NEXTera ENERGY SEABROOK

October 27, 2011

SBK-L-11192
Docket No. 50-443

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852

Seabrook Station

Request for Relief from ASME Code Case N-729-1 Requirements for Examination of Reactor Vessel Head Penetration Welds

Pursuant to 10 CFR 50.55a(a)(3)(ii), NextEra Energy Seabrook, LLC (NextEra) requests NRC approval for relief from ASME Code Case N-729-1 requirements for examination of reactor vessel head penetration welds. This relief request is for the third ten-year inspection interval for Seabrook Station which commenced August 19, 2010.

The Code of Federal Regulations 10 CFR 50.55a(g)(6)(ii)(D)(1) requires that examinations of the reactor pressure vessel (RPV) head be performed in accordance with ASME Code Case N-729-1 (N-729-1) subject to conditions specified in paragraphs 10 CFR 50.55a(g)(6)(ii)(D)(2) through (6). NextEra is unable to meet required examination coverage below the J-groove weld on four control rod drive mechanism (CRDM) penetrations. The four CRDM penetrations are configured such that the volumetric examination distance required by N-729-1 can not be met. Although able to meet the required examination coverage for a fifth CRDM penetration, it has been included in this relief because its coverage does not provide sufficient margin. The attachment to this letter, Relief Request 3IR-4, documents ultrasonic coverage limitations.

Relief Request 3IR-4 has been formatted in accordance with NEI White Paper Rev. 1, "Standard Format for Requests from Commercial Reactor Licensees Pursuant to 10 CFR 50.55a."

NextEra respectfully requests approval of this request by September 30, 2012, in order to prepare for inspections during the fall 2012 refueling outage.

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NRR

There are no regulatory commitments contained in this letter.

If you have any questions regarding this submittal, please contact Mr. Michael O'Keefe, Licensing Manager at (603) 773-7745.

Sincerely,

NextEra Energy Seabrook, LLC

Paul O. Freeman
Site Vice President

Attachments:

cc: W.M. Dean, NRC Region I Administrator
G. E. Miller, NRC Project Manager, Project Directorate I-2
W. J. Raymond, NRC Resident Inspector

Attachment

Relief Request 3IR-4

Request for Relief from ASME Code Case N-729-1 Requirements for Examination of Reactor Vessel Head Penetration Welds

Request for Relief from ASME Code Case N-729-1 Requirements for Examination of Reactor Vessel Head Penetration Welds
3IR-4, Rev. 0

NextEra Energy Seabrook, LLC
Third Ten-Year Interval

Proposed Alternative
in Accordance with 10 CFR 50.55a(a)(3)(ii)

--Hardship or Unusual Difficulty Without Compensating Increase in Level of Quality or Safety--

Request for Relief from ASME Code Case N-729-1 Requirements for Examination of Reactor Vessel Head Penetration Welds

1. ASME Code Components Affected

Code Class:	1
Reference:	ASME Code Case N-729-1 / 10 CFR 50.55a(g)(6)(ii)(D)
Item No.:	B4.20
Description:	UNS N06600 Nozzles and UNS N06082 or UNS W86182 Partial-Penetration Welds in Head

2. Applicable Code Edition and Addenda

The current code of record for NextEra Energy's Seabrook Station (NextEra) third ten-year Inservice Inspection (ISI) interval is ASME Code Section XI, 2004 Edition, as augmented by ASME Code Case N-729-1, "Alternative Examination Requirements for PWR Reactor Vessel Upper Heads with Nozzles Having Pressure-Retaining Partial-Penetration Welds Section XI, Division 1," as amended by 10 CFR 50.55a(g)(6)(ii)(D).

3. Applicable Code Requirement

10 CFR 50.55a(g)(6)(ii)(D)(1) requires that examinations of the reactor vessel head be performed in accordance with ASME Code Case N-729-1 subject to the conditions specified in paragraphs 10 CFR 50.55a(g)(6)(ii)(D)(2) through (6).

Paragraph -2500 of Code Case N-729-1 states, in part:

> If obstructions or limitations prevent examination of the volume or surface required by Figure 2 for one or more nozzles, the analysis procedure of Appendix I shall be used to demonstrate the adequacy of the examination volume or surface for each such nozzle. If Appendix I is used, the evaluation shall be submitted to the regulatory authority having jurisdiction at the plant site.

Figure 2 in ASME Code Case N-729-1, as referenced by paragraph -2500, requires that the volumetric or surface examination coverage distance below the toe of the J-groove weld (i.e. dimension "a") be 1.5 inches for incidence angle, θ, less than or equal to 30 degrees; 1 inch for incidence angle, θ, greater than 30 degrees; or to the end of the tube, whichever is less. These coverage requirements are applicable to Seabrook reactor vessel head penetrations as shown in Table 1.

Table 1: Seabrook Reactor Vessel Head Penetration Coverage Requirements

Penetration Numbers	Incidence Angle, θ (degrees)	Required Coverage, "a" (inches)
1 to 29	≤ 30	1.5
30 to 78	> 30	1.0

4. Reason for Request

Due to physical configuration of certain reactor vessel head penetration nozzles, full examination volume required by ASME Code Case N-729-1 Table 1 cannot be achieved for Item B4.20, therefore, use of Mandatory Appendix I is requested in accordance with 10 CFR 50.55a(g)(6)(ii)(D)(6).

Reactor Vessel Head CRDM Penetrations at Seabrook have two styles of ends, referred to as Type "X" and Type "Y" (Figure 1). Penetrations 1 through 73 are Type "Y" that are essentially a smooth wall cylinder with a radius at the outer diameter and inner diameter. Penetrations 74 through 78 have a threaded outside diameter and an internal taper.

The design of RPV head penetration nozzles 74 through 78, referred to as Type "X", (Figure 1) includes a threaded section, approximately 1.19 inch in length at the bottom of the nozzles. These penetrations are located at the 48.7 degree location. The dimensional configuration at this location is such that the distance from the lowest point at the toe of the J-groove weld to the top of the threaded region is less than the required coverage dimension "a" shown in Figure 2 of ASME Code Case N-729-1. Therefore, deviation from the required inspection coverage is sought for reactor vessel head penetrations 74, 75, 76, 77 and 78. Penetration 77, although meeting examination coverage requirements, has been included in this relief because it is also a Type X style and its coverage does not provide sufficient margin.

5. Proposed Alternative And Basis for Use

As an alternative to the volumetric and surface examination coverage requirements shown as dimension "a" in Figure 2 of ASME Code Case N-729-1, NextEra proposes the use of attainable ultrasonic examination distances shown in Table 2. The required examination coverage dimension for the other penetrations will be met or exceeded.

Table 2: Seabrook Inspection Coverage Obtained for CRDM Penetrations Having Limited Coverage

Penetration No.	θ (degrees)	N-729-1 Required Exam Coverage (inches)	Inspection Coverage Obtained (inches)
74	48.7	1.0	0.94
75	48.7	1.0	0.32
76	48.7	1.0	0.43
77	48.7	1.0	1.07
78	48.7	1.0	0.48

Appendix I of ASME Code Case N-729-1 provides the analysis procedure for evaluation of an alternative examination area or volume to that specified in Figure 2 of Code Case N-729-1 if impediments prevent examination of the complete zone. Section I-1000 of ASME Code Case N-729-1 requires, for alternative examination zones, that analyses shall be performed using at least the stress analysis method (Section I-2000) or the deterministic fracture mechanics analysis method (Section I-3000) to demonstrate that the applicable criteria are satisfied. The techniques described in Section I-2000 were validated in the Westinghouse analysis (Reference 2). Although not required, the deterministic fracture mechanics analysis described in Section I-3000 was also validated in the Westinghouse analysis. This analysis does not fully meet the requirements stated in I-3200(a) Method 1 in that the Westinghouse analysis (Reference 2) used the crack growth formula in the Electric Power Research Institute report, "Materials Reliability Program (MRP) Crack Growth Rates for Evaluating Primary Stress Corrosion Cracking (PWSCC) of Thick Wall Alloy 600 Material (MRP-55), Revision 1."

5.1 Stress Analysis in Accordance with ASME Code Case N-729-1 Section I-2000

Section I-2000 of ASME Code Case N-729-1 requires that plant-specific analysis demonstrate that the hoop and axial stresses remain below 20 kips per square inch (ksi) (tensile) over the entire region outside the alternative examination zone but within the examination zone defined in Figure 2 of the Code Case.

The distance below the J-groove weld that requires examination, as determined by the point at which the CRDM penetration hoop stress distribution for the operating stress levels is less than 20 (ksi) tension, was obtained from Appendix A of Reference 2, Topical Report WCAP-16550-P, Revision 0, "Structural Integrity Evaluation of Reactor Vessel Upper Head Penetrations to Support Continued Operation: Seabrook Station," dated April 2006.

The hoop stress distribution plot for penetrations 74 through 78 is provided in Figure 2 of this submittal. Note that hoop stresses during steady state operation are much greater than the axial stresses. The hoop stress distribution plot in Figure 2 indicate that the minimum achievable inspection coverage below the bottom of the J-groove weld insures stresses remain below 20 ksi tensile over the entire region outside the alternative examination zone but within the examination zone defined in Figure 2 of ASME Code Case N-729-1. The hoop stress distribution plot displays the downhill side as this is more limiting. Also, stress distribution shown is for the inside and outside surface. Table 3 summarizes the distance from below the toe of the downhill side J-groove weld to where both the inside and outside surface hoop stress drops below 20 ksi for penetrations 74 through 78.

Table 3: Distance Below Toe of Downhill Side J-Groove Weld Where Hoop Stress is Less Than 20 KSI

Penetration Nozzle No.	Source	Distance Below Toe of Downhill Side J-Groove Weld Where Hoop Stress <20ksi (inch)
74 – 78	Figure 2	0.30

5.2 Deterministic Fracture Mechanics Analysis in Accordance with ASME Code Case N-729-1 Section I-3200, Method 1

A fracture mechanics analysis was performed and documented in Reference 2. As previously stated, this analysis is not required and does not fully meet the requirements stated in I-3200(a) Method 1 because the analysis used the crack growth formula in EPRI MRP-55. The analysis does demonstrate that a potential axial crack in the unexamined zone will not grow to the toe of the J-groove weld prior to the examination frequency specified in Table 1 of ASME Code Case N-729-1.

The fracture mechanics analysis was performed using input from the previously discussed stress analysis. The results of the analysis are shown as flaw tolerance charts, which can be used to determine minimum required inspection coverage. This insures that any flaws initiated below the weld, in the region of the penetration nozzle not being inspected, would not reach the bottom of the weld before the next inspection. The flaw tolerance chart for penetrations 74 through 78 is presented in Figure 3.

The flaw tolerance chart in Figure 3 demonstrates that a postulated through-wall flaw at the bottom edge of the proposed alternative examination zone will not grow to the toe of the J-groove weld within an inspection interval of four refueling cycles. The crack growth prediction shows greater than six EFPY of operation required to grow the postulated flaw to the toe of the weld. Additionally, the assumed initial upper extremity locations of axial through-wall flaws are conservative based on achievable inspection coverage, because the assumed upper crack extremities are located within the achievable inspection zone.

Examination of portions of the nozzle significantly below the J-groove weld is not pertinent to the phenomena of concern, which include leakage through the J-groove weld and circumferential cracking in the nozzle above the J-groove weld. In all cases, the measured coverage is adequate to allow Seabrook to continue to operate prior to the hypothetical flaws reaching the J-groove weld. In accordance with 10 CFR 50.55a(g)(6)(ii)(D) requirements, the next required examination would be completed prior to potential flaw propagation into the J-groove welds.

5.3 Surface Examination

10 CFR 50.55a(g)(6)(ii)(D)(3) states in part that "if a surface examination is being substituted for a volumetric examination on a portion of a penetration nozzle that is below the toe of the J-groove weld, the surface examination shall be of the inside and outside wetted surface of the penetration nozzle not examined volumetrically."

To reduce personnel radiation exposure, the nozzles are typically inspected using remotely operated volumetric examination equipment. Although dye penetrant testing of threaded surfaces is possible, it is not practical. The threaded outside diameter (OD) makes a dye penetrant examination on the lower section of the penetration impractical because of excessive bleed out from the threads. Eddy current examination would similarly not be effective due to the threaded configuration. In addition, radiation levels under the reactor vessel head were measured during the previous inspection in 2006 and ranged from 7000mR/hour to 10,000 millirem (mr)/hour at the bottom of the CRDM nozzles resulting in an exposure of approximately 1750 to 2500 mr per nozzle to perform surface examination. Therefore, no alternative is proposed for the five CRDM nozzles with limited examination coverage below the J-groove weld.

6. Duration of Proposed Alternative

The alternative requirements of this request will be applied for the remaining duration of the current 3rd 10-year ISI interval.

7. Precedents

Similar relief requests have been granted to the following plants:

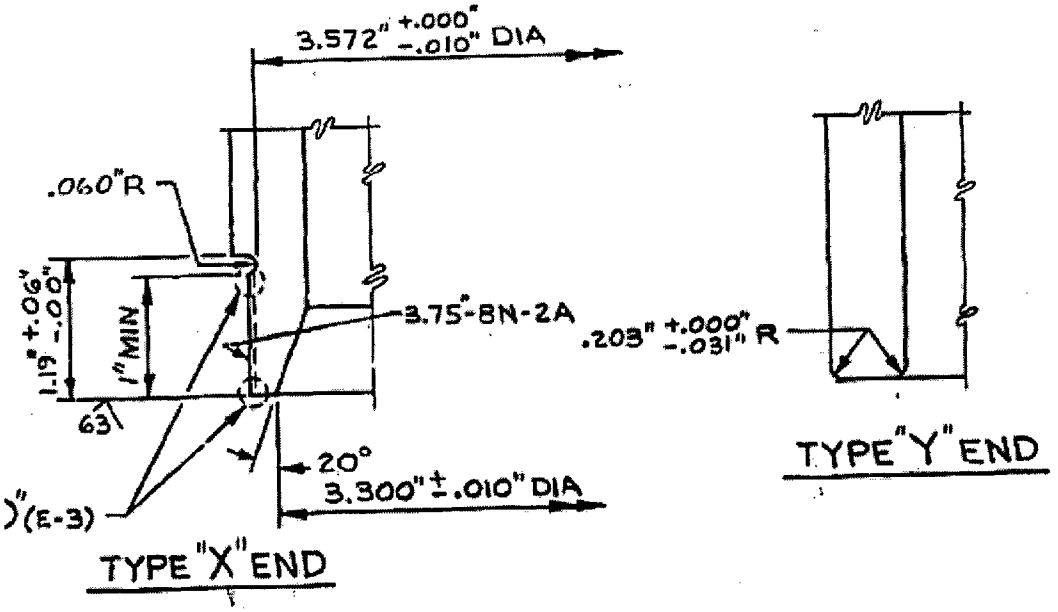
- NRC Safety Evaluation dated December 22, 2009, for San Onofre Nuclear Generating Station, Units 2 and 3, "Relief Request ISI-3-29, Request for Relief from Inspection Requirements of ASME Code Case N-729-1 for Control Element Drive Mechanism Penetrations (TAC Nos. ME0768 and ME0769)" (ML093441035)

- NRC Safety Evaluation dated March 3, 2011, for Braidwood Station Units 1 and 2, and Byron Station Units 1 and 2, "Relief Request from ASME Code Case N-729-1 Requirements for Examination of Reactor Vessel Head Penetration Welds (TAC Nos. ME3510, ME3511, ME3512 and ME3513)" (ML110590921)

8. References

1. ASME Code Case N-729-1, "Alternative Examination Requirements for PWR Reactor Vessel Upper Heads with Nozzles Having Pressure-Retaining Partial-Penetration Welds, Section XI, Division 1," dated March 28, 2006
2. WCAP-16550-P, Revision 0, "Structural Integrity Evaluation of Reactor Vessel Upper Head Penetrations to Support Continued Operation: Seabrook Station," dated April 2006
3. Letter from C.F. Holden (U.S. NRC) to G. F. St. Pierre (FPL Energy Seabrook Station), "Seabrook Station, Unit No. 1 – Relaxation of the First Revised Order EA-03-009 (TAC No. MD2112)," dated September 27, 2006 (ML062620342)
4. Letter SBK-L-06119 from G. F. St. Pierre (FPL Energy Seabrook Station) to U.S. NRC, "Relaxation Request from the First Revised NRC Order EA-03-009 Regarding Requirements for Nondestructive Examination of Nozzles Below the J-Groove," dated May 30, 2006
5. US NRC Letter EA-03-009, "Issuance Of First Revised NRC Order (EA-03-009) Establishing Interim Inspection Requirements For Reactor Pressure Vessel Heads At Pressurized Water Reactors," dated February 20, 2004.

Figure 1
Seabrook Reactor Vessel Head Penetration Ends



Details of the threaded and tapered portion of Penetrations 74, 75, 76, 77, and 78 referred to as "Type X" and the end of Penetrations 1 through 73, referred to as "Type Y".

Figure 2
Hoop Stress Distribution Downhill Side
(48.7° CRDM Penetration Nozzle)

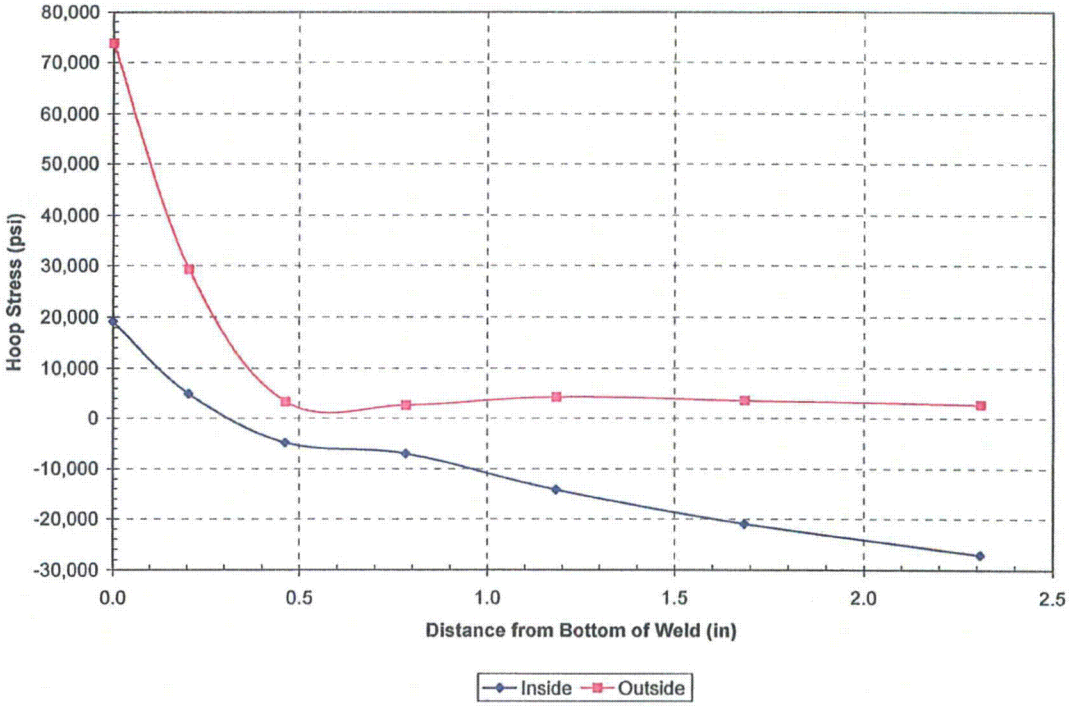


Figure 3
Crack Growth Prediction for Seabrook for Through-Wall Longitudinal Flaws Located in the 48.7° Row of CRDM Penetrations, Downhill Side