Brunswick Nuclear Plant
P.O. Box 10429
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April 24, 2018

Serial: BSEP 18-0054 10 CFR 50.55a(z)(1)

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

Subject: Brunswick Steam Electric Plant, Unit Nos. 1 and 2
Renewed Facility Operating License Nos. DPR-71 and DPR-62
Docket Nos. 50-325 and 50-324
Response to Request for Additional Information Regarding Inservice Inspection Program Proposed Alternative ISI-09 In Accordance With 10 CFR 50.55a(z)(1) Regarding Reactor Pressure Vessel Circumferential Shell Weld Examinations

References:
1. Letter from Bryan B. Wooten (Duke Energy) to the U.S. Nuclear Regulatory Commission Document Control Desk, *Inservice Inspection Program Proposed Alternative ISI-09 In Accordance With 10 CFR 50.55a(z)(1) Regarding Reactor Pressure Vessel Circumferential Shell Weld Examinations*, dated January 23, 2018, ADAMS Accession Number ML18023A134

2. NRC E-mail Capture, *Brunswick Unit 1 and Unit 2 - Request for Additional Information by the Reactor Systems Branch, Relief Request for Examination of Reactor Vessel Shell Welds for Brunswick Steam Electric Plant, Units 1 and 2, Duke Energy Progress, LLC, Docket Number 50-235 and 50-324, (EPID L-2018-LLR-0001),* dated March 27, 2018

Ladies and Gentlemen:

By letter dated January 23, 2018 (i.e., Reference 1), Duke Energy Progress, LLC (Duke Energy), submitted a relief request (i.e., ISI-09) for the Brunswick Steam Electric Plant (BSEP), Unit Nos. 1 and 2. The request proposed an alternative to the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, 2001 Edition through 2003 Addenda. Specifically, to Table IWB-2500-1, Category B-A, Item B1.11 for examination of reactor pressure vessel (RPV) circumferential shell welds.

On March 27, 2018, by electronic mail (i.e., Reference 2), the NRC provided a request for additional information (RAI) regarding the ISI-09 relief request. Duke Energy's response to the RAI is provided in the Enclosure.

No regulatory commitments are contained in this letter.

Please refer any questions regarding this submittal to Mr. Lee Grzeck, Manager - Regulatory Affairs, at (910) 832-2487.

Sincerely,

Bryan B. Wooten
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Brunswick Steam Electric Plant

BBW/mkb

Enclosure:

Response to Request for Additional Information

cc:

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Response to Request for Additional Information

By letter dated January 23, 2018, Duke Energy Progress, LLC (Duke Energy), submitted a relief request (i.e., ISI-09) for the Brunswick Steam Electric Plant (BSEP), Unit Nos. 1 and 2. The request proposed an alternative to the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, 2001 Edition through 2003 Addenda. Specifically, to Table IWB-2500-1, Category B-A, Item B1.11 for examination of reactor pressure vessel (RPV) circumferential shell welds.

On March 27, 2018, by electronic mail, the NRC provided a request for additional information (RAI) regarding the ISI-09 relief request. Those questions, and Duke Energy's responses, are provided below.

SRXB-RAI 1

In the Enclosure to Reference 1, the second paragraph under the heading "Review of Low Pressure Injection Sources" states:

> For the low pressure make-up systems, the Core Spray and Residual Heat Removal systems, these system's pumps have a shutoff head of approximately 313 psig and 250 psig, respectively. The BSEP pressure-temperature limit curves for hydrostatic testing allow pressures up to 313 psig at a temperature of 70°F.

The above information is inconsistent with the BSEP Units 1 and 2 TS Section 3.4.9, Pressure-Temperature (P-T) limits, Figures 3.4.9-3 and 3.4.9-4, and 3.4.9-5 for hydrostatic and leak tests. The RPV beltline curves in these figures allows a maximum pressure of 283 psig in the RCS temperature range of 70°F and 110°F. In addition, the RPV beltline curve in TS Figure 3.4.9-1 for the RPV heatup/cooldown also requires to operate below 283 psig pressure in the RCS temperature range of 70°F to 110°F.

a) Justify the inconsistency between the above Reference 1 statement, which states 313 psig as the allowed pressure limit, and the TS Figures 3.4.9-1, 3.4.9-3, 3.4.9-4, and 3.4.9-5 which shows the maximum pressure limit of 283 psig.
b) Justify the inconsistency between the above Reference 1 statement, which states Core Spray (CS) pump shutoff head of 313 psig, and UFSAR Figure 6-49 which shows the CS pump shutoff head as approximately 790 ft (342 psig approximately based on water density of 62.4 lb/ft^3).
c) As per UFSAR Table 6-19, the pressure at which CS injection valve opens is 395 psig. On an inadvertent initiation of the CS system, with its pump shutoff head of approximately 342 psig (considering UFSAR Figure 6-49 is correct), the system would inject water into the RPV at a significantly high flow rate (2 pump minimum rated flow of approximately 8,200 gpm). In this situation, explain how a cold overpressre of the RCS will be prevented during RPV normal heatup/cooldown (TS Figure 3.4.9-1), and during RPV hydrostatic test (TS Figure 3.4.9-3, 3.4.9-4, and 3.4.9-5) so that the RCS pressure remains below the TS limiting pressure of 283 psig.

References

1. Letter from Duke Energy to NRC dated January 23, 2018, "Brunswick Steam Electric Plant, Unit Nos. 1 and 2 Renewed Facility Operating License Nos. DPR-71 and DPR-62 Docket Nos. 50-325 and 50-324 Inservice Inspection Program Proposed Alternative ISI-09 In Accordance with 10 CFR 50.55a(z)(1) Regarding Reactor Pressure Vessel Circumferential Shell Weld Examinations," (ADAMS Accession No. ML18023A134)

Response to SRXB-RAI 1

a) During development of the revised relief request ISI-09 for the period of extended operation, the stated 313 psig value was incorrectly transposed from the original submittal. The allowed pressure limit of 283 psig in Technical Specifications (TS) Figures 3.4.9-1, 3.4.9-3, 3.4.9-4 and 3.4.9-5 is correct. The 313 psig value in Reference 1 was originally submitted in the June 21, 2000, relief request and was updated in 2002 as part of extended power uprate (EPU) activities. At this time, the existing set of pressure-temperature (P-T) curves using 313 psig as the allowed pressure limit and valid through 19 Effective Full Power Years (EFPY) were replaced with a new set of curves using 283 psig as the allowed pressure limit to bound EPU to 32 EFPY. The new P-T curves compensated for pressure and temperature instrument uncertainties by conservatively reducing the allowed pressure limit from 313 psig to 283 psig.

b) During development of the revised relief request ISI-09 for the period of extended operation, the stated 313 psig value was incorrectly transposed from the original submittal. Updated Final Safety Analysis Report (UFSAR) Figure 6-49 showing the Core Spray (CS) pump shutoff head as 790 feet is correct. BSEP Strategic Engineering has verified that the UFSAR Figure 6-49, CS pump characteristic curve, is the original and correct curve. It is unknown why the original submittal stated the incorrect value of 313 psig as the CS pump shutoff head, as 790 feet is the correct value and has been unchanged since plant startup.

   As the pump shutoff head has been confirmed to be 790 feet (i.e., approximately 342 psig with assumed water density of 62.4 lb/ft^3), BSEP acknowledges the CS pumps are capable of providing head pressure in excess of the 283 psig allowed pressure limit found in TS Figures 3.4.9-1, 3.4.9-3, 3.4.9-4 and 3.4.9-5.

   Per NRC Report, "Final Safety Evaluation of the BWR Vessel and Internals Project BWRVIP-05 Report (TAC No M93925)," Appendix C, Section C.1.4 “Low Pressure Core Injection and/or Core Spray Injection,” the safety evaluation acknowledges that while some facilities’ low pressure injection systems have the potential to provide greater pressures than the allowed pressure limit, the Low Pressure Coolant Injection (LPCI) and CS systems do not represent a significant challenge to the RPV based on the normal shutoff heads of the low pressure pumps. However, the high flow rates of the

systems are capable of quickly increasing the RPV water level and will affect time available for operator/system recovery.

In addition, the same Final Safety Evaluation, Appendix C, Section C.1.8 “Cold Over Pressurization Condition,” discusses the December 1997 BWRVIP RAI response that concluded several actions would have to take place for a low temperature over-pressure (LTOP) event to occur, including operators violating the P-T curves, ignoring water level instrumentation, isolating the vessel, and continual injection via Control Rod Drive (CRD) flow for an extended period of time. The BWRVIP concluded that these actions are extremely unlikely to occur and cause a LTOP event. The NRC staff and BWRVIP estimates of the frequency of LTOP events are nearly equivalent.

In order to use NRC Generic Letter 98-05, licensees must have implemented operator training and established procedures that limit the frequency of LTOP events to the amount specified in the above Final Safety Evaluation. BSEP has met this basis by implementing periodic operator training on brittle fracture limits, compliance with P-T curves and procedural requirements. Operators are directed by multiple procedure steps to maintain the RPV pressure and temperature in accordance with the applicable TS P-T figure.

c) As stated in the response to (b), BSEP acknowledges that the CS pumps, with the pump shutoff head of approximately 342 psig, are capable of providing pressure in excess of the 283 psig pressure limit under certain temperatures per TS Figures 3.4.9-1, 3.4.9-3, 3.4.9-4, 3.4.9-5. BSEP also acknowledges that the conditions under which RPV temperatures are in the region of 283 psig allowed pressure exist primarily during startup from cold shutdown, and during the ASME Section XI required RPV pressure test after vessel maintenance. During these online and startup conditions, operator action will prevent exceeding the 283 psig allowed pressure limit. Level bands exist to prevent the RPV from a water-solid condition, and during startup the main steam isolation valves (MSIVs) are open to provide a greater system volume than the RPV alone. The greater system volume provides operators a longer response time to an inadvertent initiation of the CS system. Prior to performance of the ASME Section XI pressure test, operators are instructed on the requirements to maintain Reactor Coolant System (RCS) conditions within the boundaries of the applicable TS P-T curves.

Through compliance with plant operating procedures, continuing training on brittle fracture limits and LTOP events, and timely operator action, the risk of pressurization of the RCS above the boundaries of the TS P-T curve limits is minimized due to an inadvertent initiation of the CS system.