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W3F1-2007-0011

April 11, 2007

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

SUBJECT: Response to Request for Additional Information on NRC Bulletin 2004-01 Regarding Alloy 600 Pressurizer Penetration Inspections
Waterford Steam Electric Station, Unit 3
Docket No. 50-382

REFERENCES:

1. NRC letter dated May 28, 2004, *NRC Bulletin 2004-01: Inspection of Alloy 82/182/600 Materials Used In the Fabrication of Pressurizer Penetrations and Steam Space Piping Connections at Pressurized-Water Reactors*
2. Entergy letter dated July 27, 2004, Response to NRC Bulletin 2004-01 Regarding Inspection of Alloy 82/182/600 Materials Used In Pressurizer Penetrations and Steam Space Piping Connections (W3F1-2004-0058)
3. Entergy letter dated July 19, 2005, 60-Day Report for Waterford Steam Electric Station, Unit 3 Reactor Pressure Vessel Head and Pressurizer Inspection for the Spring 2005 Refueling Outage (W3F1-2005-0045)
4. Entergy letter dated August 29, 2006, Additional Information in Response to NRC Bulletin 2004-01, Inspection of Alloy 82/182/600 Materials Used In Pressurizer Penetrations and Steam Space Piping Connections (W3F1-2006-0043)
5. Entergy letter dated February 21, 2007, Inspection and Mitigation of Alloy 600/82/182 Pressurizer Butt Welds (CNRO-2007-00005)
6. NRC CAL No. NRR-07-006 dated March 20, 2007, Confirmatory Action Letter - Waterford Steam Electric Station, Unit 3 (TAC NO. MD4196)

Dear Sir or Madam:

On May 28, 2004, the Nuclear Regulatory Commission (NRC) issued NRC Bulletin 2004-01, *Inspection of Alloy 82/182/600 Materials Used In the Fabrication of Pressurizer Penetrations and Steam Space Piping Connections at Pressurized-Water Reactors.* The NRC requested that

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all pressurized water reactor addressees provide a description of their pressurizer heater and steam space penetrations and inspection plans for the forthcoming and subsequent refueling outages. On July 27, 2004 (Reference 2), Entergy provided the response to the bulletin for Waterford Steam Electric Station, Unit 3 (Waterford-3). On July 19, 2005 (Reference 3), Entergy provided the results of the bare metal visual (BMV) inspections of the pressurizer penetrations for the spring 2005 refueling outage. In Reference 4, Entergy provided a status of the small bore nozzle repairs that were performed during the spring 2005 refueling outage (RF-13). On February 21, 2007 (Reference 5), Entergy provided actions planned to mitigate Alloy 600/82/182 butt welds on pressurizer spray, surge, and relief lines. On March 20, 2007, the NRC issued Confirmatory Action Letter NRR-07-006 to confirm commitments made by Entergy regarding Alloy 82/182 butt welds in the pressurizer. Since repairs have not been performed on the large bore nozzles, additional information was requested (RAI) of Entergy to supplement the original bulletin response. Our response to the RAI is contained in Attachment 1. This response to NRC Bulletin 2004-01 includes a new commitment as summarized in Attachment 2.

If you have any questions or require additional information, please contact Ron Williams at 504-739-6255 or Steve Bennett at 479-858-4626.

Sincerely,

KSC/sab/rlw/

Attachments:

1. Response to Request for Additional Information (RAI) for Bulletin 2004-01
2. List of Regulatory Commitments

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Attachment 1

W3F1-2007-0011
Response to Request for Additional Information (RAI)
for Bulletin 2004-01

Waterford Steam Electric Station, Unit 3
Response to Request for Additional Information (RAI)
for Bulletin 2004-01

RAI 1 - *Item 1(c) in Bulletin 2004-01 requests, in part, that you provide a description of the Alloy 82/182/600 pressurizer penetration and steam space piping connection inspection program that will be implemented at your plant during the next and subsequent refueling outages. The description should include the qualification standards for the inspection methods and personnel; the process used to resolve any inspection indications and the inspection documentation to be generated. Your response did not provide this information. Please provide this information to supplement your response to item 1(c) in Bulletin 2004-01.*

Entergy Response:

Waterford 3 pressurizer nozzles receive a bare metal visual examination for visible leakage or the presence of boric acid deposits. These bare metal visual examinations are capable of identifying boric acid deposits resulting from leakage significantly less than that detectable by the Waterford 3 online leakage detection systems. Small pressure boundary leakage would be detected either when performing the outage walkdowns per Waterford-3 Procedure UNT-007-027, *Control of Boric Acid Corrosion on the Reactor Coolant System* or by the Alloy 600 inspections performed in accordance with NOECP-107, *Boric Acid Corrosion Control Program.*

Experienced engineering personnel perform the visual inspections of the nozzles on the pressurizer. Engineering personnel are required to obtain boric acid inspection training as part of their qualifications before conducting inspections in the field. Per Entergy Nuclear Management Manual (NMM) Procedure SEP-A600-001, *Alloy 600 Management Program*, training is provided on identification of boric acid corrosion control (BACC). The training includes industry operating experience covering BACC inspection techniques and challenges. Any boric acid leakage detected by these inspections is documented by Waterford Procedure UNT-006-031, *Identification and Evaluation of Boric Acid Leakage.* Engineering performs an evaluation of the boric acid leak and appropriate corrective actions are identified. Records for performance of the pressurizer inspections are documented in NOECP-107. Documentation and evaluation of boric acid leaks are performed per UNT-006-031 including determination of pressure boundary leaks. Condition Reports are generated and License Event Reports (LERs) are submitted to document reactor coolant system (RCS) pressure boundary leakage. RCS pressure boundary repairs are tracked and must be performed prior to entering Mode 4 operations.

Entergy has made NRC commitments to perform specific actions to address the potential of primary water stress-corrosion cracking (PWSCC) of the pressurizer surge, spray, safety, and relief nozzle dissimilar metal butt welds containing Allow 82/182 material per References 5 and 6.

RAI 2 - *Item 1(c) in Bulletin 2004-01 states in part, "Provide your plans for expansion of the scope of NDE to be performed if circumferential flaws are found in any portion of the leaking pressurizer penetrations or steam space piping connections." Please supplement your response to provide a statement that, where evidence of apparent reactor coolant pressure boundary leakage is discovered by visual examination, NDE capable of determining crack orientation will be performed in order to accurately characterize the flaw, its orientation and its extent. The response should also provide your plans for expansion of the scope of NDE to other components in the pressurizer to be performed if circumferential flaws are found in any portion of the leaking pressurizer penetrations or steam space piping connections.*

Entergy Response:

In response to this RAI of Bulletin 2004-01, Entergy makes the following commitment for Waterford-3:

> *If circumferential cracking is observed in either the pressure boundary or non-pressure boundary portions of any locations covered under the scope of Bulletin 2004-01, Entergy will develop plans to perform an adequate extent-of-condition evaluation and will discuss those plans with cognizant NRC technical staff prior to restarting the affected unit.*

Since repairs have been performed on the Waterford-3 small bore pressurizer penetrations per References 3 and 4, these inspections are only applicable to the remaining large bore piping until such time that repairs are performed. The surge line has been excluded from the scope of Bulletin 2004-01.

Entergy has made NRC commitments to perform specific actions to address the potential of PWSCC of the pressurizer surge, spray, safety, and relief nozzle dissimilar metal butt welds containing Allow 82/182 material per References 5 and 6.

RAI 3 - *Item 1(c) in Bulletin 2004-01 requests that the licensee provide the basis for concluding that their plant will satisfy applicable regulatory requirements related to the structural and leakage integrity of pressurizer penetrations and steam space piping connections. Your response to this item does not provide a specific explanation of these items. Please supplement your response to provide this basis. The section titled, "Applicable Regulatory Requirements" starting on page 5 in Bulletin 2004-01 lists some of the regulatory requirements that should be addressed in your response.*

Entergy Response:

Waterford pressurizer heater sleeves and small bore penetrations (including piping and instrument nozzles) have undergone mitigative repair due to the potential of PWSCC. Also, Entergy has made NRC commitments to perform specific actions to address the potential of PWSCC of the pressurizer surge, spray, safety, and relief nozzle dissimilar metal butt welds containing Allow 82/182 material per References 5 and 6.

Ongoing integrity of the remaining Waterford-3 pressurizer steam space Alloy 600/82/182 connections is assured by performing visual examinations, at a minimum,

each refueling outage (approximately 18 months). These examinations will be performed until further repair of the pressurizer is performed.

The specific regulatory requirements are listed below with the associated response addressing how each regulatory requirement is met.

Compliance with Design Requirements: 10 CFR 50, Appendix A - General Design Criteria (GDC)

Criterion 14 - Reactor Coolant Pressure Boundary - *The reactor coolant pressure boundary shall be designed, fabricated, erected and tested so as to have an extremely low probability of abnormal leakage, of rapidly propagating failure, and of gross rupture.*

The Waterford-3 pressurizer penetrations are designed, fabricated, tested, and examined in accordance with the requirements of the ASME Code Section III and XI. In general, the controls established by these construction and inspection codes assure that the reactor coolant pressure boundary maintains an extremely low probability of rapidly propagating failure and gross rupture. The visual examination technique has been shown to be a reliable means for identifying very low leakage rates associated with Alloy 600 cracking. Therefore, based on the visual inspections being performed as requested by Bulletin 2004-01, additional assurance is provided for the Waterford-3 pressurizer for complying with the requirements of GDC 14.

Criterion 31 - Fracture Prevention of Reactor Coolant Pressure Boundary - *The reactor coolant pressure boundary shall be designed with sufficient margin to assure that when stressed under operating, maintenance, testing, and postulated accident conditions (1) the boundary behaves in a non-brittle manner and (2) the probability of rapidly propagating fracture is minimized. The design shall reflect consideration of service temperatures and other conditions of the boundary material under operating, maintenance, testing and postulated accident conditions and the uncertainties in determining (1) material properties, (2) the effects of irradiation on material properties, (3) residual, steady state and transient thermal stresses, and (4) size of flaws.*

The Waterford-3 pressurizer penetrations are designed in accordance with the requirements of the ASME Code Section III with sufficient margin to the stresses encountered during operating, maintenance, testing, and postulated accident conditions. The pressurizer penetrations will continue to behave in a non-brittle manner. Ongoing visual examinations of the pressurizer Alloy 600 steam space connections at Waterford-3 will provide additional assurance from rapidly propagating fracture until the susceptibility of Alloy 600 to PWSCC has been acceptably mitigated.

Criterion 32- Inspection of Reactor Coolant Pressure Boundary - *Components which are part of the reactor coolant pressure boundary shall be designed to permit (1) periodic inspection and testing of important areas and features, to assess their structural and leak tight integrity, and (2) an appropriate material surveillance program for the reactor pressure vessel.*

The Waterford-3 pressurizer penetrations were designed to accommodate the visual, surface, and volumetric examinations of the ASME Code Section XI. While the Alloy 82/182 to safe-end weld configurations and some material characteristics present

limitations to performance demonstration initiative (PDI) volumetric examinations, ongoing visual examinations will provide additional assurance of the structural and leak tight integrity of the pressurizer penetrations at Waterford-3.

Compliance with Operating Requirement: 10 CFR 50.36

Waterford-3 Technical Specifications (TSs) include requirements and associated action statements addressing reactor coolant pressure boundary (RCPB) leakage. Waterford-3 TS 3.4.5.2 limits reactor coolant system operational leakage to one gallon per minute (gpm) for unidentified leakage, 10 gpm for identified leakage, and no pressure boundary leakage. Compliance with the zero non-isolable leakage criteria is met by conducting inspections and repairs in accordance with ASME Code, Section XI, and 10 CFR 50.55a, *Codes and Standards*. The unidentified leakage limit of one gpm is established as a quantity which can be accurately measured, while sufficiently low, to ensure early detection of leakage. Leakage of this magnitude can be reasonably detected within a short time, thus providing confidence that cracks associated with such leakage will not develop into a critical size before mitigating actions can be taken. If a through-wall boundary leak increases to the point where it is detected by the RCS leakage detection instrumentation per TS 3.4.5.1, the leak must be evaluated in accordance with the specified acceptance criteria, and the plant must be shut down if the leak is determined to be a non-isolable reactor coolant system pressure boundary fault.

Compliance with Inspection Requirements for 10 CFR 50.55a and the ASME Code Section XI:

10 CFR 50.55a, *Codes and Standards*, requires that inservice inspection and testing be performed in accordance with the requirements of the ASME B&PV Code, Section XI, *Inservice Inspection of Nuclear Plant Component*. Section XI contains applicable rules for examination, evaluation, and repair of code class components, including the RCPB. However, examination of all Alloy 600 susceptible locations is not required to be inspected on a refueling outage basis. To compensate for the volumetric examination limitations of the ASME Code, the Waterford-3 pressurizer steam space Alloy 600 connections will be visually examined each refueling outage per Reference 2 until appropriate mitigation has been employed.

Compliance with Quality Assurance Requirements:

Criterion V of Appendix B to 10 CFR 50, *Instructions, Procedures, and Drawings.*

Criterion V states: *Activities affecting quality shall be prescribed by documented instructions, procedures, or drawings, of a type appropriate to the circumstances and shall be accomplished in accordance with these instructions, procedures, or drawings. Instructions, procedures, or drawings shall include appropriate quantitative or qualitative acceptance criteria for determining that important activities have been satisfactorily accomplished.*

The ASME Code Section XI requires that visual examinations be performed using procedures that contain specific acceptance criteria or detailed recording criteria that are subsequently evaluated for acceptability. The visual examinations are performed using detailed instructions with a combination of qualitative and quantitative standards for the

essential examination variables. Supplemental BMV examinations of the pressurizer steam space Alloy 600 connections at Waterford-3 are performed using Procedure NOECP-107. This procedure is classified as safety-related.

Criterion IX of Appendix B to 10 CFR 50, *Control of Special Processes.*

Criterion IX states that *special processes, including nondestructive testing, shall be controlled and accomplished by qualified personnel using qualified procedures in accordance with applicable codes, standards, specifications, criteria, and other special requirements:*

Engineering personnel performing Alloy 600 visual inspections for pressurizer leakage are qualified as discussed in response to RAI #1.

Criterion XVI of Appendix B to 10 CFR 50, *Corrective Actions*,

Criterion XVI states that *measures shall be established to assure that conditions adverse to quality are promptly identified and corrected. For significant conditions adverse to quality, the measures taken shall include root cause determination and corrective action to preclude repetition of the adverse conditions.*

The identification of an unacceptable visual indication requires repair, replacement or acceptance by analytical evaluation. In all cases, these indications would be tracked by the Entergy Corrective Action Program. In the case of a significant adverse condition, the corrective action process requires determination of the cause of the failure, evaluation of the extent of condition, and assignment of appropriate corrective actions to preclude recurrence. The Entergy Corrective Action Program under NMM procedure EN-LI-102 meets the requirements of 10 CFR 50, Appendix B, Criterion XVI.

Attachment 2

W3FI-2007-0011

List of Regulatory Commitments

List of Regulatory Commitments

The following table identifies those actions committed to by Entergy in this document. Any other statements in this submittal are provided for information purposes and are not considered to be regulatory commitments.

COMMITMENT	TYPE (Check one)		SCHEDULED COMPLETION DATE (If Required)
	ONE-TIME ACTION	CONT COMP	
If circumferential cracking is observed in either the pressure boundary or non-pressure boundary portions of any locations covered under the scope of Bulletin 2004-01, Entergy will develop plans to perform an adequate extent-of-condition evaluation and will discuss those plans with cognizant NRC technical staff prior to restarting the affected unit.		X	Spring 2008 Refueling Outage and subsequent refueling outages.