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Dale E. James
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0CAN090501

September 21, 2005

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

SUBJECT: Response to NRC Request for Additional Information for Bulletin 2004-01 Regarding Inspection of Pressurizer Penetrations
Arkansas Nuclear One, Units 1 and 2
Docket Nos. 50-313 and 50-368
License Nos. DPR-51 and NPF-6

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* (0CNA050408)
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* (0CAN070404)
3. Entergy letter dated June 7, 2005, *60-Day Report for ANO-2 Reactor Pressure Vessel Head and Pressurizer Inspection for Refueling Outage 2R17* (2CAN060503)

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* (Reference 1). The NRC requested that all Pressurized Water Reactor addressees provide description of their pressurizer heater and steam space penetrations and inspection plans for the forthcoming and subsequent refueling outages.

The Arkansas Nuclear One, Unit One (ANO-1) and Unit Two (ANO-2) responses to the bulletin were provided to the NRC in Reference 2. Requests for Additional Information (RAIs) were received from the NRC Staff on November 9, 2004. As a result of discussions between Entergy and the NRC staff, Entergy provided a draft response to the RAIs on March 2, 2005. The responses at that time were provided prior to the ANO-2 refueling outage which occurred in the spring of 2005. For ANO-2, this pressurizer inspection was the last inspection to be performed

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since the pressurizer will be replaced during the next refueling outage in the fall of 2006. Therefore, Entergy is providing modified responses to these RAIs which reflect actions that were taken during the ANO-2 refueling outage.

Entergy is making an additional commitment as provided in Attachment 2. If you have any questions or require additional information, please contact Steve Bennett at 479-858-4626.

I declare under penalty of perjury that the foregoing is true and correct. Executed on September 21, 2005.

Sincerely,

DEJ/sab

Attachments:

1. Response to NRC Request for Additional Information for Bulletin 2004-01 for Arkansas Nuclear One
2. List of Regulatory Commitments

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**Attachment 1**

**0CAN090501**

**Response to NRC Request for Additional Information for Bulletin 2004-01 for Arkansas Nuclear One**

**Response to NRC Request for Additional Information for Bulletin 2004-01 for Arkansas Nuclear One**

*The NRC staff has completed its review of your response, dated July 27, 2004, to NRC Bulletin 2004-01, "Response to 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." Based on the staff's review, please provide a supplemental response which addresses the following questions.*

**NRC RAI 1:** *Your response to Bulletin 2004-01 Question (1)(c) did not clearly communicate your intentions with respect to ensuring that an appropriate dialogue would be established with NRC technical staff in the event that circumferential primary water stress corrosion cracking (PWSCC) is identified at any locations covered under the scope of Bulletin 2004-01. The NRC staff addressed this issue, in part, on page 5 of Bulletin 2004-01 stating, ". . . the NRC staff believes that the topic of NDE scope expansion should be discussed with the NRC if circumferential PWSCC is observed in either the pressure boundary or non-pressure boundary portions of any locations covered under the scope of this bulletin to ensure that the licensee has performed an adequate extent-of-condition evaluation."*

*Because of the potential plant-specific and generic significance of circumferential PWSCC at locations covered under the scope of Bulletin 2004-01, it is the NRC staff's position that cognizant members of the Office of Nuclear Reactor Regulation's Materials and Chemical Engineering Branch (EMCB) should be promptly made aware of any emerging issue regarding this degradation phenomena at your facility. This is important not only for the reason cited in the passage above from Bulletin 2004-01, but also so that the NRC staff can evaluate any such information and fulfill its obligation to inform other U.S. nuclear power plant licensees of new operational experience which may be relevant to the continued safe operation of their facilities.*

*It is the NRC staff's expectation that if you obtain inspection results in the future which indicate that circumferential PWSCC may be occurring at any location covered under the scope of Bulletin 2004-01, you should contact your NRC Headquarters Project Manager (PM) and request a teleconference or meeting with EMCB technical staff. Notification of your NRC PM should allow ample time for you to incorporate any insights from the aforementioned teleconference or meeting into your plans for evaluating the extent of condition at your facility prior to the end of the outage during which the degradation was discovered.*

*In order to document your intent to follow the guidance provided above, please provide a supplement to your Bulletin 2004-01 item (1)(c) response which states:*

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

**ANO Response:**

The ANO-2 pressurizer received a visual inspection on all of the Alloy 600 pressurizer penetrations during the most recent 2R17 refueling outage (spring 2005). As discussed in Reference 3, Entergy identified nine (9) heater sleeves and one previously plugged penetration to be leaking. NDE was performed on the nine heater sleeves. The NDE revealed the indications were axially oriented and additional extent of condition was not warranted. Conclusive NDE could not be performed on the previously repaired heater penetration. Entergy will be replacing the ANO-2 pressurizer at the next refueling outage. Therefore, a commitment for additional examinations of the ANO-2 pressurizer is not necessary.

The ANO-1 pressurizer heater bundles are stainless steel and are not subject to primary water stress corrosion cracking (PWSCC). The side shell, steam space, and top head nozzles on the ANO-1 pressurizer are the only nozzles that would be within the scope of this commitment. Therefore, Entergy makes the following commitment for the ANO-1 pressurizer:

*If circumferential cracking is observed in either the pressure boundary or non-pressure boundary portions of any ANO-1 Alloy 600 pressurizer side shell, steam space, or top head penetrations, Entergy will develop plans to perform an adequate extent-of-condition evaluation and will discuss these plans with cognizant NRC technical staff prior to restarting the affected unit.*

**NRC RAI 2**: *Items 1(b) and1(c) in Bulletin 2004-01 request 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. Entergy's response to this item does not provide a specific explanation of the items discussed in the section titled, "Applicable Regulatory Requirements" starting on page 5 in Bulletin 2004-01. This section of the Bulletin lists the regulatory requirements that should be addressed in your response. Please supplement your response to provide this basis.*

**ANO Response:**

**Basis for Concluding Regulatory Requirements are Satisfied**

ANO-1 small bore piping penetrations and ANO-2 pressurizer heater sleeves and small bore piping penetrations have been inspected due to the potential of PWSCC flaws. Any flaws were repaired prior to resumption of operation from the refueling outage.

Ongoing integrity of the ANO-1 and ANO-2 pressurizer steam space Alloy 600 connections is assured by performing visual examinations, at a minimum, each refueling outage (approximately 18 months). The examinations will be performed until repair of the ANO-1 pressurizer is performed. Due to replacement of the ANO-2 pressurizer at the next refueling outage, Entergy performed the last inspection of the ANO-2 pressurizer during the spring 2005 refueling outage.

The specific regulatory requirements are listed below with the associated response addressing how the 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 ANO pressurizer penetrations are designed, fabricated, tested, and examined in accordance with the requirements of the ASME Code Sections 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 to be used is a reliable means for identifying the very low leakage rates potentially associated with Alloy 600 cracking. Therefore, based on the design, materials, and examination methods, the ANO pressurizers continue to comply 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 ANO-1 and ANO-2 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 steam space connections at ANO will assure sufficient margin 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 ANO pressurizer penetrations were designed to accommodate the visual, surface, and volumetric examinations of the ASME Code Section XI. Ongoing visual examinations of the ANO-1 pressurizer will assure the structural and leak tight integrity of the pressurizer penetrations at ANO.

Compliance with Operating Requirement: 10 CFR 50.36

ANO-1 and ANO-2 Technical Specifications include requirements and associated action statements addressing reactor coolant pressure boundary (RCPB) leakage. The ANO-1 and ANO-2 Technical Specification limits for reactor coolant system operational leakage is 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 B&PV Code, Section XI, and 10 CFR 50.55a, *Codes and Standards*, as described below. 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 ANO established reactor coolant system (RCS) leak detection methods, 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 RCS pressure boundary fault. In addition, ANO-1 and ANO-2 has implemented controls and expectations to address RCS leakage below Technical Specification limits.

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 Components*. Section XI contains applicable rules for examination of RCPB butt welds. However, examination of Alloy 600 J-weld locations is not required per ASME Code. The ANO-1 pressurizer steam space Alloy 600 connections will be visually examined each refueling outage until appropriate mitigation has been employed.

Compliance with Quality Assurance Requirements:

10 CFR 50. Appendix B, 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 required visual examinations are 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 ANO-1 will be performed using Procedure 2311.009, *ANO-1 and ANO-2 Alloy 600 Inspections*. This procedure is classified as safety-related.

10 CFR 50, Appendix B, 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:*

The Responsible Engineers who perform the visual inspections received classroom training on the identification of boric acid leakage and the ANO Boric Acid Control Program. The boric acid training includes understanding the importance of identification and removal of suspected boric acid leaks, examples of industry boric acid leaks, introduction to industry documents that address boric acid corrosion (i.e. WCAP 15988 and EPRI BAC Guidebook), and operating experience on review and identification of boric acid on Alloy 600 components.

10 CFR 50, Appendix B, Criterion XVI of to 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. Entergy is taking action to preclude recurrence as discussed in the response to question 4 below. The Entergy Corrective Action Program meets the requirements of 10 CFR 50, Appendix B, Criterion XVI.

**NRC RAI 3**: *Item 1(d) in Bulletin 2004-01 states, "In light of the information discussed in this bulletin and your understanding of the relevance of recent industry operating experience to your facility, explain why the inspection program identified in your response to item (1)(c) above is adequate for the purpose of maintaining the integrity of your facility's RCPB and for meeting all applicable regulatory requirements which pertain to your facility." Entergy's response to this item does not provide a specific explanation of these items. Please provide this explanation.*

**ANO Response:**

See response to RAI #2 above.

**NRC RAI 4:** *On page 7 of Bulletin 2004-01 the bulletin states, "Plant TSs pertain to this issue insofar as they do not allow operation with known through-wall reactor coolant system pressure boundary leakage." Since Entergy has not specifically stated that they will examine 100% of each 82/182 weld in the pressurizer, please clarify how they intend on meeting the requirement that, ". . . they do not allow operation with known through-wall reactor coolant system pressure boundary leakage," since there have already been leaks in some of these types of welds and steps have not been taken to mitigate the possibility that cracks will occur in them.*

**ANO Response:**

In response to item 1(c) of NRC Bulletin 2004-01 (Reference 2) Entergy stated:

> *Entergy at ANO will continue to perform bare metal visual inspections of pressurizer penetrations in accordance with Procedure 2311.009 in future refueling outages for those penetrations that contain Alloy 600 material. Procedure 2311.009 will be revised to include inspection of other pressurizer Alloy 600 nozzle to stainless steel connections not previously inspected. If leakage is found on ANO-2 Alloy 600 pressurizer heater sleeves, Entergy will perform additional NDE to characterize the degradation present in the leaking penetration in accordance with the January 30, 2004 Westinghouse Owners Group letter and NRC Bulletin 2004-01. Entergy is planning to replace the ANO-2 pressurizer by the fall 2006 refueling outage with improved Alloy 690 material. Entergy also intends to replace the ANO-1 Alloy 600 J-welded pressurizer nozzles and stress improve the butt welded joints.*

With the inclusion of the additional Alloy 600 steam space piping welds committed in the original response to Bulletin 2004-01, Procedure 2311.009 will require inspection of the pressurizer penetrations required by Bulletin 2004-01. Therefore, the subject Alloy 600 penetrations and steam space piping on the ANO-2 pressurizer have received visual inspection to assure that there are no leaking pressurizer connections. A similar inspection will be applied to the ANO-1 pressurizer for the subject welds during the fall 2005 refueling outage.

**NRC RAI 5**: *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." Your response to this item in the bulletin did not include this item. Please provide your plans for expansion of the scope of NDE to other components in the pressurizer, if circumferential flaws are found in any portion of the leaking pressurizer penetrations or steam space piping connections.*

**ANO Response:**

As discussed in response to RAI #1, Entergy has already performed the appropriate inspections on ANO-2 and the pressurizer is being replaced during the next refueling outage. Entergy is making a commitment to perform an extent of condition evaluation for the ANO-1 Alloy 600 pressurizer penetrations that contain circumferential cracking and to contact the NRC of our repair plans.

**Attachment 2**

**0CAN090501**

**List of Regulatory Commitments**

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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 ANO-1 Alloy 600 pressurizer side shell, steam space, or top head penetrations, Entergy will develop plans to perform an adequate extent-of-condition evaluation and will discuss these plans with cognizant NRC technical staff prior to restarting the affected unit.* | | X | 1R19 and subsequent refueling outages for Alloy 600 penetrations |