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2CAN070404

July 1, 2004

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

Subject: Request for Additional Information Responses for
License Renewal Application TAC No. MB8402
Arkansas Nuclear One – Unit 2
Docket No. 50-368
License No. NPF-6

Dear Sir or Madam:

By letter dated May 28, 2004 (2CNA050408), the NRC requested additional information on the Arkansas Nuclear One, Unit 2 (ANO-2) License Renewal Application (LRA) within 30 days of receipt. The requests for additional information (RAIs) are from the LRA Section 3.1, Reactor Vessel. The responses to the RAIs are contained in Attachment 1. Also, by letter dated January 22, 2004 (2CAN010401), Entergy committed to remove the following references from Appendix A. Entergy is rescinding that commitment and will not be removing the following references from the Safety Analysis Report (SAR) Supplement.

- A reference to EPRI TR-104213, "Bolted Joint Maintenance and Applications Guide," will remain included in Section A.2.1.2 of Appendix A, the SAR Supplement.

- A reference to EPRI TR-107396, "Closed Cooling Water Chemistry Guidelines," will remain included in Section A.2.1.32 of Appendix A, the SAR Supplement.

New commitments contained in this submittal are summarized in Attachment 2. Should you have any questions concerning this submittal, please contact Ms. Natalie Mosher at (479) 858-4635.

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I declare under penalty of perjury that the foregoing is true and correct. Executed on July 1, 2004.

Sincerely,

Timothy G. Mitchell
Director, Nuclear Safety Assurance

TGM/nbm

Attachments

cc: Dr. Bruce S. Mallett
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Attachment 1

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RAI Responses

Section 3.1 RAI Responses

RAI 3.1.1-1: For Item 3.1.1-2, the applicant identifies the Inservice Inspection Program to manage loss of material due to pitting and crevice corrosion in the steam generator shell assembly. NRC Information Notice (IN) 90-04 states that the American Society of Mechanical Engineers (ASME) Code Section XI inservice inspection method may not be sufficient to detect general and pitting corrosion in the shell/transition cone welds. The applicant states that the concerns of NRC IN 90-04 are not applicable to ANO-2 steam generators because they were replaced in 2000 and pitting corrosion of the steam generator shell is not known to currently exist. However, the Staff believes that the current operating experience does not provide reasonable assurance that pitting will not occur at the shell assembly in the future. In absence of corrosion tests to demonstrate that the shell and transition cone would not develop pitting corrosion at the end of the extended period of operation, pitting and general corrosion should be assumed and inspection methods should be implemented to detect such corrosion. Clarify whether any inspection procedures in addition to the ASME Code will be implemented to inspect the shell assembly, including transition cone, in the ANO-2 steam generators for pitting and general corrosion.

Response: The rules of Section XI of the ASME Code require a volumetric examination of one upper shell-to-transition cone weld during each 10-year inspection interval. However, Information Notice 90-04 states that if general corrosion pitting of the steam generator shell is known to exist, the requirements of Section XI of the ASME Code may not be sufficient to differentiate isolated cracks from inherent geometric conditions. IN 90-04 indicates that the degradation probably results from corrosion-assisted thermal fatigue due to relatively cold water impinging upon the weld region during reactor trips from full power and certain transient operations.

Localized corrosion is heavily dependent on contaminants for initiation and propagation. The ANO-2 Water Chemistry Control Program controls these contaminants which precludes localized corrosion. The program relies on monitoring and control of water chemistry based on the Electric Power Research Institute (EPRI) guidelines in TR-102134 for secondary water chemistry. In addition, the shell-to-transition cone welds in the ANO-2 replacement steam generators have very low cyclic stress (thermal fatigue) levels (cumulative usage factor = 0.15). The ANO-2 replacement steam generators were installed in 2000 with a design life extending to 2040, which is beyond the period of extended operation ending in 2038. Therefore, the corrosion mechanisms described in IN 90-04 are not applicable to the ANO-2 replacement steam generators due to control of water chemistry. No additional inspections are required for the shell-to-transition cone weld for the period of extended operation.

RAI 3.1.1-2: For Items 3.1.1-19 and 3.1.1-20, the applicant states that the ANO-2 steam generators do not have carbon steel tube support plates and carbon steel tube support lattice bars. Discuss the tube support material and support configuration in the ANO-2 steam generators.

Response: The ANO-2 steam generator tubes are supported by tube support plates maintained in place with a system of stayrods and spacer pipes. The support plates are fabricated from stainless steel; the stayrods and spacer pipes are fabricated from carbon steel. The U-bend portions of the tubes are supported by a system of anti-vibration bars

fabricated from stainless steel. These items are all subject to aging management review and are included in the ANO-2 LRA, Table 3.1.2-5, pages 3.1-99 and 3.1-106.

RAI 3.1.1-3: For Item 3.1.1-21, the applicant states that the feedwater ring discussed in generic aging lessons learned (e.g., Generic Aging Lessons Learned (GALL) Section IV.D1.3-a) is applicable to Combustion Engineering System 80 steam generators and is not applicable to the Westinghouse steam generators at ANO-2. However, the Staff understands that the ANO-2 steam generators do have a feedwater ring and fittings which have a potential for degradation under adverse operating conditions. Justify why these components are not included in the scope of the license renewal and not subject to aging management.

Response: The internal feedwater distribution rings are within the scope of license renewal but are not subject to aging management review since they do not support any intended function of the steam generators. There are no design bases events or regulated events at ANO-2 that rely on the steam generator feedwater ring to demonstrate successful mitigation and recovery from the event. Please refer to the response to RAI 2.3.1.5-1.

RAI 3.1.1-4: For Item 3.1.1-39, the applicant states that loss of material due to erosion affecting steam generator secondary manways and handholds is applicable to once-through steam generators and is not applicable to the Westinghouse steam generators at ANO-2. However, the ANO-2 steam generators do have manways and handholds and will have the potential for erosion. Justify why loss of material due to erosion is not an applicable aging mechanism to these components in the ANO-2 steam generators.

Response: Item 3.1.1-39 of Table 3.1.1 represents NUREG-1801, Item IV.D2.1.10, erosion of carbon steel manway covers. As Section IV.D2 of NUREG-1801 is specific to once-through steam generators and ANO-2 has recirculating steam generators, this NUREG-1801 line item is not applicable to ANO-2. NUREG-1801 does not identify loss of material due to erosion as an aging effect requiring management for recirculating steam generators. This is consistent with the results of the operating experience review which did not identify erosion as an applicable aging mechanism for manway and inspection port covers of recirculating steam generators. However, as identified in Table 3.1.2-5 of the LRA, page 3.1-98, loss of material is an aging effect requiring management for the secondary manway and inspection port covers (6-inch and 8-inch) exposed to internal treated water. Loss of mechanical closure integrity is an aging effect requiring management for secondary bolted closures as indicated on page 3.1-104 of the ANO-2 LRA. Localized leakage at bolted closures may cause loss of material by erosion at ferritic seating surfaces, which is managed by bolting and torquing activities and the Inservice Inspection Program.

RAI 3.1.2.5-1: In Table 3.1.2-5, the applicant identifies the Steam Generator Integrity Program in license renewal application (LRA) Section B.1.25 to manage cracking in the following components: anti-vibration bar end caps, peripheral retaining rings, U-bend, and U-shaped retainer bars (page 3.1-100) and stay rods, stayrod hex nuts, spacer pipes, peripheral backup bars, wrapper, and wrapper jacking screws (page 3.1-106). (1) Discuss how these components are inspected and the frequency of inspection under the Steam Generator Integrity Program and (2) clarify whether the U-bend referred to on page 3.1-100

is applicable to the U-bend region of the tube, or, to the U-bend tube supports (e.g., peripheral retaining rings and retainer bars).

Response: (1) The ANO-2 Steam Generator Integrity Program includes visual inspection of the steam generator lower internals (tube support structures and tube bundle including the U-bend). This inspection is completed at least once every five years. This inspection checks for loose parts as well as corrosion and other damage in this region. The steam generator upper internals (moisture separators) require a thorough visual inspection once every five years. This inspection examines for mechanical damage, corrosion, or other unusual conditions. (2) This is a typographical error in the LRA. The U-bend referred to in Table 3.1.2-5 on page 3.1-100 of the LRA is applicable to the peripheral retaining rings. The Component Type column on that page should read:

Anti-vibration bar end caps
U-bend peripheral retaining ring
U-shaped retainer bars

RAI 3.1.2.5-2: The applicant identified steam generator instrument nozzles in Table 3.1.1, Item 3.1.1-12; however, this component is not identified in LRA Table 3.1.2-5. Clarify why the instrument nozzles are not included for the aging management in LRA Table 3.1.2-5.

Response: Instrument nozzles are included in Table 3.1.2-5 of the LRA on page 3.1-101. These nozzles are not identified as consistent with GALL Section IV.A1.1-j as the GALL instrument nozzles are nickel-based alloy (Alloy-600) while the ANO-2 steam generator instrument nozzles are low-alloy steel. The Component column of Table 3.1.1 identifies the summary components from NUREG-1801, not items specific to ANO-2. In the "Discussion" column of Table 3.1.1 for Item 3.1.1-12, reference is made to Section 3.1.2.2.7 of the ANO-2 LRA which identifies steam generator items at ANO-2 applicable to this GALL item.

RAI 3.1.2.5-3: The applicant identifies LRA Section B.1.28, "System Walkdown Program," to manage loss of material in an air environment for many steam generator components in LRA Table 3.1.2-5. (1) Clarify how the steam generator components are documented in the System Walkdown Program because it is not evident that these steam generator components are included in LRA Section B.1.28, and (2) for those steam generator components that are not accessible for the inspection during system walkdown, discuss how those components will be inspected.

Response: The primary program to manage loss of material in an air environment in Table 3.1.2-5 is the Boric Acid Corrosion Prevention Program. This is consistent with NUREG-1801, which does not indicate the need for a program to manage loss of material due to general corrosion from external surfaces in an air environment for systems that operate at temperatures above 212°F. Because steam generator components operate at temperatures above 212°F, general corrosion in air is not an applicable aging mechanism. For these components, loss of material due to corrosion in air can be caused only by leakage. During system walkdowns, leakage can be detected from both accessible and inaccessible components. For reactor coolant system components, the System Walkdown Program is redundant to the Boric Acid Corrosion Prevention Program since both programs rely on visual inspections to detect evidence of leakage.

RAI 3.1.2.5-4: The applicant identifies several aging mechanisms in the secondary side of the steam generators that contribute to tube degradation. Discuss (1) whether there have been any loose parts in the secondary side of the steam generators, (2) whether there are procedures to retrieve and monitor loose parts in the secondary side, (3) whether sludge lancing is performed periodically, and (4) whether the secondary side inspection procedures are a part of the current licensing basis such that the procedures will be carried over to the period of extended operation.

Response:

(1) The first inservice inspection for the replacement steam generators was performed during the spring 2002 refueling outage. This inspection identified one loose part in the secondary side of the steam generators which was retrieved during that outage.

(2) Measures are in place to monitor for loose parts within the steam generators and to prevent the introduction of foreign objects into the steam generators. Loose parts are removed whenever possible. In the unlikely event an object cannot be readily removed, it remains in the steam generator only if an evaluation is performed to verify that the object will not cause unacceptable tube degradation.

(3) Sludge lancing of the ANO-2 steam generators is performed at least once every five years.

(4) The secondary side inspections are completed in accordance with ANO-2 operating procedures for the Steam Generator Integrity Program. The Steam Generator Integrity Program is an aging management program credited for license renewal that carries forward into the period of extended operation.

RAI 3.1.2.5-5: The component type "tube plugs" is listed in Table 3.1.2-5 (page 3.1-96). Please discuss (1) the types and materials of tube plugs that have been installed in the ANO-2 steam generator tubes, and (2) whether the following NRC generic communications are applicable to the tube plugs installed in the ANO-2 steam generators: NRC Bulletin 89-01, and associated supplements 1 and 2; NRC Information Notice (IN) 89-33, IN 89-65, and IN 94-87.

Response:

(1) There are two welded plugs (one at each end of the same tube) in steam generator B. These Alloy-690 plugs were welded in place at the factory prior to steam generator shipment. There are no plugs in steam generator A.

(2) The generic communications listed describe failures of certain installed steam generator tube plugs fabricated of Alloy-600 material due to primary water stress corrosion cracking (PWSCC). Since the only plugs currently installed in the ANO-2 steam generator tubes are fabricated of Alloy-690 material (which is highly resistant to PWSCC), the generic communications described in the RAI above are not applicable to ANO-2.

RAI 3.1.2.5-6: On page 3.1-96 the applicant identifies the Water Chemistry Control Program as an aging management program to manage loss of material and cracking in the steam generator tubes. Clarify whether the Water Chemistry Control Program follows the guidance in EPRI reports TR-102134 and TR-105714 and identify which revisions of the reports are being used at ANO-2.

Response: The Water Chemistry Control Program relies on monitoring and control of water chemistry based on the EPRI guidelines in TR-105714 (Revision 4) for primary water chemistry and TR-102134 (Revision 5) for secondary water chemistry.

RAI 3.1.2.5-7: On pages 3.1-96 and 3.1-97 industry experience has identified denting of Alloy-600 tubes due to corrosion of carbon steel tube support plate as an aging effect. The applicant does not identify tube denting as an aging effect. Justify why tube denting is not an aging effect for the ANO-2 steam generators.

Response: The ANO-2 steam generators have stainless steel tube support plates which are inherently resistant to the type of corrosion (magnetite) leading to tube denting. Therefore, the ANO-2 steam generator tubes are not susceptible to denting.

RAI 3.1.2.5-8: On page 3.1-98 for the 6-inch and 8-inch inspection port covers, the applicant identifies internal treated water as an environment. Clarify why the internal treated water is not identified as an environment for the 3-inch inspection port cover. Additionally, the applicant identifies the diaphragms in the 3-inch inspection port as a component for aging management. Clarify why the diaphragms are not identified in the 6-inch or 8-inch inspection ports.

Response: The ANO-2 steam generator 3-inch inspection ports have Alloy-690 diaphragms which prevent the treated water from contacting the underside of the low-alloy steel inspection port covers. The ANO-2 steam generator design does not include similar diaphragms for the 6-inch and 8-inch inspection ports.

RAI 3.1.2.5-9: On page 3.1-99 the applicant identifies the Inservice Inspection Program to manage the aging effect of cracking in the anti-vibration bars and tube support plates. (1) Clarify how the Inservice Inspection Program would be used to manage cracking in these components because the Staff is not aware of any Inservice Inspection Program that follows ASME Code Section XI and includes the inspection of these steam generator components, and (2) discuss the details of how these two components would be inspected under the Steam Generator Integrity Program, including inspection scope, frequency and method.

Response:

(1) The Inservice Inspection Program was inadvertently identified as managing cracking for the anti-vibration bars and tube support plates. LRA Table 3.1.2-5 page 3.1-99 should identify only Steam Generator Integrity and Water Chemistry Control Programs as applicable aging management programs for these items.

(2) The ANO-2 Steam Generator Integrity Program, in concert with the Water Chemistry Control Program, manages the applicable aging effects for the anti-vibration bars and tube support plates. The program requires visual inspection of the steam generator lower internals (tube support structures and tube bundle). This inspection

is completed at least once every five years. This inspection checks for loose parts as well as corrosion and other damage in this region. An integrity assessment is performed after each steam generator inspection which addresses all known degradation mechanisms in the steam generator being evaluated. The integrity assessment is performed in two parts, i.e., a condition monitoring assessment and an operational assessment. The condition monitoring assessment ensures structural integrity was maintained during the previous operating cycle while the operational assessment ensures structural integrity will continue to be maintained during the upcoming operating interval. Each operational assessment addresses past operating experience, current degradation mechanisms and locations, and other insights from previous condition monitoring assessments.

RAI 3.1.2.5-10: On page 3.1-100 the applicant identifies anti-vibration bar end caps, peripheral retaining rings, U-bend, and U-shaped retainer bars as components in the steam generator that require aging management. (1) Clarify whether the U-bend identified on page 3.1-100 is the U-bend region of a steam generator tube or U-bend tube support, and (2) discuss where the peripheral retaining rings are located with respect to the tube and discuss their safety function.

Response:

(1) As indicated in the response to RAI 3.1.2.5-1, the text should read: U-bend peripheral retaining ring.

(2) The end of each anti-vibration bar is welded to a U-bend peripheral retaining ring in the U-bend portion of the tube bundle. The U-bend peripheral retaining rings maintain the structural integrity of the tube bundle and, thereby, ensure the integrity of the primary pressure boundary.

RAI 3.1.2.5-11: On page 3.1-102 for the feedwater inlet nozzles (1) discuss whether a flexitallic gasket is used in the ANO-2 feedwater system; (2) if the flexitallic gasket is used, discuss whether the flexitallic gasket has broken; (3) if the gasket has broken, discuss whether the small pieces of the broken gasket have entered in the steam generator tube bundle and damaged the tube(s); (4) discuss the corrective actions that have been implemented due to the gasket loose parts; and (5) if the flexitallic gasket has not broken, discuss the monitoring procedures to prevent the potential gasket loose parts from entering into the tube bundle.

Response:

(1) The ANO-2 steam generator feedwater inlet nozzle is welded to the steam generator shell. As such, there is no flexitallic gasket used at the feedwater inlet nozzle to the steam generator.

(2), (3), (4), and (5) Not applicable. Refer to (1).

RAI 3.1.2.5-12: On pages 3.1-102 and 3.1-103 the applicant identifies the Inservice Inspection Program to manage cracking in feedwater inlet nozzles, feedwater thermal sleeves, and flow limiting insert (integral flow restrictors). Discuss the inspection method and frequency for these components.

Response: The feedwater inlet nozzles are inspected in accordance with ASME Section XI, Examination Category C-B. The Inservice Inspection Program was inadvertently

identified as managing the aging effect of cracking for the feedwater thermal sleeves and flow limiting inserts (integral flow restrictors) on the ANO-2 steam generators. Because these items are internal to the steam generator feedwater and steam nozzles, they are not accessible for performance of inservice inspection.

For the nickel-based alloy feedwater thermal sleeves and flow limiting inserts, cracking and loss of material are managed by the Water Chemistry Control Program alone. The Water Chemistry Control Program maintains the environment in the steam generators by controlling contaminants that could lead to loss of material and cracking. A review of ANO-2 operating experience identified no failures caused by inadequate chemistry control. The feedwater thermal sleeves and flow limiting inserts are internal to steam generator feedwater and steam nozzles and, as such, do not have a pressure boundary function. The ANO-2 Water Chemistry Control Program alone is sufficient to manage the aging effect of cracking for steam generator feedwater nozzle thermal sleeves and flow limiting inserts. This is consistent with the previously approved Staff position documented in Section 3.1.5.2.2 of the safety evaluation report for the LRA for Catawba/McGuire. Both the Catawba/McGuire and ANO-2 Secondary Water Chemistry Control Programs are based on the EPRI secondary water chemistry guidelines, TR-102134.

RAI 3.1.2.5-13: On page 3.1-104 the applicant identifies the Steam Generator Integrity Program to manage cracking in key bracket and snubber lugs. Clarify where the key bracket is located and whether it has a safety-related function. The Staff is not aware that the Steam Generator Integrity Program as specified in GALL is designed to manage the key bracket and snubber lugs. If the ANO-2 plant-specific Steam Generator Integrity Program does include these two components, the applicant's needs to identify the components in LRA B.1.25.

Response: The ANO-2 LRA inadvertently identified the Steam Generator Integrity Program as managing cracking in the key brackets and snubber lugs. These components are located on the outer surface of the steam generator shell and interface with the steam generator lateral support system. The ANO-2 Inservice Inspection Program (in accordance with ASME Section XI) manages cracking of these components for the period of extended operation.

RAI 3.1.2.5-14: On page 3.1-105 discuss why wall thinning/flow-accelerated corrosion is not identified as an aging effect for the ANO-2 steam outlet nozzle because this aging effect is specified for the steam outlet nozzle.

Response: The nozzle in GALL Item IV.D1.1-d is carbon steel. The ANO-2 steam generators are fabricated with integral flow restrictors in the steam outlet nozzles which are nickel-based alloy. These flow restrictors are identified in Table 3.1.2-5 on page 3.1-103 of the LRA. Nickel-based alloy material (Alloy-690) is not susceptible to flow-accelerated corrosion. Because of the integral flow restrictors, the low-alloy steel of the steam outlet nozzles is not exposed to the high velocity fluid that causes flow-accelerated corrosion.

Attachment 2

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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	CONTINUING COMPLIANCE	
The ANO-2 Steam Generator Integrity Program includes visual inspection of the steam generator lower internals (tube support structures and tube bundle including the U-bend). This inspection is completed at least once every five years. This inspection checks for loose parts as well as corrosion and other damage in this region. The steam generator upper internals (moisture separators) requires a thorough visual inspection once every five years. This inspection examines for mechanical damage, corrosion, or other unusual conditions.		X	July 17, 2018
The ANO-2 Steam Generator Integrity Program manages the applicable aging effects for the anti-vibration bars and tube support plates. The program requires visual inspection of the steam generator lower internals (tube support structures and tube bundle). This inspection is completed at least once every five years. This inspection checks for loose parts as well as corrosion and other damage in this region. An integrity assessment is performed after each steam generator inspection which addresses all known degradation mechanisms in the steam generator being evaluated.		X	July 17, 2018
A reference to EPRI TR-104213, "Bolted Joint Maintenance and Applications Guide," will remain included in Section A.2.1.2 of Appendix A.	X		Upon issuance of renewed license

A reference to EPRI TR-107396, "Closed Cooling Water Chemistry Guidelines," will remain included in Section A.2.1.32 of Appendix A.	X		Upon issuance of renewed license