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JAFP-13-0133
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United States Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

Subject: Response to Request for Additional Information for the Core Plate Rim Hold Down Bolting, License Renewal Commitment 23 (TAC No. ME9698)

James A. FitzPatrick Nuclear Power Plant
Docket No. 50-333
License No. DPR-59

References:

1. Letter, USNRC to Entergy, "Safety Evaluation Report Related to the License Renewal of James A. FitzPatrick Nuclear Power Plant," NUREG-1905, dated April, 2008
2. Letter, Entergy to USNRC, "Core Plate Rim Hold Down Bolting, Plant Specific Analysis and Inspection Plan, License Renewal Commitment #23," JAFP-12-0122, dated September 28, 2012
3. Letter, Entergy to USNRC, "Response to Request for Additional Information Core for Plate Rim Hold Down Bolting, Plant Specific Analysis and Inspection Plan, License Renewal Commitment #23," JAFP-13-0035, dated April 17, 2013
4. Email, USNRC to Entergy, "Plant-Specific Core Plate Rim Hold Down Bolt Analysis – Commitment 23," dated August 6, 2013
5. Letter, Entergy to USNRC, "Core Plate Rim Hold Down Bolting, Plant Specific Analysis and Inspection Plan – Revision, License Renewal Commitment #23 (TAC No. ME9698)," JAFP-13-0126, dated September 27, 2013

Dear Sir or Madam:

In April 2008, a License Renewal Safety Evaluation [Reference 1] was released for James A. FitzPatrick Nuclear Power Plant (JAF). One of the commitments in that report was for Core Plate Rim Hold Down Bolting (Commitment 23). JAF submitted a Plant Specific Analysis and Inspection Plan in accordance with the commitment on September 28, 2012 [Reference 2]. A request for additional information (RAI) was answered on April 17, 2013 [Reference 3] and a followup request was made on August 6, 2013 [Reference 4]. Contained in the Attachment to this letter is JAF's response to the RAIs in Reference 4.

Subsequent to the RAI made in Reference 4, JAF submitted a revision to its Plan for an inspection schedule and commitment 23 [Reference 5].

This letter contains no new regulatory commitments. If you have any questions regarding this report, please contact Chris M. Adner, Licensing Manager, at 315-349-6766.

Sincerely,

Chris M. Adner
Licensing Manager - JAF

CA/mh

Attachment: JAF Core Plate Rim Hold Down Bolting RAI Responses

cc: Regional Administrator, Region I
JAF Resident Inspector
Mr. Mohan Thadani, Senior Project Manager
New York State Department of Public Service (PSC)
New York State Energy and Research Development Authority (NYSERDA)

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Attachment

JAF Core Plate Rim Hold Down Bolting RAI Responses

(4 Pages)

JAF Core Plate Rim Hold Down Bolting RAI Responses

RAI 1

Section 2.4.2 of Attachment 1 to the September 28, 2012, submittal notes that the gap between the aligner pin and the core support ring results in an impact load between the aligner pin and the core support ring when the reactor internals are subjected to horizontal loading resulting from a seismic event. However, neither the summary of this evaluation in the aforementioned attachment nor the calculation which considers the aligner pins contribution to resisting the horizontal loading (JAF-CALC-12-00017, "Minimum Required Number of Core Plate Bolts – Consideration of Aligner Brackets," submitted on March 6, 2013) discusses the core plate bolt hole gaps.

Please provide information regarding the nominal design values for the gaps between the core plate bolts and core plate bolt holes. Provide confirmation that the gap between the aligner pin and the core support ring is smaller than any potential gap between the core plate bolts and the core plate bolt holes on the core plate. Determine whether the core plate bolt hole gap could potentially be closed prior to the aligner pin gap such that core plate bolt bending action and frictional resistance at the core plate rim would resist the applied horizontal loads instead of the scenario postulated in JAF-CALC-12-00017. If the core plate bolt hole gap is smaller, such that the core plate bolt and core plate impact occurs prior to the impact between the aligner pin and core support ring, determine what effect this has on the minimum number of bolts required to withstand the applied horizontal loads.

Entergy Response:

According to the Reference [2] drawing, the core plate bolt holes have a nominal diameter of 1.375 inches with a fractional tolerance of $^{1}/_{16}$ or 0.0625 inches and a center line (X_{CS} and Y_{CS}) tolerance of 0.060 inches on diameter. Since the tolerance of 0.060 inches is the diameter of the tolerance zone about the true position given by the Basic Dimension, the as-built centerline of the hole can be anywhere in a cylinder of 0.060 inches diameter about the true position, which results in a maximum of 0.030 inches offset from true position. Therefore, the minimum diameter of the bolt holes is:

$$1.375 - 0.0625 - 0.030 = 1.283 \; inches$$

From Reference [3], the nominal diameter of the bolts is 1.125 inches with a tolerance of ± $^{1}/_{32}$ or 0.03125 inches on diameter; therefore, the maximum diameter of the bolt is:

$$1.125 + 0.03125 = 1.156 \; inches$$

The average minimum radial clearance of the bolts within the bolt holes is:

$$\frac{(1.283 - 1.156)}{2} = 0.0635 \; inches$$

From Reference [4], the aligner pin assembly has a typical gap of 0.010 ± 0.005 inches, so the maximum typical gap is 0.015 inches. The average minimum radial clearance between the through hole in the core plate and the core plate bolt is approximately 4 times larger than the maximum typical gap of 0.015 inches expected between the aligner pin and bracket assembly;

therefore, it is reasonable to expect that the aligner pin gap will close prior to the bolt hole gap.

It should also be noted that the results of JAF-CALC-12-00017 [7] were not intended to justify taking credit for a reduced number of bolts, but rather to show that redundant load carrying capacity is present when considering the contribution of the aligner pins. The inspection protocol developed in JAF-CALC-12-00018 [8] was developed without taking credit for the aligner pin and bracket assemblies.

RAI 2

The sixth assumption provided on Page 7 of calculation JAF-CALC-12-00016, "Minimum Required Number of Core Plate Bolts," submitted on March 6, 2013, notes that the remaining number of bolts calculated are assumed to be evenly distributed around the core plate. The basis for this assumption is that no region of the core plate is more susceptible to degradation than others. As described in Section 3.3.4.1 of the JAF Final Safety Analysis Report (FSAR), the JAF core plate consists of the typical circular stainless steel plate stiffened with a rim and beam structure. The basic construction of the core plate ensures that the loading will not be evenly distributed due to the core plate stiffener beams which tend to place higher loads on some core plate bolts than others. Assuming an uneven load distribution on the core plate bolts, describe what impact this assumption has on the analysis results for both calculations (JAF-CALC-12-00017 and JAF-CALC-12-00016).

Entergy Response:

It is recognized that an uneven load distribution exists on the core plate bolts for some loading scenarios, such as those encountered during transient loading events. Appendix A of BWRVIP-25 [5] provides an illustration of the uneven vertical and horizontal load distributions on the core plate bolts for an example analysis considering Level A/B and Level C/D loadings.

The degradation referred to in JAF-CALC-12-00016 [6] is the failure of bolts due to intergranular stress corrosion cracking (IGSCC), and the assumption states that the locations of the remaining intact bolts are assumed to be evenly distributed. IGSCC is a time dependent degradation mechanism and occurs primarily under sustained loads during normal operating conditions. Short duration transient loads do not act over a long enough time period to result in significant IGSCC growth.

The normal operating loads on the core plate are deadweight (compressive force on the core plate rim reacted by the core plate support ring) and the reactor internal pressure difference (RIPD) across the core plate. The RIPD load is expected to be fairly evenly distributed since it acts over the entire core plate surface and is not an inertial load which will by definition accumulate where there is more mass and stiffness in the structure (at the stiffener beams). The dominant sustained load acting on the core plate bolts is due to bolt preload, which is not affected by the basic construction of the core plate. Further, proper specification of bolt preload is such that the preload exceeds the operating loads; thereby preventing separation of the joint and consequent vibration or movement. Under the applied sustained loads there is no reason to expect that any region of the core plate is more susceptible than others to IGSCC degradation at the bolt locations.

With respect to the evaluations for the minimum required number of remaining bolts in JAF-CALC-12-00016 [6] and JAF-CALC-12-00017 [7], the vertical loads are used to develop a resultant normal force that contributes to the friction force between the core plate rim and the

core plate support ring. The friction force is compared to the applied horizontal forces to determine the amount of margin. The total resultant normal force is not affected by an uneven load distribution because it is the sum of the individual normal forces contributed by the individual intact bolts. Consequently, the friction force available to resist the applied seismic load is not affected by a potential distribution of vertical loading as observed in the sample BWRVIP-25 [5] analysis in which a configuration with fewer bolts and low preload is evaluated. Further, the JAF core plate configuration has 72 bolts compared to the 32 used in the example analysis in BWRVIP-25, which would have resulted in a more even load distribution than that shown in the sample BWRVIP-25 analysis due to closer proximity of the bolts.

Accordingly, the analysis results for JAF-CALC-12-00016 [6] and JAF-CALC-12-00017 [7] remain valid.

RAI 3

Appendix A ("Example Core Plate Bolt Analysis") to Boiling Water Reactor Vessel and Internals Project (BWRVIP)-25, "BWR Core Plate Inspection and Flaw Evaluation Guidelines," considers three different loading scenarios for the core plate bolts under design basis loads: (1) loads on the core plate bolts with no credit for aligner pins; (2) shear-only load on the aligner pins with no credit for horizontal bolt restraint; and (3) load on the core plate bolts with no credit for aligner pin and also with the stiffener-beam-to-rim weld cracked. Scenario 1 is the only scenario which appears to be explicitly considered in the present evaluation of the JAF core plate bolts. Please discuss how the other scenarios used in BWRVIP-25 are addressed by the evaluations performed for the JAF core plate bolts.

Entergy Response:

The example analysis presented in Appendix A of BWRVIP- 25 is a sample analysis that investigates structural characteristics and considers three postulated scenarios as follows [5]:

1. Determine load on core plate bolts with no credit for aligner pins.
2. Determine shear load on aligner pins with no credit for core plate bolts.
3. Determine load on core plate bolts with no credit for aligner pins or rim weld.

As indicated in RAI 3, Scenario 1 is considered in JAF-CALC-12-00016 [6] by evaluating the friction force needed to resist the horizontal forces due to Level A/B and Level C/D events. The second and third scenarios used in BWRVIP-25 are specifically not addressed because they do not apply when determining an inspection protocol for the core plate bolts.

Scenario 2 does not apply because not all bolts are assumed to be failed in the JAF analysis. The impact of the aligner pins is considered in JAF-CALC-12-00017 [7], but the objective of the evaluation is to determine the additional margin provided by the aligner pins, not to assume that the bolts have all failed and do not contribute structurally.

Scenario 3 does not apply because whether the rim weld is intact or not is irrelevant as long as sufficient preload force in the bolts exists to keep the joint together and provide enough friction force to prevent movement of the core plate. Further, calculation JAF-CALC-12-00016 [6] does not take any credit for the aligner pin assembly. Table 3-2 of BWRVIP-25 specifically indicates that inspections of the rim weld are not required because failure of this weld has no adverse safety consequences.

Therefore, Scenario 1 is the only relevant scenario for determining an inspection protocol for the

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JAF core plate bolts. The evaluations in JAF-CALC-12-00016 [6] and JAF-CALC-12-00017 [7] determine the minimum number of bolts required to ensure sufficient friction force exists to prevent movement of the core plate. Further, the inspection protocol developed in JAF-CALC-12-00018 [8] was developed without taking credit for the aligner pin and bracket assemblies, which is conservative.

REFERENCES

1. Requests for Additional Information (RAIs), Entergy Nuclear Operations, Inc (ENO), James A. Fitzpatrick Nuclear Power Plant (JAF) Plant-Specific Core Plate Rim Hold Down Bolt Analysis Performed to Address License Renewal Commitment 23, Docket Number 50-333, TAC No. ME9698.
2. Sun Shipbuilding & Drydock Co. Drawing No. 42360-6, Rev. 7, “Core Support for Core Structure,” JAF MPL No. B11-0003, SI File No. 1101291.201 (JAF Drawing 5.10-43 Rev 1).
3. GE Drawing No. 158B7234, “Stud,” SI File No. 1101291.201 (JAF Drawing 5.11-11 Rev 2).
4. JAF Drawing No 5.01-136, Revision D, “Reactor Assembly Nuclear Boiler Sh. 1,” SI File No. 1101291.201.
5. EPRI TR-107284, “BWR Vessel and Internals Project, BWR Core Plate Inspection and Flaw Evaluation Guidelines (BWRVIP-25)”, December 1996, **EPRI Proprietary Information**.
6. JAF-CALC-12-00016, Revision 0, “Minimum Required Number of Core Plate Bolts,” SI File No. 1101291.304, Rev. 0.
7. JAF-CALC-12-00017, Revision 0, “Minimum Required Number of Core Plate Bolts – Consideration of Aligner Brackets,” SI File No. 1101291.305, Rev. 0.
8. JAF-CALC-12-00018, Revision 0, “Recommendations for a Core Plate Bolt Inspection Protocol,” SI File No. 1101291.306, Rev. 0.