

**Marty L. Richey**  
Site Vice President724-682-5234  
Fax: 724-643-8069November 7, 2016  
L-16-282

10 CFR 50.54(f)

ATTN: Document Control Desk  
U.S. Nuclear Regulatory Commission  
11555 Rockville Pike  
Rockville, MD 20852**SUBJECT:**

Beaver Valley Power Station, Unit Nos. 1 and 2  
Docket No. 50-334, License No. DPR-66  
Docket No. 50-412, License No. NPF-73  
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 (NTTF) Review of Insights from the Fukushima Dai-ichi Accident  
(CAC Nos. MF3726, MF3727, MF5223, and MF5224)

On March 12, 2012, the Nuclear Regulatory Commission (NRC) issued a Request for Information per 10 CFR 50.54(f) (Reference 1) to all power reactor licensees. Enclosure 1, 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 (Reference 2), the NRC transmitted final seismic information request tables, which identified that FirstEnergy Nuclear Operating Company (FENOC) is to conduct a limited scope SFP evaluation for Beaver Valley Power Station (BVPS), Unit Nos. 1 and 2. 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)* (Reference 4), for NRC review and endorsement. NRC endorsement was provided by Reference 5.

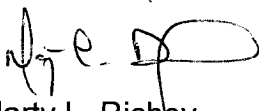
EPRI 3002007148 provides criteria for evaluating the seismic adequacy of a SFP to the reevaluated ground motion response spectrum (GMRS) hazard levels. This report supplements the guidance in the *Seismic Evaluation Guidance, Screening, Prioritization and Implementation Details (SPID) for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic* (Reference 8) report 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 BVPS, and that the BVPS Unit No. 1 and Unit No. 2 SFPs are seismically adequate in accordance with NTTF 2.1 Seismic evaluation criteria.

The attachments to this letter provide the data for BVPS Unit No. 1 and BVPS Unit No. 2 (Attachments 1 and 2, respectively) that confirms applicability of the EPRI 3002007148 criteria, confirms that the SFP is seismically adequate, and provides the requested information in response to Item (9) of the 50.54(f) letter associated with NTTF Recommendation 2.1 Seismic evaluation criteria.

There are no new regulatory commitments contained in this letter and no revisions to existing regulatory commitments. If there are any questions or if additional information is required, please contact Mr. Thomas A. Lentz, Manager – Fleet Licensing, at 330-315-6810.

I declare under penalty of perjury that the foregoing is true and correct. Executed on November 7, 2016.

Respectfully,



Marty L. Richey

Attachments

1. Site-Specific Spent Fuel Pool Criteria for Beaver Valley Power Station Unit No. 1
2. Site-Specific Spent Fuel Pool Criteria for Beaver Valley Power Station Unit No. 2

References:

1. 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. 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. EPRI Report 3002007148, *Seismic Evaluation Guidance Spent Fuel Pool Integrity Evaluation*, February 2016, 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. FENOC Letter, FirstEnergy Nuclear Operating Company (FENOC) Seismic Hazard and Screening Report (CEUS Sites), Response to NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding Recommendation 2.1 of the Near-Term Task Force (NTTF) Review of Insights from the Fukushima Dai-ichi Accident, dated March 31, 2014, ADAMS Accession Number ML14092A203.
7. NRC Letter, Beaver Valley Power Station, 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 (TAC Nos. MF3726 and MF3727), dated October 5, 2015, ADAMS Accession Number ML15274A307.
8. EPRI Report 1025287, *Seismic Evaluation Guidance, Screening, Prioritization and Implementation Details [SPID] for the Resolution of Fukushima Near-Term Task Force Recommendation 2.1: Seismic*, November 2012, ADAMS Accession Number ML12333A170.
9. FENOC Letter, FirstEnergy Nuclear Operating Company (FENOC) Expedited Seismic Evaluation Process (ESEP) Reports, Response to NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding Recommendation 2.1 of the Near-Term Task Force (NTTF) Review of Insights from the Fukushima Dai-ichi Accident, dated December 19, 2014, ADAMS Accession Number ML14353A059.
10. NRC Letter, Beaver Valley Power Station, Units 1 and 2 - Staff Review of Interim Evaluation Associated with Reevaluated Seismic Hazard Implementing Near-Term Task Force Recommendation 2.1 (TAC Nos. MF5223 and MF5224), dated August 25, 2015, ADAMS Accession Number ML15233A120.

cc: Director, Office of Nuclear Reactor Regulation (NRR)  
NRC Region I Administrator  
NRC Resident Inspector  
NRR Project Manager  
Director BRP/DEP (without Enclosure)  
Site BRP/DEP Representative (without Enclosure)

ATTACHMENT 1

FirstEnergy Nuclear Operating Company

Beaver Valley Power Station Unit No. 1

Docket No. 50-334

License No. DPR-66

Site-Specific Spent Fuel Pool Criteria for Beaver Valley Power  
Station Unit No. 1

The 50.54(f) letter (Reference 1) requested that, in conjunction with the response to NTTF Recommendation 2.1, a seismic evaluation be made of the 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 staff confirmed through References 2 and 7 that the GMRS exceeds the SSE and concluded that a SFP evaluation is merited for the FirstEnergy Nuclear Operating Company (FENOC, the licensee) Beaver Valley Power Station (BVPS) Unit No. 1. By letter dated March 17, 2016 (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 data for BVPS Unit No. 1 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 NTTF 2.1 Seismic evaluation criteria.

SFP Criteria from EPRI 3002007148	Site-Specific Data
<b>Site Parameters</b>	
1. The site-specific GMRS peak spectral acceleration at any frequency should be less than or equal to 0.8g.	The GMRS peak spectral acceleration, initially reported in NTTF 2.1 Seismic Hazard and Screening Report for Beaver Valley Power Station Unit 1 Beaver County, Pennsylvania (March 31, 2014) (Reference 6), as accepted by the NRC in Beaver Valley Power Station, Units 1 and 2 - Staff Assessment of Information Provided Pursuant to Title 10 of the <i>Code of Federal Regulations</i> 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 (TAC Nos. MF3726 and MF3727) (Reference 7), has been superseded by the Expedited Seismic Evaluation Process (ESEP) Reports (Reference 9) as accepted by the NRC in Beaver Valley Power Station, Units 1 and 2 - Staff Review of Interim Evaluation Associated with Reevaluated Seismic Hazard Implementing Near-Term Task Force Recommendation 2.1 (Reference 10), is 0.62g, which is $\leq 0.8g$ , therefore, this criterion is met.
<b>Structural Parameters</b>	
2. The structure housing the SFP should be designed using an SSE with a peak ground acceleration (PGA) of at least 0.1g.	The SFP is housed in the fuel building, which is seismically designed to the site SSE with a PGA of 0.125g. The BVPS Unit No. 1 PGA is greater than 0.1g; therefore, this criterion is met.

SFP Criteria from EPRI 3002007148	Site-Specific Data
<p>3. 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>The SFP is located in the fuel building. The Unit 1 Fuel Building is supported on a continuous reinforced concrete foundation mat. The walls are of reinforced concrete. The SFP is lined with stainless steel plate that is backed by reinforced concrete walls along the sides and concrete slab along the bottom. The SFP rests directly on the concrete foundation mat for the fuel building. The reinforced concrete foundation mat under the SFP is 6.5 feet thick. The reinforced concrete foundation mat bears directly on the soil. This is in accordance with drawings 8700-RC-0027A, 8700-RC-0027B, 8700-RC-0027C Section 1-1, and 8700-RC-0027D Section 5-5; therefore, this criterion is met for BVPS Unit No. 1.</p>
<p>4. The SFP structure should be included in the Civil Inspection Program performed in accordance with Maintenance Rule.</p>	<p>The SFP structure is included in the BVPS Unit No. 1 Civil Inspection Program (BVPS Procedure 1/2-ADM-2016, General Area Structural Inspections) 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 BVPS Unit No. 1.</p>
<p><b>Non-Structural Parameters</b></p>	
<p>5. To confirm applicability of the piping evaluation in Section 3.2 of EPRI 3002007148, piping attached to the SFP up to the first valve should have been evaluated for the SSE.</p>	<p>Piping attached to the SFP is evaluated to the SSE as documented in numerous pipe stress calculations. These include NP(B)-105-X for the 6" return pipes from the fuel pool cooling pumps, NP(B)-198-X and DMC-2576 for the 10" supply pipe to the fuel pool cooling pumps, DMC-1013 for the 6" piping tie-in from the river water system, and NP(B)-198-X and DMC-2478 for the 4" supply piping to the fuel pool purification pumps; therefore, this criterion is met for BVPS Unit No. 1.</p>

SFP Criteria from EPRI 3002007148	Site-Specific Data
<p>6. 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.</p>	<p>No anti-siphoning devices are used. Piping design is such that it is not possible to siphon the spent fuel pool water level down as the result of a failed pipe or component to a water level below 9 feet 6-3/4 inches above the top of the spent fuel rack. This level provides adequate shielding and cooling of the spent fuel pool system. Spent fuel pool cooling system equipment, piping, and associated component cooling water piping are designed for seismic conditions. The spent fuel pool cooling piping conforms to piping Class Q3 (defined in UFSAR Section 6.2.2.1).</p> <p>Since the piping of the SFP cooling system cannot lead to rapid drain down due to siphoning, this criterion is met for BVPS Unit No. 1.</p> <p>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 BVPS Unit No. 1.</p>
<p>7. To confirm applicability of the sloshing evaluation in Section 3.2 of EPRI 3002007148, the maximum SFP horizontal dimension (length or width) should be less than 125 ft, the SFP depth should be greater than 36 ft, and the GMRS peak <math>S_a</math> should be <math>&lt;0.1g</math> at frequencies equal to or less than 0.3 Hz.</p>	<p>The BVPS Unit No. 1 SFP has a length of 39.5 ft, a width of 29.5 ft and a depth of 40.5 ft based on drawings 8700-RC-27A through 8700-RC-27E; therefore, this criterion is met.</p> <p>The BVPS Unit 1 GMRS maximum spectral acceleration in the frequency range less than 0.3 Hz is <math>0.02g</math> from the FirstEnergy Nuclear Operating Company (FENOC) Expedited Seismic Evaluation Process (ESEP) Reports, Response to NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding Recommendation 2.1 of the Near-Term Task Force (NTTF) Review of Insights from the Fukushima Dai-ichi Accident (Reference 9), which is less than <math>0.1g</math>; therefore, this criterion is met.</p>
<p>8. To confirm applicability of the evaporation loss evaluation in Section 3.2 of EPRI 3002007148, the SFP surface area should be greater than <math>500 \text{ ft}^2</math> and the licensed reactor core thermal power should be less than 4,000 MWt per unit.</p>	<p>The surface area of the BVPS Unit No. 1 SFP is <math>1060.25 \text{ ft}^2</math> (without the cask pit area), which is greater than <math>500 \text{ ft}^2</math>; and licensed reactor thermal power for BVPS Unit No. 1 is 2,900 MWt per unit, which is less than 4,000 MWt per unit; therefore, these criteria are met.</p>

## ATTACHMENT 2

FirstEnergy Nuclear Operating Company

Beaver Valley Power Station Unit No. 2

Docket No. 50-412

License No. NPF-73

Site-Specific Spent Fuel Pool Criteria for Beaver Valley Power  
Station Unit No. 2



The 50.54(f) letter (Reference 1) requested that, in conjunction with the response to NTTF Recommendation 2.1, a seismic evaluation be made of the 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 staff confirmed through References 2 and 7 that the GMRS exceeds the SSE and concluded that a SFP evaluation is merited for the FirstEnergy Nuclear Operating Company (FENOC, the licensee) Beaver Valley Power Station (BVPS) Unit No. 2. By letter dated March 17, 2016 (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 data for BVPS Unit No. 2 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 NTTF 2.1 Seismic evaluation criteria.

SFP Criteria from EPRI 3002007148	Site-Specific Data
<b>Site Parameters</b>	
1. The site-specific GMRS peak spectral acceleration at any frequency should be less than or equal to 0.8g.	The GMRS peak spectral acceleration, initially reported in NTTF 2.1 Seismic Hazard and Screening Report for Beaver Valley Power Station Unit 2 Beaver County, Pennsylvania (March 31, 2014) (Reference 6), as accepted by the NRC in Beaver Valley Power Station, 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 (TAC Nos. MF3726 and MF3727) (Reference 7), has been superseded by the Expedited Seismic Evaluation Process (ESEP) Reports (Reference 9) as accepted by the NRC in Beaver Valley Power Station, Units 1 and 2 - Staff Review of Interim Evaluation Associated with Reevaluated Seismic Hazard Implementing Near-Term Task Force Recommendation 2.1 (Reference 10), is 0.62g, which is $\leq 0.8g$ ; therefore, this criterion is met.
<b>Structural Parameters</b>	
2. The structure housing the SFP should be designed using an SSE with a peak ground acceleration (PGA) of at least 0.1g.	The SFP is housed in the fuel building, which is seismically designed to the site SSE with a PGA of 0.125g. The BVPS Unit No. 2 PGA is greater than 0.1g; therefore, this criterion is met.

SFP Criteria from EPRI 3002007148	Site-Specific Data
<p>3. 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>The SFP is located in the fuel building. The Unit 2 Fuel Building is supported on a continuous reinforced concrete foundation mat. The walls are of reinforced concrete. The SFP is lined with stainless steel plate that is backed by reinforced concrete walls along the sides and concrete slab along the bottom. The SFP rests directly on the concrete foundation mat for the fuel building. The reinforced concrete foundation mat under the SFP is 10 feet thick. The reinforced concrete foundation mat bears directly on the soil. This is in accordance with drawings 10080-RC-0038A, 10080-RC-0038B, 10080-RC-0038D Section 1-1, 10080-RC-0038E Section 5-5, and 10080-RC-0038F Section 7-7; therefore, this criterion is met for BVPS Unit No. 2.</p>
<p>4. The SFP structure should be included in the Civil Inspection Program performed in accordance with Maintenance Rule.</p>	<p>The SFP structure is included in the BVPS Unit No. 2 Civil Inspection Program (BVPS Procedure 1/2-ADM-2016, General Area Structural Inspections) 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 BVPS Unit No. 2.</p>
<p><b>Non-Structural Parameters</b></p>	
<p>5. To confirm applicability of the piping evaluation in Section 3.2 of EPRI 3002007148, piping attached to the SFP up to the first valve should have been evaluated for the SSE.</p>	<p>Piping attached to the SFP is evaluated to the SSE as documented in several pipe stress calculations. These include SCE-0649 for the 1" line from the A/C Unit drain tank, NP(B)-201-X9 for the 6" emergency makeup line from the service water system, NP(N)-X77A for the 4" lines to the fuel pool purification system, NP(T)-X77H for the 10" line to the fuel pool cooling system, and NP(T)-X77L for the 6" line from the fuel pool cooling system; therefore, this criterion is met for BVPS Unit No. 2.</p>

SFP Criteria from EPRI 3002007148	Site-Specific Data
<p>6. 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.</p>	<p>No anti-siphoning devices are used. The spent fuel pool is designed such that the water level in the pool cannot be decreased below the top of the fuel stored in the spent fuel racks. The fuel transfer gates do not extend below the top of the spent fuel assemblies, and all piping and piping penetrations of the spent fuel pool terminate no lower than elevation 750 feet, 10 inches. A spent fuel pool water elevation of 750 feet, 10 inches provides suitable shielding for radiation protection. The fuel building, the spent fuel pool, the fuel pool cooling portion of the spent fuel pool cooling and cleanup system, and all supporting structures are designed for the SSE and OBE seismic loads.</p> <p>Since the piping of the SFP cooling system cannot lead to rapid drain down due to siphoning, this criterion is met for BVPS Unit No. 2.</p> <p>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 BVPS Unit No. 2.</p>
<p>7. To confirm applicability of the sloshing evaluation in Section 3.2 of EPRI 3002007148, the maximum SFP horizontal dimension (length or width) should be less than 125 ft, the SFP depth should be greater than 36 ft, and the GMRS peak <math>S_a</math> should be <math>&lt;0.1g</math> at frequencies equal to or less than 0.3 Hz.</p>	<p>The BVPS Unit No. 2 SFP has a length of 39.5 ft, a width of 29.5 ft and a depth of 40.5 ft based on drawings 10080-RC-38A through 10080-RC-38J; therefore, this criterion is met.</p> <p>The BVPS Unit 2 GMRS maximum spectral acceleration in the frequency range less than 0.3 Hz is 0.02g from the FirstEnergy Nuclear Operating Company (FENOC) Expedited Seismic Evaluation Process (ESEP) Reports, Response to NRC Request for Information Pursuant to 10 CFR 50.54(f) Regarding Recommendation 2.1 of the Near-Term Task Force (NTTF) Review of Insights from the Fukushima Dai-ichi Accident (Reference 9), which is less than 0.1g; therefore, this criterion is met.</p>
<p>8. To confirm applicability of the evaporation loss evaluation in Section 3.2 of EPRI 3002007148, the SFP surface area should be greater than 500 ft<sup>2</sup> and the licensed reactor core thermal power should be less than 4,000 MWt per unit.</p>	<p>The surface area of the BVPS Unit 2 SFP is 1060.25 ft<sup>2</sup> (without the cask pit area), which is greater than 500 ft<sup>2</sup>; and licensed reactor thermal power for BVPS Unit No. 2 is 2,900 MWt per unit, which is less than 4,000 MWt per unit; therefore, these criteria are met.</p>