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May 15, 2013
L-13-157

10 CFR 50.54(f)

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

SUBJECT:
Davis-Besse Nuclear Power Station
Docket No. 50-346, License Number NPF-3
Generic Safety Issue 191 Resolution Plan (TAC No. MC4681)

This letter forwards information regarding resolution of Generic Safety Issue 191, Assessment of Debris Accumulation on Pressurized-Water Reactor Sump Performance, for Davis-Besse Nuclear Power Station (DBNPS). Nuclear Regulatory Commission (NRC) staff has interacted with the industry and stakeholders to develop options for the resolution of Generic Safety Issue 191. The NRC staff paper SECY-12-0093, "Closure Options for Generic Safety Issue 191, Assessment of Debris Accumulation on Pressurized-Water Reactor Sump Performance," presents closure options for Generic Safety Issue 191.

Attachment 1 provides information regarding the current status of efforts to address Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors," and describes the Generic Safety Issue 191 closure option, resolution plan, and associated implementation schedule for DBNPS. Attachment 2 provides a list of regulatory commitments included in this submittal.

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 May 15, 2013.

Sincerely,

Raymond A. Lieb

Attachment:

1. Generic Safety Issue 191, In-Vessel Effects Resolution Plan
2. Regulatory Commitment List

cc: NRC Region III Administrator
NRC Resident Inspector
NRC Project Manager
Utility Radiological Safety Board

Introduction

FirstEnergy Nuclear Operating Company (FENOC) has selected Option 2, deterministic path, of Nuclear Regulatory Commission (NRC) staff paper SECY-12-0093, "Closure Options for Generic Safety Issue 191, Assessment of Debris Accumulation on Pressurized-Water Reactor Sump Performance," for Davis-Besse Nuclear Power Station (DBNPS) and intends to pursue refinements to evaluation methods and acceptance criteria. In addition, the resolution schedule defined in SECY-12-0093 will also be adhered to, as described herein. The Nuclear Energy Institute (NEI) closure option template dated November 9, 2012, "Closure Option Templates for Generic Safety Issue 191 (GSI-191), Assessment of Debris Accumulation on Pressurized Water Reactor Sump Performance" was used in developing this response. This submittal provides a resolution plan that follows the deterministic path of Option 2 (referred to as NEI template option 2a).

To support use of this path for the period required to complete the necessary analysis and testing, FENOC has evaluated the design and procedural capabilities that exist to identify and mitigate in-vessel blockage. A description of these capabilities is provided later in this document. A summary of the existing margins and conservatisms that exist for DBNPS are also included in this document.

Characterization of Current Containment Fiber Status

From the debris generation and debris transport analysis, FENOC has established that a maximum quantity of six cubic feet (6 ft^3) of fibrous debris from destroyed insulation could be generated as a result of analyzed breaks, as documented in References 1 and 7. At the time of the Reference 1 submittal, all fibrous piping insulation in containment had been removed or replaced with reflective metal insulation (RMI) with the exception of three locations that total less than 1ft^3 of Nukon™ insulation. The analysis therefore provided at least 5 ft^3 of low density fiberglass insulation margin. Subsequent modifications associated with the reactor vessel head replacement have reduced the number of locations with fibrous insulation from three to one, with a total of 0.307 ft^3 of fibrous insulation with an assumed density of 2.4 pounds per cubic foot.

Within the debris generation and debris transport analysis, FENOC has established that 75 pounds of latent fiber could be generated as a result of analyzed breaks, as documented in References 1 and 7. The 75 pounds of latent fiber is based on a conservative assumption of 500 pounds of latent debris in containment with a maximum 15 percent by weight fiber content, consistent with NEI 04-07, "Pressurized Water Reactor Sump Performance Evaluation Methodology," Volume 2, "Safety Evaluation by

the Office of Nuclear Reactor Regulation Related to NRC Generic Letter 2004-02, Revision 0, December 6, 2004," Appendix VII, "Characterization of Pressurized-Water-Reactor Latent Debris" (Reference 9). This initial conservative assumption of 500 pounds of latent debris was used for analysis purposes, except for analysis of reactor coolant system (RCS) breaks inside the reactor vessel cavity where plant-specific quantification was necessary because of the reduced strainer surface area available. Sampling of containment latent debris was conducted based on guidance provided in NEI 04-07, as modified by the NRC SER. The latent debris loading in containment was determined to be 46 pounds, with 15 percent, or 6.9 pounds considered fiber. Although not credited, laboratory analysis of DBNPS containment debris samples identified only 1 of 13 samples to contain greater than 10 percent fiber by weight, with an over all containment latent fiber load of 5.5 percent of containment debris, by weight.

The debris types, sizes, transport fractions, and quantities postulated to be transported to the strainers for analyzed break locations are provided in Reference 1. Essentially all fiber has been removed from the DBNPS containment, and thus the limiting fiber loads are generated thru latent fiber. For the DBNPS limiting break scenario, the total calculated quantity of fiber to be transported to the strainers is approximately 9.5 pounds. The fibrous debris sources considered in these analyses include a very small amount of installed Nukon™ insulation and latent fiber consistent with administrative limits for permissible debris within containment.

Characterization of Strainer Head Loss Status

FENOC provided the results of the strainer head loss analysis, including the impact of chemical effects, in correspondence dated February 28, 2008 (Reference 1). DBNPS has limited amounts of fibrous insulation postulated to be destroyed in a design basis accident. As a result of having less than a thin bed, clean screen area is expected in all postulated breaks. Thus, while a chemical effects analysis was performed, it did not influence the overall results of the strainer head loss analysis because, when less than a thin bed exists, the chemical products do not contribute to head loss.

The NRC inspection utilizing Temporary Instruction (TI) 2515/166, "Pressurized Water Reactor Containment Sump Blockage (NRC Generic Letter 2004-02)," confirmed that FENOC completed the required analyses that were documented in Reference 1 for DBNPS (Reference 8). The inspection report noted that there were no outstanding actions to be completed and, therefore, TI 2515/1666 was closed. Subsequent to the completion of this inspection, the NRC staff review of Reference 1 indicated that the staff had no further questions at that time regarding performance of the Davis-Besse emergency core cooling strainers, in part, based on the very low potential debris loading (Reference 3).

Characterization of In-Vessel Effects

FENOC performed a plant-specific analysis using the 45 percent bypass fraction considered by the staff to be conservative for most typical perforated plate strainer installations where flow patterns do not result in fragmentation of debris (Reference 2). The DBNPS strainer is made of perforated plate. This analysis resulted in an approximate value of 11 grams of fiber per fuel assembly. FENOC is currently evaluating a plant-specific bypass fraction based on similarity to other strainers that have been tested to eliminate reliance on the staff's conservative value.

To provide design and operating margins, FENOC intends to follow the resolution strategies proposed by the Pressurized Water Reactor Owners Group (PWROG) to establish in-vessel debris limits applicable to the plant design features that exist at DBNPS. This approach is expected to establish in-vessel debris limits in excess of that currently established in Westinghouse evaluation report WCAP-16793, Revision 2 (Reference 10).

Licensing Basis Commitments

FENOC has no open regulatory commitments for DBNPS to provide additional updates or information to the NRC regarding GL 2004-02; however, a request for additional information (RAI) was included in Reference 3, which states:

> FENOC is requested to report how DBNPS has addressed the in-vessel downstream effects issue within 90 days of issuance of the final NRC staff SE on WCAP-16793.

Reference 3 also stated that the NRC staff had no further questions concerning the FENOC response to the "Davis-Besse Nuclear Power Station, Unit No. 1 – Request for Additional Information Related to Response to Generic Letter 2004-02, Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors." The RAI mentioned above is the only outstanding item in response to Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation during Design Basis Accidents at Pressurized Water Reactors," and will be provided in accordance with Reference 3.

New regulatory commitments included in this submittal are listed in Attachment 2.

Resolution Schedule

FENOC will achieve closure of GSI-191 and address GL 2004-02 for the Davis-Besse Nuclear Power Station per the following schedule.

- Reference 3, in part, requests FENOC to submit how DBNPS has addressed the in-vessel downstream effects issue within 90 days of issuance of the final NRC staff SER on WCAP-16793. As stated above, a plant-specific analysis has been performed assuming the 45 percent bypass fraction considered by the staff to be conservative for most typical perforated plate strainer installations where flow patterns do not result in fragmentation of debris. This analysis resulted in an approximate in-vessel fiber loading of 11 grams of fiber per fuel assembly. Follow-up action to close this assumption will validate the DBNPS strainer bypass percentage results is less than or equal to 15 grams of fiber per fuel assembly. FENOC will report on the progress toward confirming the strainer bypass percentage results is less than or equal to 15 grams of fiber per fuel assembly for DBNPS. Since this SER was made available on April 16, 2013, this progress report will be provided by July 15, 2013.

- The final Generic Letter 2004-02 supplemental response for DBNPS will be provided to the NRC 6 months after the NRC approves, by issuance of a safety evaluation, the new PWROG topical report addressing additional in-vessel effects testing efforts that are currently being pursued.

- Updated Final Safety Analysis Report changes will be completed to update the current licensing basis for DBNPS as appropriate, following NRC acceptance of the final docketed Generic Safety Issue 191 response for DBNPS.

Summary of Actions Completed to Address GL 2004-02

A strainer replacement was installed at DBNPS during the 2002-2004 outage. The new strainer utilizes the Enercon top hat design, which increased the available surface area from approximately 50 square feet to 1226 square feet. The design basis function of the strainer has been incorporated in the Updated Final Safety Analysis Report (UFSAR) in accordance with 10 CFR 50.71(e).

DBNPS is considered a low fiber plant based on approved industry and NRC standards associated with GSI-191 and Generic Letter 2004-02. This has been accomplished through removal of nearly all installed fibrous insulation from inside containment.

Controls on coatings, insulation, and signage have been established. Procedures have been instituted that require verification of strainer integrity and containment cleanliness prior to entering a mode of operation that requires emergency core cooling system operability.

Modifications to the high pressure injection pumps and the cyclone separators for the emergency core cooling system (ECCS) pump seals were implemented to ensure continued operation in the post-LOCA environment. In addition, cyclone separators were installed on the containment spray pump seal supply lines.

Summary of Margins and Conservatisms for Completed Actions for GL 2004-02

Margins and conservatisms associated with debris generation, debris transport, strainer head loss, chemical effects, and ECCS flow have been summarized in Generic Letter 2004-02 submittals previously submitted for NRC review (Reference 1). Additional information on margins and conservatisms associated with debris generation, debris transport, strainer head loss, chemical effects, and ECCS flow are provided below.

Debris Generation

- The debris generation and transport analyses assume 6 ft^3 of low density fiberglass (Nukon™ insulation) is available to be destroyed in the NPSH analyses for two of three analyzed break locations. The current as-built configuration only includes only 0.307 ft^3 of installed fiber insulation. This margin may be used to resolve issues relative to ECCS pump performance if additional low density fiberglass insulation is discovered.

Debris Transport

- It was conservatively assumed that all latent debris is in lower containment and would be uniformly distributed in the containment pool at the beginning of recirculation. This is a conservative assumption because no credit is taken for debris remaining on structures and equipment above the pool water level.

Strainer Head Loss

- As noted above, the amount of installed fiber within the plant has been further reduced, increasing the conservatism included in the strainer head loss calculation.

- The containment latent debris load was quantified and found to be less than the allowable amount used in the strainer head loss analysis. In addition, the fiber content of the containment latent debris was assessed and was found to be lower than the 15% fiber assumed in the head loss analyses. Only one sample was found to be greater than 10% fiber.

In-Vessel

- An analysis has been completed using methodology documented in Reference 2. The analysis used the 45 percent bypass fraction presented in Reference 2, which is considered by the staff to be conservative for most typical perforated plate strainer installations where flow patterns do not result in fragmentation of debris.

- No credit was taken for fiber recirculation through the containment spray system, which removes some of the fiber.

Summary of Defense-In-Depth (DID) Measures

The following describes the plant-specific design features and procedural capabilities that exist for detecting and mitigating a fuel blockage condition.

- If a condition of inadequate reactor core flow were to develop, then increasing core outlet temperature indication is the primary method expected for detection. Existing procedural guidance (Reference 5) directs actions to be taken if inadequate core cooling is detected. If initial procedural guidance for verifications and alternate system line-ups results in continued increasing core outlet temperature, existing procedural guidance directs starting one reactor coolant pump per loop. This action is expected to remove any established blockage to the core to once again allow normal recirculation injection flow paths to become effective at maintaining adequate core cooling (Reference 6). However, if core outlet temperatures continue to rise, ultimately a transition to the severe accident management guidelines will be implemented. Further direction will then be provided by the emergency response organization based on the Davis-Besse Severe Accident Management Guidelines.

Although these measures are not expected to be required based on the very low probability of an event that would result in significant quantities of debris being transported to the reactor vessel that would inhibit the necessary cooling of the fuel, they do provide additional assurance that the health and safety of the public would be maintained. These measures provide support for the extension of time required to completely address GL 2004-02 for DBNPS.

Conclusion

The GSI-191 resolution path for Davis-Besse Nuclear Power Station is acceptable based on the information provided in this document along with previous documents submitted to and reviewed by the NRC. The execution of the actions identified in this document will result in successful resolution of GSI-191 and closure of GL 2004-02.

References

1. FENOC letter to NRC, "Supplemental Response to Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized Water Reactors" (TAC No. MC4681), February 28, 2008 (Accession No. ML080650368).

2. NRC letter to Nuclear Energy Institute, "NRC Review of NEI Clean Plant Acceptance Criteria for Emergency Core Cooling Systems," May 2, 2012 (Accession No. ML120730181).

3. NRC letter to FENOC, "Davis-Besse Nuclear Power Station, Unit No. 1 – Request for Additional Information Related to Response to Generic Letter 2004-02, Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors (TAC No. MC4681)," July 10, 2008 (Accession No. ML081780330).

4. PWROG letter to NRC, "Submittal of Supplement to WCAP-16793-NP," Revision 2, July 20, 2012 (Accession No. ML12207A115).

5. Davis-Besse Nuclear Power Station Emergency Procedure titled "RPS, SFAS, SFRCS Trip, or SG Tube Rupture," Revision 26.

6. NEI letter to NRC, "Defense-In-Depth Measures in Support of GSI-191 Resolution Options," March 5, 2012 (Accession No. ML120730654).

7. FENOC letter to NRC, "Supplemental Response to Generic Letter 2004-02, 'Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized Water Reactors' (TAC No. MC4681)," dated April 30, 2010 (Accession No. ML101250217).

8. NRC Inspection Report 05000346/2008-003 for Davis-Besse Nuclear Power Station, July 21, 2008 (Accession No. ML082040478).

9. NEI 04-07, "Pressurized Water Reactor Sump Performance Evaluation Methodology," Volume 2, "Safety Evaluation by the Office of Nuclear Reactor Regulation Related to NRC Generic Letter 2004-02, Revision 0, December 6, 2004," Appendix VII, "Characterization of Pressurized-Water-Reactor Latent Debris."

10. Westinghouse Report WCAP-16793, Revision 2, "Evaluation of Long-Term Cooling Considering Particulate, Fibrous and Chemical Debris in the Recirculating Fluid," dated October 2011 (Accession No. ML11292A021).

Attachment 2
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Regulatory Commitment List

The following list identified those actions committed to by FirstEnergy Nuclear Operating Company (FENOC) for Davis-Besse Nuclear Power Station (DBNPS) in this document. Any other actions discussed in this submittal represent intended or planned actions by FENOC. They are described only as information and are not regulatory commitments. Please notify Mr. Thomas A. Lentz, Manager – Fleet Licensing, at (330)-315-6810

Regulatory Commitment	Due Date
1. FENOC will report on the progress toward confirming the strainer bypass percentage results is less than or equal to 15 grams of fiber per fuel assembly for DBNPS.	July 15, 2013
2. The final Generic Letter 2004-02 supplemental response for DBNPS will be provided to the NRC.	Six months after the NRC approves, by issuance of a safety evaluation, the new PWROG topical report addressing additional in-vessel effects testing efforts that are currently being pursued.
3. Updated Final Safety Analysis Report changes will be completed to update the current licensing basis for DBNPS as appropriate.	Following NRC acceptance of the final docketed Generic Safety Issue 191 response for DBNPS.