UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

October 14, 2011

Vice President, Operations
Entergy Operations, Inc.
Waterford Steam Electric Station, Unit 3
17265 River Road
Killona, LA 70057-3093

SUBJECT: WATERFORD STEAM ELECTRIC STATION, UNIT 3 – REQUEST FOR ALTERNATIVE W3-ISI-019, INSPECTION OF REACTOR VESSEL HEAD IN-CORE INSTRUMENT NOZZLES DURING THIRD 10-YEAR INSERVICE INSPECTION INTERVAL (TAC NO. ME5701)

Dear Sir or Madam:

Pursuant to paragraph 50.55a(a)(3)(ii) of Title 10 of the *Code of Federal Regulations* (10 CFR), Entergy Operations, Inc. (the licensee), by letter dated February 16, 2011, submitted request for alternative W3-ISI-019, "Inspection of Reactor Vessel Head In-Core Instrument Nozzles During the Third Ten-Year Inservice Inspection Interval," for U.S. Nuclear Regulatory Commission (NRC) review and authorization. The request pertained to augmented examination of reactor vessel head (RVH) in-core instrumentation (ICI) nozzles at Waterford Steam Electric Station, Unit 3 (Waterford 3) for the third 10-year inservice inspection (ISI) interval, which began on May 31, 2008, and is scheduled to end on July 1, 2017. The licensee requested relief from the examination requirements of American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) Case N-729-1, "Alternative Examination Requirements for PWR [Pressurized-Water Reactor] Reactor Vessel Upper Heads With Nozzles Having Pressure-Retaining Partial Penetration Welds, Section XI, Division 1," as required and conditioned by 10 CFR 50.55a(g)(6)(ii)(D). Specifically, the licensee stated that, due to the inability to qualify the ultrasonic examination (UT) techniques and personnel for examination of ICI nozzle tubes in accordance with the requirements of 10 CFR 50.55a(g)(6)(ii)(D)(4), performance of a surface examination of the ICI nozzle tube to the extent specified by Code Case N-729-1, as required and conditioned by 10 CFR 50.55a(g)(6)(ii)(D)(3), would present a hardship without a compensating increase in the level of quality or safety. The NRC staff granted the verbal authorization of this request on April 6, 2011.

The licensee proposes to perform an eddy-current examination (ET) of the nozzle tube inside diameter (ID) and bottom surfaces, a time-of-flight diffraction UT examination of the nozzle tube on the ID from 1.5-inch above the J-groove weld root to detectable extent of the nozzle tube below the J-groove weld as well as on the nozzle tube lower-end surface, and where the UT data quality between the J-groove weld root to 1-inch below the J-groove weld root is determined to be unacceptable, a compensatory manual ET examination of the ICI nozzle tube outside diameter surface below the J-groove weld.

The NRC staff has reviewed the licensee's request and determined that the proposed alternative provides reasonable assurance of structural integrity and leak tightness of the subject ICI nozzles, and that complying with the requirements of Code Case N-729-1, as

required and conditioned by 10 CFR 50.55a(g)(6)(ii)(D), would result in a hardship due to significant personnel radiological exposure without a compensating increase in the level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), the NRC staff authorizes the use of the proposed alternative for the third 10-year ISI at Waterford 3, for the 17th operating cycle, beginning in spring of 2011, up to the commencement of the 18th refueling outage in fall of 2012 when the RVH is replaced.

All other ASME Code, Section XI requirements for which relief was not specifically requested and approved in this relief request remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

The staff's safety evaluation is enclosed.

Sincerely,

Michael T. Markley, Chief
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-382

Enclosure:
Safety Evaluation

cc w/encl.: Distribution via Listserv

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST FOR ALTERNATIVE W3-ISI-019, INSPECTION OF

REACTOR VESSEL HEAD IN-CORE INSTRUMENTATION NOZZLES

DURING THIRD 10-YEAR INSERVICE INSPECTION INTERVAL

ENTERGY OPERATIONS, INC.

WATERFORD STEAM ELECTRIC STATION, UNIT 3

DOCKET NO. 50-382

1.0 INTRODUCTION

By letter dated February 16, 2011 (Reference 1), Entergy Operations, Inc. (the licensee), submitted request for alternative W3-ISI-019, "Inspection of Reactor Vessel Head In-Core Instrument Nozzles During the Third Ten-Year Inservice Inspection Interval," for U.S. Nuclear Regulatory Commission (NRC) review and authorization. The request pertained to augmented examination of reactor vessel head (RVH) in-core instrumentation (ICI) nozzles at Waterford Steam Electric Station, Unit 3 (Waterford 3).

Pursuant to paragraph 50.55a(a)(3)(ii) of Title 10 of the *Code of Federal Regulations* (10 CFR), the licensee requested relief from the examination requirements of American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) Case N-729-1, "Alternative Examination Requirements for PWR [Pressurized-Water Reactor] Reactor Vessel Upper Heads With Nozzles Having Pressure-Retaining Partial Penetration Welds, Section XI, Division 1," as required and conditioned by 10 CFR 50.55a(g)(6)(ii)(D). Specifically, the licensee stated that, due to the inability to qualify the ultrasonic examination (UT) techniques and personnel for examination of ICI nozzle tubes in accordance with the requirements of 10 CFR 50.55a(g)(6)(ii)(D)(4), performance of a surface examination of the ICI nozzle tube to the extent specified by Code Case N-729-1, as required and conditioned by 10 CFR 50.55a(g)(6)(ii)(D)(3), would present a hardship without a compensating increase in the level of quality or safety.

The licensee planned to replace the RVH during refueling outage (RFO) 17 concurrent with replacement of the original steam generators. Replacement of each component would necessitate a temporary opening be made in containment. The licensee discovered a manufacturing condition with the replacement steam generators which would prevent their

installation during RFO 17. Replacing the RVH alone in RFO 17 and then the steam generators in RFO 18 would require temporary openings be made in containment during sequential refueling outages.

On April 6, 2011, the NRC staff verbally authorized the use of Relief Request W3-ISI-019, which was documented in a memorandum dated April 18, 2011 (ADAMS Accession No. ML111010356). This safety evaluation documents the NRC staff's basis for the verbal authorization.

2.0 REGULATORY EVALUATION

The regulations in 10 CFR 50.55a(g)(6)(ii)(D) require that licensees of existing operating PWRs augment their existing inservice inspection (ISI) program with examination of RVH penetration nozzles in accordance with ASME Code Case N-729-1, subject to the conditions specified in 10 CFR 50.55a(g)(6)(ii)(D), paragraphs (2) through (6). Paragraph (3) of 10 CFR 50.55a(g)(6)(ii)(D) states, in part, that

> Instead of the specified 'examination method' requirements for volumetric and surface examinations in Note 6 of Table 1 of Code Case N-729-1, the licensee shall perform volumetric and/or surface examination of essentially 100 percent of the required volume or equivalent surfaces of the nozzle tube, as identified by Figure 2 of ASME Code Case N-729-1.

Paragraph (a)(3) of 10 CFR 50.55a states, in part, that alternatives to the requirements of 10 CFR 50.55a(g) may be used when authorized by the NRC, if the applicant demonstrates that: (i) the proposed alternatives would provide an acceptable level of quality and safety, or (ii) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. The licensee's relief request defining an alternative examination volume or surface for each nozzle has been submitted on the basis that compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

The ISI Code of record for Waterford 3 for the third 10-year ISI interval, which began on May 31, 2008, and is scheduled to end on July 1, 2017, is Section XI of the ASME Code, 2001 Edition through the 2003 Addenda.

3.0 TECHNICAL EVALUATION

3.1 Licensee's Request for Alternative

3.1.1 Components Affected

Ten ASME Code Class 1 RVH penetration ICI nozzles and their associated J-groove welds, 02-T-92 through 02-T-101, identified by item number B4.20 in Table 1 of ASME Code Case N-729-1.

3.1.2 Code Requirements

The regulations in 10 CFR 50.55a(g)(6)(ii)(D)(1) require, in part, that licensees of existing operating PWRs augment their existing ISI program with examination of reactor vessel head penetration nozzles in accordance with ASME Code Case N-729-1, subject to the conditions specified in 10 CFR 50.55a (g)(6)(ii)(D)(2) through (6). The licensee is to perform a volumetric and/or surface examination of essentially 100 percent of the required volume or equivalent surfaces of the nozzle tube, as identified in Figure 2 of ASME Code Case N-729-1. Figure 2 identifies the required volume of tube to be inspected as a distance "a" above the highest point of the root of the J-groove weld to a distance "a" below the lowest point of the toe of the J-groove weld. The distance "a" is equal to 1.5 inches (38mm) for incidence angle, Θ, $\leq$ 30 degrees and for all nozzles $\geq$ 4.5 inches (115 mm) outside diameter (OD) or 1 inch (25 mm) for $\Theta \geq 30$ degrees; or to the end of the tube, whichever is less. If a surface examination is being substituted for a volumetric examination on a portion of a penetrating 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.

3.1.3 Licensee's Reason for Request

The licensee stated that qualification of volumetric examination techniques in accordance with 10 CFR 50.55a(g)(6)(ii)(D)(4) for inspection of ICI nozzle tubes has not been successful. As a result, compliance with regulations would require a surface examination of the ICI nozzle tube on the inside and outside wetted surfaces. Eddy current examination (ET) of the ICI penetration inside diameter (ID) and lower-end surfaces can be performed remotely. However, dimensional variations that result from tolerances in allowable J-groove weld reinforcement during original fabrication and the elliptical cross-section that results from conforming the lower end to the spherical head surface, has impeded development of remotely controlled ET examinations of the ICI nozzle tube outside diameter (OD) surface below the J-groove weld. The licensee has estimated the total personnel dose for performing manual ET examination OD nozzle scans to be between 1.0 to 3.0 person-rem and liquid penetrant (PT) examination of the same surfaces would be expected to result in significantly higher values. Additionally, the Waterford 3 head stand is elevated such that manual delivery would require additional time for accessing the ICI nozzle OD. The licensee states that either the ET or PT examination of the OD surfaces below the J-groove weld toe would result in a significant radiological dose and would present a hardship.

The licensee planned to replace the RVH during RFO 17 concurrent with replacement of the original steam generators. The licensee discovered a manufacturing condition with the replacement steam generators which would prevent their installation during RFO 17. Replacing the RVH alone in RFO 17, then the steam generators in RFO 18, would require temporary openings to be made in containment during sequential refueling outages, and would present a hardship.

3.1.4 Licensee's Proposed Alternative and Basis for Use

The licensee proposes to perform an ET examination of the nozzle tube ID and bottom surfaces. The ET examination will extend from a distance "a," per ASME Code Case N-729-1, above the highest point of the J-groove weld root to the extent possible below the J-groove

weld, and include the bottom surface of the penetration nozzle tube. The ICI penetration tube OD wetted surface is formed by a short extension of the tube below the J-groove weld. The estimated extension of Waterford 3 nozzle tubes below the ICI J-groove weld is approximately 1 inch. Instead of an ET examination of the nozzle tube OD surface, the licensee proposes to perform a time-of-flight diffraction (TOFD) UT examination of the nozzle tube on the ID from 1.5-inch above the J-groove weld root to detectable extent of the nozzle tube below the J-groove weld as well as on the nozzle tube lower-end surface. Where the UT data quality between the J-groove weld root to 1-inch below the J-groove weld root is determined to be unacceptable, a compensatory manual ET examination of the ICI nozzle tube OD surface below the J-groove weld will be performed. The licensee will also perform a bare metal visual inspection of the RVH surface and a demonstrated volumetric leak path assessment of the J-groove weld.

The licensee states that the short extension of the ICI penetration below the J-groove weld has no structural function and cracks that are confined to this volume have no significance to quality or pressure boundary integrity. For primary-water stress-corrosion cracking (PWSCC) to develop into a reactor coolant system pressure boundary defect, a crack must grow upward through the nozzle tube volume adjacent to the J-groove weld and extend above it, or it must grow through the J-groove weld itself. The time required for a hypothetical through-wall axial crack to grow, from the bottom of an ICI penetration tube upward to reach the root of the J-groove weld, has been calculated using finite element flaw tolerance methodologies documented in Westinghouse Electric Company LLC's WCAP-15815-P, Revision 1, "Structural Integrity Evaluation of Reactor Vessel Upper Head Penetrations to Support Continued Operation: Waterford Unit 3 and ANO Unit 2," March 2002 (Reference 2). The results from these calculations show that the hypothetical crack will take time in excess of one refueling cycle to grow to the root of the J-groove weld.

The licensee states that the combination of the ET examination of the nozzle ID and bottom-end surfaces, along with TOFD UT examination from the nozzle ID and bottom-end surfaces and the flaw growth evaluation demonstrates that sufficient length exists so that a hypothetical axial crack located at least 1-inch below the root of the J-groove weld will not reach the root of the J-groove weld within one operating cycle, thus assuring the integrity of the pressure boundary until the RVH is replaced during RFO 18 in fall of 2012.

3.2 NRC Staff Evaluation

The susceptibility of PWR RVH penetration nozzles to PWSCC is a safety concern. The nozzles are nickel-based alloys and are welded using nickel-based weld metal to the RVH. Primary-water coolant, high-tensile stresses, and elevated operating temperatures can result in PWSCC of susceptible nickel-based alloys. The subject ICI nozzles and associated welds at Waterford 3 meet the conditions for PWSCC and, therefore, may be susceptible to cracking which could result in leakage of boric acid causing corrosion of the low-alloy steel head.

The licensee has identified physical limitations which prevent qualification of UT examination of the ICI nozzle tubes. These limitations include dimensional variations that result from tolerances in allowable J-groove weld reinforcement during original fabrication and an elliptical cross-section that results from a lower end of the tube conforming to the spherical head surface. The tube distortion can make it difficult to maintain adequate contact of the UT transducers with

the tube ID, resulting in the inability to qualify and perform the UT examination. The NRC staff notes that other licensees have also been unable to qualify UT examination of the ICI nozzle tubes to the requirements of 10 CFR 50.55a(g)(6)(ii)(D)(4) and is satisfied that qualification of UT volumetric examination of the ICI nozzle tube OD cannot be accomplished at this time.

3.2.1 Hardship Evaluation

The regulations in 10 CFR 50.55a(g)(6)(ii)(D)(3) give the licensee the option of performing a surface examination of the wetted surface of the penetration nozzle not examined volumetrically. The nozzle tube ID and lower-end surface inspections can be performed remotely using ET equipment, but the dimensional variations in the nozzles that result from allowable tolerances in J-groove weld reinforcement during original fabrication and the elliptical cross-section that results from the lower end of the tube conforming to the spherical head surface prevent remote ET examination of the nozzle OD, making manual surface examination of the nozzle OD necessary to attain the required coverage. The licensee estimated that manual examination of the OD surfaces would result in a high radiation exposure to the workers, approximately 1 to 3 person-rem for ET examination of all ICI locations, and that PT examination of the same surfaces would be expected to result in significantly higher values. The NRC staff notes that other licensees are also unable to remotely perform ET examination of ICI nozzle tube OD, and concludes that remote ET examination cannot be accomplished at this time. The NRC staff concludes that compliance with the surface coverage requirements of 10 CFR 50.55a(g)(6)(ii)(D)(3) would result in a hardship due to significant personnel radiation exposure without a compensating increase in the level of quality and safety. Therefore, the NRC staff concludes that compliance with the inspection requirements of 10 CFR 50.55a(g)(6)(ii)(D) would result in a hardship.

The licensee planned to replace the RVH during RFO 17 in the spring of 2011 when the steam generators were scheduled to be replaced. The licensee stated that it discovered a manufacturing condition with the replacement steam generators which would prevent their installation during RFO 17. The NRC staff concludes that replacing the RVH alone in RFO 17 would present a significant hardship since a temporary opening would need to be made in containment during RFO 17 to replace the RVH and then again during RFO 18 to replace the steam generators.

3.2.2 Proposed Alternative Evaluation

As an alternative to the required examination, the licensee proposes to perform an ET examination of the ICI nozzle tubes from the required distance "a," per Code Case N-729-1, above the highest point of the root of the J-groove weld to the maximum extent possible below the J-groove weld, including the bottom-end surface of the nozzle. The OD of the Waterford 3 ICI nozzles is 5.563 inches, thus the distance "a" is equal to 1.5 inches or to the end of the tube, whichever is less. Instead of performing an ET examination of the nozzle tube OD below the J-groove weld toe, the licensee proposes to perform a supplemental TOFD UT examination on the nozzle tube ID and bottom-tube surfaces using personnel which were Electric Power Research Institute (EPRI) qualified to perform UT examinations on control element drive mechanism (CEDM) nozzle tubes. The extent of the ID UT examination is from a distance "a" above the root of the J-groove weld to the extent possible below the J-groove weld toe. The NRC staff notes that although the ID UT examination does not meet the requirements of

10 CFR 50.55a(g)(6)(ii)(D)(4), such UT examination has been used to satisfy the requirements of the First Revised NRC Order EA-03-009 (Reference 3).

The licensee has recognized that the physical limitations that prevented the UT procedure and personnel from being qualified for ICI nozzles will also be present during the UT examination of the ICI nozzle tube, and may result in areas where the quality of the TOFD UT data is unacceptable. The licensee states that if EPRI-qualified analysts determine that the TOFD UT data from the root of the J-groove weld to 1-inch below the root of the J-groove weld has unacceptable quality, a manually delivered ET examination of the ICI penetration tube OD surface will be performed. The NRC staff notes that where this OD surface examination is performed in combination with the ET examination of the nozzle tube ID and end face, along with a demonstrated volumetric leak path assessment of the J-groove weld, the extent of examination required by 10 CFR 50.55a(g)(6)(ii)(D) has been achieved for that nozzle tube.

In response to the NRC staff's request for additional information (RAI) concerning the expected extent of UT coverage, the licensee provided data of the extent of UT examination coverage from RFO 15 in 2008 (Reference 4). These data showed that UT examination extent was obtained down to at least the toe of the J-groove weld in all cases, and was in excess of 2-inch below the J-groove weld root in over 90 percent of the measurements. The staff has reviewed these data and concludes that the UT examination will capture the critical areas of the ICI nozzle tubes and will be carried out to the extent possible.

The licensee has carried out an analysis of the stresses in the nozzle and expected propagation of a postulated axial through-wall crack below the J-groove weld (Reference 2). The first part of the analysis consisted of a three-dimensional elastic-plastic finite element (FE) stress analysis to evaluate the axial and hoop stresses in the head penetration region. This analysis considered the pressure loads associated with steady-state operation, as well as the residual stresses from the fabrication process. The second part of the analysis consisted of a fracture mechanics (FM) evaluation of the propagation distance of various hypothetical axial through-wall crack configurations. The crack growth formula and the associated numerical constants used by the licensee are the same as those given in ASME Code, Section XI, Appendix O, 2004 Edition for RVH penetration nozzles. Based on the above, the NRC staff concludes that the formula and numerical constants used to determine crack growth are acceptable.

The bounding condition for a hypothetical axial crack in contact with primary water that is not examined by a Code-compliant technique is a surface crack on the nozzle tube OD below the J-groove weld whose crack depth, a, approaches the wall thickness, t, at the time of ET ID examination (i.e., a/t approaches 1). If the crack were any deeper, a/t = 1 and it would penetrate the nozzle tube wall and be detected by the ET examination of the ID surface. The uppermost extent that such a hypothetical crack on the nozzle tube could exist is determined by the supplemental TOFD UT examination from the ID surface. The licensee's requirement of a minimum of 1-inch of acceptable UT data below the J-groove weld root ensures that a crack cannot exist in this inspected volume. The NRC staff concludes that the UT examination provides reasonable assurance that an OD surface flaw does not exist within the specified 1-inch distance to the J-groove weld root.

After a small increment in operating time, such a hypothetical axial OD surface crack could become a through-wall crack, i.e., a/t = 1, and begin to propagate in the axial direction. The licensee has analyzed the time required for a through-wall crack whose upper tip is located 1-inch below the root of the J-groove weld to propagate to the root of the J-groove weld. The NRC staff has evaluated the licensee's FM crack growth data for this condition (Reference 2, Figures 6-10A and 6-11A) and determined that the minimum time for such a through-wall crack to propagate to the root of the J-groove weld is in excess of 2.6 years, a time period significantly greater than that of one operating cycle. Based on the above, the NRC staff concludes that there is sufficient margin to ensure pressure boundary integrity of the ICI nozzles for one cycle of operation.

The NRC staff notes that there are several areas of conservatism in the determination of sufficient margin. First, the licensee's analysis assumes the worst-case condition, an axially-oriented OD surface flaw just before it becomes through-wall, and ignores the time that the flaw would require to propagate in depth to become a through-wall crack. In addition, although the licensee has specified that the UT data needs to have acceptable quality only to 1- inch below the weld root, the data from RFO 15 (Reference 4) shows that UT examination extends to at least the weld toe in all cases and significantly extends beyond the J-groove weld toe in most cases. Also, the UT examination from the bottom nozzle tube surface will perform a second volumetric examination of the nozzle tube below the J-groove weld, ensuring that cracks do not exist in this volume.

The NRC staff notes that the licensee did not evaluate propagation of hypothetical OD circumferential cracks below the J-groove weld in its flaw growth analysis. However, the NRC staff concludes that circumferentially oriented PWSCC below the J-groove weld does not pose a concern to leak integrity since circumferential cracks are not projected to grow in the direction of the J-groove weld. The staff further concludes that Code-compliant ET examination of the ID surface above the J-groove weld along with the demonstrated volumetric leak path assessment through the J-groove weld adequately addresses the potential for circumferential cracking originating above the J-groove weld. Therefore, the staff accepts the crack propagation evaluation without further consideration of circumferential crack propagation.

The NRC staff notes that ASME Code Case N-729-1, on which the examination requirements are based, allows justification of an alternative examination zone when it can be demonstrated, using the methodology in Appendix I of the Code Case, that a hypothetical axial crack in the unexamined zone below the J-groove weld will not grow to the J-groove weld toe prior to the next examination[1]. The subject request for alternative evaluates the time for growth of the hypothetical crack to the weld root rather than the weld toe, a less conservative criterion. The NRC staff concludes that for continuing long0term operation of the RVH over several operating cycles, the possibility of corrosion of the steel RVH must be avoided and an acceptance criterion of propagation to the J-groove weld toe is reasonable and conservative. However, the NRC staff concludes that when the RVH will be replaced during the next refueling outage, as is the case for Waterford 3, an appropriate acceptance criterion is to ensure the integrity of the pressure boundary for that one cycle. Therefore, the NRC staff concludes that crack

[1] Paragraph 6 of 10 CFR 50.55a(g)(6)(ii)(D) does not allow the use of Appendix I of Code Case N-729-1 to determine an alternate examination zone without prior NRC approval.

propagation to the root of the J-groove weld is an appropriate evaluation criterion for the present case and accepts the licensee's analysis.

Finally, the NRC staff notes that examinations of the Waterford 3 ICI nozzle tubes since the issuance of the Order have not found any indication of PWSCC, an indication that the materials from which the nozzle tubes are fabricated and the fabrication conditions employed make the Waterford 3 ICI nozzle tubes less susceptible to PWSCC than those of some other plants.

The NRC staff also notes that a similar alternative was authorized for Waterford 3 ICI nozzle examination (Reference 5) and that UT examination of these nozzles during RFO 16 was able to obtain quality UT data for essentially 100 percent of the volume of interest and did not detect any PWSCC.

In summary, the NRC staff concludes that the licensee's proposed alternative inspection provides reasonable assurance of structural integrity and leak tightness of the ICI nozzles, and that compliance with the requirements of 10 CFR 50.55a(g)(6)(ii)(D) would result in hardship without a compensating increase in the level of quality and safety.

3.2.3 Regulatory Commitments

In its letter dated February 18, 2011, the licensee made the following regulatory commitments scheduled to be completed during the spring 2011 refueling outage:

- Entergy will perform eddy current examinations of the inside diameter and the nozzle tube lower face in accordance with Code Case N-729-1 as conditioned by 10CFR50.55a(g)(6)(ii)(D). Entergy will also acquire and analyze ICI ultrasonic data from a minimum of 1.5 inches above the J-groove weld to the detectable extent of the nozzle tube below the J-groove weld. (Improvements in data acquisition and analysis that were developed during qualification of CEDM volumetric examinations will be incorporated in the proposed ICI examinations).

- If ultrasonic (TOFD) data is determined to have unacceptable quality in the nozzle tube from the root of the J-groove weld to 1 inch below the root of the J-groove weld, then a manually delivered eddy current examination of the ICI penetration tube OD surface will be performed.

The NRC staff concludes that reasonable controls for the implementation and for subsequent evaluation of proposed changes pertaining to the regulatory commitments are best provided by the licensee's administrative processes, including its commitment management program. The regulatory commitments do not warrant the creation of regulatory requirements (items requiring prior NRC approval of subsequent changes). The NRC staff concludes these regulatory commitments are acceptable.

4.0 CONCLUSION

As set forth above, the NRC staff concludes that the proposed alternative provides reasonable assurance of structural integrity and leak tightness of the ICI nozzles, and that complying with the requirements of ASME Code Case N-729-1, as required and conditioned by 10 CFR 50.55a(g)(6)(ii)(D), would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(a)(3)(ii) and authorizes the licensee's proposed alternative at Waterford 3, will apply to the existing RPV head until RFO 18 in the fall of 2012 when the RVH will be replaced.

All other requirements for which relief was not specifically requested and approved remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

5.0 REFERENCES

1. Steelman, W. J., Entergy Operations, Inc., letter to U.S. Nuclear Regulatory Commission, "Request for Alternative W3-ISI-019, Inspection of Reactor Vessel Head In-Core Instrument Nozzles During Third Ten-Year Inservice Inspection Interval," dated February 16, 2011 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML110480488).

2. Westinghouse Electric Company LLC, "Structural Integrity Evaluation of Reactor Vessel Upper Head Penetrations to Support Continued Operation: Waterford Unit 3 and ANO Unit 2," WCAP-15815-P, Revision 1, March 2002 (*not publicly available – proprietary*); transmitted by letter dated November 4, 2009 (ADAMS Accession No. ML093080343).

3. Borchardt, R. W., U.S. Nuclear Regulatory Commission, letter to Holders of Licenses for Operating Pressurized Water Reactors, "First Revised NRC Order (EA-03-009) Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors," dated February 20, 2004 (ADAMS Accession No. ML040220181).

4. Murillo, R. J., Entergy Operations, Inc., letter to U.S. Nuclear Regulatory Commission, "Response to NRC Request for Additional Information for Alternative W3-ISI-015, Inspection of Reactor Pressure Vessel Head In-Core Instrument Nozzles during Third Ten-Year Inservice Inspection Interval," dated November 2, 2009 (ADAMS Accession No. ML093080127).

5. Markley, M. T., U.S. Nuclear Regulatory Commission, letter to Entergy Operations, Inc., "Waterford Steam Electric Station, Unit 3 - Request for Alternative W3-ISI-015, Inspection of Reactor Vessel Head In-Core Instrument Nozzles during Third 10-Year Inservice Inspection Interval (TAC No. ME2401)," dated July 6, 2010 (ADAMS Accession No. ML1016005691).

Principal Contributor: J. Wallace

Date: October 14, 2011

required and conditioned by 10 CFR 50.55a(g)(6)(ii)(D), would result in a hardship due to significant personnel radiological exposure without a compensating increase in the level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), the NRC staff authorizes the use of the proposed alternative for the third 10-year ISI interval at Waterford 3, for the 17th operating cycle, beginning in spring of 2011, up to the commencement of the 18th refueling outage in fall of 2012 when the RVH is replaced.

All other ASME Code, Section XI requirements for which relief was not specifically requested and approved in this relief request remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

The staff's safety evaluation is enclosed.

Sincerely,

/RA/

Michael T. Markley, Chief
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-382

Enclosure:
Safety Evaluation

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ADAMS Accession No. ML112570168 *SE memo dated 9/13/11

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