NEXTera ENERGY DUANE ARNOLD

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

Duane Arnold Energy Center
Docket 50-331
License No. DPR-49

Response to Request for Additional Information Regarding the Duane Arnold Energy Center License Renewal Application - Aging Management Review Line Items

References:
1. Letter, Richard L. Anderson (FPL Energy Duane Arnold, LLC) to Document Control Desk (USNRC), "Duane Arnold Energy Center Application for Renewed Operating License (TSCR-109)," dated September 30, 2008, NG-08-0713 (ML082980623)
2. Letter, Richard L. Anderson (FPL Energy Duane Arnold, LLC) to Document Control Desk (USNRC), "License Renewal Application, Supplement 1: Changes Resulting from Issues Raised in the Review Status of the License Renewal Application for the Duane Arnold Energy Center," dated January 23, 2009, NG-09-0059 (ML090280418)
3. Letter, Brian K. Harris (USNRC) to Christopher Costanzo (NextEra Energy Duane Arnold, LLC), "Request for Additional Information for the Review of the Duane Arnold Energy Center License Renewal Application - Aging Management Review Line Items (TAC No. MD9769)," dated November 13, 2009 (ML092940591)

By Reference 1, FPL Energy Duane Arnold, LLC submitted an application for a renewed Operating License (LRA) for the Duane Arnold Energy Center. Reference 2 provided Supplement 1 to the application. By Reference 3 the U.S. Nuclear Regulatory Commission (NRC) Staff requested additional information for the review of the LRA.

The NextEra Energy Duane Arnold, LLC, responses to the Staff's requests for additional information are provided in Enclosure 1.

In a telephone conference call on November 12, 2009, the NRC raised follow-up questions related to the LRA or previous responses to RAIs. NextEra Energy agreed to docket the responses to several of the questions. Enclosure 2 provides the NextEra Energy responses to those questions.

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This letter contains no new commitments or changes to existing commitments.

If you have any questions or require additional information, please contact Mr. Kenneth Putnam at (319) 851-7238.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on December 14, 2009.

Dean Curtland for

Christopher R. Costanzo
Vice President, Duane Arnold Energy Center
NextEra Energy Duane Arnold, LLC

Enclosures: 1. DAEC Responses to NRC Requests for Additional Information
2. DAEC Responses to NRC Questions from 11/12/09 Conference Call

cc: Administrator, Region III, USNRC
Project Manager, DAEC, USNRC
Senior Resident Inspector, DAEC, USNRC
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M. Rasmusson (State of Iowa)

RAI 3.1.2.1-a

Background

LRA Table 3.1.1, Item 3.1.1-40 and GALL Report Volume 1 Table 1 ID 40 address cracking due to stress corrosion cracking, intergranular stress corrosion cracking, cyclic loading for stainless steel and nickel alloy penetrations for control rod drive stub tubes instrumentation, jet pump instrument, standby liquid control, flux monitor, and drain line exposed to reactor coolant. The applicant proposes to manage this aging process through the use of its AMPs "Water Chemistry" (LRA B.3.XX) and either "BWR penetration" (LRA B.3.XX) or "BWR vessel internals" (LRA B.3.XX) or "ASME Section XI" (LRA B.3.XX). The GALL Report recommends that this aging process be managed through the use of the AMPs "Water Chemistry" (GALL AMP XI.M2) and BWR Penetrations (GALL AMP XI.MXX). The applicant proposes that the aging management review items are either consistent with the GALL Report in all respects (Generic Note A) or are consistent with the GALL Report in terms of material, environment, and aging effect but a different AMP is credited (Generic Note E).

Issue

In its review of LRA components subordinate to LRA Item 3.1.1-40 for which the applicant assigned Generic Note E, the staff noted that GALL AMP refers to BWRVIP-49 and BWRVIP-27. The staff also noted that these BWRVIPs have been approved by the staff and that they contain inspection procedures for detection and sizing of cracks. The staff further noted that the GALL AMPs to which the applicant's proposed AMP claim consistency do not include references BWRVIP-49 and BWRVIP-27. The staff, therefore, assumes that the AMPs proposed by the applicant also do not refer to these BWRVIPs. Given that these BWRVIPs contain inspection procedures and recommendation, and given that it appears that the applicant's AMPs do not include these procedures and recommendations, it is not clear to the staff that the applicant's proposed AMPs will adequately inspect the components under consideration.

Request

For each component or group of components for which Generic Note E has been applied, please demonstrate that the AMP proposed will perform inspections and evaluations which are consistent with those recommended in the GALL Report AMP, or revise the proposed AMPs so that they are consistent with the AMP recommended by the GALL Report, or select the AMP recommended by the GALL Report.

DAEC Response to RAI 3.1.2.1-a

As stated above in "Background", NUREG-1801 (GALL) Report Volume 1, Table 1, ID 40 addresses the following penetrations: control rod drive stub tubes instrumentation, jet pump instrument, standby liquid control, flux monitor, and drain line, and lists BWR Penetrations and Water Chemistry as the appropriate aging management programs. There is an inconsistency, however, between the penetrations listed in GALL Volume 1,

Table 1, and the associated description for the BWR Penetrations Program in GALL Chapter XI, Section XI.M8. The discussion and guidance provided in GALL XI.M8 is limited to only the standby liquid control and instrumentation penetrations. GALL XI.M8 provides no guidance for the other components listed in GALL Report Volume 1, Table 1, ID 40.

As discussed in the response to RAI B.3.10-7 in letter NG-09-0764 dated October 13, 2009, the DAEC standby liquid control and instrumentation penetrations are nozzles N10, N11A/B, N12A/B and N16A/B. These penetrations are managed by the BWR Penetrations Program. The response to RAI B.3.10-7 also revised LRA Table 3.1.2-1 to correct the aging management program assignments for the jet pump instrumentation nozzle and safe end, control rod drive safe end, and core differential pressure and standby liquid control safe end.

The following table summarizes the resulting aging management program assignments at DAEC for components in LRA Table 3.1.2-1, as they relate to LRA Table 3.1-1, item 3.1.1-40, or the BWR Penetrations Program.

Component Type	Aging Management Program	Table 3.X.1 Item	Notes
Control rod drive stub tubes	BWR Vessel Internals Program	3.1.1-40	E
Control rod drive stub tubes	Water Chemistry Program	3.1.1-40	A
Nozzle – core differential pressure and standby liquid control	BWR Penetrations Program Water Chemistry Program	3.1.1-40	A
Nozzle- drain	ASME Section XI Inservice Inspection, Subsections IWB, IWC and IWD Program	3.1.1-40	E
Nozzle-drain	Water Chemistry Program	3.1.1-40	A
Nozzle – instrumentation	BWR Penetrations Program Water Chemistry Program	3.1.1-40	A
Nozzle - jet pump instrumentation	ASME Section XI Inservice Inspection, Subsections IWB, IWC and IWD Program *(Response to RAI B.3.10-7 revised from BWR Penetrations Program)* Water Chemistry Program	3.1.1-20 *(Response to RAI B.3.10-7 revised from 3.1.1-40)*	C
Safe end - control rod drive	BWR Control Rod Drive Return Line Nozzle Program *(Response to RAI B.3.10-7 revised from BWR Penetrations Program)*	3.1.1-38	C
Safe end - core differential pressure and standby liquid control	BWR Penetrations Program *(Response to RAI B.3.10-7 revised from BWR Stress Corrosion Cracking Program)* Water Chemistry Program	3.1.1-40 *(Response to RAI B.3.10-7 revised from 3.1.1-41)*	C

Component Type	Aging Management Program	Table 3.X.1 Item	Notes
Safe end – instrumentation	BWR Penetrations Program Water Chemistry Program	3.1.1-40	A
Safe end - jet pump instrumentation	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program *(Response to RAI B.3.10-7 revised from BWR Penetrations Program)* Water Chemistry Program	3.1.1-20 *(Response to RAI B.3.10-7 revised from 3.1.1-40)*	C
Thermal sleeve - control rod drive	BWR Vessel Internals Program	3.1.1-40	E
Thermal sleeve - control rod drive	Water Chemistry Program	3.1.1-40	A

With the LRA changes made in the response to RAI B.3.10-7, there are three components which refer to item 3.1.1-40 that use Note E; these are the drain nozzle, Control Rod Drive (CRD) stub tube, and CRD thermal sleeve.

As shown in the above table, the CRD stub tubes and thermal sleeves are managed with the BWR Vessel Internals Program, rather than the BWR Penetrations Program. As noted in the Issue description above, the BWR Penetrations Program uses the guidance of Boiling Water Reactor Vessel and Internals Program (BWRVIP) reports BWRVIP-27-A and BWRVIP-49-A. BWRVIP-27-A and BWRVIP-49-A do not encompass the CRD stub tubes and thermal sleeves. The inspection and flaw evaluation guidelines applicable to vessel lower plenum components, which include the CRD housing and stub tubes, are given in BWRVIP-47-A. BWRVIP-47-A is included within the scope of the BWR Vessel Internals Program. The BWR Vessel Internals Program will, therefore, adequately manage aging of the CRD stub tubes and thermal sleeves.

The drain nozzle is managed with the ASME Section XI Inservice Inspection, Subsections IWB, IWC and IWD Program, rather than the BWR Penetrations Program. The BWR Penetrations Program uses the guidance of BWRVIP-27-A and BWRVIP-49-A, which do not include the drain nozzle in their scope. The ASME Section XI Inservice Inspection, Subsections IWB, IWC and IWD Program incorporates the inspection requirements of ASME Code, Section XI, in accordance with 10 CFR 50.55a, and will adequately manage aging of the drain nozzle.

RAI 3.1.2.2.4-1

<u>Background</u>

In LRA Section 3.1.2.2.4, "Cracking due to SCC and IGSCC", Item 1 states that cracking due to stress corrosion cracking (SCC) and inter-granular stress corrosion cracking (IGSCC) in the stainless steel and nickel alloy BWR top head enclosure vessel flange leak detection lines does not apply at Duane Arnold because the reactor vessel flange leak-off line is made of carbon steel and no program is therefore required to manage stress corrosion cracking or intergranular stress corrosion cracking.

Issue

However, in the LRA Table 3.1.2-1 the applicant credits the One Time Inspection Program and the Water Chemistry Program to manage cracking of the nickel alloy leakage detection line which is exposed to reactor coolant. LRA Table 3.1.2-1 points to LRA Table 3.1.1, Item 19 where a plant-specific program is credited for management of cracking.

The GALL Report recommends in Item IV.A1-10 (R-61) for the applicant to develop a plant-specific program to manage cracking of nickel alloy in reactor coolant. The staff noted that one time inspection is used for verification that an aging effect is not occurring or occurring at such a slow rate that it will not cause the loss of intended function during the period of extended operation. The staff does not consider cracking of nickel alloy in reactor water unlikely. Additionally the staff noted that the applicant's One Time Inspection Program does not specify the method to be used to detect cracking.

Request

Please provide consistency between LRA Section 3.1.2.2.4, LRA Table 3.1.2-1 and LRA Table 3.1.1 Item 19. Please also provide the correct material for the leak line and if it is nickel alloy provide the plant-specific program. Please provide additional information demonstrating that cracking of nickel alloy in reactor water is unlikely or occurring very slowly such that one time inspection is appropriate if the plant-specific program is based on one time inspection.

DAEC Response to RAI 3.1.2.2.4-1

At DAEC the Reactor Vessel Flange Leak Detection Line is constructed from ASTM A-106 Gr. B carbon steel material. However, at the point the leak detection line is attached to the reactor vessel carbon steel head flange, a short coupling or nozzle is installed which is made from SB-166 nickel alloy. For License Renewal, the assigned internal environment for these components is reactor coolant. This is conservative since the instrument line is drained in conjunction with reactor vessel reassembly during refueling outages. A separate, spare flange leak detection line has a capped connection and is assumed to remain filled with reactor coolant.

While the nickel-alloy couplings are appropriately addressed in LRA Table 3.1.2-1, the discussions in LRA Section 3.1.2.2.4 and Table 3.1-1, Item 3.1.1-19, do not acknowledge the nickel-alloy material. These discussions are revised below to indicate that, while the reactor vessel flange leak detection line is carbon steel and not susceptible to SCC, the line attachment nozzle at the reactor vessel flange is nickel alloy and is susceptible to SCC.

NUREG-1801 Item IV.C1-6; LRA Section 3.1.2.2.4; LRA Table 3.1-1 item 3.1.1-13; and the LRA Table 3.1.2-1 line item for Component Type Pipe Class 1, pipe fittings, tubing of Carbon steel with a Reactor coolant (internal) environment, all apply to the head seal leak detection line. As shown in LRA Table 3.1.2-1 on page 3.1-48, this carbon steel line is managed for loss of material by the Water Chemistry and One-Time Inspection Programs.

NUREG-1801 Items IV.A1-8 and IV.A1-10; LRA Table 3.1-1 items 3.1.1-14 and 3.1.1-19 (as modified below); and the LRA Table 3.1.2-1 line items for Component Type Nozzle – high pressure/low pressure seal leak detection of Nickel alloy in a Reactor coolant (internal) environment, all apply to the head seal leak detection nozzle. As shown in LRA Table 3.1.2-1, on pages 3.1-44 and 3.1-45, the nickel alloy nozzles are managed for cracking and loss of material by the Water Chemistry and One-Time Inspection Programs.

NUREG-1800, Section 3.1.2.2.2, Item 3 provides a discussion of loss of material due to pitting and crevice corrosion for nickel alloy nozzles exposed to reactor coolant. This paragraph lists the reactor water chemistry program as the program to mitigate corrosion, with the one time inspection program to provide verification whether an aging effect is not occurring or is progressing very slowly such that the component's intended function will be maintained during the period of extended operation. NUREG-1800, Section 3.1.2.2.4, provides a discussion concerning cracking of nickel alloy BWR vessel flange leak detection lines due to SCC or IGSCC and recommends a plant specific program. At DAEC the Water Chemistry and One-Time Inspection Programs were chosen to manage these aging effects. The One-Time Inspection Program was chosen to verify the effectiveness of the Water Chemistry Program because the nozzles involved are only pressurized if the inboard reactor vessel head seal fails, and there is no OE suggesting this has ever occurred at DAEC; the nozzles involved are small (one inch) and difficult to access; and cracking is an aging effect which the One-Time Inspection Program is credited with detecting to provide reasonable assurance that the intended function will be maintained during the period of extended operation.

The LRA changes to reflect the above discussion are as follows:

In LRA Section 3.1.2.2.4, Cracking Due to Stress Corrosion Cracking and Intergranular Stress Corrosion Cracking, item 1 is revised in its entirety to read as follows:

1. Cracking due to SCC and IGSCC could occur in the stainless steel and nickel alloy BWR top head enclosure vessel flange leak detection lines.

   At Duane Arnold, the reactor vessel flange leak detection line is made of carbon steel. However, the reactor vessel attachment nozzles for the leak detection lines are made from nickel alloy and are conservatively assigned a reactor coolant environment. These nozzles are being managed for SCC by the Water Chemistry Program. The effectiveness of the Water Chemistry Program is verified by the One-Time Inspection Program. Selected components are inspected to determine if an aging effect is occurring or is progressing very slowly such that the components' intended function will be maintained during the period of extended operation.

In LRA Table 3.1-1, Item Number 3.1.1-19, the Discussion entry is revised in its entirety to read as follows:

Program is consistent with NUREG-1801. Applicable to nickel alloy leak detection line nozzles. Not applicable to carbon steel leak detection line. Further evaluation is provided in LRA Section 3.1.2, NUREG-1800 Section 3.1.2.2.4, item 1.

RAI 3.1.2.2.7-1

Background

In LRA Section 3.1.2.2.7, Cracking Due to Stress Corrosion Cracking, Item 2 states that cracking, due to stress-corrosion cracking (SCC) in Class 1 PWR cast austenitic stainless steel (CASS) reactor coolant system piping, piping components, and piping elements exposed to reactor coolant is not applicable for Duane Arnold because this is only applicable to pressurized water reactors.

However, in the LRA Table 3.4.2-4 the applicant credits the One Time Inspection Program and the Water Chemistry Program to manage cracking of cast austenitic stainless steel Class 1 flow elements that are exposed to reactor coolant. LRA Table 3.4.2-4 points to LRA Table 3.1.1, Item 41 where the BWR Stress Corrosion Cracking and Water Chemistry Programs are credited for management of cracking.

Issue

The GALL Report recommends in Item IV.C1-9 (R-20), GALL AMPs XI.M7, "BWR Stress Corrosion Cracking," and XI.M2, "Water Chemistry," to manage cracking of CASS components in reactor coolant environment. The staff noted that one time inspection is used for verification that an aging effect is not occurring or occurring at such a slow rate that it will not cause the loss of intended function during the period of extended operation. The staff does not consider cracking of CASS in reactor water unlikely. The staff noted that GALL AMP XI.M7 element 5 "monitoring and trending" recommends additional sampling in accordance with GL 88-01 or approved BWRVIP-75 guidelines. Additionally the staff noted that the applicant's One Time Inspection Program does not specify the method to be used to detect cracking whereas GALL AMP XI.M7 recommends detection of cracking in accordance with GL 88-01 or approved BWRVIP-75.

Request

Please provide additional information demonstrating that cracking of CASS in reactor coolant is unlikely or occurring very slowly such that one time inspection is appropriate.

DAEC Response to RAI 3.1.2.2.7-1

At DAEC, the main steam line flow elements are fabricated from CASS material and are welded inside carbon steel pipe. The flow elements are not a pressure boundary and are not subject to tensile stress that would promote stress corrosion cracking. Therefore, stress corrosion cracking is not a potential aging effect for these components.

In addition, since the main steam line flow elements are made from A451, CPF8 centrifugally cast CASS material with a delta ferrite content <20%, these components are not susceptible to thermal aging embrittlement in accordance with the criteria contained in NUREG-1801 Section XI.M13 and the letter from Christopher Grimes, USNRC, to the Nuclear Energy Institute dated May 19, 2000. The LRA should not have indicated that cracking and loss of fracture toughness were aging effects that required management.

To clarify the LRA treatment of the main steam line flow elements, the following LRA changes are made:

In LRA Table 3.1-1, Summary of Aging Management Evaluations in Chapter IV of NUREG-1801 Reactor Coolant System, line item 3.1.1-57 on page 3.1-22, the Discussion entry is revised in its entirety to read, "Not applicable to the Reactor Coolant System Section."

In LRA section 3.4.1.4, Main Steam Isolation and Automatic Depressurization System, on page 3.4-5, under Aging Effects Requiring Management, the bullet "Loss of fracture toughness" is deleted.

In LRA Table 3.4.2-4, Summary of Aging Management Review Results Main Steam Isolation and Automatic Depressurization System, on page 3.4-51, the line items for Flow element Class 1 with Aging Effect Requiring Management of "Cracking" and "Loss of fracture toughness" are deleted. In the one remaining Flow element Class 1 line item with Aging Effect Requiring Management of "Loss of material", the Notes entry is changed from A to C.

RAI 3.2.2.1-1

Background

In LRA Table 3.2.2-6, standby gas treatment system, on page 3.2-68, the applicant has identified one line item for steel valve damper in a raw water internal environment with aging effect of loss of material. The applicant credited the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program with a Footnote E, and referenced GALL Report Item VII.G-24.

Issue

In the same Table, on page 3.2-68, for another line item for steel valve damper in the same environment and the same aging effect, the applicant has credited the Fire Water System Program.

Request

Please justify why two different programs are credited for the same material, environment, and aging effect combination.

DAEC Response to RAI 3.2.2.1-1

The components which credit the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program are two manual valves on the Carbon Bed Filter Drain lines, one per train, that return to each Standby Gas Treatment Room sump. The valves are normally open and are not liquid filled. They are made of carbon steel and were conservatively assigned a raw water internal environment. The valves are in scope for 10 CFR 54.4(a)(1). Since the valves rarely have raw water in them, the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program was determined to be the most appropriate.

The components credited under the Fire Water System Program were two control valves, the Standby Gas Treatment (SBGT) Carbon Bed Deluge Isolation valves, one each per train. They open to supply fire water (raw water) from the fire water system header to spray water on the Carbon Bed in either SBGT train if Carbon Bed Temperature exceeds a specific temperature. The control valves are made of carbon steel and are normally closed with raw fire water in the pipe leading up to and including the control valves. The control valves are safety related and are in scope for 10 CFR 54.4(a)(1). Since the valves normally have an internal environment of raw water, the Fire Water System Program was determined to be most appropriate.

RAI 3.3.2.1-2

Background

In LRA Table 3.3.1, line Item 3.3.1-63, the applicant stated in the discussion column that wear of steel fire doors exposed to air is managed by the Fire Protection Program at DAEC, and that this is addressed in Section 3.5. In LRA Table 3.5.2-8, for the two line items for carbon steel fire door in air-indoor uncontrolled environment that reference line Item 3.3.1-63, the applicant has credited the Fire Protection Program in one line item, and the Structures Monitoring Program in the other line item and referenced Footnote

E. The Footnote E indicates that this line is consistent with NUREG-1801 item for material, environment, and aging effect, but a different AMP is credited.

Issue

LRA Table 3.3.1, Item 3.3.1-63 does not identify Structures Monitoring Program. It only identifies Fire Protection Program.

Request

Please resolve the discrepancy between the discussion column of LRA Table 3.3.1, line 3.3.1-63 and LRA Table 3.5.2-8; and if Structures Monitoring Program is also used, then clarify how these two programs will be used to manage the aging effect of loss of material of steel fire doors.

DAEC Response to RAI 3.3.2.1-2

Both the Fire Protection Program and the Structures Monitoring Program manage the Fire Doors for loss of material. However, the line item in LRA Table 3.5.2-8 which cites the Structures Monitoring Program for managing the Fire Doors for Loss of Material should have referenced a different 3.x.1 table item. Accordingly, the LRA is being revised as follows:

In LRA Table 3.5.2-8, Summary of Aging Management Review Results Pump House, on page 3.5-94, in the line item Fire door with Aging Effect Requiring Management of Loss of material being managed by the Structures Monitoring Program, the NUREG-1801 Volume 2 Line Item is changed from VII.G-3 (A-21) to III.A3-12 (T-11), the Table 3.X-1 Item is changed from 3.3.1-63 to 3.5.1-25, and the Notes entry is changed from E to A.

RAI 3.3.2.1-3

Background

In LRA Table 3.3.1, line Item 3.3.1-64, the applicant has proposed Fuel Oil Chemistry and One-Time Inspection Program to manage the aging effect of loss of material due to general, pitting, and crevice corrosion of steel piping, piping components, and piping elements exposed to fuel oil. This line item is referenced in Table 3.3.2-11, fire protection system, page 3.3-128, for component type accumulator, pulsation damper, low pressure tank, and GALL Report Volume 2 Item VII.G-21 is referenced. This line item also references plant-specific Footnote 202, which states that additional aging mechanisms such as galvanic corrosion, Microbiologically-Influenced Corrosion (MIC), wear and/or selective leaching are also included.

Issue

GALL Report Volume 2 Item VII.G-21 recommends Fuel Oil Chemistry and Fire Protection Programs to manage the aging effect of loss of material due to general, pitting, and crevice corrosion of steel piping, piping components, and piping elements exposed to fuel oil. The Fire Protection Program is used to verify the effectiveness of the Fuel Oil Chemistry Program. It is not clear whether the One-Time Inspection Program is used to verify the effectiveness of the Fuel Oil Chemistry Program. Furthermore, it is not clear if the applicant expects selective leaching to be an issue in carbon steel components in a fuel oil environment.

Request

Please justify the use of One-Time Inspection Program in lieu of the periodic inspections as recommended by the Fire Protection Program. Also, please provide the basis for considering selective leaching to be an aging mechanism for carbon steel material in a fuel oil environment.

DAEC Response to RAI 3.3.2.1-3

The component that is represented by this line item in LRA Table 3.3.2-11 is the Fire Protection System diesel fire pump fuel oil day tank. This is a relatively small (300 gallon) indoor tank that is classified as an accumulator in the DAEC equipment data base. In the applicable NUREG 1801 component listings, most accumulators are grouped as piping components. In this case, however, the program assigned in NUREG-1801 was not appropriate to the component; i.e., fuel oil tanks are not appropriately managed by the XI.M26 Fire Protection Program.

It has been determined that a more appropriate NUREG-1801 Volume 2 citation is available for this component. NUREG-1801 line item VII.H1-10 (A-30) includes carbon steel piping components and tanks in a fuel oil environment and manages them with the Fuel Oil Chemistry Program augmented with the One-Time Inspection Program. These programs properly manage fuel oil tanks for loss of material by controlling the quality of the fuel oil added and stored in the fuel oil tank. In addition the program requires the tanks to be periodically drained and cleaned. The effectiveness of the program is verified to ensure significant degradation is not occurring during the period of extended operation by periodically measuring the thickness of the tank bottom. Accordingly, the LRA is changed as follows:

In LRA Table 3.3.2-11, Summary of Aging Management Review Results Fire Protection System, on page 3.3-128, in the line items Accumulator, pulsation damper, low pressure tank with an Environment of Fuel oil (internal), the NUREG-1801 Volume 2 Line Item entries are changed to VII.H1-10 (A-30), and the corresponding 3.X-1 Table Item entries are changed to 3.3.1-20.

The Note 202 that was cited for these line items is a generic note that is applied when additional aging effects are managed in addition to the ones specified in NUREG-1801.

The additional aging effect managed for this component is galvanic corrosion due to the fact there is a stainless steel sample valve attached to the tank wall. Selective leaching is not managed for this carbon steel tank.

Due to these changes, Table 3.3-1, line item 3.3.1-64, is no longer used in the LRA. Accordingly, the discussion entry for this line item is revised, as follows:

In LRA Table 3.3-1, line item 3.3.1-64 on page 3.3-57, the Discussion entry is revised to read, "Not applicable at DAEC. The auxiliary systems have no Fire Protection carbon steel piping components exposed to fuel oil."

RAI 3.3.2.1-4

Background

LRA Table 3.3.1, Item 3.3.1-65 states in the discussion column that this line is not applicable to the Auxiliary Systems at DAEC, however, cracking and spalling, aggressive chemical attack of reinforced concrete structural fire barriers exposed to indoor air is managed by the Fire Protection and Structural Monitoring Programs at DAEC (in Section 3.5).

Issue

The staff reviewed LRA Section 3.5, Table 2 and could not find any line item that referenced Table 3.3.1, Item 3.3.1-65 where Structures Monitoring Program was credited.

Request

Please confirm if Structures Monitoring Program is used in addition to the Fire Protection Program in Table 3.3.1, Item 3.3.1-65. If not used, please justify the inclusion of Structures Monitoring Program in the discussion column.

DAEC Response to RAI 3.3.2.1-4

In nearly all cases, when there is a line item in a 3.5.2-X table that lists a Table 3.X-1 item of 3.3.1-65, the next line item is identical in Component, Material, Environment, and Aging Effect Requiring Management, but the second line cites the Structures Monitoring Program. The Structures Monitoring Program references the applicable Structural 3.X-1 table line item rather than 3.3.1-65. The Discussion entry for Table 3.3.1, item 3.3.1-65, does not need to cite the Structures Monitoring Program. For clarity, the LRA discussion entry for this item is being changed, as follows:

In LRA Table 3.3.1, Summary of Aging Management Evaluations in Chapter VII of NUREG-1801 Auxiliary Systems, in line item 3.3.1-65 on page 3.3-57, the Discussion entry is revised to read as follows:

Not applicable to the Auxiliary Systems at DAEC. However, cracking and spalling, aggressive chemical attack of reinforced concrete structural fire barriers exposed to indoor air is managed by the Fire Protection Program (In Section 3.5).

RAI 3.3.2.1-5

Background

LRA Table 3.3.1, Item 3.3.1-66 states in the discussion column that cracking and spalling of reinforced concrete structural fire barriers exposed to outdoor air is managed by the Structural Monitoring Programs at DAEC (in Section 3.5). This line item is referenced in LRA Table 3.5.2-2 for one component type (concrete) on page 3.5-47, and in LRA Table 3.5.2-5 for four component types on pages 3.5-61, 3.5-66 and 3.5-67. These lines also reference GALL Report Item VII.G-30.

Issue

All lines in LRA Tables 3.5.2-2 and 3.5.2-5 that reference Table 3.3.1, Item 3.3.1-66 as identified above, credit the Fire Protection Program to manage cracking and spalling, and not the Structures Monitoring Program, and reference Footnote B. The GALL Report Item VII.G-30 recommends Fire Protection and Structures Monitoring Programs.

Request

Please resolve the discrepancy between the discussion column of LRA Table 3.3.1, line 3.3.1-66 and LRA Tables 3.5.2-2 and 3.5.2-5. Also, please confirm if Fire Protection Program is only used, then justify why Footnote E is not used, instead of Footnote B.

DAEC Response to RAI 3.3.2.1-5

The Structures Monitoring Program, which includes reinforced concrete structural fire barriers – walls, ceilings, and floors exposed to air - outdoor, will confirm the absence of aging effects requiring management. The Fire Protection Program will also perform its own fire barrier visual inspection by a qualified fire protection inspector to examine for any sign of degradation such as cracking. Since the Fire Protection Program will perform its own inspection, the footnote B is still correct.

For clarity, the discussion in LRA Table 3.3-1, Item 3.3.1-66, is being revised to include the Fire Protection Program, as follows:

In LRA Table 3.3-1, Item 3.3.1-66 on page 3.3-57, the Discussion entry is revised in its entirety to read as follows:

Cracking and spalling of reinforced concrete structural fire barriers exposed to outdoor air is managed by the Fire Protection and Structural Monitoring Programs at DAEC.

During the review of Table 3.5.2-2 on page 3.5-47, it was determined that an incorrect NUREG-1801 line item was cited. Accordingly, the LRA is revised to correct the incorrect citation, as follows:

In LRA Table 3.5.2-2, Summary of Aging Management Review Results Control Building, in the line item for Concrete with an Aging Effect Requiring Management of Expansion and cracking with an Aging Management Program of Fire Protection Program, the NUREG-1801 Volume 2 Line Item entry is changed to VII.G-29 (A-92) and the Table 3.X-1 Item entry is changed to 3.3.1-67.

RAI 3.3.2.1-6

Background

LRA Table 3.3.1, Item 3.3.1-68 states in the discussion column that loss of material of steel piping, piping components, and piping elements exposed to raw water is managed by the Fire Water System, Bolting Integrity and Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Programs.

LRA Table 3.3.2-11, fire protection system, references line Item 3.3.1-68 for carbon steel fastener, bolting, washer and nuts in a raw water external environment and credits the Bolting Integrity Program. Footnote E is referenced indicating that a different program is credited than what the GALL Report recommends. The staff noted that this component is in an external environment of raw water, implying that this component is under water.

Issue

LRA Section B.3.28 states in its Bolting Integrity Program that the DAEC External Surfaces Monitoring Program provides the requirements for the inspection of bolting for steel components such as piping, piping components, ducting and other components within the scope of license renewal. The staff noted that the External Surface Monitoring Program utilizes visual inspection at periodic intervals to detect age related degradation.

Request

Please confirm how and at what frequency the visual inspection will be performed on bolting in raw water external environment to detect age related degradation.

DAEC Response to RAI 3.3.2.1-6

In LRA Table 3.3.2-11 the fasteners referred to are the bolting, nuts and washers which secure the pump and column sections of the Electric Fire Pump, 1P048, and the Diesel

Fire Pump, 1P049. A refueling outage preplanned task is scheduled every refueling outage, when the circulating water pit, where the fire pumps are located, is drained and accessible. A step is included in the preplanned task to inspect the condition of the pump, pump casing and bolting of both fire pumps.

RAI 3.3.2.1- A

Background

In LRA Table 3.3.1, Item 3.3.1-61, discussion column states that increased hardness, shrinkage and loss of strength of elastomer fire barrier penetration seals exposed to indoor and outdoor air is managed by the Fire Protection and the Structures Monitoring Programs at Duane Arnold Energy Center (DAEC) (in Section 3.5). In LRA Tables 3.5.2-8, 3.5.2-9, and 3.5.2.11, the applicant has referenced Footnote E for lines where the Structures Monitoring Program is credited. These lines also reference GALL Report Items VII.G-1 and VII.G-2, which recommends GALL AMP XI.M26, "Fire Protection" program only to manage the aging effects of elastomer fire barrier penetration seals.

Issue

It is not clear how these two programs will be used to manage the aging effects. There are different frequencies and acceptance criteria recommended in these two programs.

Request

Please clarify how these two programs will be used to manage the aging effects of elastomer fire barrier penetration seals. Please clearly indicate what will be the frequency of the inspection and what acceptance criteria will be used.

DAEC Response to RAI 3.3.2.1- A

The Fire Protection Program provides the guidelines for periodic visual inspection of penetration seals for signs of cracking, separation, rupture and puncture. As discussed in the DAEC response to RAI B.3.22-1 in letter NG-09-0764 dated October 13, 2009, this program will be enhanced to ensure approximately 10% of each type of penetration seal is included in the 35 percent of fire penetration seals that are visually inspected each 18 month interval. The Fire Protection Program states that results are acceptable if there are no visual indications of cracking, separation of seals from building structures and components, and no rupture or puncture of seals. This use of the Fire Protection Program is consistent with NUREG-1801 items VII.G-1 and VII.G-2.

The DAEC Structures Monitoring Program inspects elastomer seals without regard to the function of the seal (Fire Protection or other functions). Structures Monitoring Program inspections are performed in addition to, and not instead of, inspections under the Fire Protection Program. The specific aging effects for elastomers that are managed by this program include the following:

- Deterioration of Seals – Loss of Sealing & Leakage Through Containment
- Ionizing Radiation – Change in Material Properties & Cracking
- Weathering – Increased Hardness & Shrinkage

The frequency of inspection will be based on the environment (Harsh or Non-Harsh), but shall not exceed once each ten years. The visual inspections conducted under the Structures Monitoring Program are performed by qualified personnel possessing appropriate expertise with structural elastomers. Elastomers which show signs of degradation (e.g., loss of seal, leakage, hardening, cracking) that could impair the components' function would be repaired or dispositioned within the Corrective Action Program.

RAI 3.3.2.1.x-1

Background

In LRA Table 3.3.2-27 (page 3.3-219), the applicant addressed an AMR item for the stainless steel heat exchanger, condenser, cooler and fan coil of the safety related air system, which are subject to loss of material due to pitting and crevice corrosion in a condensation (internal) environment in relation with LRA Table 1, Item 3.3.1-54. Similarly, in LRA Table 3.3.2-29 (pages 3.3-232, 239 and 246), the applicant addressed AMR items for the stainless steel components (including pipe, pipe fittings and valve damper) of the standby diesel generators, which are subject to loss of material due to pitting and crevice corrosion in a condensation (internal) environment in relation with LRA Table 1, Item 3.3.1-54.

As indicated by the applicant's consistency Note E, the applicant credited the "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program" for the AMR items in lieu of GALL AMP XI.M24, "Compressed Air Monitoring," which is recommended by the GALL Report.

Issue

The staff found a need to clarify why the "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program" is credited in lieu of GALL AMP XI.M24 and how the credited program can adequately manage the aging effect of loss of material for the AMR items.

Request

1. Clarify why the "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program" is credited for the AMR items of the safety-related air system

and standby diesel generators instead of GALL AMP XI.M24, "Compressed Air Monitoring," which is recommended by the GALL Report.

2. Provide justification why the credited program can adequately manage loss of material for the AMR items of the safety-related air system and standby diesel generators.

DAEC Response to RAI 3.3.2.1.x-1

The questions raised in this RAI concern stainless steel components in the starting air systems for the Standby Diesel Generator (SBDG) System. The air operated instrumentation associated with the Standby Diesel Generators is supplied by the plant instrument air system and is managed by the Compressed Air Program.

NUREG-1801, program XI.M24, and the DAEC Compressed Air Monitoring Program, apply to maintaining the air quality of the instrument air systems (instrument air, service air, breathing air, and Control Building/Standby Gas Treatment Instrument Air). The DAEC Instrument Air System is addressed in LRA Section 2.3.3.15, Instrument Air System, and the aging management review results are provided in LRA Table 3.3.2-27. The Compressed Air Monitoring Program is based on plant responses to NRC Generic Letters, Information Notices, etc., related to instrument air systems and not diesel generator air start systems.

Each Standby Diesel Generator (SBDG) has its own starting air system which is only associated with the diesel generator. SBDG starting air is completely separate from the other plant compressed air systems which comprise the Instrument Air System. The SBDG air start system was not designed to provide dried high quality air to safety related instruments like an instrument air system. Its purpose is to provide a reliable source of SBDG starting air. As discussed in LRA Section 2.3.3.29, Standby Diesel Generators, the SBDG starting air systems are addressed as part of the diesel generators, and aging management review results are provided in LRA Table 3.3.2-29. The Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program is the most appropriate aging management program for the Standby Diesel Generator air start components.

As discussed above, the starting air systems on the diesel generators have no connection to, and are completely separate from, the Instrument Air System. Much of the piping and several valves in the diesel starting air systems are made from carbon steel and align well with NUREG-1801,Table VII.H2, Emergency Diesel Generator System, item VII.H2-21, which provides the correct component, material, environment, aging effect and aging management program (Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components) for these components. However, the DAEC starting air systems also contain stainless steel components, and NUREG-1801, Table VII.H2, does not contain a line item for components of stainless steel with the correct environment, aging effect and aging management program. As an alternative for these stainless steel components, NUREG-1801 Table VII.D, Compressed Air System, item VII.D-4 was referenced because it had the correct material and environment. Unfortunately, item VII.D-4 only cites the Compressed Air Program instead of the more appropriate Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program for aging management. In LRA Table 3.3.2-29, therefore, the stainless steel components in the starting air systems cited NUREG-1801 Volume 2 Line Item VII.D-4, and used Note E to indicate that a different aging management program (i.e., Inspection of Internal Surfaces in Piping and Ducting) was specified. These lines also cited Table 3.3-1 item 3.3.1-54 as the Table 3.X-1 Item. In turn, the Discussion for line item 3.3.1-54 indicated that either the Compressed Air Monitoring Program or the Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components is credited where appropriate. The Inspection of Internal Surfaces of Miscellaneous Piping and Ducting Components Program will manage the SBDG starting air components, and the Compressed Air Monitoring Program will monitor the instrument air components.

The Inspection of Internal Surfaces in Piping and Ducting Program performs visual inspections of internal surfaces of plant components to manage effects of loss of material, heat transfer degradation, fouling and cracking. Procedural requirements exist to blow down the diesel start air receivers once per day to remove any accumulated moisture. This minimizes corrosion products in the system should any moisture be present in the receivers. The system also has an air start filter installed to remove foreign matter if present. The air start filter and downstream piping to the SBDG are made of stainless steel, which does not contribute to degraded air quality. DAEC has not identified OE that specifically relates to failures or problems associated with air quality in the SBDG air start system. Therefore, the Inspection of Internal Surfaces in Piping and Ducting Program is adequate to manage loss of material in the diesel air start piping.

RAI 3.3.2.1-a

Background

LRA and SRP Tables 3.3.1, Item 76 address the loss of material due to general, pitting, crevice, and microbiologically influenced corrosion, fouling, and lining-coating degradation of steel piping, piping components, and piping elements exposed to raw water. The applicant proposes to manage this aging process for the component under consideration through the use of its AMP "External Surfaces Monitoring" (LRA B.3.21). The GALL Report recommends that this aging process be managed through the use of the AMP "Open Cycle Cooling Water System" (GALL Report Vol. 2 XI.M20). The applicant proposes that the aging management review items are consistent with the GALL Report in terms of material, environment, and aging effect but a different AMP is credited (Generic Note E).

Issue

In its review of LRA components subordinate to Table 3.3.1, Item 76 for which the applicant assigned Generic Note E and for which the applicant proposes to use the LRA

AMP "External Surfaces Monitoring," the staff noted that the applicant selected a GALL Report item for which the Open Cycle Cooling Water AMP was the recommended AMP. The staff also noted that for the subordinate item the applicant identifies the component as traveling screens. The staff further noted that at least some portions of the intakes and traveling screens are scoped into license renewal as safety related components. In the absence of evidence to the contrary, the staff must find that the applicant appropriately selected an AMR item for which the recommended AMP is "Open Cycle Cooling Water". The Open Cycle Cooling Water AMP implements Generic Letter (GL) 89-13 for license renewal. GL 89-13 contains 5 actions to be undertaken by license holders. Two of these actions, monitoring for corrosion and monitoring for the presence of biofouling appear to be specifically applicable to traveling screens.

Enclosure 1 to GL 89-13 specifically cites inspection of the intake structure, of which the traveling screens appear to be a part, to detect biofouling. While it is clear to the staff that the applicant's external surfaces monitoring program is designed to detect loss of material from external surfaces such as the traveling screen and it is also clear that in the process of inspecting the screens for loss of material, the presence of biofouling would be detected, it is not clear to the staff that the external surfaces monitoring program will be fully effective in managing the aging of these components.

Request

Please revise the AMR items to indicate that the aging of the components under consideration will be managed using the Open Cycle Cooling Water AMP or describe why the Open Cycle Cooling Water AMP is not applicable to these components or justify why the External Surfaces Monitoring Program will be fully effective in managing the aging of these components.

DAEC Response to RAI 3.3.2.1-a

DAEC concurs that the Open Cycle Cooling Water System Program is the appropriate program for the traveling screen units. DAEC relies on the Open Cycle Cooling Water System Program to monitor for corrosion and the presence of biofouling at the Intake and Traveling Screens. Accordingly, the LRA is changed as follows:

In LRA Table 3.3.2-16, Summary of Aging Management Review Results Intake and Traveling Screens, on page 3.3-163, in line item Structures, buildings (traveling screen units) with an environment of raw water (external), the Aging Management Program is changed to Open Cycle Cooling Water System Program, and the Notes entry is changed to A.

RAI 3.3.2.1-d1

Background

LRA Table 3.3.1, Item 3.3.1-79 and SRP-LR Table 3.3-1 ID 79 address the loss of material due to pitting and crevice corrosion as well as fouling of stainless steel piping, piping components, and piping elements exposed to raw water. In Item 3.3.1-79, the applicant proposes to manage this aging process through the use of its AMP "Open Cycle Cooling Water" (LRA B 3.33). In items subordinate to Item 3.3.1-79, the applicant proposes to manage this aging process through the use of its AMPs "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" (LRA B.3.28), "External Surfaces Monitoring" (LRA B.3.21), "Bolting Integrity" (LRA B.3.6) and Open Cycle Cooling Water (LRA B 3.33).

Issue

In its comparison of LRA Item 3.3.1-79 with its subordinate items the staff noted LRA Item 3.3.1- 79 lists "Open Cycle Cooling Water" as the only AMP used for this LRA item. The staff also noted that subordinate items list other AMPs. It is not clear to the staff whether LRA Item 3.3.1-79 is missing AMPs or whether the subordinate items contain AMPs which are not being used.

Request

Please modify LRA Item 3.3.1-79 to include all AMPs being utilized or modify the subordinate items to indicate that only the Open Cycle Cooling Water AMP is being used.

DAEC Response to RAI 3.3.2.1-d1

In LRA Table 3.3-1, Summary of Aging Management Evaluations in Chapter VII of NUREG-1801 Auxiliary Systems, line item 3.3.1-79, the Discussion entry is revised in its entirety to read as follows:

> Loss of material of stainless steel piping, piping components, and piping elements exposed to raw water is managed by the Open-Cycle Cooling Water System Program, Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program, Bolting Integrity Program, and External Surfaces Monitoring Program at DAEC.

RAI 3.3.2.1-d2

Background

LRA and SRP Tables 3.3.1, Item 79, address the loss of material due to pitting and crevice corrosion as well as fouling of stainless steel piping, piping components, and piping elements exposed to raw water. The applicant proposes to manage this aging process through the use of its AMP "External Surfaces Monitoring" (LRA B.3.21). The GALL Report recommends that this aging process be managed through the use of the AMP "Open Cycle Cooling Water System" (GALL Report Vol. 2 XI.M20). The applicant proposes that the aging management review items are consistent with the GALL Report in terms of material, environment, and aging effect but a different AMP is credited (Generic Note E).

Issue

In its review of LRA components subordinate to Table 3.3.1, Item 79 for which the applicant assigned Generic Note E and for which the applicant proposes to use the LRA AMP "External Surfaces Monitoring" the staff noted that the applicant selected a GALL Report item for which the Open Cycle Cooling Water AMP was the recommended AMP. The staff also noted that for the subordinate item the applicant identifies the component as filter, screens, and strainer. These components are included in LRA Table 3.3.2-16 which includes the intake and traveling screens. The staff further noted that at least some portions of the intakes and traveling screens are scoped into license renewal as safety related components. In the absence of evidence to the contrary, the staff must find that the applicant appropriately selected an AMR item for which the recommended AMP is "Open Cycle Cooling Water". The Open cycle cooling water AMP implements GL 89-13 for license renewal. GL 89-13 contains five actions to be undertaken by license holders. Two of these actions, monitoring for corrosion and monitoring for the presence of biofouling appear to be specifically applicable to traveling screens. Enclosure 1 to GL 89-13 specifically cites inspection of the intake structure, of which the traveling screens appear to be a part, to detect biofouling. While it is clear to the staff that the applicant's external surfaces monitoring program is designed to detect loss of material from external surfaces such as the traveling screen and it is also clear that in the process of inspecting the screens for loss of material, the presence of biofouling would be detected, it is not clear to the staff that the external surfaces monitoring program will be fully effective in managing the aging of these components.

Request

Please revise the AMR items to indicate that the aging of the components under consideration will be managed using the Open Cycle Cooling Water AMP or describe why the Open Cycle Cooling Water AMP is not applicable to these components or justify why the External Surfaces Monitoring program will be fully effective in managing the aging of these components.

DAEC Response to RAI 3.3.2.1-d2

DAEC relies on the Open Cycle Cooling Water System Program to monitor for corrosion and biofouling at the Intake and Traveling Screens. The reference to the External Surfaces Monitoring Program for these components in LRA Table 3.3.2-16 was incorrect. Accordingly, the LRA is revised as follows:

In LRA Table 3.3.2-16, Summary of Aging Management Review Results Intake and Traveling Screens, on page 3.3-161, in the line item Filter, screens, strainer with an Intended Function of Filter, the Aging Management Program entry is changed to Open-Cycle Cooling Water System Program, and the Notes entry is changed to A.

RAI 3.3.2.2-1

Background

In LRA Tables 3.3.2-18 (pages 3.3-172, 174 and 175) and 3.3.2-23 (pages 3.3-195, 196 and 198), the applicant addresses the aging management review (AMR) items of loss of material due to pitting, crevice and galvanic corrosion in the copper and copper alloy heat exchanger, condenser, cooler, fan coil, pipe, pipe fitting, hoses, tubes, rupture disk, valve, and damper in the plant ventilation system and reactor building heating, ventilation and air conditioning system, respectively.

The applicant states that the components of the AMR items are exposed to treated water (internal) and related with LRA Table 3.3-1, Item 3.3.1-31 that requires further evaluation of detection of aging effects. Using plant-specific Note 219, the applicant also states that galvanic corrosion is not applicable to the components since it is not in contact with metal higher in the galvanic series.

The staff noted that whereas the Generic Aging Lessons Learned (GALL) Report recommends GALL Aging Management Program (AMP) XI.M2, "Water Chemistry" and GALL AMP XI.M32, "One-Time Inspection" for acceptable verification of the water chemistry program's effectiveness, the applicant credits the "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program" (LRA Section B.3.28).

Issue

The applicant's aging management described in the LRA does not include water chemistry control to minimize adverse effects of the environment on the degradation of the components.

Request

1. Clarify whether the applicant's aging management for the AMR items includes water chemistry control to minimize adverse effects of the environment on the degradation of the components. If the water chemistry is controlled to manage the aging effects of the AMR items, provide how the water chemistry is controlled to manage the aging effects.

2. If water chemistry control is not performed to minimize the environmental effect on loss of material in the components, justify why the aging management approach

without water chemistry control is adequate to manage the aging effects. Please, include the operating experience as part of the RAI response if applicable.

DAEC Response to RAI 3.3.2.2-1

The copper alloy components listed in LRA Tables 3.3.2-18 and 3.3.2-23 are piping components, valves and heat exchanger tubes contained in the plant ventilation and reactor building heating systems. The treated water used in these systems is supplied by the demineralized water systems. There are water chemistry controls for the purity of this make-up water, and oxygen scavenging chemicals are maintained in these heating systems to reduce internal corrosion of these components.

The XI.M2 Water Chemistry Program for boiling water reactors specifies the use of EPRI guidelines to maintain the water chemistry in the reactor water, systems directly connected to the reactor, the feedwater and condensate systems and the control rod drive system. The water quality in the heating loop is not maintained to these standards.

The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components was chosen to replace the XI.M2 program for these heating systems. The program will visually inspect these copper alloy components to ensure that existing environmental conditions are not causing metal degradation, and that the component's intended function (to not impair the intended function of any safety related equipment due to spatial interactions) is maintained during the period of extended operation.

RAI 3.3.2.2-2

Background

In LRA Table 3.2.2-4 (page 3.2-46), the applicant addresses the AMR item of reduction of heat transfer due to fouling in the admiralty brass heat exchanger, condenser, cooler and fan coil of the reactor core isolation cooling system in the engineered safety features. The applicant states that the components of the AMR item are exposed to treated water (internal) and related with LRA Table 3.4-1, Item 3.4.1-9 that requires further evaluation of detection of aging effects. The applicant also states that the consistency note for the AMR item is Note A, which means that the AMR item is consistent with the GALL item for component, material, environment and aging effect and the applicant's AMP is consistent with the GALL AMP.

Issue

However, the staff noted that where the GALL Report recommends GALL AMP XI.M2, "Water Chemistry" and GALL AMP XI.M32, "One-Time Inspection" for acceptable verification of the water chemistry program effectiveness, the applicant credits the Lubricating Oil Analysis Program (LRA Section B.3.30) and the One-Time Inspection Program (LRA Section B.3.32) in contrast with the consistency Note A the applicant claimed for the AMR item.

Request

1. Clarify why the Lubricating Oil Analysis Program is credited for the AMR item instead of the Water Chemistry Program in contrast with the consistency Note A that the applicant claimed for the AMR item.

DAEC Response to RAI 3.3.2.2-2

The Lubricating Oil Analysis Program was listed in error. The correct programs for the Reactor Core Isolation Cooling heat exchanger admiralty brass tubes exposed to treated water in LRA Table 3.2.2-4 are the Water Chemistry Program and the One-Time Inspection Program.

Accordingly, in LRA Table 3.2.2-4, Summary of Aging Management Review Results, Reactor Core Isolation Cooling System, on page 3.2-46, in the line item for Heat exchanger, condenser, cooler, fan coil with a material of Admiralty brass in a treated water (internal) environment and an aging effect requiring management of Heat transfer degradation, the Aging Management Program entry is changed from Lubricating Oil Analysis Program to Water Chemistry Program.

RAI 3.3.2.2-3

Background

In LRA Table 3.3.2-1 (pages 3.3-67 and 69), the applicant addresses the AMR items of loss of material due to pitting and crevice corrosion in the copper alloy components of the auxiliary heating boiler. The applicant states that the components of the AMR items are exposed to treated water (internal) and related with LRA Table 3.4-1, Item 3.4.1-15 that requires further evaluation of detection of aging effects.

In relation to LRA Table 3.4-1, Item 3.4.1-15, the applicant states that the consistency note for the AMR items is Note E, which means that the material, environment, and aging effect are consistent with the GALL Report, but a different AMP is credited. The staff noted that where the GALL Report recommends GALL AMP XI.M2, "Water Chemistry" and GALL AMP XI.M32, "One-Time Inspection" for acceptable verification of the water chemistry program effectiveness, the applicant credits the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program (LRA Section B.3.28).

Issue

The staff found a need to clarify whether water chemistry control is performed to minimize the adverse effect of the treated water environment on loss of material in the components.

Request

1. Clarify whether water chemistry control is performed to minimize the adverse effect of the environment on loss of material in the copper alloy components of the auxiliary heating boiler as recommended in the GALL Report.

2. If water chemistry control is not performed to minimize the environmental effect on loss of material in the components, justify why the aging management approach without water chemistry control is adequate to manage the aging effects. Also include the operating experience as part of the RAI response if applicable.

DAEC Response to RAI 3.3.2.2-3

As discussed in the response to RAI 3.3.2.2-1 above, GALL AMP XI.M2 and the DAEC Water Chemistry Program apply to water chemistry control of reactor water and systems which communicate with the reactor. The auxiliary heating boiler does not contain reactor water and does not communicate with the reactor. The auxiliary heating boiler is in scope for 10 CFR 54.4(a)(2) with an intended function of leakage boundary. NUREG-1801 item VIII.A-5 was chosen because of the structure, material, and environment match, not because the auxiliary boiler is part of the steam turbine system.

Water chemistry control for the auxiliary heating boiler and heat loop is maintained in accordance with plant chemistry procedures. While these chemistry controls are intended to control corrosion in the system, they are not equivalent to water chemistry controls of reactor grade water. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program was chosen for aging management of the Auxiliary Heating Boiler System because it is the most appropriate program for this system.

RAI 3.3.2.2.3.2-1

Background

SRP-LR Section 3.3.2.2.3.2 states that cracking due to SCC could occur in stainless steel and stainless clad steel heat exchanger components exposed to treated water greater than 60°C (>140°F) and the GALL Report recommends further evaluation of a plant-specific AMP to ensure that these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of this SRP-LR.) In the LRA the applicant credits the One Time Inspection and Water Chemistry programs for management of SCC.

Issue

The staff noted that one-time inspection is used to verify that material degradation is not occurring or is occurring so slowly such that the component will be able to perform its intended function during the period of extended operation.

Request

Please provide additional information demonstrating that SCC is not expected or occurring slowly such that the intended function of heat exchangers is not compromised during the period of extended operation and therefore a one-time inspection is adequate to manage SCC and a plant-specific program in accordance with Technical Position RLSB-1 is not necessary.

DAEC Response to RAI 3.3.2.2.3.2-1

SCC is not expected to occur in stainless steel heat exchanger components exposed to treated water greater than 60°C (>140°F) since they are being managed with the Water Chemistry Program. As discussed in LRA Sections B.3.12 and B.3.39, the Water Chemistry Program manages the aging effects of loss of material due to corrosion and cracking (SCC) by monitoring and controlling water chemistry in accordance with EPRI water chemistry guidelines. The program uses Hydrogen Water Chemistry (HWC) and Noble Metal Chemical Addition (NMCA) as preventive actions to minimize the susceptibility of exposed components to cracking due to SCC. The effectiveness of the Water Chemistry Program will be confirmed by the One-Time Inspection Program through inspections of a representative sample of components, including susceptible locations such as areas of low or stagnant flow, using visual and ultrasonic inspection techniques. Therefore, the use of the Water Chemistry Program with the One-Time Inspection Program provides both preventive and inspection attributes, and precludes the need for an additional plant-specific program.

As discussed in LRA Sections B.3.12 and B.3.39, DAEC Operating Experience demonstrates that the current programs are effective in managing the aging effect of cracking due to SCC in the Hydrogen Water Chemistry and Reactor Water Cleanup piping.

For clarity, the following changes are being made to the LRA.

In LRA Section 3.3.2.3.2 on page 3.3-27, the last sentence is revised to read as follows:

> The effectiveness of the Water Chemistry Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program, including susceptible locations such as areas of low or stagnant flow, using visual and ultrasonic techniques.

In LRA Table 3.3-1, Summary of Aging Management Evaluations in Chapter VII of NUREG-1801, Auxiliary Systems, on page 3.3-45, the Discussion entry of line item 3.3.1-5 is revised to read:

> Further evaluation is provided in LRA Subsection 3.3.2, NUREG-1800 Section 3.3.2.2.3, Item 2

RAI 3.3.2.2.5.1-01

Background

GALL Report, Volume 1, Table 3, Item 11, and SRP-LR Subsection 3.3.2.2.5.1 state that hardening and loss of strength due to elastomer degradation may occur in elastomer seals and components in heating and ventilation systems exposed to air-indoor uncontrolled (internal/external). The GALL Report recommends further evaluation of a plant-specific program to ensure that these aging effects are adequately managed.

In lieu of providing a plant-specific program to manage these aging effects in elastomer seals and components in heating, ventilation, and air conditioning (HVAC) systems, the LRA Section 3.3.2.2.5, parapraph 1, states that this item is not applicable because elastomer flexible connections of heating and ventilation systems exposed to air – indoor uncontrolled (internal/external) are periodically replaced.

Issue:

Information provided in the LRA does not provide sufficient detail for the staff to determine whether the periodic replacement of elastomer flexible connections in heating and ventilation systems is sufficient to ensure that these components will remain capable of performing their intended function during the period of extended operation.

Request:

1. Describe the basis used to determine the periodicity upon which these components are replaced (e.g., manufacturer's recommendation, plant operating experience, material qualification, examination of component condition).

2. Please make your response sufficiently broad to encompass a similar issue in LRA Section 3.3.2.2.13, where the aging effect is loss of material due to wear in elastomer seals and components in the HVAC systems.

DAEC Response to RAI 3.3.2.2.5.1-01

Part 1

Replacement periodicity is based on plant operating experience, component examinations, engineering judgment, and replacement periodicity for similar components. DAEC has conservatively assigned the replacement periodicity of sixteen years. This periodicity for replacement of applicable HVAC elastomer flexible connections is a reasonable frequency to ensure the components' intended functions are maintained during the period of extended operation.

Part 2

DAEC System Engineers monitor HVAC elastomer components for cracking, flexibility and overall component condition as part of their system walk down, and align with preventive maintenance actions appropriately. Recent examinations of the entire exposed surface, both visually and using physical manipulation, confirm that applicable HVAC elastomer components are not degraded, are installed correctly, and are in good condition.

Review of the DAEC operating experience revealed that no degradation has been identified at DAEC for the applicable HVAC elastomer components exposed to air-indoor uncontrolled (internal / external) environment.

Elastomers of flexible connections of HVAC systems exposed to air-indoor uncontrolled (internal / external) environment are periodically replaced; therefore, Section 3.3.2.2.13 is not applicable to DAEC.

RAI 3.3.2.2.7-1

Background

In LRA Section 3.3.2.2.7.3, the applicant stated that loss of material due to general, pitting and crevice corrosion for carbon steel and stainless steel diesel exhaust piping and components exposed to diesel exhaust is managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

Issue

In LRA B.3.28, the applicant stated that its new Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is consistent with GALL AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," with no exceptions or enhancements. However, the GALL AMP XI.M38 only addresses steel material.

Request

Please justify why the inclusion of stainless steel material in the scope of the program is not considered an exception or an enhancement to the GALL AMP XI.M38. Also please provide the acceptance criteria used for detecting loss of material in stainless steel material.

DAEC Response to RAI 3.3.2.2.7-1

The DAEC LRA contains several instances in which the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program was credited for providing aging management for components made from stainless steel as well as carbon steel.

NUREG-1801, XI.M38, Program Description describes the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program as, "The program consists of inspections of the internal surfaces of steel piping, piping components, ducting, and other components that are not covered by other aging management programs." Element 1, Scope of Program, of the NUREG-1801 program description states: "The program visual inspections include internal surfaces of steel piping, piping elements, ducting, and components in an internal environment (such as indoor uncontrolled air, condensation, and steam) that are not included in other aging management programs for loss of material." The concept behind this program is to provide an inspection program for miscellaneous components subject to loss of material that do not reasonably fit within other aging management programs. The program, as designed, is fully applicable to components of various materials; its effectiveness as an aging management program is not limited to carbon steel.

Consistent with this definition, DAEC has selected this NUREG-1801 program to manage loss of material in metallic components that are not included in other aging management programs. In addition to steel (e.g., carbon steel, galvanized steel) components, the Duane Arnold Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program manages metallic components made of stainless steel, copper alloy, nickel alloy, and aluminum alloy for loss of material. Even though materials other than steel are not explicitly mentioned in NUREG-1801 for this program, the visual inspections conducted under this program are capable of identifying and managing loss of material for all the components within the scope of the program, whether made of steel or other metallic materials. Going beyond the NUREG-1801 description to apply the program to additional metallic materials is not considered an exception or an enhancement to NUREG-1801 as these terms are defined in NUREG-1800, Section 3.0.1.

The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program relies on established visual examination techniques for the detection of loss of material due to corrosion and loss of material due to fouling. Inspections are performed at a frequency sufficient for the detection of aging effects prior to the loss of component intended function. The presence of corrosion or fouling on the internal surfaces of metallic materials will be identifiable as surface discontinuities and imperfections or localized discoloration. Surface discontinuities include indications such as rust, scale/deposits (debris), pitting, and coating degradation. For painted or coated surfaces, the visual inspections will confirm the integrity of the coating as a method to manage the effects of corrosion of the underlying metal surface. Inspection locations will be chosen to include conditions susceptible to the aging effects of concern (e.g., stagnant and/or low flow locations). Inspections are conducted on an ongoing basis at established intervals to assure timely detection of degradation.

Based on the discussion above, the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is capable of managing loss of material in the components made of carbon steel, stainless steel, galvanized steel, nickel alloy, copper alloy and aluminum alloy components which are subject to the program.

RAI 3.3.2.2.9-1

Background

LRA Section 3.3.2.2.9, Loss of Material Due to General, Pitting, Crevice, Microbiologically Influenced Corrosion (MIC) and Fouling, Item 1 states that carbon steel piping, piping components, piping elements, and tanks exposed to fuel oil using the Fuel Oil Chemistry Program and One Time Inspection Programs. In the LRA Table 3.3-1, Item 3.3.1-20 the applicant credits the One Time Inspection Program and the Fuel Oil Chemistry program to manage loss of material of Steel piping, piping components, piping elements, and tanks exposed to fuel oil. Further evaluation is provided in LRA Subsection 3.3.2.

Issue

However, the Plant-Specific Note 230 of LRA page 3.3-268 states that loss of material due to fouling does not apply to carbon steel components exposed to fuel oil that are not tanks and do not have a potential for particulate fouling (sediment, silt, dust, and corrosion products). The staff noted that the sources of fuel oil for carbon steel components exposed to fuel oil that are not tanks are various tanks where particulate and water have been present and therefore there is the potential that contaminants could accumulate in piping systems etc., particularly in crevices, that could promote fouling.

Request

Please provide additional information demonstrating that fouling does not apply to carbon steel components exposed to fuel oil that are not tanks and do not have a potential for particulate fouling are not applicable at DAEC.

DAEC Response to RAI 3.3.2.2.9-1

As discussed in NUREG-1800 Section 3.3.2.2.9.1, loss of material due to various aging mechanisms could occur in steel components exposed to fuel oil. This section states, "The existing aging management program relies on the fuel oil chemistry program for monitoring and control of fuel oil contamination to manage loss of material due to corrosion or fouling. Corrosion or fouling may occur at locations where contaminants accumulate. The effectiveness of the fuel oil chemistry control should be verified to ensure that corrosion is not occurring."

At DAEC, consistent with NUREG-1800, the aging effect of loss of material is managed by the Fuel Oil Chemistry Program (LRA Section B.3.25) which monitors and controls fuel oil for potential contaminants. In addition, the One-Time Inspection Program (LRA Section B.3.32) will confirm the effectiveness of fuel oil chemistry controls by performing a one-time inspection of selected components determined to be most susceptible to the potential corrosion mechanisms.

It has been determined that LRA Note 230 is unclear and unnecessary. Accordingly, Note 230 is hereby deleted from the LRA and replaced with the words, "Not used." The LRA sections affected by this change are:

LRA Section 3.1 Plant-Specific Notes on page 3.1-78
LRA Section 3.2 Plant-Specific Notes on page 3.2-72
LRA Section 3.3 Plant-Specific Notes on page 3.3-268
LRA Section 3.4 Plant-Specific Notes on page 3.4-74

Note 230 is also deleted from LRA Tables 3.3.2-28 and 3.3.2-29 in all locations where the note currently appears. The LRA pages affected by this change are as follows:

LRA Table 3.3.2-28 on pages 3.3-223 through 3.3-226
LRA Table 3.3.2-29 on pages 3.3-229 through 3.3-231, 3.3-237, 3.3-241, 3.3-242, and 3.3-244 through 3.3-246.

In addition, in LRA Section 3.3.2.2.9.1 on page 3.3-40, the first sentence is revised to read as follows:

> At Duane Arnold, carbon steel piping, piping components, piping elements, and tanks exposed to fuel oil are managed for loss of material due to general, crevice, pitting, and microbiologically influenced corrosion and fouling by the Fuel Oil Chemistry Program.

RAI 3.3.2.2.10.2-1

<u>Background</u>

LRA and SRP Table 3.3.1, Item 23 address loss of material due to general, pitting, and crevice corrosion of stainless steel and steel with stainless steel cladding heat exchanger components exposed to treated water. LRA and SRP Table 3.3.1, Item 24 address loss of material due to general, pitting, and crevice corrosion of stainless steel and aluminum piping, piping components and piping elements exposed to treated water. These items recommend further evaluation on the part of the staff and refer to LRA and SRP Sections 3.3.2.2.10.2. The applicant proposes to manage this aging process through the use of its AMPs "Water Chemistry" (LRA B.3.39), "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" (LRA B.3.28), and "One Time Inspection" (LRA B.3.32). The GALL Report recommends that this aging process be managed through the use of "Water Chemistry" (GALL Vol. 2 XI.M2) and "One Time Inspection (GALL Vol. 2 XI.M32) AMPs. The applicant proposes that the aging management review items associated with Table 3.3.1, Items 23 and 24 are fully consistent with the GALL Report (Generic Note A), consistent with the GALL report except some exceptions are taken (Generic Note B), or consistent with the GALL Report for material, environment, and aging effect but a different AMP is credited (Generic Note E).

Issue

The staff reviewed LRA Table 3.3.1 Item 23 in accordance with SRP Section 3.3.2.2.10.2. The staff noted that the applicant applied Generic Note B to these items. This generic note states that exceptions have been taken to the AMP. The staff checked both of the proposed AMPs, Water Chemistry and One Time Inspection, and found that both indicate that no exception has been taken. While the staff accepts the concept of using these to AMPs to manage the aging under consideration, it cannot concur with this proposal until the issue of exceptions has been resolved.

The staff reviewed subordinate items to LRA Table 3.3.1, Item 24 for which the applicant assigned Generic Note E in accordance with SRP Section 3.3.2.2.10.2. The staff noted that the water chemistry programs are limited to high purity water, i.e., boiling-water reactor (BWR) water chemistry, pressurized water reactor (PWR) primary water chemistry, and PWR secondary water chemistry. The staff also noted that the definition of treated water as contained in both the GALL Report and the LRA is less restrictive, i.e., it is possible to have water which meets the definition of treated water which does not meet the scope of the Water Chemistry programs. The staff further noted that the systems for which the applicant assigned Generic Note E may contain treated water but may not contain water meeting the scope of the water treatment program. While the staff would normally consider this sufficient to agree with the applicant's proposal to use an AMP other than Water Chemistry, in this case the staff notes that there are items in the systems where the staff does not expect high purity water, e.g., heating and ventilation systems, where the applicant proposes to manage aging through the use of the Water Chemistry program. This apparent contradiction merits further inquiry on the part of the staff. If the Generic Note E items are components exposed to treated water other than that in scope of the Water Treatment AMP, the staff concurs with the applicant's proposal to manage aging using the Inspection of Internal surfaces program because the aging effects under consideration can be detected by visual inspection and the proposed program contains appropriate visual inspection procedures.

Request

Please identify the exceptions being taken to the Water Chemistry and/or One Time Inspection AMPs, as indicated in Table 3.3.2-24 and justify why such exceptions do not affect the ability of these AMPs to manage aging in the present case or correct the generic note for these items.

Please clarify whether the "Water Chemistry" program is being used only for items exposed to high purity water and the Inspection of Internal Surfaces is being used only to address items exposed to treated water of lesser purity. If this is not the case, justify the use of these programs for the specific situations being considered.

DAEC Response to RAI 3.3.2.2.10.2-1

In LRA Table 3.3.2-24, for component type Heat exchanger, condenser, cooler, fan coil referenced to Table 3.3-1 Item 3.3.1-23, the Notes entry "B" is incorrect. Accordingly, the Notes entry is corrected as follows:

In LRA Table 3.3.2-24, Summary of Aging Management Review Results, Reactor Water Cleanup System, on page 3.3-203, for component type Heat exchanger, condenser, cooler, fan coil, with an environment of Treated water (internal), the Notes entry is changed to "A".

A review of the subordinate items to LRA Table 3.3-1, item 3.3.1-24, for which Plant Specific Note "E" was assigned, confirmed that the Water Chemistry Program was only being used for high purity water items, if any. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program was being used for items exposed to treated water of lesser purity for which the Water Chemistry Program did not apply. The results of this review indicated that the appropriate aging management program and Note "E" were correctly assigned.

For clarity, LRA Section 3.3.2.2.10.2 on page 3.3-41 is revised to incorporate the following additional paragraph:

> At Duane Arnold, some stainless steel components are exposed to treated water which is not high purity, reactor grade treated water. As a result, these components are not managed by the Water Chemistry Program. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program was selected to manage the aging effects for these components.

RAI 3.3.2.2.12-1

Background

In LRA Section 3.3.2.2.12, "Loss of Material Due to Pitting, Crevice, and Microbiologically-Influenced Corrosion", Item 1 states that loss of material for copper alloys exposed to fuel oil is managed using the Fuel Oil Chemistry and One Time Inspection Programs. In the LRA Table 3.3.1, Item 3.3.1-32, the applicant credits the One Time Inspection Program and the Fuel Oil Chemistry Program to manage loss of material of copper alloy and bronze pipe, pipe fittings, hoses, tubes, rupture disks, valves, exposed to fuel oil, and references plant-specific Notes 202 and 225. Additionally, in LRA Section 3.2.2.2.3, "Loss of Material Due to Pitting, Crevice, and Microbiologically-Influenced Corrosion", Item 4 states that loss of material for copper alloys exposed to lubricating oil is managed using the Lubricating Oil Analysis and One Time Inspection Programs. In the LRA, the applicant credits the One Time Inspection Program and the Oil Analysis Program to manage loss of material of copper alloy and bronze pipe, pipe fittings, hoses, tubes, rupture disks, valves, exposed to lubricating oil, and references plantspecific Note 225.

Issue

However, the plant-specific Note 225 of LRA page 3.3-268 states that crevice and pitting corrosion are not applicable aging mechanisms for copper alloy components with less than 15% zinc and aluminum bronze components with less than 8% aluminum in fuel oil and lubricating oil environments at DAEC. Also, plant-specific Note 202 on LRA page 3.3-267 states that aging mechanism is in addition to aging mechanisms in NUREG-1801. This may include galvanic corrosion, MIC, wear and/or selective leaching.

Request

Please provide additional information demonstrating that crevice and pitting corrosion of bronze and copper alloys exposed to fuel oil and lube oil are not applicable at DAEC. Also, please justify if selective leaching mechanism could occur, why the LRA Appendix B.3.36, Selective Leaching of Materials Program is not credited.

DAEC Response to RAI 3.3.2.2.12-1

EPRI TR-1010639, Non Class 2 Mechanical Implementation Guideline and Mechanical Tools, Revision 4, dated January 2006, Appendix C - Lubricating Oil and Fuel Oil, provides a methodology for identifying the aging effects in portions of systems and components that may be subjected to an internal environment of either lubricating oil or diesel fuel oil.

Crevice Corrosion

Section 3.1.3 of EPRI TR-1010639 Appendix C states, "Crevice corrosion of copper and copper alloys is a result of oxygen depletion in the crevices such that the crevice metal is anodic relative to metal outside the crevice that is exposed to an oxygen bearing environment. For most copper metals, the location of the attack is generally outside the crevice, immediately adjacent the crevice region. It can result from the accumulation of rust, permeable scales or deposit of corrosion products at the crevice location. Copper zinc alloys with less than 15% Zn exhibit high resistance to crevice corrosion whereas copper zinc alloys with Oil and Fuel Oil greater than 15% Zn are susceptible. When the aluminum content of aluminum copper alloys is greater than 8% the aluminum is present in what is referred to as the "alpha-beta" phase, which is much less resistant to corrosion than the "alpha" phase aluminum present in bronzes containing less than 8% aluminum. Oil and fuel oil are not good electrolytes unless water and other contaminants are present. In flowing systems, even if contaminated, water and contaminants cannot accumulate in crevices to a significant extent and crevice corrosion is not expected to be a significant aging concern under flowing conditions. Crevice corrosion is, therefore, only a concern for stainless steel, aluminum and aluminum alloys, carbon and low allow steel, cast iron, and high zinc (> 15%) and aluminum bronze (> 8% Al) copper alloys under stagnant conditions where water contamination is present."

Pitting corrosion

Section 3.1.4 of EPRI TR-1010639 Appendix C states, "Pitting is an aging mechanism for copper and copper alloys as with most commercial metals. Pitting can occur either as localized or general attack. Localized attack takes the form of various shapes and sizes and is typically concentrated on surface locations at which the protective film has been broken, and where non-protective deposits of scale, dirt, or other substances are present. General pitting takes the form of a roughened and irregular appearance over the entire material surface. Pitting and crevice corrosion are similar corrosion mechanisms, with crevice corrosion sometimes considered localized pitting in a crevice. While copper alloys are generally resistant to pitting and crevice corrosion, copper zinc alloys with greater than 15% Zn are susceptible. Aluminum bronzes with greater than 8% Al are considered susceptible to pitting under stagnant or low flow conditions.

Oil and fuel oil are not good electrolytes, and water and aggressive species are necessary to propagate this corrosion mechanism. Therefore, pitting corrosion is an aging concern for carbon and low-alloy steel, cast iron, stainless steel, aluminum and aluminum alloys, and high zinc (> 15%) and aluminum bronze (> 8% Al) copper alloys under stagnant conditions where water contamination is present."

Selective Leaching

Section 3.1.8 of EPRI TR-1010639 Appendix C states, "Oil and fuel oil are not good electrolytes. The intrusion of moisture into these systems is required for selective leaching to be a concern. As such, selective leaching is an applicable mechanism for gray cast iron, brass and bronze (> 15% Zn) copper alloys, and aluminum bronze (> 8% Al) in oil and fuel oil environments in locations where any moisture can condense and/or collect such as the bottom of tanks and heat exchangers and in low points of the system."

Conclusion

At Duane Arnold crevice corrosion and pitting corrosion in lubricating oil and fuel oil environments are not applicable aging mechanisms because the copper alloy components are less than 15% zinc and the aluminum bronze components are less than 8% aluminum.

The Selective Leaching of Material Program in LRA Section B.3.36 is not credited because at Duane Arnold, brass, bronze and copper alloy components are less than 15% zinc, and aluminum bronze components are less than 8% aluminum.

RAI 3.3.2.3-1

Background

In LRA Table 3.3.2-22 (page 3.3-188), the applicant addresses the AMR item of copper alloy heat exchanger, condenser, cooler and fan coil of the reactor building closed cooling water system in the auxiliary systems that are subject to no aging effect in a lubricating oil (internal) environment. The applicant also indicates that the consistency note for the AMR item is Note I, which means that aging effect in the GALL Report for this component, material and environment is not applicable.

The staff reviewed the AMR item and related information in comparison with GALL Report Vol. 2, Items VII.C1-8 (AP-47) and VII.C2-5 (AP-47) for the copper alloy piping, piping components and piping elements of the open-cycle cooling water system and closed-cycle cooling water system, respectively, in the auxiliary systems. The staff noted that the two AMR items of the GALL Report indicate that the copper alloy components exposed to lubricating oil are subject to loss of material due to pitting and crevice corrosion.

Issue

In relation to the aging effect of loss of material, the staff noted that using plant-specific Note 232, the applicant states that the component does not have the potential for water contamination. The staff found a need to further clarify the technical basis of the applicant's statement.

Request

1. Clarify why the components of the AMR item do not have the potential for water contamination in the lubricating oil. In conjunction to the foregoing request, clarify why the AMR item is not subject to loss of material.

2. If applicable, provide the operating experience that supports the applicant's statement that no potential exists for the water contamination in the lubricating oil. If applicable, include the operating experience in terms of the occurrence of loss of material in the components as part of the RAI response.

DAEC Response to RAI 3.3.2.3-1

This question involves two components, the Control Rod Drive Pump lube oil coolers 1E216A and 1E216B. These are small tube and shell lube oil coolers with lube oil on the shell side and Reactor Building Closed Cooling Water on the tube side. NUREG-1801 item VII.C1-8 does not apply since open cycle cooling water is not involved. The heat exchanger shell material is copper alloy (brass/bronze) with <15% zinc. As discussed in the response to RAI 3.3.2.2.12-1 above, crevice and pitting corrosion are applicable aging effects only if the copper alloy material has >15% Zn. Since the Zn concentration is less than 15%, NUREG-1801 item VII.C2-5 does not apply and the aging effects were properly evaluated.

The review of LRA Table 3.3.2-22 indicated that Note 232 was listed in error for one line item. Accordingly, in LRA Table 3.3.2-22, Summary of Aging Management Review Results Reactor Building Closed Cooling Water System, on page 3.3-188, for line item Heat Exchanger, condenser, cooler, fan coil with a Lube oil (internal) environment, the Notes entry 232, I is changed to 225, I.

RAI 3.3.2.13-1

Background

In the LRA Table 3.3.2-13 the applicant credits the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program to manage loss of material of nickel piping, piping components, and piping elements exposed to raw water.

Issue

However, the GALL Report recommends in VII.C1-13 (AP-53), GALL AMP XI.M20 "Open-Cycle Cooling Water System" to manage loss of material for nickel in raw water. The staff noted that GALL AMP XI.M20 recommends, in the "scope of program", "preventive actions", monitoring and trending", "operating experience" elements, the provisions of NRC GL 89-13. These provisions include visual and nondestructive inspection introduction of biocides, chemical treatments and periodic flushing to manage loss of material in accordance with the applicant commitments under GL 89-13. The staff noted that GALL AMP XI.M38, "Internal Surfaces in Miscellaneous Piping and Ducting Components Program" provides for only visual examinations of components during maintenance procedures for components that are not covered by other AMPs. Additionally the staff noted that GALL AMP XI.M38 provide for preventive actions because it is an inspection program.

Request

Provide justification for not using GALL AMP XI.M38 to manage loss of material nickel components exposed to raw water.

DAEC Response to RAI 3.3.2.13-1

It is assumed that this RAI requests justification for not using NUREG-1801 AMP XI.M20 to manage loss of material in nickel components exposed to raw water rather than XI.M38.

NUREG 1801, Section XI.M20, "Open Cycle Cooling Water System", relies on implementation of the recommendations of NRC Generic Letter (GL) 89-13, "Service Water System Problems Affecting Safety-Related Equipment," to ensure that the effects of aging on the OCCW or service water system will be managed for the period of extended operation.

Generic Letter 89-13 applies to safety-related raw water systems, including the DAEC River Water Supply System, Residual Heat Removal Service Water System and Emergency Service Water System. The General Service Water (GSW) System does not provide raw water to safety-related components and is not in the scope of either GL

89-13 or the Open Cycle Cooling Water Program. GSW is in scope of License Renewal for 10 CFR 54.4(a)(2) with the intended function of leakage boundary (spatial).

The nickel alloy components in the General Service Water System that are in scope of license renewal, are ¾" supply and drain valves (V46-0258 and V46-0259) to Corrosion Monitor 1C713. These components are not within the scope of the Open Cycle Cooling Water System Program, and do not reasonably fit within other aging management programs. Therefore, as discussed in the response to RAI 3.3.2.2.7-1 above, the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is an appropriate program for managing components such as these for loss of material.

RAI 3.4.2.2.4.1-1

Background

LRA and SRP Table 3.4.1, Item 9 address reduction of heat transfer due to fouling of stainless steel and copper alloy heat exchanger tubes exposed to treated water. These items recommend further evaluation on the part of the staff and refer to LRA and SRP Sections 3.4.2.2.4.1. In Section 3.4.2.2.4.1, the applicant states that the steam and power conversion systems at DAEC have no stainless steel or copper alloy heat exchanger tubes in a treated water environment with an intended function of heat transfer and associated aging effect of fouling. The applicant also states that LRA Section 3.4.2.2.4.1 is applied to the High Pressure Coolant Injection and Reactor Core Isolation Cooling Engineered Safety Features Systems which have copper alloy heat exchanger tubes exposed to water. The applicant further states that aging effect loss of heat transfer due to fouling is managed for these heat exchanger tubes by the Water Chemistry Program. The effectiveness of the Water Chemistry Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program, including susceptible locations such as areas of stagnant flow.

Issue

The staff reviewed LRA Table 3.4.1, Item 9 in accordance with SRP Section 3.4.2.2.4.1. In this review the staff noted that two table 2 line items are associated with Table 3.4.1, Item 9. These items are contained in LRA Table 3.2.2-2. Both components are designated heat exchanger, condenser, cooler, fan coil. Both items are admiralty brass and are exposed to treated water. The AMPs for one are Water Chemistry and One Time Inspection. The AMPs for the other are Lubricating Oil Analysis and One Time Inspection. It is unclear to the staff whether the applicant actually proposes to manage the aging of the component which is exposed to water with the Lubricating Oil Analysis program or whether the applicant erred in designating the proposed AMP or whether the applicant erred in designating the environment.

<u>Request</u>

Please clarify the use of the Lubricating Oil Analysis program for components exposed to treated water.

DAEC Response to RAI 3.4.2.2.4.1-1

The two 3.X.2 table references to LRA Table 3.4.1, item 9, are in Table 3.2.2-2 on page 3.2-32 and Table 3.2.2-4 on page 3.2-46. The program entries for this item in Table 3.2.2-2, Water Chemistry Program and One-Time Inspection Program, are correct.

As discussed in the response to RAI 3.3.2.2-2 above, the Lubricating Oil Analysis Program was listed in error in Table 3.2.2-4. The subject line item in LRA Table 3.2.2-4 has been corrected to cite the Water Chemistry Program instead of the Lubricating Oil Analysis Program.

RAI 3.4.2.2.4.2-1

<u>Background</u>

LRA and SRP Table 3.4.1, Item 10 address reduction of heat transfer due to fouling of steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil. These items recommend further evaluation on the part of the staff and refer to LRA and SRP Sections 3.4.2.2.4.2. In Section 3.4.2.2.4.2, the applicant states that the steam and power conversion systems have no heat exchanger tubes in a lubricating oil environment with an intended function of heat transfer and associated aging affect of fouling.

<u>Issue</u>

The staff reviewed LRA Table 3.4.1, Item 10 in accordance with SRP Section 3.4.2.2.4.2. In this review the staff noted that there are no subordinate items to LRA Table 3.4.1, Item 10. However, the staff recalls that Table 3.4.1, Item 9 contains an item which uses the Lubricating Oil Analysis program for aging management for a treated water environment (see RAI 3.4.2.2.4.1). The staff questions whether the appropriate environment for this component is water (in which case the AMP cited is in error) or lube oil (in which case the environment is incorrect and the item may belong in 3.4.1, Item 10).

<u>Request</u>

Please clarify whether the environment and proposed AMP for this component and, based on this clarification whether LRA section is applicable or not.

DAEC Response to RAI 3.4.2.2.4.2-1

The line item in question is for the RCIC Lube Oil Cooler (1E206) tubes. Treated water flows through the cooler tubes and lubricating oil flows through the shell.

As discussed in the responses to RAIs 3.3.2.2-2 and 3.4.2.2.4.1-1 above, the Lubricating Oil Analysis Program was listed in error in Table 3.2.2-4. The subject line item in LRA Table 3.2.2-4 has been corrected to cite the Water Chemistry Program instead of the Lubricating Oil Analysis Program.

RAI 3.4.2.4-1

Background

In the LRA Table 3.4.2-4, the applicant credits the One Time Inspection Program to manage loss of fracture toughness of cast austenitic stainless steel that are exposed to reactor coolant >250°C (>482°F).

Issue

However, the GALL Report recommends in IV.C1-2 (R-52) GALL AMP XI.M12, "Thermal Aging Stress Corrosion Cracking," to manage loss of fracture toughness of cast austenitic stainless steel in reactor coolant >250°C (>482°F). GALL AMP XI.M12 provides for characterization and evaluation of loss of fracture. The staff noted that one time inspection is used for verification that an aging effect is not occurring or occurring at such a slow rate that it will not cause the loss of intended function during the period of extended operation. The staff does not consider loss of fracture toughness of CASS in reactor coolant unlikely. The staff noted that the applicant's One Time Inspection Program does not indicate how loss of fracture toughness will be detected and how loss of fracture toughness, if discovered, will be evaluated.

Request

Provide justification for not subjecting components to the recommendations of GALL AMP XI.M12.

DAEC Response to RAI 3.4.2.4-1

The LRA Table 3.4.2-4 items referred to in this RAI are the main steam line flow elements. At DAEC, the main steam line flow elements are fabricated from CASS material and are welded inside carbon steel pipe. The flow elements are not a pressure boundary and are not subject to tensile stress that would promote stress corrosion cracking. Therefore, stress corrosion cracking is not a potential aging effect for these components.

In addition, since the main steam line flow elements are made from A451, CPF8 centrifugally cast CASS material with a delta ferrite content <20%, these components are not susceptible to thermal aging embrittlement in accordance with the criteria contained in NUREG-1801 Section XI.M13 and the letter from Christopher Grimes, USNRC, to the Nuclear Energy Institute dated May 19, 2000. The LRA should not have indicated that cracking and loss of fracture toughness were aging effects requiring management.

As discussed in the response to RAI 3.1.2.2.7-1 above, the LRA treatment of the main steam line flow elements has been clarified to remove the discussions related to the management of cracking and loss of fracture toughness.

RAI 3.4-7

Background

According to information provided in DAEC Relief Request MC-R001, 14,229 repairs have been performed on the torus shell surface until 2005. The torus shell was initially coated in 1973 and recoated in 1985.

Issue

The large number of repairs, excessive zinc depletion, pitting at more than 14,229 locations indicates that integrity of the torus coating cannot be relied upon during the period of extended operation. Normal life of the torus coating is less than 20 years. At the start of period of extended operation, it will be 29 years since the torus was recoated in 1985.

Request

Provide the following information:

1. How many repairs have been performed to the Duane Arnold torus shell coating until now.

2. How many of these repairs were performed at locations where the torus base metal thickness had been reduced by greater than 10 percent.

3. How many of the repairs required augmented inspection (including UT examination) in accordance with ASME Section XI, subsection IWE Code, Table 2500-1. Articles IWE- 3122.3.b, IWE 3200, IWE 3511.3 and IWE-2420 of the ASME Code requires augmented examination of the area containing flaw or degradation if the base metal thickness is reduced by greater than 10 percent.

4. The bottom half of interior surface is not easily accessible for visual examination. Therefore, does Duane Arnold has any plans to perform UT examination from the

torus exterior surface at a number of randomly selected locations to demonstrate with 95 percent confidence that 95 percent of the torus surface has base metal thickness greater than 90 percent of the nominal thickness?

5. Are there any plans to recoat the torus since the last recoating was performed 24 years ago?

The staff needs the above information to confirm that the effects of aging of the torus will be adequately managed so that that it's intended function will be maintained consistent with the current licensing basis for the period of extended operation as required by 10 CFR 54.21(a).(3).

DAEC Response to RAI 3.4-7

Part 1

The total number of coating repairs since 1995 is 15,487.

Part 2

Only one pit exceeded the maximum allowable pit depth of 0.053 inches (10% of 0.534 inch nominal shell thickness). That pit measured 0.056 inches in depth and 0.25 inches in diameter. The pit was found during an examination in 2005. The pit was dispositioned in the Corrective Action Program as acceptable without repair. The coating around the pit was repaired.

Part 3

There have been no repairs of pits on the torus. The overall average pit depths are less than 0.020 inch and flaws or degradation does not approach the 10% thickness loss of material. Coating repairs were made at the pit locations to correct the coating degradation which enabled the pits to form.

The one pit that exceeded the 10% pit depth allowable was evaluated in the Corrective Action Program and found to be acceptable by engineering evaluation.

Part 4

The bottom half of the interior surface of the torus is accessible and is routinely inspected using divers. No UT exams are planned unless visual examination results indicate a need.

Part 5

The current plan has recoating of the torus scheduled in 2012. This schedule is dependent on the results of ongoing inspections.

RAI 3.5.2.1-1

Background

In LRA Table 3.5.2-8, on page 3.5-93, the applicant has credited the Fire Protection Program to manage cracking of concrete masonry units in air-indoor uncontrolled exterior environment. The applicant referenced GALL Report Item III.A3-11, LRA Table 3.5.1, Item 3.5.1-43 and Footnote E.

Issue

In LRA Table 3.5.1, line 3.5.1-43, discussion column states that this program is consistent with NUREG-1801 and that the Structures Monitoring Program will confirm the absence of aging effects requiring management. However, there is no mention of the Fire Protection Program. Furthermore, GALL Report Item III.A3-11, recommends GALL AMP XI.S5, "Masonry Wall Program."

Request

1. Please resolve the discrepancy between LRA Tables 3.5.1 and 3.5.2-8 and confirm if the Fire Protection Program should have been included in Table 3.5.1, Item 3.5.1-43 discussion column.

2. Since GALL AMP XI.S5 does not recommend a specific frequency, please confirm that if the Fire Protection Program is used in lieu of GALL AMP XI.S5, that a frequency of once every refueling outage as recommended by GALL AMP XI.M26, "Fire Protection," is maintained for visual inspection of concrete masonry units.

3. The acceptance criteria of GALL AMP XI.S5 are different than the acceptance criteria of Fire Protection Program. However, the Fire Protection Program has not been enhanced to include the acceptance criteria of GALL AMP XI.S5, which includes observing degradation of steel edge supports and bracing so as not to invalidate the evaluation basis. Please provide information on what acceptance criteria will be used, if the Fire Protection Program is credited to manage cracking of concrete masonry walls.

4. GALL AMP XI.S5 recommends that visual examination of the masonry walls by qualified inspection personnel is sufficient. GALL AMP XI.M26 recommends visual inspection by fire protection qualified inspectors to perform inspections of fire barrier walls. Please confirm if the fire protection qualified inspectors are also qualified to inspect concrete masonry walls.

DAEC Response to RAI 3.5.2.1-1

Part 1

The Fire Protection Program should have been listed in the Table 3.5.1, item 3.5.1-43 discussion. Accordingly, in LRA Table 3.5.1, Item Number 3.5.1-43 on page 3.5-37, the Discussion entry is revised to read as follows:

> This program is consistent with NUREG-1801. The Structures Monitoring Program, which includes Masonry Walls, will confirm the absence of aging effects requiring management. The Fire Protection Program will perform its own fire barrier visual inspection by a qualified fire protection inspector to examine for any sign of degradation such as cracking.

Part 2

The Fire Protection Program will perform visual inspection for cracking on fire barrier walls, ceiling and floors (concrete masonry fire barrier walls are treated as concrete fire barrier walls) with a qualified fire protection inspector at a frequency prescribed by the Fire Protection Program. As discussed in the response to RAI B.3.22-5 provided in letter NG-09-0764 dated October 13, 2009, the DAEC Fire Barrier Penetration Seal Inspection surveillance performs a visual inspection of 35 percent of fire barrier walls, ceilings and floors on an 18 month frequency, with 100 percent of fire barrier walls, ceilings and floors inspected each 5 years.

Part 3

As discussed in Part 2 above, the Fire Protection Program will provide its own visual inspection of fire barrier walls, ceilings and floors by a qualified fire protection inspector to examine for any sign of degradation such as cracking, spalling and loss of material caused by freeze-thaw, chemical attack and reaction with aggregates.

As discussed in LRA Section B.3.37, Structures Monitoring Program, the GALL AMP XI.S5 Masonry Wall Program has been combined with the GALL AMP XI.S6 Structures Monitoring Program. Inspections of masonry walls are performed in conjunction with, and at the same frequency as, the Structures Monitoring Program inspections. Acceptance criteria are specified in the Structures Monitoring Program.

Part 4

Qualified fire protection inspectors will inspect concrete and masonry walls that are used as fire barriers. As discussed in the response to RAI B.3.22-1 provided in letter NG-09-0764 dated October 13, 2009, the Fire Barrier Penetration Seal Inspection surveillance procedure will be enhanced to include criteria for visual inspection by a qualified fire protection inspector for cracking on fire barrier walls, ceiling and floors (masonry fire barrier walls are treated as concrete fire barrier walls).

RAI 3.5.2.1-2

Background

SRP-LR Table 3.5-1, Item 5 recommends the ASME Section XI, Subsection IWE to manage loss of material and general corrosion for steel elements of containment.

Issue

LRA Table 3.5.2-7 states that the Structures Monitoring Program manages loss of material for carbon steel in treated water, and references Table 3.5-1, Item 5. The staff is unclear how the Structures Monitoring Program meets or exceeds the recommendations of the IWE Program.

Request

Compare the Structures Monitoring Program to the IWE Program and explain how the Structures Monitoring Program will meet or exceed the requirements of the IWE Program in relation to the aging effect "loss of material/general and pitting corrosion." Include inspection methods and frequencies in the discussion.

DAEC Response to RAI 3.5.2.1-2

This question relates to LRA Table 3.5.2-7 line item, Torus Structural Steel, on page 3.5-86. Torus Structural Steel is the structural steel associated with ladders and walkways within the torus. These items are not part of the containment structure managed by ASME Section XI, Subsection IWE, and, therefore, the IWE Program is not applicable. Due to the high humidity in the torus, the structural steel supporting the ladders and walkways will be inspected on a five year interval. The visual inspections will be conducted under the Structures Monitoring Program by qualified personnel possessing expertise in the design and inspection of steel structures.

RAI 3.5.2.1-a

Background

LRA and SRP Table 3.5.1, Item 49 address the loss of material due to general, pitting, and crevice corrosion of support members, welds, bolted connections, support anchorage to building structure. Although not specifically stated it is assumed that this GALL item refers to steel materials exposed to treated water. LRA and SRP Table 3.3.1, Item 39 address cracking due to stress corrosion cracking of stainless steel BWR spent fuel storage racks exposed to treated water at temperatures greater than 60oC. The applicant proposes to manage this aging process through the use of its AMP "ASME Section XI Subsection IWF" (LRA B.3.5) and "Water Chemistry" (LRA B.3.39). For Table 3.5.1, Item 49, the GALL Report recommends that this aging process be managed through the use of the AMP "Water Chemistry" (GALL Report Vol. 2 XI.M2) and "ASME Section XI, Subsection IWF" (GALL Report Vol. 2 XI.S2). For Table 3.3.1, Item 39, the GALL Report recommends that this aging process be managed through the use of the AMP "Water Chemistry" (GALL Report Vol. 2 XI.M2). The applicant proposes that these AMR items are consistent with the GALL Report except that a different component is named (Generic Note C) or are consistent with the GALL Report in terms of material, environment, and aging effect but a different AMP is credited (Generic Note E).

Issue

In its review, the staff noted that two items for the component "defective fuel storage container" are listed in Table 3.5.1, Item 49 in the spreadsheet of AMR items and in Table 3.3.1, Item 39 in the LRA. The staff also noted that for one of these items the generic note was C and the proposed AMP was Water Chemistry and that for the other item the generic note was E and the proposed AMP was ASME Section XI Subsection IWF. Taken individually neither of these items meets the recommendation contained in the GALL Report. Taken together, as the staff believes was intended, they at least meet the recommendations contained in both Table 3.5.1, Item 49 and Table 3.3.1, Item 39 of the GALL Report. Despite the fact that the applicant appears to have met the recommendations of the GALL Report, the staff remains confused regarding the classification of this aging effect, i.e., is it being addressed under Table 3.5.1 or Table 3.3.1 or is some other table/item combination more appropriate.

Request

Please describe the aging issues associated with the defective fuel storage container, justify the selection of an AMR item, and justify why the selected AMPs are sufficient to manage aging of this component.

DAEC Response to RAI 3.5.2.1-a

The Defective Fuel Storage Container at DAEC is a tool that is used to store a defective fuel assembly in the Spent Fuel Pool until a proper disposition of the defective fuel assembly can be accomplished. The normal external environment of the tool is air-indoor uncontrolled; however, when submerged, it has an external environment of treated water less than 140°F. While submerged, the tool is managed for loss of material due to crevice and pitting corrosion by the Water Chemistry Program. Since the Spent Fuel Pool water temperature is less than 140°F, cracking due to stress corrosion cracking (SCC) is not an applicable aging effect for Spent Fuel Pool components.

To reflect this RAI response, conforming LRA changes are made, as follows:

In LRA Table 3.5-1, Summary of Aging Management Evaluations in Chapters II and III of NUREG-1801 Structures and Structural Components, in line item 3.5.1-49 on page

3.5-39, the Discussion entry is revised to read as follows:

Water Chemistry, ASME Section XI, Subsection IWF, and Structures Monitoring Programs are used at DAEC.

In LRA Table 3.5.2-10, Summary of Aging Management Review Results Supports, on page 3.5-112, the line item for Defective fuel storage container in treated water with Aging Management Program ASME Section XI, Subsection IWF Program is deleted in its entirety.

In LRA Table 3.5.2-10, Summary of Aging Management Review Results Supports, on page 3.5-112, in the line item for Defective fuel storage container in treated water with Aging Management Program Water Chemistry Program, the entry for NUREG-1801 Volume 2 Line Item is changed to III.B1.1-11 (TP-10).

During the review of this RAI, it was determined that changes were also needed for LRA table entries related to Holtec spent fuel rack supports. The Holtec spent fuel rack support is managed for loss of material due to crevice and pitting corrosion by the Structures Monitoring Program and the Water Chemistry Program. The LRA changes are as follows:

In LRA Table 3.5.2-10, Summary of Aging Management Review Results Supports, on page 3.5-112, in the line item for Holtec spent fuel rack support, the entries for NUREG-1801 Volume 2 Line Item, Table 3.x-1 Item, and Notes are changed to III.B1.1-11 (TP-10), 3.5.1-49 and E, respectively.

In LRA Table 3.5.2-10, Summary of Aging Management Review Results Supports, on page 3.5-112, a new line item is added as follows:

Component Type	Intended Function	Material	Environment	Aging Effects Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.x-1 Item	Notes
Holtec spent fuel rack support	Structure	Stainless steel	Treated water (external)	Loss of material	Structures Monitoring Program	III.B1.1-11 (TP-10)	3.5.1-49	E

RAI 3.5.2.2-1

<u>Background</u>

SRP-LR Sections 3.5.2.2.2.2.1 and 3.5.2.2.2.4.2 recommend further evaluation of the aging effect loss of material and cracking due to freeze-thaw for plants located in moderate to severe weathering conditions. The SRP-LR further states that existing concrete with air content of 3% to 6% and water-to-cement ratio of 0.35 – 0.45 did not exhibit degradation related to freeze-thaw during subsequent inspections.

Issue

DAEC is located in a severe weathering region; however, the corresponding LRA sections make no mention of the water-to-cement ratio of DAEC concrete.

Request

1. Provide the water-to-cement ratio (w/c) for the concrete used in Groups 1-3, 4-6, and 7-9 structures.

2. If the ratio (w/c) is outside the range provided in the SRP-LR, explain how the aging effect will be managed during the period of extended operation. Focus on additional inspections or evaluations that may be necessary, or explain why the current Structures Monitoring AMP is adequate.

DAEC Response to RAI 3.5.2.2-1

Part 1

The maximum water-to-cement ratio (w/c) at DAEC is 0.47 for 3000 psi concrete strength and 0.44 for 4000 psi concrete strength.

Part 2

The water-to-cement ratio (w/c) for the concrete used in Groups 1-3, 4-6 and 7-9 was based on ACI 318-63 Section 502 Method 2. Method 2 was used for tests of trial mixes to ensure required concrete strength at water-cement ratios that provided sufficient workability. The maximum permissible water-cement ratio for the concrete used at DAEC was established by the water-cement ratio versus concrete strength curve produced by Method 2 that yielded an average strength which satisfied the requirements of ACI 318-63 Section 504 "Strength Test of Concrete". The Maximum permissible water-cement ratio was 0.47 for concrete with 3000 psi strength and 0.44 for concrete with 4000 psi strength.

The Structures Monitoring Program performs inspections of concrete in accessible areas for loss of material (spalling, scaling) and cracking due to freeze-thaw. As discussed in LRA Section 3.5.2.2.2.2.1, inspections of accessible areas have confirmed that concrete has not exhibited degradation due to freeze-thaw. Inspection results from accessible areas are used as an indicator for inaccessible areas.

As discussed in LRA Section B.3.37.1, the Structures Monitoring Program includes examinations of areas not typically accessible, such as buried concrete foundations. These examinations will be completed when the opportunity arises, such as during excavations. An evaluation of these opportunistic inspections for buried concrete will be completed every 10 years to ensure that the condition of buried concrete foundations on site is characterized sufficiently to provide reasonable assurance that the foundations on site will perform their intended function through the period of extended operation. Additional inspections may be performed in the event that an opportunistic inspection has not been conducted, or if visible portions of the concrete foundation reveal degradation.

The DAEC Structures Monitoring Program has been effective in managing aging effects in concrete and masonry structures.

RAI 3.5.2.2.1-1

Background

The SRP recommends a plant-specific program to manage corrosion in inaccessible areas if specific conditions in the GALL Report are not satisfied. One of the conditions is that water ponding on the containment concrete floor is not common and when detected is cleaned up in a timely manner.

Issue

LRA Section 3.5.2.2.1.4 does not mention water on the containment floor.

Request

Discuss plant-specific operating experience related to water ponding on the containment floor, including frequency and resulting corrective actions.

DAEC Response to RAI 3.5.2.2.1-1

DAEC has four floor drains/sumps on the containment floor outside of the Reactor Pressure Vessel pedestal and two sumps inside the pedestal under the Control Rod Drives to collect any water leakage, thereby eliminating the potential for ponding. A review of OE for the last 10 years has shown no indications of ponding on the containment floor. Accessible areas of the drywell steel liner have not exhibited significant corrosion. The elastomer sealant at the junction of the drywell liner and the concrete floor is examined and maintained to preclude any leakage from entering the concrete/drywell liner joint. The concrete floor has not exhibited any significant cracking that may allow water, should leakage occur, to pass through to the steel liner.

The ASME Section XI, Subsection IWE Program manages loss of material in the steel containment liner. Inaccessible areas of the liner inside containment are protected against general, pitting and crevice corrosion by embedment in concrete and by a moisture barrier (elastomer sealant) that prevents water from reaching inaccessible areas. The Structures Monitoring Program will identify and manage any cracks in the concrete. Degradation of the moisture barrier that could potentially provide a pathway for water to reach inaccessible portions of the steel containment liner is managed by the ASME Section XI Subsection IWE program.

RAI 3.5.2.2.1-2

Background

SRP Section 3.5.2.2.1.7 list IWE and Appendix J as the appropriate AMPs to manage the aging effect of stress corrosion cracking of stainless steel penetration sleeves, bellows, vent lines, and dissimilar metal welds. The SRP also discusses the need for further evaluation to address the effectiveness of the inspections.

Issue

LRA Section 3.5.2.2.1.7 states that this aging effect does not apply to DAEC because the necessary environment does not exist. There are also no Table 2 items in the LRA which reference the corresponding SRP Table 1 items for this aging effect (i.e. Items 10 and 11). The staff is unclear whether or not the IWE and Appendix J inspections will continue to be carried out on the corresponding components.

Request

Explain how the Appendix J leak rate testing program, and IWE inspections will be conducted on the penetration sleeves, bellows, dissimilar metal welds, and vent line bellows during the period of extended operation.

DAEC Response to RAI 3.5.2.2.1-2

During the period of extended operation, DAEC will continue to perform inspections in accordance with the requirements of ASME Section XI, Subsection IWE, and leak rate testing in accordance with the requirements of 10 CFR Part 50 Appendix J. The leak rate testing and the inspections will ensure that all pressure retaining components such as sleeves, bellows, welds, etc. will continue to perform their current licensing basis (CLB) functions during the period of extended operation.

RAI 3.5.2.2.2.1-1

Background

SRP-LR Section 3.5.2.2.2.1 recommends further evaluation of several structure/aging effect combinations if they are not covered by the Structures Monitoring Program.

Issue

Several subsections in LRA Section 3.5.2.2.2.1 state that the condition of accessible areas is used to evaluate the condition of inaccessible areas; however, the subsections also state that the aging effects do not require management for the period of extended operation. The LRA makes no mention of inspections under the Structures Monitoring Program or any other AMP. The staff is unclear whether or not inspections will be conducted on accessible areas for the applicable structure/aging effect combinations during the period of extended operation. This issue applies to Subsections 1, 2, 4, and 5.

Request

Explain whether or not the structure/aging effect combinations discussed in SRP-LR Section 3.5.2.2.2.1, Subsections 1, 2, 4, and 5 will be inspected for in accessible areas during the period of extended operation.

DAEC Response to RAI 3.5.2.2.2.1-1

As indicated in LRA Tables 3.5.2-1 through 3.5.2-11, the Structures Monitoring Program is assigned as the aging management program for the structure/aging effect combinations discussed in SRP-LR Section 3.5.2.2.2.1 (corresponds to LRA Section 3.5.2.2.2.1) and cross-referenced to Table 1 line items 3.5.1-23, 3.5.1-24, 3.5.1-26 and 3.5.1-27.

As discussed in LRA Section B.3.37, the DAEC Structures Monitoring Program includes periodic visual inspection of structures and structural components for the detection of aging effects. Accessible concrete inspected under the Structures Monitoring Program provides an indication of the condition of inaccessible concrete, since both accessible and inaccessible concrete are constructed to the same standards and are exposed to similar environments.

RAI 3.5.2.2.2.1-2

Background

SRP-LR Table 3.5-1, Items 52 and 56, discuss loss of mechanical function of sliding support surfaces due to corrosion, distortion, dirt, overload, or fatigue.

Issue

In LRA Table 3.5-1, Items 52 and 56, the applicant stated the no sliding bearing surfaces are subject to this aging affect. The staff is unclear why no sliding surfaces at DAEC are subject to loss of mechanical function.

Request

Explain why inspections to detect loss of mechanical function due to corrosion, distortion, dirt, overload, or fatigue are unnecessary for sliding support surfaces (i.e. components related to Table 3.5-1, Items 52 or 56). Include the drywell radial beam seats (sliding supports) in this discussion.

DAEC Response to RAI 3.5.2.2.2.1-2

EPRI TR-1015078, Plant Support Engineering: Aging Effects for Structures and Structural Components (Structural Tools), concluded that aging effects are not significant in fluoropolymers and lubrite sliding surfaces due to outstanding material properties, relatively low cycle application, and lack of industry experience on failures. Lubrite lubricants used in nuclear applications are designed for the environments to which they are exposed. They are designed with the ability to carry extremely heavy dynamic and static loads with a low coefficient of friction, to operate dry or wet in high or low temperature conditions, to withstand high intensities of radiation, and not to be susceptible to corrosion. An industry experience search did not find any Lubrite aging degradation that could lead to the loss of intended function.

For clarity, the LRA discussions of sliding surfaces in Table 3.5-1 are revised as follows:

In LRA Table 3.5-1, Summary Of Aging Management Evaluations In Chapters II And III Of NUREG-1801 Structures And Structural Components, Item 52, on page 3.5-40, the Discussion entry is revised in its entirety to read as follows:

> Loss of mechanical function due to corrosion, distortion, dirt, overload or fatigue is not an aging effect requiring management. Such failures typically result from inadequate design or operating events rather than from the effects of aging. Failures due to cyclic thermal loads are rare for structural supports due to their relatively low temperatures.

In LRA Table 3.5-1, Summary Of Aging Management Evaluations In Chapters II And III Of NUREG-1801 Structures And Structural Components, Item 56, on page 3.5-40, the Discussion entry is revised in its entirety to read as follows:

> Lubrite plates are used in the torus support saddles at DAEC. Lubrite materials for nuclear applications are designed to resist deformation, have a low coefficient of friction, resist softening at elevated temperatures, resist corrosion, withstand high intensities of radiation, and will not score or mar; therefore, they are not susceptible to aging effects requiring management. Nonetheless, lubrite components associated with the torus supports are included in the DAEC ASME Section XI Inservice Inspection, Subsection IWF Program.

The radial beam seats in the drywell are discussed in LRA Table 3.5-1, Item 30, on page 3.5-33, and in LRA Section 3.5.2.2.2.1.8.

RAI 3.5.2.3.2-1

Background

In LRA Table 3.5.2.2-2, on page 3.5-50, the applicant is crediting the Fire Protection Program to manage cracking and delamination of non-metallic fireproofing in an indoor uncontrolled external environment. The applicant has referenced Footnote H, which states that aging effect not in NUREG-1801 for this component, material and environment combination. The applicant has also referenced plant-specific Footnote 506, which states that component is cementitious fireproofing/insulating material and will exhibit similar aging effects as concrete.

Issue

The applicant references Table 3.3.1, Item 3.3.1-65 and GALL Report Item VII.G-28. Footnote H implies that this line item is not consistent with or not included in the GALL Report.

Request

Since this line is not consistent with the GALL Report, please justify why a GALL Report line item is referenced. Please also justify how the Fire Protection Program will manage the aging effect of cracking and delamination, and provide inspection methods and acceptance criteria to detect delamination.

DAEC Response to RAI 3.5.2.3.2-1

The non-metallic fireproofing at DAEC is managed by the Fire Protection Program to ensure the fireproofing coverage is continuous and without areas in which the underlying beam/column is visible. The aging effect that could result if the beams/columns become visible (indicating a potential for direct exposure of the structural steel to fire) would be cracking. The Fire Protection Program, as enhanced, inspects 100% of the fireproofing material on structural steel during each five year period to ensure any cracking is detected prior to loss of intended function. Any damage noted during the inspections is brought to the attention of the Fire Protection Engineer for determination of repair options. Delamination of this fireproofing material should not have been listed in the LRA as an applicable aging effect requiring management. Therefore, delamination will be deleted from this line item in LRA Table 3.5.2-2 and in section, 3.5.1.2, as noted below.

NUREG-1801 Line Item VII.G-28 is for Structural Fire Barriers with a material of reinforced concrete, environment of Air-Indoor Uncontrolled, and an Aging Effect of Cracking that is managed by the Fire Protection Program and the Structures Monitoring Program. This line item for reinforced concrete is a reasonably close match for the cementitious fireproofing material installed on structural steel. Therefore, with the removal of delamination as an aging effect for this material, the note H in this line item should be changed to note B.

To reflect this response, the LRA is revised as follows:

In LRA Section 3.5.1.2, Control Building, on page 3.5-3, under Aging Effects Requiring Management, the bullet "Cracking, delamination" is deleted.

In LRA Table 3.5.2-2, Summary of Aging Management Review Results Control Building, on page 3.5-50, in the line item for Structural steel fireproofing with a listed Aging Effect Requiring Management of Cracking, delamination, the Aging Effect Requiring Management entry is changed to Cracking and the Notes entry is changed to B.

RAI 3.6-1

Background

In LRA Section 3.6.2.2.2, the applicant stated that DAEC is located in an area with moderate rainfall and airborne particle concentrations are comparatively low and the rate of contamination buildup on the insulators is not significant.

Issue

The applicant did not address plant-specific operating experience with high-voltage insulator failures due to surface contamination.

Request

Review plant-specific operating experience to confirm that there have been no failures of high voltage insulators due to surface contamination.

DAEC Response to RAI 3.6-1

DAEC has not experienced any failures of high voltage insulators due to surface contamination.

RAI 4.7.5

Background

License renewal application (LRA) Section 4.7.5 presents fatigue evaluations and cumulative usage factor (CUF) for the control rod drive mechanism (CRDM).

Issue

However, the analysis methodology used by the applicant for the CRDM fatigue analysis is not adequately described in the application. Additionally, in the LRA the applicant stated that for the scram headers, acceptable 60 year CUF can not be obtained by raising the 40 year CUF by 1.5. The applicant then stated that "since the design number of scram cycles is being reduced from 200 to 150, and the earthquake assumptions remain unchanged, the 60 year CUF values remain below 1.0 and are therefore acceptable." However, there is insufficient information provided in the application to draw such a conclusion.

Request

1. Provide the reference (e.g., U.S. Nuclear Regulatory Commission document) which was used as the basis for the fatigue analysis for CRDM at extended power uprate (EPU) conditions. Also describe the input data relevant to the analysis, and the thermal/mechanical conditions of the EPU that were used for the fatigue analysis.

2. Provide the calculation that demonstrates that reducing the design cycles of scram from 200 to 150 will lead to an acceptable 60 year CUF for the scram headers.

3. Provide the basis to support the conclusion that the fatigue analysis exemption for the SDV vent and drain valves will remain bounding for a 60 year life. Also, define the acronym SDV, which is not included in the abbreviation table of the LRA.

4. Analyses for the CRDM were placed in mixed categories of Title 10 of the *Code of Federal Regulations* Part 54.21(c)(1)(i) (10 CFR 54.21(c)(1)(i)) and 10 CFR 54.21(c)(1)(ii). Please separate the dispositions appropriately for different components and/or systems.

DAEC Response to RAI 4.7.5

Part 1

By letter NG-01-0523 dated May 8, 2001, (ADAMS Accession Number ML011350607), DAEC submitted revision 1 of GE report NEDC-32980P, Safety Analysis Report for Duane Arnold Energy Center Extended Power Uprate (EPU). This report includes a discussion regarding the evaluation of the CRDM CUF.

By letter dated November 6, 2001, the NRC issued Amendment 243 which allowed an increase in the maximum power level at DAEC from 1658 MW_{th} to 1912 MW_{th}. The letter is ADAMS Accession Number ML013050321, and the NRC Safety Evaluation for EPU is ADAMS Accession Number ML013050342.

Part 2

As stated in "Issue" above, the 60 year cumulative usage factors (CUFs) for the scram headers could not be shown to be acceptable by simply multiplying the 40 year CUF by 1.5 (60 years/40 years), and so further review was performed. A new value of CUF was not calculated using 60 year cycle assumptions, however, since a review of the existing calculation's input assumptions shows that the existing evaluation remains bounding.

As discussed in LRA Section 4.7.5, cyclic fatigue on the scram headers is due primarily to scram cycles and earthquake cycles. The reason for the impact of the number of scram cycles on CUF for the scram header is seen in the operation of the CRD hydraulic system. As discussed in UFSAR Section 3.9.4.1.2, Control Rod Drive Hydraulic System, the scram discharge volume is used to limit the loss of reactor water discharged from all of the drives during a scram. It is also used to contain the reactor water that leaks past the drives following a scram. This volume is provided in the scram discharge header. During normal plant operation, each scram discharge header is empty, and the drain and vent valves are open. Position indicator switches on the drain and vent valves actuate valve lights in the control room. During a scram, the scram discharge volume partly fills with water discharged from above the drive pistons. While scrammed, the CRD seal leakage from the reactor continues to flow into the scram discharge volume until the discharge volume pressure equals the reactor vessel pressure.

As discussed in LRA Section 4.3.1, the number of scram cycles assumed for the 60 year analysis is 150, compared to 200 scram cycles assumed in the existing analysis. The number of earthquake cycles assumed for the 60 year analysis is the same as the number assumed in the existing analysis. Therefore, the existing evaluation for the scram headers remains valid for 60 years of operation.

Part 3

SDV is the acronym for Scram Discharge Volume.

The calculation discussed in the LRA determined whether or not the SDV vent and drain valves required a cyclic analysis in accordance with NB-3222.4(d). As discussed in response to RAI 4.3.3-1 (provided in letter NG-09-0764 dated October 13, 2009), piping components may not require analysis for cyclic operation if the piping component meets the six requirements of Subparagraph NB-3222.4(d). The evaluation determined that the six requirements were met, and so the vent and drain valves did not require a cyclic analysis.

The existing evaluation assumes 200 scram cycles. Since the number of scram cycles for 60 years is assumed to be 150, the existing evaluation (that assumes 200 cycles) remains valid.

Part 4

In LRA Section 4.7.5, Control Rod Drive Mechanism Fatigue, on page 4.7-4, the regulatory disposition statement is revised to read as follows:

Disposition: 10 CFR 54.21(c)(1)(i) and 10 CFR 54.21(c)(1)(ii) as indicated below:

(i) The analyses remain valid for the period of extended operation for the fatigue-exempt SDV vent and drain valves and for the scram headers.

(ii) The analyses have been projected to the end of the period of extended operation for the CRDM, insert/withdraw lines, discharge piping, and scram monitoring stations.

RAI B.3.31-1

Background

The applicant proposed to perform a visual inspection of the metal-enclosed bus (MEB) connections on a six year frequency. This is less conservative than the five year frequency recommended by GALL AMP XI.E4, "Metal Enclosed Bus." Industry operating experience indicates that buses in MEBs may experience loosening of bolted connections resulting from repeated cycling of connected loads. This phenomenon can occur in heavy loaded circuits (i.e., those exposed to appreciable ohmic heating). NRC Information Notice 2000-14 identifies torque relaxation of splice plate connecting bolts as one potential cause of a MEB fault. In addition, Sandia Laboratory Report, SAND-0344 identifies instances of termination loosening at several plants due to thermal cycling.

Issue

It is not clear to the staff that the applicant's six year visual inspection frequency exception to GALL XI.E4 is adequately justified based on industry operating experience and the corresponding five year recommended inspection frequency in GALL AMP XI.E4.

Request

Provide additional technical justification to demonstrate that inspecting MEB connections every six years will detect loosening of bolted connections resulting from repeated cycling of connected loads consistent with industry experience and the GALL AMP XI.E4 recommended inspection frequency.

DAEC Response to RAI B.3.31-1

Basis for 6 Year Inspection Frequency

DAEC has operating experience with metal enclosed bus inspections that supports the adequacy of a six year inspection frequency. Visual inspections of metal enclosed bus (MEB) have been performed on a six year frequency since 1990. The initial inspection in 1990 did identify degraded bus insulation, but the degradation was not severe enough to result in failure of the bus. The MEB insulation and bolting hardware were replaced in 1992 and 1993. Subsequently, visual inspections have been performed in 1996, 2002, and 2009. Since the repairs were completed, the periodic inspections have not identified any problems with insulation degradation, signs of thermal damage (indicating loose bolting) or the presence of foreign material. DAEC has not experienced failures of metal enclosed bus.

The six year MEB inspections are performed as part of the six year major inspection of the Startup Transformer. The bus and transformer must be taken out of service to provide access for inspection. Taking the Startup Transformer out of service increases the overall risk to the plant since the Startup Transformer is one of the two off-site power sources. It is not desirable from the standpoint of nuclear safety to take the Startup transformer and MEB out of service more frequently than necessary just to perform an inspection, especially when the inspection history continues to confirm that age-related degradation is not occurring.

The six year inspection frequency for the Startup Transformer considers industry operating experience to prevent failure of the transformer. NUREG-1801 Section XI.E4, Metal Enclosed Bus, indicates that a primary aging stressor for MEB is to have heavily loaded connections combined with cyclic loading. As discussed below, the MEB within the scope of license renewal at DAEC is not normally heavily loaded, and the cyclic loading that does occur on the bus is not of large magnitude and does not result in significant rises in bus temperature.

Description of MEB Loads and Worst Case Cycling

The MEB in the scope of license renewal is a 1200 amp bus with a short section of 3000 amp bus near the Startup Transformer. The major loads fed by each in-scope MEB are:

- Control Building Load Center
- Intake Structure Load Center
- Core Spray Pump Motor (700 hp)
- RHR Pump Motor (600 hp)
- RHR Pump Motor (600 hp)
- RHR Service Water Pump Motor (600 hp)
- RHR Service Water Pump Motor (600 hp)
- General Service Water Pump Motor (250 hp)
- CRD Pump Motor (250 hp)

The Control Building Load Center and Intake Structure Load Center combined form the base load of approximately 100 amps or 8.3% of the rated bus ampacity. This represents only 0.7% of the rated bus temperature rise. The General Service Water (GSW) Pump Motor and the CRD Pump Motor may be loaded on the bus for extended periods of time (greater than 1 week). Each of these motors draws approximately 33 amps. The maximum normal loading on the bus for an extended period would be approximately 166 amps (100 amps + 66 amps) or 13.8% of the rated bus ampacity. This loading represents only 2% of the rated bus temperature rise. Therefore, the bus is not normally heavily loaded.

There is no scenario during normal plant operations that would have all the other five motors operating at the same time. The worst case loading would have the two RHR and two RHRSW pump motors operating at the same time as a GSW pump and a CRD pump during an outage. Each RHR and RHRSW pump motor draws approximately 80 amps. This would increase the current flowing through the bus from 166 amps to 482 amps, which is approximately 40% of the rated bus ampacity. Therefore, even under these conditions, the bus is not heavily loaded. This loading represents the worst case from the standpoint of normal operating load cycling. Operating the six motors in this situation would increase bus temperature from 0.7% of the rated bus temperature rise due to the base load to approximately 16% of the rated bus temperature rise. This is not considered a major transient with respect to bus temperature cycling.

Typical MEB Load Cycling

Typical operating histories for the motors which are powered from the in-scope MEB, and their contributions to bus temperature cycling, are summarized below.
The General Service Water Pump Motor and the CRD Pump Motor are cycled infrequently. The CRD Pump Motor was cycled 17 times in the last year (cycled defined as either turned on or turned off). The General Service Water Pump Motor was cycled 28 times in the last year. These two motors combined represent 5.5% of the rated bus ampacity. Cycling these motors on and off the bus does not significantly stress the bolting since these motors combined only represent an incremental bus temperature rise of 0.3%.

Cycling the two RHR and two RHRSW pump motors on the bus is the most significant cycling performed. This scenario only happens during testing or an outage, and would only occur a small number of times per year based on current operating history. These four motors combined represent 27% of the rated bus ampacity. Cycling these motors on and off the bus does not significantly stress the bolting since these motors combined only represent an incremental bus temperature rise of 7.1%.

Surveillance testing cycled the Core Spray Pump Motor on and off the bus 14 times in the last year. This motor draws approximately 95 amps which represents 8% of the rated bus ampacity. Cycling this motor on and off the bus does not significantly stress the bolting since this motor only represents an incremental bus temperature rise of 0.6%.

Surveillance testing cycled the RHR and RHRSW Motors on and off the bus less than 100 times over the last year. Less than 50 of these cycles would include more than two motors. The motors are sequenced on during these tests, which limits to some extent the thermal transient on the bus. The RHR system surveillance test only operates one RHR pump at a time, but both RHRSW pumps may be operating. If it is assumed that the three motors are cycled on at one time, the three motors represent 20% of the rated bus ampacity. Cycling these motors on and off the bus does not significantly stress the bolting since these motors combined only represent an incremental bus temperature rise of 4%.

Conclusion

Based on the above information, the worst case load cycling would increase the bus temperature from 0.7% of the rated bus temperature rise due to the base load to 16% of the rated bus temperature rise. Since the metal enclosed buses within the scope of license renewal are not heavily loaded, and the cyclic loading does not cause significant thermal cycles, the bolting is not stressed significantly. The three periodic inspections that have been performed on the metal enclosed bus since they were reinsulated in 1992 and 1993 have not identified any degradation of the insulation. Therefore, the continuation of the current six year inspection frequency provides reasonable assurance that the metal enclosed bus will be maintained consistent with the current licensing basis through the period of extended operation.

RAI Copper Alloy

Background

The GALL Report recommends the use of the Water Chemistry Program augmented by the One-Time Inspection Program to manage the aging effect of loss of material due to various corrosion mechanisms for copper alloy components in treated water (e.g., GALL Items VII.A4-7, VII.E3-9, and VIII.A-5). The One-Time Inspection Program provides measures to verify the effectiveness of the Water Chemistry Program.

Issue

For some of the Table 3.X-1 items, identified as 3.3.1-25, 3.3.1-31, and 3.4.1-15, the DAEC LRA Supplement 1, Section B.3.28, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program" is credited for managing the loss of material for copper alloy components exposed to a treated water environment. In these situations, the LRA Supplement 1 indicates that the AMR results are consistent with the GALL Report for material, environment, and aging effect, but a different AMP is credited. There is insufficient information to determine how the applicant's "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program" is consistent with the GALL Report and how the credited AMP provides adequate aging management for this aging effect in these components.

Request

Provide justification for the effectiveness of the "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program" in managing the aging effect of loss of material in the identified copper alloy components exposed to a treated water environment.

DAEC Response to RAI Copper Alloy

See related information in the responses to RAIs 3.3.2.2-1 and 3.3.2.2.10.2-1 above.

At Duane Arnold, certain copper alloy components exposed to a treated water environment, as identified in Table 3.X-1 items 3.3.1-31 and 3.4.1-15, are being managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program rather than the Water Chemistry Program specified in NUREG-1801. The program will visually inspect affected components to ensure that existing environmental conditions are not causing metal degradation and that the component's intended functions are maintained during the period of extended operation.

The NUREG-1801 XI.M2 Water Chemistry Program for boiling water reactors specifies the use of EPRI guidelines to maintain the water chemistry in the reactor water, systems directly connected to the reactor, the feedwater and condensate systems and the control rod drive system. While there are other systems which contain water that meets the definition of treated water, the water quality in these systems is not maintained to the same standards as reactor water, and the chemistry controls for these systems are not included as part of the Water Chemistry Program. The treated water used in these systems is supplied by the demineralized water systems. Water chemistry controls are in place for these systems to maintain the purity of this treated water to minimize internal corrosion.

During the review it was noted that one line item in LRA Table 3.3.2-6 with a treated water environment erroneously references Table 3.X-1 Item 3.3.1-25. Item 3.3.1-25, addresses an internal environment of condensation, not treated water. Accordingly, the LRA is revised to correct this table entry, as follows:

In LRA Table 3.3.2-6, Summary of Aging Management Review Results Control Building Heating, Ventilation and Air Conditioning, on page 3.3-105, in the line item for Valve, damper in the environment Treated water (internal), the Table 3.X-1 Item entry is changed to 3.3.1-31.

In addition, a clarification is provided to LRA Section 3.3.2.2.11, as follows:

In LRA Section 3.3.2.2.11, Loss of Material Due to Pitting, Crevice and Galvanic Corrosion, on page 3.3-43, a new paragraph is added following the existing discussion, to read as follows:

> At Duane Arnold, copper alloy components exposed to treated water are managed for loss of material due to pitting and crevice corrosion by the Water Chemistry Program. The effectiveness of the Water Chemistry Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of the components crediting this program. Sample selection includes consideration of susceptible locations, such as areas of low or stagnant flow and areas of high concentrations of impurities.

RAI Stainless Steel

<u>Background</u>

NUREG-1833, "Technical Bases for Revision to the License Renewal Guidance Documents, Table II.B, Item TP-6, indicates that stainless steel exposed to an outdoor air environment could result in loss of material, pitting, and crevice corrosion due to constant wetting and drying conditions. The report also states that the aging effect can be managed by the implementation of the AMP, Chapter XI.S6, "Structures Monitoring Program."

Issue

The DAEC LRA Supplement 1, Table 3.4.2-1, pages 3.4-22, 3.4-27, and 3.4-28, indicates that when stainless steel components are exposed to external atmosphere/weather, there is no aging effect requiring management.

Request

Provide additional information justifying why stainless steel components exposed to external atmosphere/weather do not have any aging degradation effect that requires an AMP.

DAEC Response to RAI Stainless Steel

The components listed in LRA Table 3.4.2-1 are mechanical components, not structural components; therefore, the Structures Monitoring Program is not applicable.

EPRI TR-1010639, Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools, Revision 4, Appendix E, Table 4-1, "Aging Effects Summary - External Surfaces," concludes that loss of material due to crevice and pitting corrosion are applicable aging mechanisms for stainless steel exposed to outdoor locations (Atmosphere/Weather) if the following applicability criteria exist:

1. Temperature < 212°F, and

2a. Surface is buried or subject to a concentration of contaminants[1], or
2b. Surface is exposed to an aggressive environment in outdoor locations[2]

Note 2 states: "Where plant-specific operating experience has shown exposure to aggressive species in outdoor locations, such as salt air in marine areas and sulfur dioxide, acid rain etc. in industrial areas, the normal atmosphere should be considered to be aggressive to exposed metals."

At DAEC, the outdoor environment does not result in exposure of stainless steel to aggressive species, such as salt air, sulfur dioxide, acid rain, etc. Therefore, loss of material due to crevice and pitting corrosion is not an applicable aging effect.

RAI Steel - Other

Background

The GALL Report, Table 2, Item 31, states that external surfaces of steel components exposed to indoor uncontrolled air are subject to loss of material due to general corrosion. The GALL Report states that the aging effect/mechanism can be managed by the External Surfaces Monitoring Program.

Issue

The DAEC LRA Supplement 1, Table 3.4.2-4, page 3.4-55, indicates that when carbon steel valve operators and damper operators are exposed to indoor uncontrolled air (external), loss of material due to corrosion is not an applicable aging effect, because system temperatures are greater than 100°C [212°F]. In the LRA Supplement 1, the applicant also indicates that the aging effect for this component, material, and environment combination is not applicable. These statements are not consistent with the GALL Report, which states that external surfaces of steel components exposed to indoor uncontrolled air are subject to loss of material due to general corrosion. The general corrosion rates due to uncontrolled air exposure tend to increase at higher temperatures. It is not clear to the staff why an AMP for carbon steel components exposed to indoor uncontrolled air was not included.

Request

Provide additional information justifying why carbon steel valve dampers and damper operators exposed to indoor uncontrolled air do not have aging degradation effects that require an AMP.

DAEC Response to RAI Steel - Other

A review of the components represented by Table 3.4.2-4 line item for Valve operator, damper operator in an Air-indoor uncontrolled (external) environment indicates that the line item contains an error. The valve operators do not have temperatures greater than 100 °C [212 °F]. Therefore, loss of material due to general corrosion is an applicable aging effect. Accordingly, the LRA is revised as follows:

In LRA Table 3.4.2-4, on page 3.4-55, the line item for Valve operator, damper operator with an Environment of Air-indoor uncontrolled (external) is revised to appear as follows:

Component Type	Intended Function	Material	Environment	Aging Effects Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.x-1 Item	Notes
Valve operator, damper operator	Pressure boundary	Carbon Steel	Air-indoor uncontrolled (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A

RAI Table Item 3.3.1-52-01

Background

GALL Report Volume 1, Table 1, line ID 52, and in the LRA, Table 3.1-1, Item Number 3.1.1-52 provide summaries of aging management evaluation results for steel and stainless steel reactor coolant pressure boundary (RCPB) pump and valve closure bolting, manway and holding bolting, flange bolting, and closure bolting in high pressure and high temperature systems. Both documents show aging effects of cracking due to stress corrosion cracking, loss of material due to wear, and loss of preload due to thermal effects, gasket creep, and self-loosening. Both documents show the aging effect managed by Bolting Integrity Program.

In the GALL Report unique Items IV.C1-10, IV.C1-12, and IV.C1-13 for BWRs all refer to GALL Report, Volume 1, Table 1, line ID 52. The unique items are:

- pump and valve closure bolting made of low alloy steel SA 193, Gr. B7 in an environment of "system temperature up to 288°C (550°F)" with an aging effect of loss of preload due to thermal effects, gasket creep, and self-loosening;
- pump and valve closure bolting made of steel in an environment of "system temperature up to 288°C (550°F)" with an aging effect of loss of material due to wear; and
- pump and valve seal flange closure bolting made of steel or stainless steel in an environment of "system temperature up to 288°C (550°F)" with an aging effect of loss of material due to wear.

Issue

The staff noted that in LRA Table 3.1.2-1 (Summary of AMR Review Results for Nuclear Boiler) and in LRA Table 3.1.2-2 (Summary of AMR Review Results for Reactor Vessel Recirculation System) there are no AMR result lines that refer to LRA Table 3.1-1, Item Number 3.1.1-52. The staff also noted that the only AMR result line that refers to Item Number 3.1.1-52 is a line for fasteners, bolting, washers, nuts in LRA Table 3.3.2-30 (page 3.3-250), in the standby liquid control system, which is not a high temperature system. The staff also noted that AMR results for carbon steel fasteners, bolting, washers, nuts in Tables 3.1.2-1 and 3.1.2-2 refer to LRA Items Number 3.2.1-23 and 3.2.1-24, where the Bolting Integrity program is credited to manage the aging effects of loss of material and loss of preload, respectively. Also, for stainless steel bolting in Tables 3.1.2-1 and 3.1.2-2, Generic Note F was cited indicating that the material is not in the GALL Report for this component. The staff does not understand why AMR results for bolting in the reactor vessel, internals, and reactor coolant system was presented in this way in the LRA.

Request

1. Explain why the AMR results for bolting and fasteners in the reactor vessel, internals, and reactor coolant system was referenced to LRA Table 3.2.1, Items 3.2.1-23 and -24, and why there was no reference to LRA Table 3.1.1, Item 3.1.1-52 for these components.
2. Explain why AMR results for bolting and fasteners in the standby liquid control system was referenced to LRA Table 3.1.1, rather than to LRA Table 3.3.1, Item 3.3.1-45.

DAEC Response to RAI Table Item 3.3.1-52-01

Part 1

The Nuclear Boiler and Reactor Vessel Recirculation Systems fasteners in LRA Tables 3.1.2-1 and 3.1.2-2 are Class 1 components. The environments listed for these fasteners are incorrect. Accordingly, the LRA is revised to show the fasteners with an external environment of "System Temperature up to 288°C (550°F)" and aligned with NUREG-1801, Volume 1, Table 1, line item 52, as follows:

In LRA Table 3.1.2-1, Summary of Aging Management Review Results Nuclear Boiler, on page 3.1-33, the three line items for Fastener, bolting, washers, nuts are deleted and replaced with the following:

Component Type	Intended Function	Material	Environment	Aging Effects Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.x-1 Item	Notes
Fastener, bolting, washers, nuts	Leakage boundary (spatial)	Carbon Steel	System Temperature up to 288°C (550°F) (external)	Loss of material	Bolting Integrity Program	IV.C1-12 (R-26) IV.C1-13 (R-29)	3.1.1-52	A
Fastener, bolting, washers, nuts	Leakage boundary (spatial)	Carbon Steel	System Temperature up to 288°C (550°F) (external)	Loss of preload	Bolting Integrity Program	IV.C1-10 (R-27)	3.1.1-52	A
Fastener, bolting, washers, nuts	Pressure boundary	Stainless Steel	System Temperature up to 288°C (550°F) (external)	Loss of material	Bolting Integrity Program	IV.C1-13 (R-29)	3.1.1-52	A
Fastener, bolting, washers, nuts	Pressure Boundary	Stainless Steel	System Temperature up to 288°C (550°F) (external)	Loss of preload	Bolting Integrity Program			207, H

In LRA Table 3.1.2-2, Summary of Aging Management Review Results Reactor Vessel Recirculation System, on page 3.1-67, the three line items for Fastener, bolting, washers, nuts are deleted and replaced with the following:

Component Type	Intended Function	Material	Environment	Aging Effects Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.x-1 Item	Notes
Fastener, bolting, washers, nuts	Leakage boundary (spatial)	Carbon Steel	System Temperature up to 288°C (550°F) (external)	Loss of material	Bolting Integrity Program	IV.C1-12 (R-26) IV.C1-13 (R-29)	3.1.1-52	A

Component Type	Intended Function	Material	Environment	Aging Effects Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.x-1 Item	Notes
Fastener, bolting, washers, nuts	Leakage boundary (spatial)	Carbon Steel	System Temperature up to 288°C (550°F) (external)	Loss of preload	Bolting Integrity Program	IV.C1-10 (R-27)	3.1.1-52	A
Fastener, bolting, washers, nuts	Pressure boundary	Stainless Steel	System Temperature up to 288°C (550°F) (external)	Loss of material	Bolting Integrity Program	IV.C1-13 (R-29)	3.1.1-52	A
Fastener, bolting, washers, nuts	Pressure Boundary	Stainless Steel	System Temperature up to 288°C (550°F) (external)	Loss of preload	Bolting Integrity Program			207, H

In LRA Section 3.1.1.1, Nuclear Boiler, under Heading Environments on page 3.1-2, a new bullet is added to read:

- System temperature up to 288°C (550°F)

Part 2

The Standby Liquid Control System, addressed in LRA Table 3.3.2-30, contains both Class 1 and Non-Class 1 components. Table 3.3.2-30 shows the Class 1 fasteners, bolting, washers, nuts aligned to LRA Table 3.1.1, line item 52; and the non-Class 1 fasteners, bolting, nuts, washers aligned to LRA Table 3.3.1, line items 43 and 45.

RAI Table 3.3.2-23

Background

In LRA Table 3.3.2-23, the applicant assigned a Note E for carbon steel drip pans exposed to an air-indoor uncontrolled (external) environment. This AMR line item referenced Table 3.X-1 Item 3.3.1-58. According to the GALL Report it is to be inspected for rust through the External Surfaces Monitoring Program.

Issue

For this item (drip pans), the applicant credits the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Component Program. The staff compared GALL AMP XI.M38 (Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Component Program) to GALL AMP XI.M36 (External Surfaces Monitoring Program) and noted that there is no stated frequency of inspections under the program that is being proposed. GALL AMP XI.M36 recommends a visual inspection to be performed at least once per refueling cycle. GALL AMP XI.M38 states that inspection intervals are dependent on component material and environment, and take into consideration industry and plant-specific operating experience.

Request

Please provide the frequency of inspections for these drip pans. Please justify this frequency, if it is different than the maximum frequency recommended by GALL AMP XI.M36, External Surfaces Monitoring Program.

DAEC Response to RAI Table 3.3.2-23

The drip pans in question are the engineered safeguard room cooling unit drip pans. The drip pans are constructed of galvanized carbon steel. The pans are totally enclosed within their cooling unit housings and are not readily inspectable with an external inspection program. The units have to be opened to make the drip pans visible for inspection, which requires entry into a Technical Specification LCO action statement. In addition the "dry" (bottom or external) side of these drip pans is coated with an insulation material. Annual condition-based inspections are performed on these room coolers that assess temperatures, vibration, external leakage, etc. If any problems are detected, then the units are opened for a more detailed internal inspection. Opening a unit provides an opportunity for inspection of the drip pan. A review of plant-specific OE did not reveal any degradation having been identified in the drip pans. Therefore, the current condition-based approach to drip pan inspections will continue to be acceptable in the future under the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

Given that the drip pans are not accessible without opening the cooling units, and have external surfaces that are insulated, the External Surfaces Monitoring Program is not a suitable aging management program. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is an appropriate aging management program for the configuration of these drip pans.

RAI Table 3.3.2-25-01

Background

In the LRA Tables 3.3.2-10, -11, -16, -25 and -26 (pages 3.3-123, -129, -161, -209, and -213, respectively), there are AMR result lines for stainless steel or carbon steel bolting in a raw water environment with an aging effect of loss of preload. The AMR results credit the Bolting Integrity Program with managing the aging effect of loss of preload for bolts in a raw water environment.

Issue

The LRA does not provide sufficient information for the staff to understand how the Bolting Integrity Program can effectively manage loss of preload for bolts in a raw water environment where signs of closure bolt loosening such as indications of seepage around a flange or gasket would not be readily noticed.

Request

1. Explain what specific features or activities of the Bolting Integrity Program will manage the aging effect of loss of preload for the bolting that is in a raw water environment.

2. As part of your response clarify whether the subject bolting is pressure boundary closure bolting or structural bolting.

DAEC Response to RAI Table 3.3.2-25-01

The subject bolting (fasteners) is pump column pressure boundary closure bolting for Tables 3.3.2-10, -11, -25 and -26, and traveling screens structural support bolting for Table 3.3.2-16.

The fasteners (Tables 3.3.2-10, -11, -16, -25 and -26) are assembled using the Bolting Integrity Program (i.e. torquing, proper design, installation, and maintenance practices etc.) prior to being installed (submerged).

During plant operation, plant operators monitor pump performance utilizing installed instrumentation (pressure indication, flow indication, etc.). In addition, vibration monitoring equipment is installed on rotating equipment at DAEC. Should operating parameters change to indicate that pump performance is degrading, the condition would be entered into the Corrective Action Program, and appropriate action would be initiated. Also, when the pump pits are drained or pump maintenance is performed, fasteners can be inspected (opportunistic inspection) for any evidence of loss of preload.

The Intake Traveling Screens' stainless steel fasteners in raw water (Table 3.3.2-16) are inspected under the Bolting Integrity Program during the External Surfaces Monitoring Program walkdowns.

As discussed in LRA Section B.3.6, the Bolting Integrity Program manages loss of preload associated with closure bolting through the site maintenance procedures by specifying proper torque selection, design, installation, and maintenance practices for bolting materials, including gaskets, as recommended by various EPRI documents.

For clarity, the LRA is revised as follows:

In LRA Table 2.3.3-16, Intake and Traveling Screens, on page 2.3-93, for the line item Fasteners, an additional Intended Function, Structural support, is added.

In LRA Table 3.3.2-16, Summary of Aging Management Review Results Intake and Traveling Screens, on page 3.3-161, in the two line items for Fastener, bolting, washers, nuts of Material, Stainless steel, the Intended Functions are changed from Pressure boundary to Structural support.

RAI Table 3.4.2-1-01

Background

LRA Tables 3.4.2-1 (page 3.4-24) provides an AMR result line for stainless steel bolting in an environment of atmosphere/weather. The aging effect is identified as loss of preload, and the Bolting Integrity Program is credited to manage this aging effect.

Issue

LRA Table 3.0-1 (Service Environments) describes atmosphere/weather as moist air, ambient temperature and humidity, exposure to weather, including precipitation. For other stainless steel components in a moist (or intermittently wet) environment, the GALL Report identifies loss of material due to pitting or crevice corrosion as a potential aging effect.

Request

Explain why loss of material due to pitting or crevice corrosion is not included as an aging effect requiring management for stainless steel bolting in an environment of atmosphere/weather.

DAEC Response to RAI Table 3.4.2-1-01

At DAEC, the determination of aging effects for materials in specific environments was based on EPRI TR-1010639, Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools. The Mechanical Tools indicate that pitting and crevice corrosion are strongly dependent on the presence of aggressive chemical species such as halides, sulfates, etc. Contaminants that are present in the atmosphere can be further concentrated due to alternate wetting and drying. Therefore, the loss of material due to pitting and crevice corrosion may be a concern only for plants which are exposed to an aggressive species (e.g., salt air, sulfur dioxide and acid rain) contained within the atmosphere/weather environment. Furthermore, in an outdoor environment, the precipitation tends to wash a surface rather than concentrate contaminants.

DAEC is located in a rural area with a mild atmosphere/weather environment. The plant is not exposed to salt air, nor is it exposed to industrial pollutants which could create aggressive environments. DAEC does not have operating experience which would suggest a concern with pitting or crevice corrosion of stainless steel components exposed to an atmosphere/weather environment. Therefore, at DAEC, pitting and crevice corrosion are not applied as aging effects for stainless steel component exposed to atmosphere/weather.

Fire Protection - Partition Between Computer Room and Control Room

RAI 2.3.3.11-4 raised a question about a glass partition between the computer room and the control room that had been mentioned in a 1981 NRC safety evaluation report. In the response to RAI 2.3.3.11-4 (letter NG-09-0646 dated 9/3/09), DAEC indicated that a wall constructed with gypsum board separated the Control Room computer area and the Control Room front panel area, and that the wall was a heat resistant partition and not a fire barrier that separated fire areas.

The response to RAI 2.3.3.11-4 is clarified to indicate that the gypsum wall was constructed instead of a glass partition. This wall was constructed with a one hour fire rating.

Stoplogs

The response to RAI 2.4.2-1 (letter NG-09-0753 dated 10/1/09) stated that the treated wood timber stoplogs are not permanently installed, but are stored in a warehouse protected from the elements until needed. LRA Table 3.5.2-5 lists stoplogs as a component type, with a material of steel, but the components represented by this line item are actually the steel bracing and support materials for the wood stoplogs. These materials are also not permanently installed, but are stored in the warehouse with the stoplogs. To clarify the environment of the timber stoplogs and their steel bracing/support materials, and to correct the component type description for stoplog bracing/support materials, the following LRA changes are provided:

In LRA Table 2.4-5, Miscellaneous Yard Structures, on page 2.4-21, the existing entries for stoplogs are deleted and replaced with the following:

Component Types	Intended Function
Timber Stoplog carbon steel bolting, bracing and support materials in air - indoor uncontrolled	Flood barrier
Stoplogs timber in air - indoor uncontrolled	Flood barrier

In LRA Table 3.5.2-5, Summary of Aging Management Review Results Miscellaneous Yard Structures, on page 3.5-71, in the line item Stoplogs, the Component Type "Stop logs" is changed to "Timber stoplog bolting, bracing and support materials" and the Environment is changed to "Air - indoor uncontrolled."

Reactor Water Cleanup System Program

The response to RAI B.3.11-2 (letter NG-09-0764 dated 10/13/09) indicated that Duane Arnold is classified as an inspection schedule A plant for the purpose of scheduling inspections under the BWR Reactor Water Cleanup System Program. It has been concluded that the LRA description of the BWR Reactor Water Cleanup System

Program should be revised to reflect this inspection schedule and to remove the identified exception. Accordingly, the LRA is revised as follows:

LRA Section B.3.11, BWR Reactor Water Cleanup System Program, on pages B-28 and B-29, is revised in its entirety to read as follows:

B.3.11 BWR REACTOR WATER CLEANUP SYSTEM INSPECTION PROGRAM

B.3.11.1 PROGRAM DESCRIPTION

The DAEC Reactor Water Cleanup System Program is an existing program. The program manages the aging effects of cracking due to SCC or IGSCC in the RWCU pipe welds.

NUREG-1801, XI.M25, BWR Reactor Water Cleanup System, specifies three inspection screening criteria as follows:

a) Satisfactory completion of all actions requested in NRC GL 89-10.
b) No detection of IGSCC in RWCU welds inboard of the second isolation valves (ongoing inspection in accordance with the guidance in NRC GL 88-01), and
c) No detection of IGSCC in RWCU welds outboard of the second isolation valves after inspecting a minimum of 10% of the susceptible piping.

All three of these screening criteria have been satisfied at DAEC. Therefore, no inspection is required.

The DAEC Water Chemistry Program is maintained in accordance with applicable BWRVIP and EPRI Guidelines to minimize the potential of cracking due to SCC or IGSCC.

B.3.11.2 NUREG-1801 CONSISTENCY

This program is consistent with the ten elements of NUREG-1801 XI.M25.

B.3.11.3 EXCEPTIONS TO NUREG-1801

There are no exceptions to the ten elements of NUREG-1801 XI.M25.

B.3.11.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

This program does not require any enhancements to be consistent with the ten elements of NUREG-1801 XI.M25.

B.3.11.5 OPERATING EXPERIENCE

The DAEC Reactor Water Cleanup System Program has been effective in managing the aging effects of cracking due to SCC or IGSCC in the RWCU piping. The program incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed such that these components will continue to perform their intended functions throughout the period of extended operation.

DAEC has implemented plant modifications to eliminate the IGSCC susceptible material that is exposed to temperatures equal to or greater than 140°F, except for short pieces of vendor supplied pipe and welds between heat exchangers. The short pieces of non-resistant pipe are categorized as IGSCC Category Class D.

During refueling outages 14 and 15, 10% of the Category D welds were inspected during each outage. No indication of IGSCC has been observed. In accordance with Generic Letter 88-01 Supplement 1, since the actions of Generic Letter 89-10 have been completed, inspections are no longer required.

CAP010488 documented leakage from the heat affected zone weld by valve V-27-0180 at the 3" long ¾" pipe nipple. This failure was attributed to a specific fabrication deficiency that involved re-welding on each end of a short nipple that resulted in sensitization of the pipe. This configuration was eliminated. A review for similar configurations was performed. Configurations that were deemed to be sufficiently similar to merit concern were also replaced. Welding standards for the site were revised to reduce the potential for this configuration in the future. There has been no subsequent recurrence. Given that the configuration of concern was eliminated, this operating experience does not warrant a change in inspection frequency for other piping.

B.3.11.6 CONCLUSION

The Reactor Water Cleanup System Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

To reflect this revised program description, the following additional LRA changes are made:

LRA Appendix A, Section 18.1.11, BWR Reactor Water Cleanup System Program, on page A-7, is revised in its entirety to read as follows:

18.1.11 BWR REACTOR WATER CLEANUP SYSTEM PROGRAM

The BWR Reactor Water Cleanup System Program ensures that cracks due to stress corrosion cracking and intergranular stress corrosion cracking the in the Reactor Water Cleanup System pipe welds will be detected prior to loss of its intended function. The program includes periodic inspections, water chemistry control, and plant modifications.

In LRA Table B.2.2-1, Aging Management Program Correlation, on page B-9, line item XI.M25 - BWR Reactor Water Cleanup System, the NUREG-1801 Comparison entry is changed to "Consistent with NUREG-1801."

In LRA Table 3.3.2-24, Summary of Aging Management Review Results Reactor Water Cleanup System, in the line items which cite the BWR Reactor Water Cleanup System Program on pages 3.3-202, 3.3-206 and 3.3-208, the Notes entries are changed from B to A.

Sealants in Primary Containment Heating, Ventilation and Air Conditioning

The DAEC response to RAI 2.3.3.18-1 (letter NG-09-0644 dated 9/3/09), inadvertently omitted two generic responses related to duct, pressure and wall sealants. The response to the RAI 2.3.3.18-1 subsection titled Response to Table 3.3.2-18 Examples, is clarified to include the following additional points:

10. Duct Sealants and pressure boundary sealants are not relied on to maintain leakage below established limits. The system pressure boundary is a pressure envelope for a space. Therefore, aging of the sealing materials does not jeopardize the accomplishment of the system intended functions.

11. Wall sealants are evaluated in the civil/structural area as elastomers in sections 2.4 and 3.5 of the application.

Definition of "Significant Moisture" and "Significant Voltage" in LRA

To assure that the LRA is consistent with NUREG-1801 terminology for "significant moisture" and "significant voltage," the following LRA changes are provided:

In LRA Appendix A, Section 18.1.27, Medium Voltage Cable on pages A-11 and A-12, the first paragraph is revised to read as follows:

The Inaccessible Medium-Voltage Cables Program manages the effects of aging by measuring the insulation resistance of the cables and connections at least once every 10 years in accordance with plant procedures. In-scope, medium-voltage cables exposed to significant moisture and energized a significant portion of their life are tested to provide an indication of the condition of the conductor insulation. Significant moisture is defined as periodic exposures to moisture that last more than a few days (e.g., cable in standing water). Significant voltage exposure is defined as being subjected to system voltage for more than twenty-five percent of the time. The specific type of test performed will be determined prior to the initial test, and is to be a proven test for detecting deterioration of the insulation system due to wetting, such as power factor, partial discharge, or polarization index, as described in EPRI TR-103834-P1-2, or other testing that is state-of-the-art at the time the test is performed.

In LRA Section B.3.27, Inaccessible Medium Voltage Cables Program, Subsection B.3.27.1, Program Description, the second paragraph is revised to read as follows:

The program includes medium voltage cables that support a license renewal intended function, are susceptible to significant moisture as defined in NUREG-1801 XI.E3, and are energized a significant portion of their life. Significant moisture is defined as periodic exposures to moisture that last more than a few days (e.g., cable in standing water). Significant voltage exposure is defined as being subjected to system voltage for more than twenty-five percent of the time.