Entergy

Entergy Operations, Inc.
1448 S.R. 333
Russellville, AR 72802
Tel 501 858 5000

2CAN040401

April 6, 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 March 8, 2004 (2CNA030401), the NRC requested additional information on the Arkansas Nuclear One, Unit 2 (ANO-2) License Renewal Application (LRA) within 30 days. The requests for additional information (RAIs) are from the LRA Section 3.2, Engineered Safety Features, Section 3.4, Steam and Power Conversion Systems, and Appendix, Section B.1.2, Bolting and Torquing Activities. The responses to the RAIs are contained in the attachment.

There are no new commitments contained in this submittal. Should you have any questions concerning this submittal, please contact Ms. Natalie Mosher at (479) 858-4635.

I declare under penalty of perjury that the foregoing is true and correct. Executed on April 6, 2004.

Sincerely,

Timothy G. Mitchell
Director, Nuclear Safety Assurance

TGM/nbm

Attachment

A100

cc: Dr. Bruce S. Mallett
Regional Administrator
U. S. Nuclear Regulatory Commission
Region IV
611 Ryan Plaza Drive, Suite 400
Arlington, TX 76011-8064

NRC Senior Resident Inspector
Arkansas Nuclear One
P.O. Box 310
London, AR 72847

U. S. Nuclear Regulatory Commission
Attn: Mr. Tom Alexion
Mail Stop 0-7 D1
Washington, DC 20555-0001

U. S. Nuclear Regulatory Commission
Attn: Mr. Greg Suber
Mail Stop 0-11 F1
Washington, DC 20555-0001

Mr. Bernard R. Bevill
Director, Division of Radiation
Control and Emergency Management
Arkansas Department of Health
4815 West Markham Street, Slot 30
Little Rock, AR 72205-3867

Attachment to

2CAN040401

RAI Responses

Section 3.2, Engineered Safety Features Systems RAI Responses

RAI 3.2-1: In LRA Table 3.2.1, Item 3.2.1-18, under "Discussion," the applicant stated that this aging management review item was not considered to match the ANO-2 aging management review results. The applicant also stated that for closure bolting, the aging effect requiring management is loss of mechanical closure integrity, which includes a broader range of aging mechanisms than those included in this line item (i.e., loss of material due to general corrosion; crack initiation and growth due to cyclic loading and/or stress corrosion cracking (SCC)). In view of the above, the applicant is requested to:

(1) Explain the extent to which aging management review Item 3.2.1-18 is not considered to match the ANO-2 aging management review results.

(2) Clarify whether the aging effect of "loss of mechanical closure integrity" will include loss of material and cracking, and discuss what other aging effects/mechanisms are included in the "broader range."

(3) Discuss how each of the identified aging effects will be managed and why the approach for managing the aging effects is adequate.

(4) Demonstrate that with the combination of bolting and torquing activities, boric acid corrosion prevention, and system walkdown programs, as stated in aging management review Item 3.2.1-18, the aging effects associated with closure bolting will be adequately managed, or managed in a manner equivalent to that described in NUREG-1801, XI.M18, "Bolting Integrity." This response is to include, but not be limited to, a discussion addressing why the Generic Aging Lessons Learned (GALL) program stipulates the inspection requirements of ASME Code, Section XI, whereas the bolting and torquing activities program does not.

Response:

1) Item 3.2.1-18 is not considered to match the ANO-2 aging management review results because the aging effects and aging management programs do not match.

   Item 3.2.1-18 addresses closure bolting in high pressure or high temperature systems. Within the engineered safety features (ESF) systems, the high-pressure safety injection (HPSI) portion of the emergency core cooling system (ECCS) is a high pressure system, not a high temperature system. The only bolting in a high temperature system is the bolting on components in the steam generator blowdown and sampling penetrations in the containment penetrations system.

   Differences in the ANO-2 aging effects are that in addition to loss of material, loss of mechanical closure integrity is considered an aging effect requiring management for high-temperature bolting, and cracking is not considered an aging effect requiring management. At ANO-2, the potential for SCC of bolting in non-Class 1 systems is minimized by using lower yield strength carbon steel bolting material and limiting contaminants such as chlorides and sulfur in lubricants and sealant compounds.

Consistent with NUREG-1801, the ANO-2 aging management review identifies loss of material as an aging effect requiring management. However, for carbon steel bolting in the ECCS, loss of material is managed by the Boric Acid Corrosion Prevention and System Walkdown Programs. For carbon steel bolting associated with the steam generator blowdown and sampling penetrations, loss of material is managed by the Containment Leak Rate Program since they do not contain borated water.

2) In LRA Table 3.2.1, Item 3.2.1-18, under "Discussion," the words "broader range" refer to the fact that loss of mechanical closure integrity is identified as an aging effect requiring management for bolting in the following two cases:

   - Bolting in high temperature systems and in applications subject to significant vibration is subject to loss of mechanical closure integrity due to loss of pre-load, which is managed by the Bolting and Torquing Activities Program. The same bolted closures may be subject to loss of material if they are carbon steel or wetted stainless steel. If so, the loss of material is managed by another program such as System Walkdown or Boric Acid Corrosion Prevention, as shown in the Summary of Aging Management tables in Section 3.

   - Both loss of material and loss of mechanical closure integrity are conservatively considered aging effects requiring management for carbon steel bolting in borated water systems. Although this bolting is normally exposed to air or condensation, the potential exists for exposure to borated water leakage. Due to the high corrosiveness of borated water on carbon steel, loss of material may progress to such an extent that mechanical closure integrity is threatened. Thus, both loss of material and loss of mechanical closure integrity are conservatively considered aging effects requiring management. In this case, both the loss of material and the loss of mechanical closure integrity are managed by other programs such as Boric Acid Corrosion Prevention and System Walkdown.

   Loss of mechanical closure integrity can result from excessive loss of material. Cracking is not considered a cause of loss of mechanical closure integrity.

3) For closure bolting, loss of material is managed by the Containment Leak Rate Program, the Boric Acid Corrosion Prevention Program, the System Walkdown Program, and the Periodic Surveillance and Preventive Maintenance Program. The aging effect of loss of mechanical closure integrity is managed by the Bolting and Torquing Activities Program, the Boric Acid Corrosion Prevention Program, and the System Walkdown Program. See response to item 4 below for the discussion on how these programs are adequate to manage the aging effects.

4) The Containment Leak Rate Program, Boric Acid Corrosion Prevention Program, and System Walkdown Program adequately manage loss of material for closure bolting as described in LRA Sections B.1.6, B.1.3, and B.1.28. The Bolting and Torquing Activities Program, Boric Acid Corrosion Prevention Program, and System Walkdown Program also manage loss of mechanical closure integrity for closure bolting as described in LRA Sections B.1.2, B.1.3, and B.1.28. Visual inspections of

bolting for loss of material and loss of mechanical closure integrity in the Boric Acid Corrosion Prevention Program and System Walkdown Program are adequate to assure that the closure bolting can perform its intended function since loss of material (and ultimately loss of mechanical closure integrity) for external surfaces is a long term aging effect that would be observed well before aging progressed to the point of loss of intended function. In addition, the Containment Leak Rate Program verifies that leak rates of the penetrations are acceptable which proves that the closure bolting remains capable of performing its intended function. The Bolting and Torquing Activities Program assures that proper torque values are applied to bolted closures such that loss of mechanical closure integrity as a result of loss of preload due to high temperatures does not occur. The Bolting and Torquing Activities and System Walkdown Programs are plant specific programs and are not comparable to XI.M18, "Bolting Integrity" of NUREG-1801. The GALL program XI.M18, "Bolting Integrity," stipulates the inspection requirements of the ASME Code, Section XI. These requirements are included in the ANO-2 Inservice Inspection Program for Class 1, 2 and 3 bolted closures. However, these inspection requirements are focused on identifying the aging effect of cracking. Since cracking is not an aging effect requiring management for Non-Class 1 bolted closures, the Inservice Inspection Program was not included as an aging management program for bolted closures.

RAI 3.2-2: In LRA Tables 3.2.2-1 and 3.2.2-2, respectively, for the ECCS and containment spray system, loss of mechanical closure integrity is identified as one of the aging effects (besides loss of material) requiring management for carbon steel bolting in outdoor air (external) environments. Boric acid corrosion prevention and system walkdowns are credited for managing the aging effect of loss of mechanical closure integrity. In view of the aging management review Item 3.2.1-18, the applicant is requested to explain why the Bolting and Torquing Activities Program is not also identified as a required aging management program. The applicant is also requested to provide a detailed description of the potential aging effects included under "loss of mechanical closure integrity," and discuss how they will be managed by the stated aging management programs.

Response: Outdoor air is specified as an environment for bolting in Table 3.2.2-2 for containment spray, but not in Table 3.2.2-1 for ECCS. Both systems are exposed to air indoors with the potential for leaking borated water. Due to the highly corrosive nature of boric acid on carbon steel, borated water leakage could cause significant loss of material from components of bolted closures. Loss of mechanical closure integrity is an aging effect resulting from excessive loss of material due to borated water leakage. For the ECCS and containment spray systems, loss of material, and hence loss of mechanical closure integrity, are managed by the boric acid corrosion prevention program and the system walkdown program as described in the program descriptions in Appendix B. The Bolting and Torquing Activities Program is not identified as a required aging management program since components are not exposed to high temperatures or significant vibration. The Bolting and Torquing Activities Program is identified as a required aging management program only for systems that could experience loss of mechanical closure integrity due to loss of pre-load caused by high temperature or excessive vibration.

RAI 3.2-3: In LRA Table 3.2.2-3, for the containment cooling system, loss of material is identified as the aging effect requiring management for carbon steel bolting in air (external) and condensation (external) environments and stainless steel bolting in condensation (external) environments. The applicant is requested to explain why loss of mechanical closure integrity is not identified as an aging effect requiring management for the bolting and how it would be managed if identified.

Response: Loss of mechanical closure integrity is identified as an aging effect requiring management for bolting in the following two cases:

- Bolting in high temperature systems, and in applications subject to significant vibration, is subject to loss of mechanical closure integrity due to loss of pre-load, which is managed by the Bolting and Torquing Activities Program. The same bolted closures may be subject to loss of material if they are carbon steel or wetted stainless steel. If so, the loss of material is managed by another program such as System Walkdown or Boric Acid Corrosion Prevention, as shown in the Summary of Aging Management tables in Section 3.

- Both loss of material and loss of mechanical closure integrity are conservatively considered aging effects requiring management for carbon steel bolting in borated water systems. Although this bolting is normally exposed to air or condensation, the potential exists for exposure to borated water leakage. Due to the high corrosiveness of boric acid on carbon steel, loss of material may progress to such an extent that mechanical closure integrity is threatened. Thus, both loss of material and loss of mechanical closure integrity have been conservatively considered aging effects requiring management. In this case, both loss of material and loss of mechanical closure integrity are managed by other programs such as Boric Acid Corrosion Prevention and System Walkdown.

Loss of mechanical closure integrity is not identified as an aging effect requiring management for bolting in the containment cooling system because the containment cooling system is not a high temperature system, is not subject to significant vibration, and does not contain borated water. If loss of mechanical closure integrity was identified as an aging effect requiring management for the bolting, an appropriate program would be selected to manage the aging effect.

RAI 3.2-4: In LRA Table 3.2.2-4, for the containment penetrations system in air (external) environments, loss of mechanical closure integrity is identified as one of the aging effects (besides loss of material) requiring management for carbon steel bolting and as the aging effect for stainless steel bolting. The bolting and torquing activities program was credited for managing the aging effect of loss of mechanical closure integrity for both the stainless steel and carbon steel bolting. In view of the aging management review Item 3.2.1-18, the applicant is requested to explain why the system walkdown program is not credited as an aging management program. Similar to RAI 3.2-3, the applicant is requested to provide a detailed description of the aging effects included under "loss of mechanical closure integrity," and discuss how they will be managed by the stated aging management program.

Response: Loss of mechanical closure integrity is an aging effect requiring management for bolting that can experience loss of pre-load due to exposure to high temperatures, significant vibration or significant loss of material due to borated water leakage. For the containment penetrations system, loss of mechanical closure integrity is managed by the Bolting and Torquing Activities Program since the bolting in question is exposed to high temperatures. This program manages aging through the application of proper torque values to the bolting. For containment penetrations, the Containment Leak Rate Program as described in Appendix B is used for managing loss of material without reliance upon system walkdowns.

RAI 3.2-5: In LRA Table 3.2.2-1, for the ECCS system, a water chemistry control program is used to manage cracking and loss of material for the stainless steel components, such as heat exchangers (tubes), orifices, piping, pump casings, thermowells, tubing, and valves in a treated borated water >270°F (internal) environment. The water chemistry control program is also used to manage the loss of material for the stainless steel components, such as heat exchangers (tubes), nozzles, orifices, piping, pump casings, tanks, tubing, and valves in a treated borated water (internal) environment. The applicant is requested to explain, for the above cases, why a supplemental inspection program is not needed for verifying the effectiveness of the water chemistry control program, or, otherwise, include a verification program in the components' aging management review.

Response: In NUREG-1801, the second paragraph of the program description for Water Chemistry, XI.M2, states, "The GALL report identifies those circumstances in which the water chemistry program is to be augmented to manage the effects of aging for license renewal. ... Accordingly, in certain cases as identified in the GALL report, verification of the effectiveness of the chemistry control program is undertaken to ensure that significant degradation is not occurring ... As discussed in the GALL report for these specific cases, an acceptable verification program is a one-time inspection of selected components at susceptible locations in the system." For the ESF systems, the GALL report does not identify stainless steel components among those certain cases requiring augmentation of the water chemistry program.

NUREG-1801 does not include loss of material for stainless steel in any PWR borated water environment, consistent with the minor significance of the aging effect on this material. Operating history has demonstrated that the effect is minor, even in stagnant water conditions. The response to a question from the ANO-1 LRA review documents the results of inspections of the ANO-1 control rod drive mechanisms (CRDMs) which are also exposed to treated borated water. The response (ANO correspondence 1CAN090002, item 3.3.2.8.2.2-2) states, in part, "Loss of material by corrosion and pitting, and SCC of CRDM pressure boundary items have not been observed at ANO-1 in visual inspections of drives during routine and corrective maintenance activities. In addition, inspections at other B&W operating plants have found no indications in the motor tube extensions." Thus, loss of material is not a significant aging effect for stainless steel components in a typical PWR treated borated water (primary) environment. This is not an unexpected result since the materials chosen for primary systems were selected for their ability to withstand the borated water environment. Although the loss of material is minor, the effect is possible. ANO-2 has conservatively identified loss of material as an aging effect requiring management for stainless steel in treated borated water. Since industry experience has shown that primary water chemistry programs are effective in preventing (managing) loss of material, this program alone is sufficient to manage the effect. The NRC has concurred with this

conclusion in the safety evaluation report for V. C. Summer, page 3-113, which states: "The chemistry program (LRA Section B.1.4) manages loss of material in stainless steel and Ni-alloy reactor vessel components (i.e., CRD housings, cladding, vent plug, bottom head and closure head penetration tubes, reactor vessel core support pads, and nozzle safe ends) internally exposed to chemically treated borated coolant. The staff finds the use of the chemistry program, alone, acceptable for managing loss of material in stainless steel and Ni-alloy components because these components have good resistance against pitting and crevice corrosion and it is consistent with GALL."

RAI 3.2-6: In LRA Table 3.2.2-2, for the containment spray system, a water chemistry control program is used to manage cracking and loss of material for the stainless steel components, such as orifices, piping, thermowells, tubing, and valves in a treated borated water >270°F (internal) environment. The water chemistry control program is also used to manage loss of material for the stainless steel components, such as filter housings, nozzles, orifices, piping, tanks, thermowells, tubing, and valves, as well as the cast stainless steel pump casings, in a treated borated water (internal) environment. The applicant is requested to explain, for the above cases, why a supplemental inspection program is not needed for verifying the effectiveness of the water chemistry control program, or, otherwise, include a verification program in the components' aging management review.

Response: See the response to RAI 3.2-5.

RAI 3.2-7: In LRA Table 3.2.2-4, for the containment penetration system, a water chemistry control program is used to manage cracking and loss of material for the stainless steel valves in a treated borated water >270°F (internal) environment. The applicant is requested to explain why a supplemental inspection program is not needed for verifying the effectiveness of the water chemistry control program, or, otherwise, include a verification program in the components' aging management review.

Response: See the response to RAI 3.2-5.

RAI 3.2-8: In LRA table 3.2.2-5, for the hydrogen control system, loss of material is identified as an aging effect requiring management for the carbon steel bolting in air (external) environments. The applicant is requested to explain why loss of mechanical closure integrity and its associated aging management programs are not specified for the bolting.

Response: The hydrogen control system internal environment is air and not borated water as in the other ESF systems. As a result there is little potential for carbon steel bolting in the system to be exposed to borated water leakage that would result in loss of mechanical closure integrity. The system is not subject to elevated temperatures or significant vibration.

RAI 3.2-9: In LRA tables 3.2.2-1, 3.2.2-2, 3.2.2-3, and 3.2.2-5, for the ECCS, containment spray, containment cooling, and hydrogen control systems, respectively, no aging effects are identified for the stainless steel bolting in air (external) environments; whereas in Table 3.2.2-4, for the containment penetrations system, stainless steel bolting in the same environments is subject to loss of mechanical closure integrity. Explain the differences in the above aging management review results.

Response: Some of the bolting in the containment penetrations system (blowdown and steam generator sampling) is exposed to high temperatures that could result in loss of preload and loss of mechanical closure integrity. The portions of the ECCS, containment spray, containment cooling, and hydrogen control systems that are subject to aging management review are at low temperatures and would not experience loss of mechanical closure integrity.

RAI 3.2-10: In LRA table 3.2.2-5, no aging effects are identified for the stainless steel heat exchanger (tubes) exposed to condensation (internal) environments. Industry experience has indicated that stainless steel is susceptible to the aging effect of loss of material when exposed to condensation with periodic wetting and drying. The applicant is requested to explain why an aging effect is not identified for the component.

Response: For ANO-2, loss of material is identified as an aging effect for stainless steel with condensation as an environment when there is a potential for concentrating chemical species thru repeated alternating wet and dry conditions. Conservatively, condensation is identified as an internal environment in the hydrogen control system sample coolers even though the coolers are only operated intermittently for short periods of time. The hydrogen control system normally has no flow through it, and as a result would not contain significant amounts of aggressive chemicals. As a result, there is minimal possibility of concentrating chemicals, and loss of material is not an aging effect requiring management.

Section 3.4, Steam and Power Conversion System RAI Responses

RAI 3.4-1: In LRA Table 3.4.1, Item 3.4.1-8, under "Discussion," the applicant stated that for closure bolting, the aging effect requiring management is loss of mechanical closure integrity, which includes a broader range of aging mechanisms than those included in this line item (i.e., loss of material due to general corrosion; crack initiation and growth due to cyclic loading and/or SCC). The applicant also stated that different programs than the NUREG-1801 bolting integrity program are used. The system walkdown program is used to supplement bolting and torquing activities to maintain bolting integrity. In view of the above, the applicant is requested to:

(1) Explain the extent to which aging management review item 3.4.1-8 deviates from the ANO-2 aging management review results.

(2) Clarify whether the aging effect of loss of mechanical closure will include loss of material and cracking, and discuss what other aging effects/mechanisms are included in the "broader range."

(3) Discuss how each of the identified aging effects is to be managed and why the approach for managing the aging effects is adequate.

(4) Demonstrate that with the combination of the bolting and torquing activities and system walkdown programs, as stated in aging management review Item 3.4.1-8, the aging effects associated with closure bolting will be adequately managed, or managed in a manner equivalent to that described in NUREG-1801, XI.M18, "Bolting Integrity." The response is to include, but not be limited to, a discussion addressing why the GALL program stipulates the inspection requirements of ASME Code, Section XI, whereas the bolting and torquing activities program does not.

Response:

1) Item 3.4.1-8 is not considered to match the ANO-2 aging management review results because the aging effects and programs used to manage them do not match.

   Differences in the ANO-2 aging effects are that loss of mechanical closure integrity is considered an aging effect requiring management for high-temperature bolting, and cracking is not considered an aging effect requiring management. At ANO-2 the potential for SCC of bolting in non-Class 1 systems is minimized by using lower yield strength carbon steel bolting material and limiting contaminants such as chlorides and sulfur in lubricants and sealant compounds.

   Consistent with NUREG-1801, the ANO-2 aging management review identifies loss of material as an aging effect requiring management. However, for carbon steel bolting in the steam and power conversion systems, loss of material is managed by the System Walkdown Program.

2) In LRA Table 3.4.1, Item 3.4.1-8, under "Discussion," the phrase "broader range" refers to the fact that loss of mechanical closure integrity is identified as an aging effect requiring management for bolting in the following two cases:

   - Bolting in high temperature systems, and in applications subject to significant vibration, is subject to loss of mechanical closure integrity due to loss of pre-load, which is managed by the Bolting and Torquing Activities Program. The same bolted closures may be subject to loss of material if they are carbon steel or wetted stainless steel. If so, the loss of material is managed by another program such as System Walkdown, as can be seen in the Summary of Aging Management tables in Section 3.

   - Both loss of material and loss of mechanical closure integrity are conservatively considered aging effects requiring management for carbon steel bolting in borated water systems. Although this bolting is normally exposed to air or condensation, the potential exists for exposure to borated water leakage. Due to the high corrosiveness of borated water on carbon steel, loss of material may progress at such a rate that mechanical closure integrity is threatened. Thus, both loss of material and loss of mechanical closure integrity have been conservatively considered aging effects requiring management.

   Loss of mechanical closure integrity does not cover the aging effects of loss of material or cracking.

3) For the closure bolting, the aging effect of loss of material is managed by the System Walkdown Program. The aging effect of loss of mechanical closure integrity is managed by the Bolting and Torquing Activities Program. See response to item 4 below for the discussion on how these programs are adequate to manage the aging effects.

4) The System Walkdown Program manages loss of material for closure bolting and is described in LRA Section B.1.28. The Bolting and Torquing Activities Program manages loss of mechanical closure integrity for closure bolting as described in LRA Section B.1.2. Visual inspections of bolting for loss of material in the System Walkdown Program are adequate to assure that the closure bolting can perform its intended function since loss of material from external surfaces such as closure bolting is a long term aging effect that would be observed well before aging progressed to the point of loss of intended function. The Bolting and Torquing Activities Program assures that proper torque values are applied to bolted closures such that loss of mechanical closure integrity as a result of loss of preload due to high temperatures does not occur. The Bolting and Torquing Activities and System Walkdown Programs are plant specific programs and are not comparable to XI.M18, "Bolting Integrity" of NUREG-1801. The GALL program XI.M18, "Bolting Integrity," stipulates the inspection requirements of the ASME Code, Section XI. These requirements are included in the ANO-2 Inservice Inspection Program for Class 1, 2, and 3 bolted closures. However, these inspection requirements are focused on identifying the aging effect of cracking. Since cracking is not an aging effect requiring management for Non-Class 1 bolted closures, the Inservice Inspection Program was not included as an aging management program.

RAI 3.4-2: In LRA Tables 3.4.2-1 through 3.4.2-3, loss of mechanical closure integrity is identified as an aging effect requiring management, for both the stainless steel and carbon steel bolting in an air (external) environment. Bolting and torquing activities is credited for managing the aging effect. The applicant is requested to provide a detailed description of the aging effects included under "loss of mechanical closure integrity," and discuss how they will be managed by the stated aging management program.

Response: See the response to RAI 3.2-2.

RAI 3.4-3: In LRA Table 3.4.2-1, for the main steam system, the water chemistry control program is used to manage cracking and loss of material for the stainless steel components, such as expansion joints, piping, thermowells, tubing, and valves in a steam >270°F (internal) environment, the stainless steel piping in a treated water >270°F (internal) environment, as well as the stainless tubing in a treated water >220°F (internal) environment. The applicant is requested to explain, for the above cases, why a supplemental inspection program is not needed for verifying the effectiveness of the water chemistry control program, or, otherwise, include a verification program in the components' aging management review.

Response: In NUREG-1801, the second paragraph of the program description for Water Chemistry, XI.M2, states, "The GALL report identifies those circumstances in which the water chemistry program is to be augmented to manage the effects of aging for license renewal. ... Accordingly, in certain cases as identified in the GALL report, verification of the effectiveness of the chemistry control program is undertaken to ensure that significant degradation is not occurring ... As discussed in the GALL report for these specific cases, an acceptable verification program is a one-time inspection of selected components at susceptible locations in the system." For the steam and power conversion systems' stainless steel components, the GALL report only identifies the condensate storage tank and heat exchanger tubes as requiring augmentation of the water chemistry program. Other stainless steel components require no confirmation. However, the following information is provided as confirmation of the effectiveness of the water chemistry programs at ANO-2.

The effectiveness of the Water Chemistry Programs at ANO-2 has been confirmed through routine component inspections that are performed by chemistry, maintenance and engineering personnel. This includes the primary and secondary water chemistry programs. These inspections were performed when systems were opened for maintenance, when an adverse chemistry trend existed, or when requested by the chemistry or engineering departments. The areas inspected have included stagnant areas that are most susceptible to aging effects identified in the LRA. In addition, for many components covered by the Primary and Secondary Water Chemistry Control Program, such as those in the reactor coolant system and steam generators, inspection activities included in other aging management programs provide additional confirmation of chemistry program effectiveness. These other programs include the Inservice Inspection, Alloy 600 Aging Management, Cast Austenitic Stainless Steel Evaluation, Pressurizer Examinations, Reactor Vessel Internals Inspection, and Steam Generator Integrity Programs. Some components, such as heat exchangers and steam generators, have been inspected on a periodic basis providing further evidence that the water chemistry programs are adequately

managing aging effects. If during these inspections significant abnormal conditions were noted, including those that were the result of aging effects such as loss of material and cracking, these conditions would have been documented under the corrective action program. Subsequently, actions to determine cause of the condition and corrective actions to correct and prevent recurrence would have been taken. The GALL One Time Inspection Program XI.M32, focuses on the most susceptible material and environment combinations in the most susceptible locations. Items such as heat exchangers, piping and valves normally in standby, and system low points or stagnant areas are representative of these susceptible locations. At ANO-2, inspections have been performed in systems such as emergency feedwater and emergency diesel generators which are normally in standby, steam generators, condensate storage tanks, feedwater heaters, moisture separator reheaters, chillers, main steam safety valves, and blowdown heat exchangers. All of these components are made of susceptible materials (stainless and carbon steel) and are exposed to environments (treated water and steam) that would be conducive to aging effects managed by the chemistry programs.

Many components in the steam generators have inspection activities included in other aging management programs that provide additional assurance that significant degradation is not occurring and that the Water Chemistry Control Program is effective. These inspection activities include those contained in the Inservice Inspection and Steam Generator Integrity Programs. These inspection results of steam generator components are also applicable to the main steam, main feedwater and emergency feedwater components which possess the same material and environment combinations.

As additional confirmation of the effectiveness of the water chemistry programs, the ANO-2 review of operating experience included a review of condition reports (CRs), CR trending data, and interviews with site personnel regarding water chemistry program operating experience. The operating experience review did not identify component failures or significant adverse conditions that were the result of an ineffective water chemistry program. Also, the CR trending data did not identify recurrent component degradation occurring in the systems covered under this aging management program. The review of CRs, CR trending data, and personnel interviews provided additional confirmation of chemistry program effectiveness.

The combination of inspections under the Inservice Inspection Program, the Steam Generator Integrity Program, and maintenance and routine chemistry inspections as a whole, constitute a more thorough confirmation of water chemistry aging management program effectiveness than could be obtained from one-time inspections of a sample of items.

RAI 3.4-4: In LRA Table 3.4.2-2, for the main feedwater system, the water chemistry control program is used to manage cracking and loss of material for the stainless steel tubing and valves in a treated water >270°F (internal) environment. The applicant is requested to explain why a supplemental inspection program is not needed for verifying the effectiveness of the water chemistry control program, or, otherwise, include a verification program in the components' aging management review.

Response: See the response to RAI 3.4-3.

RAI 3.4-5: In LRA Table 3.4.2-3, for the emergency feedwater system, the water chemistry control program is used to manage cracking and loss of material for the stainless steel orifices in a steam >270°F (internal) environment. The applicant is requested to explain why a supplemental inspection program is not needed for verifying the effectiveness of the water chemistry control program, or, otherwise, include a verification program in the components' aging management review.

Response: See the response to RAI 3.4-3.

RAI 3.4-6: In LRA Table 3.4.2-3, for the emergency feedwater system, the water chemistry control program is used to manage loss of material for the following component/environment combinations: the stainless steel heater housing in a treated water (external) environment; the stainless steel orifices, piping, tanks, thermowells, tubing, and valves in a treated water (internal) environment; the carbon steel piping, steam traps, tubing, and valves in a treated water (internal) environment; as well as the carbon steel piping and valves in a treated water >220°F (internal) environment. It is noted that GALL (VIII.G.1-c, VIII.G.3-a, and VIII.G.4-b) specifically recommends that the water chemistry control program is to be augmented by verifying the effectiveness of water chemistry control. The applicant is requested to justify, for the above cases, that such a supplemental program is not needed, or, otherwise, include a verification program as recommended by GALL.

Response: See the response to RAI 3.4-3. The specified GALL paragraphs (VIII.G.1-c, VIII.G.3-a, and VIII.G.4-b) require inspection of carbon steel piping and valves in treated water in the EFW system and the stainless steel condensate storage tank. As noted in the response to RAI 3.4-3, since the environment and material combinations in the steam generators are the same or worse than those in the emergency feedwater system, results of steam generator component inspections to verify the effectiveness of the Water Chemistry Control Program are also applicable to the emergency feedwater carbon steel piping and valves and the condensate storage tank. These inspection activities include those contained in the Inservice Inspection and Steam Generator Integrity Programs. LRA Table 3.1.2-5 lists carbon (low alloy) and stainless steel components inspected under these programs.

RAI 3.4-7: In LRA table 3.4.2-3, for the emergency feedwater system, no aging effect was identified for the glass component in lube oil (internal) environments. The applicant is requested to provide the basis of such conclusion.

Response: Glass is an amorphous, inorganic oxide that is mostly silica and is cooled to a rigid condition without crystallization. Glass is highly resistant to corrosion, but is susceptible to degradation in hydrofluoric acid, caustic and high temperature water. The lubricating oil does not contain hydrofluoric acid or caustic, and this glass is not exposed to high temperature water; therefore, there are no aging effects requiring management for the glass.

Section B.1.2, Bolting and Torquing Activities RAI Responses

RAI B.1.2-1: In LRA Appendix B, Section B.1.2, "Bolting and Torquing Activities," under "Scope of Program," the applicant stated that the program covers bolting in high temperature systems and in applications subject to significant vibration as determined during aging management reviews. No specific guideline was provided as to whether the program covers all bolting within the scope of license renewal including safety-related bolting, bolting for nuclear steam supply system (NSSS) component supports, bolting for other pressure retaining components, and structural bolting. In addition, no specific guideline was provided addressing whether the program covers both greater than and smaller than 2-inch diameter bolting. The applicant is requested to provide the information as stated in the above. The applicant is also requested to assure that the recommendations and guidelines for the plant-specific bolting program conform to the industry's technical basis.

Response: The Bolting and Torquing Activities Program applies to closure bolting for components subject to aging management review in high temperature systems and in applications subject to significant vibration as indicated in Section 3 of the LRA. Thus, it applies to safety-related bolting, nonsafety-related bolting and bolting for pressure retaining components. It does not apply to bolting for NSSS component supports and structural bolting. The programs managing aging of component support and structural bolting are listed in the tables in LRA Section 3.5, *Structures and Component Supports*.

The Bolting and Torquing Activities Program covers both larger than and smaller than or equal to 2-inch diameter bolting.

As stated in GALL XI.M18, Bolting Integrity, "The industry's technical basis for the program for safety related bolting and guidelines for material selection and testing, bolting preload control, inservice inspection, plant operation and maintenance, and evaluation of the structural integrity of bolted joints, are outlined in EPRI NP-5769, with the exceptions noted in NUREG 1339. For other bolting, this information is set forth in EPRI TR-104213." Also, EPRI NP-5769 states that EPRI NP-5067, Good Bolting Practices, satisfies the industry's need for guidance on assembly of bolted joints. EPRI NP-5067, Good Bolting Practices and EPRI TR-104213, Bolted Joint Maintenance & Application Guide are utilized as guidance in the Bolting and Torquing Activities Program. Therefore, the guidelines for the Bolting and Torquing Activities Program reflect industry consensus.

RAI B.1.2-2: In LRA Appendix B, Section B.1.2, "Bolting and Torquing Activities," under "Parameters Monitored/Inspected," the applicant stated that torque values are monitored when the bolted closure is assembled, and maintenance personnel visually inspect components used in the bolted closures to assess their general condition during maintenance. The applicant is requested to discuss the specifics of the conditions of the closure bolting to be inspected, and to explain why torque values are the only parameters specified to be monitored. The applicant is also requested to provide details of the methods of its visual inspection and explain why inspection techniques, other than visual inspection, are not included in the program.

Response: Under the Bolting and Torquing Activities Program, loss of mechanical closure integrity is managed by proper torquing during assembly of the bolted closure. This program is a preventive program rather than an inspection program to detect the effects of aging. Visual inspections to manage the effects of aging are not included in this program. In LRA Section B.1.2 under Parameters Monitored/Inspected the phrase, "maintenance personnel visually inspect components used in the bolted closures to assess their general condition during maintenance," is a description of how bolting and torquing activities are performed. Prior to assembly, the mating surfaces and bolting components are inspected for manufacturing defects, galls, spurs, or dirt. After assembly, the closure is inspected for uniformity of gasket compression, proper thread engagement and proper locking tab installation.

Torque values are the only parameters specified to be monitored because the aging effect being managed is loss of mechanical closure integrity, or loss of pre-load, not loss of material. If loss of material is an aging effect requiring management for the same bolted closures, it is managed by another program such as System Walkdown or Boric Acid Corrosion Prevention, as specified in the Summary of Aging Management tables in Section 3. These programs were credited for managing the same aging effects for ANO-1. As documented in the ANO-2 operating experience review and the NRC review of ANO-1 in NUREG-1743, these programs have been effective in managing aging for bolted closures.

RAI B.1.2-3: In LRA Appendix B, Section B.1.2, "Bolting and Torquing Activities," under "Detection of Aging Effects," the applicant stated that preventive actions under the program prevent loss of mechanical closure integrity. No discussion was provided as to what aging effects/mechanisms requiring management are included under the aging effect of loss of mechanical closure integrity. The applicant is, therefore, requested to provide a detailed description of the aging effects considered to attribute to the loss of mechanical closure integrity, and how the aging management program is expected to manage them. The applicant is requested to ensure that, as delineated in GALL XI.M18, Bolting Integrity, the inspection requirements of the ASME Code, Section XI are met.

Response: Loss of mechanical closure integrity is the aging effect caused by loss of pre-load due to high temperature or vibration. If loss of material is an aging effect requiring management for the same bolted closures, it is managed by another program such as System Walkdown or Boric Acid Corrosion Prevention, as specified in the Summary of Aging Management tables in Section 3. The GALL program XI.M18, "Bolting Integrity," stipulates the inspection requirements of the ASME Code, Section XI. These requirements are included in the ANO-2 Inservice Inspection Program for Class 1, 2, and 3 bolted closures. However, these inspection requirements are focused on identifying the aging effect of cracking. Since cracking is not an aging effect requiring management for Non-Class 1 bolted closures, the Inservice Inspection Program was not credited as an aging management program. Inspection requirements of ASME Code, Section XI, will continue to be met as required by 10CFR50.55a during the period of extended operation.

RAI B.1.2-4: In LRA Appendix B, Section B.1.2, "Bolting and Torquing Activities," under Monitoring and Trending, the applicant stated that torque values are monitored during the bolt torquing process. Although the applicant invokes the ANO-2 Corrective Action Program to prevent repeat failures, details of the inspection schedule were not provided. The applicant is, therefore, requested to include in the program the frequency of the inspection, and the basis for such frequency. The applicant is requested to ensure that, as delineated in GALL XI.M18, Bolting Integrity, the inspection requirements of the ASME Code, Section XI are met.

Response: Under the Bolting and Torquing Activities Program, loss of mechanical closure integrity is managed by proper torquing during assembly of the bolted closure. Visual inspections to find evidence of aging effects are not performed under this program, thus there is no frequency to discuss. The GALL program XI.M18, "Bolting Integrity," stipulates the inspection requirements of the ASME Code, Section XI. These requirements are included in the ANO-2 Inservice Inspection Program for Class 1, 2, and 3 bolted closures. However, these inspection requirements are focused on identifying the aging effect of cracking. Since cracking is not an aging effect requiring management for Non-Class 1 bolted closures, the Inservice Inspection Program was not credited as an aging management program. Inspection requirements of ASME Code, Section XI, will continue to be met as required by 10CFR50.55a during the period of extended operation.

RAI B.1.2-5: In LRA Appendix B, Section B.1.2, "Bolting and Torquing Activities," under "Acceptance Criteria," the applicant stated that typical criteria would verify that mating surfaces are smooth and free of major defects. The staff considers the applicant's criteria inadequate because potential aging effects which might render the mating surfaces unacceptable are not specified. To ensure that mating surfaces perform their intended function as a pressure retaining boundary, the applicant is requested to specify that the surfaces be thoroughly inspected, for potential aging effects, such as corrosion, cracking, and/or leaking. All relevant indications and signs of degradation would need to be identified and documented for corrective actions. As a result, adequate inspection methodologies should also be specified in the program for the aging effects which the components are susceptible to. The applicant is requested to ensure that, as delineated in GALL XI.M18, Bolting Integrity, the inspection requirements of the ASME Code, Section XI are met.

Response: Under the Bolting and Torquing Activities Program, loss of mechanical closure integrity is managed by proper torquing during assembly of the bolted closure. As discussed in the response to RAI B.1.2-2, the inspection of mating surfaces under this program is an inspection for manufacturing defects, galls, spurs, or dirt prior to assembly of the bolted closure. Management of aging of component mating surfaces to ensure they perform their intended function as a pressure retaining boundary is performed by the program which manages aging of the component itself, as specified in the LRA, Section 3. The GALL program XI.M18, "Bolting Integrity," stipulates the inspection requirements of the ASME Code, Section XI. These requirements are included in the ANO-2 Inservice Inspection Program for Class 1, 2, and 3 bolted closures. However, these inspection requirements are focused on identifying the aging effect of cracking. Since cracking is not an aging effect requiring management for Non-Class 1 bolted closures, the Inservice Inspection Program was not credited as an aging management program. Inspection requirements of ASME Code, Section XI, will continue to be met as required by 10CFR50.55a during the period of extended operation.

RAI B.1.2-6: In the LRA Appendix B, Section B.1.2, "Bolting and Torquing Activities," under Operating Experience and Conclusion, the applicant stated that "the bolting and torquing activities program provides reasonable assurance that the aging effects associated with bolted closures will be managed ..." In light of the questions raised in RAI B.1.2-3, the applicant is requested to clarify what "aging effects" are being referred to here. The applicant is also requested to elaborate on the types of repetitive occurrences of deficient bolting and torquing activities identified by the ANO staff, and how they were dispositioned.

Response: The only aging effect managed by the Bolting and Torquing Activities Program is loss of mechanical closure integrity on bolting due to high temperature or vibration as specified in Appendix B, Section B.1.2, Detection of Aging Effects. Condition report trending evaluations performed by Entergy in 1998 identified repetitive occurrences of improper torquing requirements resulting from inadequate personnel work practices evidenced by leaking connections. Corrective actions, such as procedure changes and training, were taken to address the deficient conditions and to preclude their recurrence. Independent verification of proper torque values was also added to work instructions. Subsequent trending data revealed the corrective actions were effective in precluding the identified conditions.