letter requested that, in conjunction with the response to NTF Recommendation 2.1, a seismic evaluation be made of the Spent Fuel Pool (SFP). More specifically, plants were asked to consider "all seismically induced failures that can lead to draining of the SFP." Such an evaluation would be needed for any plant in which the ground motion response spectrum (GMRS) exceeds the safe shutdown earthquake (SSE) in the 1 to 10 Hz frequency range. The NRC confirmed through References 2 and 8 that the GMRS exceeds the Safe Shutdown Earthquake (SSE) and concluded that a SFP evaluation is merited for the Brunswick Steam Electric Plant (BSEP), Unit Nos. 1 and 2. By letter dated March 18, 2016 (i.e., Reference 5) the staff determined that EPRI 3002007148 was an acceptable approach for performing SFP evaluations for plants where the peak spectral acceleration is less than or equal to 0.8g.

The table below lists the criteria from Section 3.3 of EPRI 3002007148 along with site-specific data for BSEP that confirms applicability of the EPRI 3002007148 criteria and confirms that the SFP is seismically adequate and can retain adequate water inventory for 72 hours in accordance with NTF 2.1 Seismic evaluation criteria.

SFP Criteria from EPRI 3002007148	
Site Parameters	
<p>1. The site-specific GMRS peak spectral acceleration at any frequency should be less than or equal to 0.8g.</p>	<p>BSEP Site-Specific Data: The GMRS peak spectral acceleration for BSEP provided in the Seismic Hazard Evaluation and Screening Report (i.e., Reference 6, Section 2.4, Control Point Response Spectra), as accepted by the NRC in the Staff Assessment of the BSEP Seismic Hazard Reevaluations (i.e., Reference 8, Section 3.4 Ground Motion Response Spectra), is 0.563g at 12.5 Hz, which is $\leq 0.8g$; therefore, this criterion is met.</p>
Structural Parameters	
<p>1. The structure housing the SFP should be designed using an SSE with a peak ground acceleration (PGA) of at least 0.1g.</p>	<p>BSEP Site-Specific Data: The SFP is housed in the Reactor Building, which is seismically designed to the SSE with a PGA of 0.16g. The BSEP PGA is greater than 0.1g; therefore, this criterion is met.</p>
<p>2. The structural load path to the SFP should consist of some combination of reinforced concrete shear wall elements, reinforced concrete frame elements, post-tensioned concrete elements and/or structural steel frame elements.</p>	<p>BSEP Site-Specific Data: The structural load path from the Reactor Building foundation to the SFP consists of a combination of reinforced concrete shear wall elements, reinforced concrete frame elements, post-tensioned concrete elements and/or structural steel frame elements as described in UFSAR Sections 3.8.4, Other Seismic Class I and</p>

Enclosure

Brunswick Steam Electric Plant (BSEP), Unit Nos. 1 and 2

Site-Specific Spent Fuel Pool Criteria

SFP Criteria from EPRI 3002007148

Class II Structures, UFSAR Section 3.8.4.1, Description of the Class I Structures, and UFSAR Section 3.8.4.1.1, Reactor Buildings; therefore, this criterion is met for BSEP.

A brief description of the structural load path from the Reactor Building foundation to the SFP is described below.

The BSEP buildings and structures consist of the two separate Reactor Buildings, with each housing one of the two SFP. The Reactor Buildings are Class I structures. The Reactor Building was constructed of cast-in-place reinforced concrete from the base floor slab at elevation -17.0 feet to the refueling floor at elevation 117.3 feet. The reinforced concrete mat supporting the Secondary and Primary Containments is founded on strata of very dense fine to medium coarse sand at elevation -28.3 feet.

The building framing below the refueling floor was analyzed as indeterminate frames using moment distribution methods. The reinforced concrete floor slabs were designed as one-way or two-way slabs which are supported on the exterior and interior concrete walls, columns, and beams. The Reactor Building main floor elevations are located at -17.0 feet, 20.0 feet, 50.0 feet, 80.0 feet and 117.3 feet. The beams frame into exterior or interior walls or columns around the primary containment. The floor slab over the suppression chamber is supported on radial concrete beams framed into the exterior walls or circumferential beams in pump areas, and rests on lubricated plates which are anchored to the suppression chamber concrete. Exterior walls were designed as shear walls for seismic loads with the concrete floor slabs acting as diaphragms to transmit the horizontal loads to the shear walls.

The SFP, steam separator and dryer pool, and reactor well are supported by two 5-foot wide by 140-foot long by 42.3 feet deep, pre-stressed, post-tensioned, concrete girders spanning between the exterior walls. These girders, in addition, support floor slabs at elevations 80.0 feet, 98.7 feet, and 117.3 feet.

3. The SFP structure should be included in the Civil Inspection Program performed in accordance with Maintenance Rule.

BSEP Site-Specific Data: The SFP structure is included in the BSEP Civil Inspection Program, in accordance with 10 CFR 50.65, which monitors the performance or condition of structures, systems, or components (SSCs) in a manner sufficient to provide reasonable assurance that these SSCs are capable of fulfilling their intended functions. Therefore, this criterion is met for BSEP.

Non-Structural Parameters

1. To confirm applicability of the piping evaluation in Section 3.2 of EPRI 3002007148 (i.e., Reference 4), piping attached to the SFP up to the first valve should have been evaluated for the SSE.

BSEP Site-Specific Data: Piping attached to the SFP is Class I piping. As described in UFSAR 3.2.1.6, Partially Class I Systems, the Fuel Pool Cooling diffuser lines inside the

Enclosure

Brunswick Steam Electric Plant (BSEP), Unit Nos. 1 and 2

Site-Specific Spent Fuel Pool Criteria

SFP Criteria from EPRI 3002007148

fuel storage pool and the supply header line up to and including the two shut-off valves are Class I piping and components. Class I piping and components are evaluated to the SSE (0.16g); therefore, this criterion is met for BSEP.

2. Anti-siphoning devices should be installed on any piping that could lead to siphoning water from the SFP. In addition, for any cases where active anti-siphoning devices are attached to 2-inch or smaller piping and have extremely large extended operators, the valves should be walked down to confirm adequate lateral support.

BSEP Site-Specific Data:

Piping entering the fuel storage pool is fitted with a check valve or siphon breaker holes to prevent water from being siphoned out of the pool. A check valve in the 6-inch piping outside the SFP prevents water from being siphoned from the pool. Siphon breaker holes on the 6-inch piping inside the SFP prevents water from being siphoned from the pool, as well.

As described, anti-siphoning devices are installed on all SFP piping that could lead to siphoning; therefore, this criterion is met for BSEP.

As described, no anti-siphoning devices are attached to 2-inch or smaller piping with extremely large extended operators; therefore, this criterion is met for BSEP.

3. To confirm applicability of the sloshing evaluation in Section 3.2 of EPRI 3002007148 (i.e., Reference 4), the maximum SFP horizontal dimension (length or width) should be less than 125 feet, the SFP depth should be greater than 36 feet, and the GMRS peak S_a should be $<0.1g$ at frequencies equal to or less than 0.3 Hz.

BSEP Site-Specific Data: Each BSEP SFP has an inside length of 46.0 feet, an inside width of 28.0 feet, a height of 38.75 feet, and a water depth from 37.5 to 37.75 feet based on UFSAR 9.1.2.2.1, Facilities Description - Spent Fuel Storage Pool; therefore, this criterion is met.

The BSEP GMRS maximum spectral acceleration in the frequency range less than 0.3 Hz is less than $0.0575g$ as provided in the Seismic Hazard Evaluation and Screening Report (i.e., Reference 6, Section 2.4, Control Point Response Spectra) which is less than $0.1g$; therefore, this criterion is met.

4. To confirm applicability of the evaporation loss evaluation in Section 3.2 of EPRI 3002007148 (i.e., Reference 4), the SFP surface area should be greater than 500 ft^2 and the licensed reactor core thermal power should be less than 4,000 MWt per unit.

BSEP Site-Specific Data: The surface area of each BSEP SFP is 1288 ft^2 , which is greater than 500 ft^2 , and licensed reactor thermal power for BSEP is 2923 MWt per unit, which is less than 4,000 MWt per unit; therefore, these criteria are met.