November 8, 2012

MEMORANDUM TO: James W. Clifford, Deputy Director
Division of Reactor Projects
Region I

FROM: Sher Bahadur, Deputy Director */RA/*
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

SUBJECT: FINAL RESPONSE TO TASK INTERFACE AGREEMENT 2012-01, JAMES A. FITZPATRICK NUCLEAR POWER PLANT DEFINITION OF CORE QUADRANT

By letter dated October 7, 2011 (Agencywide Documents Access and Management System Accession No. ML112800693), the U.S. Nuclear Regulatory Commission (NRC) Region I Office requested technical assistance from the Office of Nuclear Reactor Regulation (NRR) to determine whether the definition of the term "core quadrant" as established in James A. Fitzpatrick Nuclear Power Plant (JAF) procedures is consistent with the JAF licensing basis and the source range monitor (SRM) Technical Specification (TS) requirements. The NRC resident inspectors identified that the JAF procedures provided for non-stationary "rotating" quadrants to be implemented if an SRM becomes inoperable during fuel movement or core alterations. The inspectors questioned if this definition is consistent with the plain language in TS for core quadrant and documented this issue as an unresolved item in NRC inspection report 05000333/2011003 dated August 5, 2011.

The inspectors reviewed the SRM vendor document that was referenced by JAF staff as support for the 2004 definition of "core quadrant" and determined that the vendor document did not appear to be analytically based to support the definition of "core quadrant" as implemented by JAF staff in procedure changes in 2004. Based on this information, the inspectors determined that further NRC evaluation was needed to assess the analyses and licensee regulatory screening reviews to support the rotated core quadrants approach to TS requirements for SRM operability during core alterations. Subsequently, Region I requested NRR's technical assistance to address whether Entergy's definition of core quadrant satisfies the TS requirements with respect to SRM operability during core alterations.

The NRR staff has reviewed the issue and finds that (a) the Entergy definition of core quadrant represents a change to the plant's TSs that requires prior review and approval by the NRC staff as specified in Title 10 of the *Code of Federal Regulations* Section 50.59 before it could be implemented and is therefore not acceptable, and (b) implementing the Entergy definition of core quadrant does not satisfy TS 3.3.1.2 SRM operability requirements during core alterations The NRR staff position is documented in the enclosed evaluation.

Enclosure:
As stated

CONTACT: Holly D. Cruz, DPR/PLPB
(301) 415-1053

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ADAMS Accession No.: ML12290A287 **NRR-106**

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TASK INTERFACE AGREEMENT 2012-01

JAMES A. FITZPATRICK NUCLEAR POWER PLANT

DEFINITION OF CORE QUADRANT

1.0 INTRODUCTION

By letter dated October 7, 2011 (Reference 1), the U.S. Nuclear Regulatory Commission (NRC) Region I Office requested technical assistance from the Office of Nuclear Reactor Regulation (NRR) to determine whether the definition of the term "core quadrant" as established in James A. Fitzpatrick Nuclear Power Plant (JAF) procedures is consistent with the JAF licensing basis and the source range monitor (SRM) Technical Specification (TS) requirements. The NRC resident inspectors identified that the JAF procedures provided for "rotating" quadrants (non-stationary) to be implemented if an SRM becomes inoperable during fuel movement or core alterations. The inspectors questioned if this definition is consistent with the plain language in TS for core quadrant and documented this issue as an unresolved item (URI) in NRC inspection report 05000333/2011003 dated August 5, 2011 (Reference 2).

The inspectors reviewed the SRM vendor document (Reference 3) that was referenced by JAF staff as support for the 2004 definition of "core quadrant" and determined that the vendor document did not appear to be analytically based to support the definition of "core quadrant" as implemented by JAF staff in procedure changes in 2004. Based on this information, the inspectors determined that further NRC evaluation was needed to assess the analyses and licensee regulatory screening reviews to support the licensee position that rotated core quadrants comply with TS requirements for SRM operability during core alterations. Subsequently, Region I requested NRR's technical assistance to address whether Entergy's definition of core quadrant satisfies the TS requirements with respect to SRM operability during core alterations.

The NRR staff has reviewed the documents related to the above issue, and the assessment is documented in the evaluation. The assessment is performed in accordance with NRR Office Instruction COM-106 (Reference 4).

2.0 BACKGROUND

The NRC staff completed an inspection at JAF and examined activities under JAF's license as they relate to safety and compliance with the Commission's rules and regulations. The inspectors reviewed selected procedures and records and observed activities including refueling

ENCLOSURE

operations during the 2010 refueling outage at JAF (Reference 2). Inspectors observed during the refueling operations that one of the four installed SRMs was inoperable (SRM 'A'). During core alterations (movement of fuel or control rods within the reactor vessel), TS surveillance requirement (SR) 3.3.1.2.2 requires that an operable SRM is located in the core quadrant where core alterations are being performed. When the inspectors questioned how fuel movements were being controlled such that no movements would be performed in the core quadrant that contained SRM 'A', Entergy (JAF) staff responded that, in accordance with JAF plant procedure (OSP-66.001, "Management of Refueling Activities"), refueling operations could proceed in any core location with any single SRM out of service based on a definition of "core quadrant" that had been developed and adopted by the JAF staff in 2004. The inspectors reviewed the issue of SRM operability requirements during refueling operations to determine whether the core quadrant definition was consistent with the JAF TS requirements. The inspectors identified this issue as an URI associated with the adequacy of Entergy's basis for a change to the definition of "core quadrant" as applied to refueling operations that had been implemented by the Entergy staff at Fitzpatrick in 2004.

The JAF TS 3.3.1.2 applicability Table requires that two SRMs be operable in Mode 5 (Refueling). The JAF SR 3.3.1.2.2 further requires that, for non-spiral core offload and reloading, an operable SRM be located in the "core quadrant" where core alterations are being performed and a second operable SRM be located in a core quadrant adjacent to where core alterations are being performed. The TS does not define the term "core quadrant." The JAF TS Bases state that the two required SRMs provide redundant monitoring of reactivity changes during fuel or control rod movement and give the control room operator early indication of unexpected subcritical multiplication that could be indicative of an approach to criticality. The JAF TS Bases indicate that while the SRMs have no safety function and are not assumed to function during any design-basis accident or transient analysis, these instruments provide on scale monitoring of neutron flux levels during refueling and startup. The JAF TS Bases further indicate the requirement to have one operable SRM in the quadrant where core alterations are being performed and one operable SRM in an adjacent quadrant considers the local nature of reactivity changes and ensures that core reactivity will be continuously monitored during alterations.

The reactor core at JAF consists of 560 fuel assemblies, arranged symmetrically in an octagonal configuration. Due to this symmetry, the core can be divided into four equal quadrants, using two perpendicular axes (000°-180° and 090°-270°) that cross at the geometric center of the core. The reactor core also contains four installed SRMs, with one in each of the quadrants as described above.

The NRC inspectors identified that "core quadrant" as defined in the JAF station procedures and implemented by the station had the axes based on the SRM locations rather than the geometric center of the core. This orientation resulted in quadrant axes that are rotated approximately

18 degrees clockwise from the arrangement that was described above, and resulted in quadrant boundaries that bisect individual fuel assemblies. Entergy personnel determined that such fuel assemblies could be considered to reside in either of the adjacent quadrants. The inspectors reviewed the SRM vendor document (Reference 3) that was referenced by JAF staff as support for the 2004 definition of "core quadrant." The inspectors' review determined that the vendor document did not appear to be analytically based to support the definition of "core quadrant" as implemented by JAF staff in procedure changes made in 2004.

Region I requested NRR to determine whether the Entergy definition of core quadrant is applicable and satisfies the TS requirements with regards to SRM operability during core alterations.

Licensee Position

Reference 1 indicates that the Entergy personnel at JAF concluded that such fuel assemblies could be considered to reside in either of the adjacent quadrants. Entergy personnel used this concept to establish two quadrant boundaries, one rotated clockwise by 16° and the other rotated clockwise by 20°, such that every SRM could be considered to reside within two distinct sections of the core (i.e., each SRM would be located within, but at the most clockwise edge of one quadrant, and within, but at the most counterclockwise edge of a second quadrant). Entergy personnel determined that by alternatively selecting either of the “redefined” core quadrants, the “redefined” core quadrant arrangement supports TS 3.3.1.2.2 while moving fuel anywhere in the core, with any one SRM being inoperable.

3.0 EVALUATION

The NRC staff conducted a detailed evaluation of the JAF redefinition of the core quadrant issue based on technical, regulatory, and safety aspects using available documents at the agency that were obtained from the licensee and Entergy.

3.1 Applicable Technical Specifications and Regulations with Analyses

A. Applicable sections from JAF TS are:

TS 3.3.1.2, Source Range Monitor (SRM) Instrumentation, Condition E for o*ne or more required SRMs inoperable in MODE 5* requires the licensee to *immediately* s*uspend CORE ALTERATIONS except for control rod insertion* (Required Action E.1) and *immediately initiate action to fully insert all insertable control rods in core cells containing one or more fuel assemblies* (Required Action E.2).

SR 3.3.1.2. requires testing to *Verify an OPEARABLE SRM detector is located in (a) The fueled region, (b) The core quadrant where ALTERATIONS are being performed, when the*

associated SRM is included in the fueled region, and (c) A core quadrant adjacent to where CORE ALTERATIONS are being performed when the associated SRM is in the fueled region, at a frequency in accordance with the Surveillance Frequency Control Program. SR 3.3.1.2.2 is modified by two Notes: Note 1, *Only required to be met during CORE ALTERATIONS;* and Note 2, *One SRM may be used to satisfy more than one of the following.*

Table 3.3.1.2-1, Source Range Monitor Instrumentation Required Channels for Mode 5 (Refueling), specifies 2 required SRM channels with Notes (b) and (c) modifying this requirement to specify: (b) *Only one SRM channel is required to be OPEARBLE during spiral offload when the fueled region includes only that SRM detector;* and (c) *special movable detectors may be used in place of SRMs if connected to normal SRM circuits.*

Analysis

Entergy document NEA-04-065 (Reference 5) indicates that there is no specific quadrant definition in JAF documentation such as the TS, Technical Requirements Manual (TRM) or Final Safety Analysis Report. Reference 5 proposes primary and alternate quadrant definitions that minimize the impact of an inoperable SRM on refueling operations. This redefinition is based on two other quadrant definitions, from Vermont Yankee Generating Station and River Bend Station, as shown in Reference 6. The two quadrant definitions are (1) the quadrant boundaries are rotated around the geometric center of the SRMs 16° clockwise from the north-south (N-S) and east-west (E-W) axes, and (2) the alternate definition consists of quadrant boundaries rotated 70° counter clockwise from the major axis. The licensee claims that these rotations leave the SRM within the redefined quadrant. The primary and alternate core quadrants are illustrated as Figures 2 and 3 in Reference 6. Figure 4 of Reference 6 combines the two quadrant systems (primary and alternate definitions). The licensee claims that application of these two definitions simultaneously allows the refueling operations to proceed in any core location with any single SRM out-of-service. In Reference 3, supporting the redefined core at JAF and other licensee locations, General Electric Nuclear Energy (GENE) maintains that, under the primary and alternate quadrant definitions, the SRMs meet the design requirements.

The NRC staff reviewed the JAF and GENE documents referenced above (References 5 and 6). The NRC staff considered that 10 CFR 50.90 provides a regulatory process to request and receive prior approval for changes to a plant's TSs. In this instance, the staff concluded a procedure change implemented at JAF resulted in a change to the plant's TSs that did not receive prior review and approval by the NRC. Specifically, the change to TSs involved redefining stationary core quadrants in terms of operable SRMs and not as a geometric attribute of the core. Further, the GENE documents that support the licensee's action are not based on any quantitative analysis. Therefore the staff finds that the licensee's action of redefining the core quadrants does not satisfy the TS requirements.

B. Applicable sections from Regulations are:

10 CFR [Title 10 of the *Code of Federal Regulations*] 50.59 (c)(1)(i): (c)(1) *A licensee may make changes in the facility as described in the final safety analysis report (as updated), make changes in the procedures as described in the final safety analysis report (as updated), and conduct tests or experiments not described in the final safety analysis report (as updated) without obtaining a license amendment pursuant to Sec. 50.90 only if*:

(i) *A change to the technical specifications incorporated in the license is not required, and*

(ii) *The change, test, or experiment does not meet any of the criteria in paragraph (c) (2) of this section*

Analysis

The NRC staff reviewed the 10 CFR 50.59 screen control form obtained from JAF-Entergy (References 7 and 8). The NRC staff has identified that the licensee has answered the 10 CFR 50.59 screening question: "*Does the proposed activity invalidate, render incorrect or otherwise require a change to an existing Technical Specification or the Facility Operating License?"* with a *NO,* for TS change and proceeded to perform the core quadrant rotation during the refueling mode. For questions, *Does the proposed activity: (1) Invalidate or render incorrect an existing Technical Specification Bases? (2) Require a change to Technical Specification Bases?, (3) Affect the Technical Requirements Manual (TRM) or program described in TRM?* The licensee has answered *NO*.

The NRC staff determined that by answering NO to the 10 CFR 50.59 screen questions described above, the licensee proceeded to redefine the core quadrants, thereby implementing new requirements for the TS plain language meaning of the term "core quadrant." Specifically, the NRC staff concluded the procedure change involved redefining the core quadrants in terms of operable SRMs and not in geometric terms of a stationary core. The NRC staff finds this action to be an improper utilization of the 10 CFR 50.59 process, in that the procedure change resulted in a change to the plant's TS that did not receive prior review and approval by the NRC.

3.2 Technical Evaluation

The NRC staff reviewed the referenced documents in order to determine the technical and regulatory validity of JAF's interpretation of TS 3.3.1.2, "Source Range Monitor Instrumentation," to redefine core quadrants to allow movement of fuel anywhere in the core during refueling with any one system being inoperable. In addition, the NRC staff performed an audit and reviewed many documents related to the "rotating quadrants" (References (i) through (vi) of Section 5.1). This section contains the NRC staff's technical assessment of the actions undertaken by the licensee based on the review of all the documents available at the agency and at the audit.

Reference (i) is a letter to Boiling Water Reactor (BWR) Owners Group (BWROG) from GENE regarding potential reportable condition under Part 21 on the SRM ability to detect criticality along the core periphery. This reference letter to BWROG from GENE concludes that a slow or small reactivity insertion will give a delayed SRM response depending on the proximity to a SRM detector; however a slow or small reactivity insertion would not lead to a substantial safety hazard or exceeding a safety limit. The conclusion is that significant reactivity insertion would be detected before it could lead to a substantial safety hazard or exceeding a safety limit and this is not a reportable condition under 10 CFR Part 21.

The analysis accompanying the letter indicates that there are no supporting neutronics calculations to demonstrate that for large BWR cores with one or two of the SRMs inoperable, the operable SRMs will remain coupled to the area of the core where core alterations are being performed and will be capable detecting increase in subcritical multiplication due to core alteration. GENE experts opined with all four SRMs operable, the SRMs may not be sensitive enough to detect a local criticality resulting from a core alteration near the periphery. The GENE expert stated that when the quadrant axes are rotated, the distance between the SRM and the location of the core alteration in the same quadrant would be increased, which would further reduce the SRMs ability to detect such an event. Therefore, the NRC staff finds that the licensee has implemented a TS interpretation without sufficient technical basis and without NRC review.

A document (Reference 9) obtained by the NRC staff similar to Reference 5 documents a revised quadrant definition and an alternate quadrant definition that taken together is expected to minimize the impact of an inoperable SRM on refueling operations and plant startup at Pilgrim Nuclear Power Station (PNPS). PNPS core size is comparable to the core size of JAF with 580 assemblies. Reference 9 provides a table that lists the distances between the SRM and the farthest bundle in the quadrant for the current definition for the quadrant and its adjacent and for the proposed primary and alternate redefined core quadrants. A measurable effect of the proposed definition is that the distance between the SRM and the farthest bundle in the quadrant increases over that in the existing definition. Without any supporting analyses, the licensee has concluded that the SRM response at a longer distance, as shown in an unnumbered table in Reference 9, would not be significantly different for the proposed primary and alternate quadrants. Unless supported by a quantitative analysis, the NRC staff finds that the implemented redefinition of core quadrants will adversely affect the SRM detector's ability to detect reactivity changes during core alteration that could result in the operators not detecting a potential approach to criticality during refueling operations.

Reference 10 contains a qualitative analysis performed by GENE similar to Reference 3 supporting the PNPS quadrant definition. The purpose of this analysis was to determine whether the proposed rotated quadrant definition is technically acceptable such that the remaining SRMs will meet the design requirement. The analysis, without any supporting calculations, concludes that the since PNPS core is a medium sized core (comparable to JAF

core), the maximum distance between an SRM and an altered core location is less than for a larger core, therefore the SRM will be capable of monitoring any reactivity changes that might occur in the quadrant. In the absence of a quantitative or analytical assessment, the NRC staff determined that the SRM may not provide adequate indication to the operator of significant flux changes due to core alterations or control rod movement, with the rotated core quadrants.

Reference 11 is a JAF procedure that permits the plant to manage the refueling activities using the new definition of rotating quadrants. Section 4.19 of Reference 11 indicates that "Rotation of the core quadrant boundaries around the geometric center of the SRMs in a clockwise and counter-clockwise direction provides the ability to monitor each fuel bundle by either of the two SRMs." Thus, applying both rotated quadrant boundaries allows the conclusion that refueling operations can proceed in any one core location with any single SRM out of service. The JAF core consists of 560 fuel assemblies, arranged symmetrically in an octagonal configuration. By symmetry, the core can be divided into four equal quadrants using two perpendicular axes (0-180° and 90-270°) that intersect at the geometric center of the core. The core contains four installed SRMs, one in each of the quadrants as described in Section 1.0. The NRC staff finds that with no analytical or computational basis for quadrant rotation, the ability of SRMs to detect reactivity changes during core alterations with the rotated core quadrant axes around the geometric center of the SRMs can be adversely affected.

The NRC staff has searched for TS amendments and TS Task Force (TSTF) Change Traveler that might have affected the issue of core quadrants or core alterations. The staff found that the TSTF submitted TSTF-471 R1 (Reference 12), requesting to eliminate the use of the term core alterations in ACTIONS and Notes. Specifically, the proposed revisions to the Standard TS (STS) eliminates the use of term Core Alterations from NUREG-1430, "Standard Technical Specifications, Revision 3 Babcock and Wilcox Plants," dated March 2004; NUREG-1431, "Standard Technical Specifications, Revision 3 Westinghouse Plants," dated March 2004; and NUREG-1432, "Standard Technical Specifications, Revision 3 Combustion Engineering Plants," dated March 2004. The TSTF proposed to replace the Required Action to "Suspend Core Alterations" from this STS with the Action to "Suspend Positive Reactivity Additions," when required SRM instrumentation is inoperable. The NRC staff approved the change (Reference 12) because there was reasonable assurance that an accident and criticality will be avoided. This amendment does not allow the licensees to interpret the plain language meaning of core quadrants.

Reference 13 documents the answers provided by the licensee (JAF/Entergy) to questions raised by the NRC Senior Resident Inspector (SRI) at JAF regarding how the licensee complied with the TS when moving fuel in the quadrant that did not have an operable SRM. Another question raised by the SRI was whether the documents, NEA-04-065 (Reference 5) and the GENE supporting analysis (Reference 3), were supported by any analytical basis for the approach. The SRI also wanted to know whether there was an analytical basis for the position presented to the NRC or incorporated into the JAF Licensing Basis.

The licensee, in response to the first question, assigned two concepts, redundancy and proximity to TS 3.3.1.2 and concluded that the new quadrant definition per Reference 5 affects proximity and to a lesser degree redundancy. Comparing various definitions with that for JAF, the licensee has shown that the rotated quadrants increase maximum distance from SRM to farthest in-quadrant bundle compared with the definition based on the cardinal axis. However, the licensee maintained that in spite of the increase in distance, refueling operations with one SRM out-of-service (OOS) could proceed unrestricted. The NRR staff finds that the licensee's assurance of detecting reactivity changes using the rotated quadrants is not substantiated by any analytical or computational assessment.

Reference 13 also documents response to the second question raised by the SRI as to whether the GENE analysis is supported by any analytical basis. The licensee responded that the analysis may be "qualitative" but that is a "judgment." The licensee indicated that quadrant definition, in absence of any specific guidance, is a judgment.

Reference 13 documents the licensee's response to the third question raised by the SRI. In its response, the licensee indicates that there was no analytical basis developed at the time the rotated quadrant definition was made. The licensee stated that attempts to use a standard 3-D simulator to calculate the flux distribution in the cold subcritical state were not successful and more time was needed to research this technique. The simulator code is not designed for this application and the licensee thought the efforts to make it work may not be successful. Therefore, the data from startup shown in Reference 13 may be useful in validating the models that are developed. However, the data shown are for the responses from SRM due to control rod movement and not for fuel movement. The NRC staff finds that the licensee did not support its activity of redefinition of core quadrants using sound technical or analytical methodology.

The NRC has obtained a document that contains an analysis performed for the RBS (Reference 14) that evaluated the "rotating quadrant" interpretation methodology and the applicable criteria that were incorporated into RBS reactor engineering procedure for its refueling activities. RBS has a comparable core to JAF with 624 assemblies. This analysis shows that several fuel bundle locations will not be monitored effectively by the SRMs with the rotated quadrants. However, this rotating quadrant methodology was supported without any analytical/quantitative evaluation by GENE (Reference 15). Also, the Reference 14 documents 50.59 screening in support of the rotating quadrant methodology. The 50.59 screening procedure was improperly done similar to the JAF 50.59 procedure described in Section 3.1 C. of this Task Interface Agreement (TIA) response. The NRC staff finds that the rotating core quadrant methodology has no technical merit, and thus the 50.59 screening procedure was performed improperly.

The NRC staff, upon evaluating all licensee documents available to the agency related to the SRM core redefinition methodology, concludes that the SRM quadrant rotation results in asymmetric quadrants with unequal areas. Due to the asymmetry in quadrants, the staff finds

that the SRMs ability to monitor reactivity changes will be adversely affected. The NRC staff conclusions and recommendation are listed in Section 4.0 of this TIA response.

4.0 CONCLUSIONS

Based on its review of TIA 2012-01, which requested action to determine whether Entergy's definition of a core quadrant is acceptable and whether it satisfies TS requirements with regard to SRM operability during core alterations, the NRR staff finds (a) the Entergy definition of core quadrant represents a change to the plant TS that requires prior review and approval by the NRC staff as specified in 10 CFR 50.59 before it could be implemented and is therefore not acceptable, and (b) implementing the Entergy definition of core quadrant does not satisfy TS 3.3.1.2 SRM operability requirements during core alterations.

The items listed below are in support of the NRC staff's conclusions.

1. The licensee's action to redefine the SRM core quadrants is not supported by TS requirements and not approved by the NRC. (Section 3.1 A)

2. A review of 10 CFR 50.59 screening forms has revealed that the licensee proceeded to redefine the quadrants and implemented the new definition through an improper utilization of the 10 CFR 50.59 process, in that the procedure change resulted in a change to the plant's TSs that did not receive prior review and approval by the NRC. (Section 3.1 C)

3. GENE expert has indicated that the analysis accompanying the BWROG letter is not supported by any neutronics calculations to demonstrate that large BWR cores with inoperable SRMs will be capable of detecting increase in reactivity due to core alterations. (Section 3.2, Paragraphs 1-3)

4. GENE assessments show that the distance between an SRM and core alteration location has increased due to quadrant rotation. Due to increased distance with quadrant rotation, the SRM will not provide adequate indication to the operator of significant flux changes due to core alterations or control rod movements. (Section 3.0, Paragraphs 4 and 5)

5. There is no analytical or computational support to the licensee's determination that the rotation of the core quadrants around the geometric center of the SRMs will enable detection of the reactivity changes during core alterations. (Section 3.0, Paragraph 6)

6. TSTF-471 R1 permits licensees to replace the Required Action to "Suspend Core Alteration" from the STS with the Action to "Suspend Positive Reactivity Additions." This TSTF does not permit the licensees to re-define the core quadrants during refueling. (Section 3.0, Paragraph 7)

7. The licensee's response to questions raised by the Sr. Inspector as to whether (Reference 13) sound technical or analytical assessment supports the licensee's actions was inadequate. (Section 3.0, Paragraphs 8-11)

8. Due to the asymmetry of core quadrants resulting from rotation, the new configuration results in core quadrants with unequal areas. This new configuration will adversely affect the SRM's ability to detect reactivity changes.

9. Since the response time of the detector is dependent on the sensitivity of the detector and its distance from the fuel bundle, the response time will be adversely affected in medium to large sized cores.

10. With core quadrants redefined with primary and alternate definitions, plant operators have to use special tools to monitor the SRM response. This may add additional burden (and the possibility of committing errors) to operators.

5.0 REFERENCES

1. Letter from David A. Ayres (USNRC, Region I) to Robert A. Nelson (USNRC), "Request for Technical Assistance Regarding James A. Fitzpatrick Nuclear Power Plant (JAF) Definition of Core Quadrant," USNRC, October 7, 2011. (ADAMS Accession No. ML112800693)

2. US NRC Inspection Report 05000333/2011003, "James A. Fitzpatrick Nuclear Power Plant – NRC Integrated Inspection Report 05000333/2011003 and Exercise of Enforcement Discretion," USNRC, August 5, 2011. (ADAMS Accession No. ML112170136)

3. GE-NE-0000-0028-0078-R2, "Fitzpatrick SRM Quadrant Definition Analysis," GE Proprietary, August 5, 2004.

4. NRR Office Instruction, "COM-106, Revision 3, Control of Task Interface Agreements," US NRC, March 24, 2008.

5. Entergy Inter-Office Correspondence, NEA-04-065, "JAF Rotated SRM Quadrant Definition," Entergy, July 22, 2004.

6. TE 2002-017, VYAPF 6045.02, "SRM Quadrant Definition," Vermont Yankee, September 5, 2002.

7. ENN-LI-101, Revision 6, Entergy Nuclear Management Manual, Attachment 9.1, 50.59 Screen Control Form, "Add/Implement SRM Rotated Quadrant Definition in ST-40X and RAP-7.104C," Entergy-JAF, July 26, 2004.

8. ENN-LI-100, Revision 5, Entergy ENN Nuclear Management Manual, Attachment 9.1, "Part II: LBD Program questions," Entergy, 2004.

9. NEA-03-052, Memorandum to Gary James (Pilgrim) from George Rorke (Entergy), "Pilgrim Rotated SRM Quadrant Definition," Entergy Inter-Office Memorandum, April 21, 2003.

10. GE-NE-0000-0014-5292-R0, "Pilgrim SRM Quadrant Definition Analysis," GE Proprietary, April 18, 2003.

11. OSP-66.001, Revision 1, "Management of Refueling Activities, James A. FitzPatrick Procedure, JAF.

12. Letter to Technical Specification Task Force (TSTF) from Timothy J. Kobetz (USNRC), "Safety Evaluation by the Office of Nuclear Reactor Regulation Technical Specification Task Force-471 R1 "Eliminate Use of Core Alterations in Actions and Notes,"" US NRC, December 7, 2006.

13. LO-LAR-2010-00005," Entergy Corrective Action," JAF/Entergy, November 12, 2010.

14. ER-RB-2006-0038-000, Revision 0, "Evaluation and/or define SRM quadrants to support refueling operations with an inoperable SRM," Entergy/River Bend Station, April 20, 2006.

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