August 4, 2003

Mr. John L. Skolds
President and Chief Nuclear Officer
Exelon Generation Company, LLC
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE DRESDEN NUCLEAR POWER STATION, UNITS 2 AND 3, AND QUAD CITIES NUCLEAR POWER STATION, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION

Dear Mr. Skolds:

By letter dated January 3, 2003, Exelon Generation Company, LLC (EGC) submitted, for the Nuclear Regulatory Commission's (NRC's) review, an application pursuant to 10 CFR Part 54, to renew the operating license for the Dresden Nuclear Power Station (DNPS), Units 2 and 3, and Quad Cities Nuclear Power Station (QCNPS), Units 1 and 2. We are reviewing the information contained in the license renewal application (LRA) and have identified, in the enclosure, areas where additional information is needed to complete its review. Specifically, the enclosed request for additional information (RAI) is from Section 2.4, "Scoping and Screening Results: Structures," Section 3.0, "Aging Management Review Results," Section 3.2, "Aging Management of Engineered Safety Features," Section 3.3, "Aging Management of Auxiliary Systems," Section 3.4, "Aging Management of Steam and Power Conversion System," Section 3.5, "Aging Management of Containments, Structures and Component Supports," Section 4.3, "Metal Fatigue of the Reactor Vessel, Internals, and Reactor Coolant Pressure Boundary Piping and Components," Section 4.6, "Fatigue of Primary Containment, Attached Piping, and Components," Section 4.7, "Other Plant-Specific TLAAs," and Appendix B, "Aging Management Programs."

We have provided these RAIs to Messrs. R. Stachniak and F. Polaski of your staff in parts between April 29 - June 13, 2003. The staff is willing to meet with EGC prior to the submittal of the responses to provide clarifications of the staff's RAIs.

Sincerely,

/***RA***/

Tae Kim, Senior Project Manager
License Renewal Section A
License Renewal and Environmental Impacts Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket Nos.: 50-237, 50-249, 50-254,
and 50-265

Enclosure: As stated

cc w/enclosures: See next page

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DRESDEN AND QUAD CITIES
LICENSE RENEWAL APPLICATION
REQUEST FOR ADDITIONAL INFORMATION

Section 2.4 Scoping and Screening Results: Structures

RAI 2.4-1

LRA Table 2.2-2 also identifies structures that are not in scope of license renewal. These include:

- Fuel oil pump house and oil storage tank foundation (Dresden)
- Meteorological tower
- Miscellaneous administrative buildings
- Miscellaneous yard structures
- Miscellaneous radwaste buildings
- Miscellaneous river water structures
- Miscellaneous Dresden Unit 1 structures (Dresden)
- Miscellaneous transmission and distribution structures

Except for the meteorological tower and miscellaneous administrative buildings (provided there are no seismic II/I intended functions associated with these structures), the staff cannot evaluate whether these structures are correctly excluded from the license renewal scope. Additional descriptive information is needed for the remaining six (6) structures before a determination can be made. Therefore, the applicant is requested to:

(a) Submit a more detailed description of these six (6) structures, define their function, and describe the technical bases for exclusion from the license renewal scope.

(b) Verify that none of the eight (8) structures serve a seismic II/I intended function.

RAI 2.4-2

LRA Section 2.4.1 discusses the scoping and screening results for the Primary Containment. It is the staff's understanding that this section of the LRA addresses not only the primary containment (drywell, pressure suppression chamber, and the vent system connecting the two structures), but also all the structures inside the containment, all attachments to the containment, and the containment supports. LRA Table 2.4-1 identifies the primary containment component groups requiring aging management review, the associated component intended function(s), and the aging management review reference. Since LRA Table 2.4-1 combines many components under a single component group, the staff requests that the applicant identify which component group is intended to cover the specific components listed in (a) through (k) below, or identify the location in the LRA where these specific components are addressed. If these specific components are not considered to be within the scope of license renewal, please provide the technical bases for their exclusion. To assist in the review, the staff has noted figure numbers from either the Dresden or the Quad Cities UFSAR that identify specific components. However, the component list applies to all four units.

(a) Reactor Vessel to Biological Shield Stabilizers (D-UFSAR Figs. 3.9-1 and 2)

(b) Biological Shield to Containment Stabilizer (D-UFSAR Figs. 3.9-1 and 2 and QC-UFSAR Fig. 3.9-5 and 8)

(c) RPV Male Stabilizer Attached to Outside of Drywell Shell (QC-UFSAR Figs. 3.9-5 and 8)

(d) RPV Female Stabilizer and Anchor Rods (also referred to as Gib) embedded in Reactor Building concrete wall (D-UFSAR Fig. 3.9-1 and QC-UFSAR Figs. 3.9-8 and 9)

(e) Biological Shield Wall and Anchor Bolts (D-UFSAR Figs. 3.9-2 and 3 and QC-UFSAR Figs. 3.9-5 and 6))

(f) Reactor Vessel Support Skirt and Anchor bolts (D-UFSAR Figs. 3.9-2 and 3 and QC-UFSAR Figs. 3.9-5, 6 and 10)

(g) Reactor Vessel Support Ring Girder and Anchor Bolts (D-UFSAR Figs. 3.9-2 and 3 and QC-UFSAR Figs. 3.9-5, 6 and 10)

(h) Reactor Vessel Support Pedestal (D-UFSAR Figs. 3.9-2 and 3 and QC-UFSAR Figs. 3.9-5 and 6)

(i) Drywell internal 6x1-inch steel shear ring (QC-UFSAR Figs. 3.9-5 and 7)

(j) Drywell steel support skirt and anchor bolts (QC-UFSAR Figs. 3.9-5 and 7)

(k) The drywell head closure bolts and double gasket, tongue-and-groove seal arrangement (described in LRA Section 2.4.1)

RAI 2.4-3

Leakage through the refueling seals located at the top of the drywell potentially exposes the carbon steel drywell shell inner and outer surfaces to loss of material due to corrosion. This is a particular concern for the embedded portion of the drywell shell. Corrosion detected on the outer shell surface in the sand pocket region in a number of Mark I steel containments has been attributed to leakage past the drywell-to-reactor building refueling seal, coupled with clogging of the sand pocket drains. Leakage into the drywell, past the reactor vessel-to-drywell refueling seal, creates the potential for corrosion of the inaccessible portion of the inner surface of the drywell shell, embedded in the concrete floor.

From the information contained in the LRA, it is not clear to the staff (1) whether the refueling seals have been included in the license renewal scope, and (2) if included, how aging management is being addressed. Therefore, the applicant is requested to submit the following information:

(a) Verification that the refueling seals are included in the license renewal scope, or a detailed explanation for their exclusion.

(b) A detailed description of the plant-specific operating experience for the refueling seals in all four (4) units, including incidences of degradation, method of detection, root cause, corrective actions, and current inspection procedures.

(c) A detailed description of the scoping, screening, and aging management review for the refueling seals.

(d) The aging management program(s) credited to manage aging of the refueling seals.

RAI 2.4-4

LRA Table 2.4-2 presents a comprehensive list of component groups. However, for certain components, the staff requires further explanation to complete its evaluation. The applicant is requested to submit the following information:

(a) A description of “Neutron-Absorbing Sheets,” and an explanation why it is included as a structural component when the aging management results are documented in LRA 3.3 - Auxiliary Systems.

(b) A description of “Secondary Containment Boot Seals.”

(c) Verification that “Storage Racks” refers to spent fuel racks, and an explanation why it is included as a structural component when the aging management results are documented in LRA 3.3 - Auxiliary Systems.

RAI 2.4-5

Based on information provided in LRA Section 2.4.6, the exact scope of structural components included in this section is not clear to the staff. Also, clarification is needed for several “Components” listed in Table 2.4-6.

In order to complete the screening review for the station blackout building and yard structures, the staff requests the applicant to submit the following information:

(a) LRA Table 2.4-6 lists the following components requiring an aging management review: “Bus Duct Covers,” “Bus Duct Supports,” “Dead End Structures,” and “Transmission Towers.” These appear to be the yard structures. Verify that the staff’s interpretation is correct, or describe more completely the yard structures included in the scope of this section.

(b) The staff has assumed that the foundations for the bus duct supports, dead end structures, and transmission towers, and also for the transformers and circuit breakers are included with the SBO building foundation under the LRA Table 2.4-6 component group “Foundations.” Verify that the staff’s interpretation is correct, or describe more completely the foundations included in the scope of this section.

(c) The component “steel piles (Dresden only)” is also listed in LRA Table 2.4-6. LRA Section 2.4.6 provides no description of the steel piles. Describe the steel piles at Dresden and define intended function(s). Also explain why the “Aging Management Ref” for the steel piles is 3.3.2.207. LRA Section 3.3 covers Auxiliary Systems.

<u>RAI 2.4-6</u>

LRA Table 2.4-10 presents the list of structural components applicable to the miscellaneous foundations. The applicant's description of the miscellaneous foundations does not explain the component "Caulking/Sealants (Dresden)." It is not clear to the staff what the application would be for foundations. The applicant is requested to submit a detailed description of this component and its intended function.

<u>RAI 2.4-7</u>

UFSAR Section 9.2.5 describes the ultimate heat sink for both stations. A summary of these descriptions is contained in LRA Section 2.3.3.22 "Ultimate Heat Sink." The staff reviewed this information in depth, in order to ensure that all structures and structural components, including earthen embankments, that are necessary to guarantee the ultimate heat sink, have been identified to be within the scope of license renewal and subject to an aging management review. To complete its review of LRA Section 2.4.11, the staff requires a number of clarifications concerning the ultimate heat sink at both stations.

Quad Cities: LRA Section 2.4.11 Crib House states that at Quad Cities, the crib house includes the suction lines for the RHR service water system. It also states that for license renewal purposes the Quad Cities discharge flume weir wall that forms one of the boundaries of the UHS is included as part of the crib house. To complete the review the staff requests the following information:

(a) Clarify why the suction lines for the QC Diesel Generator Cooling Water Pumps are not included in the discussion since they are described in LRA Section 2.3.3.22 as taking suction from the crib house.

(b) Explain why the following components related to the Quad Cities crib house are not included in the aging management review, or identify the component group in LRA Table 2.4-11 that includes them (for reference, some of the items are identified in Figure 2.4-2 of the QC UFSAR):

- Intake flume/canal (define all boundaries that form the basin)
- Log Boom
- Crib House wire mesh screens, if applicable
- Crib House stop logs, if applicable
- Crib house dewatering valves and trash rake refuse pit, if applicable
- Discharge structure, including rolling gates
- 16 ft diameter discharge piping
- 96" Ice Melting Line, including gate
- 14" Circulating Water Pipe
- Discharge flume/canal (define all boundaries that form the basin)
- Weir gate in the discharge canal

Dresden: LRA Section 2.4.11 Crib House states that at Dresden, the crib house includes the diesel generator cooling pumps and the suction piping for the containment cooling service water system pumps. It also states that the crib house contains stop logs that can be used to isolate the compartment and raise its water level where the containment cooling service water system

pump and the diesel fire pump take their suction. To complete the review the staff requests the following information:

(c) Confirm that for Dresden the cooling lake and associated “hot” and “cold” canals, described in Dresden Station UFSAR Section 2.4, are not part of the ultimate heat sink and do not serve an intended function for license renewal. If they do, submit the aging management review, including the credited aging management program(s).

(d) Explain why the following components related to the Dresden crib house are not included in the aging management review, or identify the component group in LRA Table 2.4-11 that includes them (for reference, some of the items are identified in Figure 2.4-1 of the Dresden UFSAR):

- Intake flume/canal (define all boundaries that form the basin)
- Floating Boom protecting intake canal
- Crib House wire mesh screens
- Crib House stop logs
- Crib house dewatering valves and trash rake refuse pit
- Discharge Outfall Structure, including rolling gates
- 14.0 ft Diameter Circulating Water Pipe from Power Plant
- 8.0 ft Diameter Ice Melt Recirculating Pipe, including ice melt gate (or deicing valve)
- Circulating water pipe, similar to 14" circulating water pipe shown on Figure 2.4-2 of the QC UFSAR, if applicable
- Discharge flume/canal (define all boundaries that form the basin)
- Flow-regulating Station

RAI 2.4-8

Based on the information provided in LRA Section 2.4.12, it is not clear to the staff that “fire barrier” is the only intended function for the walls and ceilings of the Dresden Unit 1 crib house. The applicant is requested to submit the following information:

(a) How would collapse of the building walls and ceiling effect the availability of the diesel-driven fire pump?

(b) Are the walls and ceiling inspected as part of Maintenance Rule structures monitoring, and is this program credited to manage aging of the walls and ceiling for license renewal?

RAI 2.4-9

Based on information provided in LRA Section 2.4.14, the staff cannot identify which “LRA Aging Management Ref No” is applicable to each of the crane/rail systems included in the scope of LRA 2.4.14. Also, it is unclear to the staff why cranes and hoists have been split into two (2) groups, covered under different sections of LRA Section 2.0, and why all references to aging management results point to LRA Section 3.3 - Auxiliary Systems.

The applicant is requested to clarify the treatment of cranes and hoists in the scoping and screening, and in the aging management review. Please submit the following information:

(a) A list of all cranes/hoists/rails and associated components in the scope of license renewal.

(b) A list of all cranes/hoists/rails and associated components excluded from the license renewal scope, and the technical bases for their exclusion.

(c) A list of all cranes/hoists/rails and associated components requiring an aging management review (i.e., passive, long-lived).

(d) A list of all cranes/hoists/rails and associated components requiring aging management and/or TLAA, and the specific aging management program(s) and TLAAs credited to manage aging.

RAI 2.4-10

Based on information provided in LRA Section 2.4.15, it is not clear to the staff that all component supports within the scope of license renewal are included in the component supports commodity group. Also, clarification is needed for several “Components” listed in Table 2.4-15.

In order to complete the screening review for component supports, the staff requests the applicant to submit the following information:

(a) Clarify if the ASME Class 1 supports in this commodity group include the reactor vessel support skirt /support ring and reactor vessel upper lateral stabilizer support. If not, where are these supports addressed in the LRA? If not managed by ASME Section XI, Subsection IWF, submit the technical basis for crediting an alternate aging management program.

(b) Clarify if the ASME Class MC supports in this commodity group include the drywell lower ring support and the drywell upper lateral support. If not managed by ASME Section XI, Subsection IWF, submit the aging management review for the drywell supports, including the technical basis for this exception.

(c) Since LRA Section 2.4.15 is not referenced anywhere in LRA Sections 2.3 or 2.4, verify that all supports associated with “Components” listed in LRA Sections 2.3 and 2.4.1 through 2.4.14 are included in the component supports commodity group. If not, identify the supports not included and submit the aging management review, including credited aging management programs.

(d) Verify that the “Anchorage to Buildings Including Bolted/Welded Connections” component in LRA Table 2.4-15 includes anchors directly into concrete.

RAI 2.4-11

Based on information provided in LRA Section 2.4-16, the staff cannot identify the insulation and insulation jacketing included in the license renewal scope nor the specific subset that is included in this commodity group. It is also unclear whether insulation and jacketing on the reactor coolant system has been included.

In LRA Table 2.4-16, the aging management references are to LRA Sections 3.2 (Engineered Safety Features), 3.3 (Auxiliary Systems), and 3.4 (Steam and Power Conversion Systems). However, in LRA Section 2.3 (Scoping and Screening Results: Mechanical), insulation is not discussed and there are no references to LRA Section 2.4.16.

In order to complete the screening review for insulation and insulation jacketing, the staff requests the applicant to submit the following information:

(a) Specifically identify the mechanical systems or portions of systems that have insulation and/or insulation jacketing within the license renewal scope, and their location in the plant.

(b) Specifically identify the structures and structural components that have insulation and/or insulation jacketing within the license renewal scope, and their location in the plant.

(c) Specifically identify any insulation and/or insulation jacketing within the license renewal scope, but not included in the insulation commodity group; submit the aging management review for this insulation and/or insulation jacketing.

(d) List all insulation and insulation jacketing materials included in the insulation commodity group and the results of the aging management review for each.

(e) For insulation and insulation jacketing materials not requiring aging management, submit the technical basis for this conclusion, including plant-specific operating experience.

(f) For insulation and insulation jacketing materials requiring aging management, identify the aging management program(s) credited to manage aging.

Section 3.0 Aging Management Review Results

RAI 3.0-1

The following RAI is applicable to various subsections of LRA Section 3.0.

Numerous tables included in the application list the component material and environment to which the component is exposed. However, the applicant did not provide a description of these environments (both internal and external) in the LRA. It should be noted that the aging effect depends on the component material as well as the plant specific environment characteristic. A description of the specific information, such as dry gas, moist air, warm moist air, air, moisture and humidity <100°C, indoor and outdoor environment, outdoor ambient condition, raw water, treated water, soil and groundwater, leaking fluid, refrigerant and sheltered, should be defined in terms of ranges of temperature, humidity, pressure, compositions, etc. This environmental information is necessary for the staff to perform its AMR of structures and components in the LRA. Provide a description of the environments included in the LRA.

Section 3.2 Aging Management of Engineered Safety Features

RAI 3.2-1

(a) To satisfy the "Further Evaluation Criteria" for the components covered by LRA Tables 3.2-1, Items 3.2.1.3 and 3.2.1.5, GALL recommends a plant-specific aging management program. The aging effects identified for the components covered by Items 3.2.1.3 and 3.2.1.5 are loss of material due to general corrosion and pitting/crevice corrosion, respectively. LRA Sections 3.2.1.1.3 and 3.2.1.1.5 state that the one-time inspection (B.1.23) will be used rather than an aging management program that requires periodic monitoring of these components to manage loss of material. Since these components are carbon steel and may be subjected to moisture, an aging management program requiring periodic inspections should be used rather than a one-time inspection. Justify the use of the one-time inspection program for the components covered by Table 3.2-1, Items 3.2.1.3 and 3.2.1.5.

(b) LRA Table 3.2-1, Items 3.2.1.3 and 3.2.1.5, states that further evaluation of loss of material due to general corrosion, and pitting/crevice corrosion, are described in Sections 3.2.1.1.3 and 3.2.1.1.5, respectively, for the components in standby gas treatment, containment isolation, and emergency core cooling systems. In Sections 3.2.1.1.3 and 3.2.1.1.5 of the LRA, the applicant provides a description of an one-time inspection, which consists of four ultrasonic tests to detect reduction in wall thickness at specific locations. The applicant states that engineering will specify one safety relief (SR) discharge piping inspection location at Dresden and another at Quad Cities, and that engineering will also specify one HPCI piping inspection location at Dresden and another at Quad Cities. No sample RCIC piping at Quad Cities was specified, however. Provide the basis for the determination of the sample size and location for inspection and justify why the proposed one-time inspection of the HPCI and SR piping will be adequate to ensure that the effects of aging to the RCIC piping will be adequately managed during the extended operation.

RAI 3.2-2

LRA Table 3.2-1, Items 3.2.1.3 and 3.2.1.5, address loss of material due to general corrosion and pitting/crevice corrosion, respectively, for components in standby gas treatment, containment isolation, and emergency core cooling systems. LRA Table 2.3.2-1, for HPCI system, and Table 2.3.2-4, for RCIC system (Quad Cities only), however, does not provide Items 3.2.1.3 and 3.2.1.5 as the AMR links for components in the two systems. Explain why Items 3.2.1.3 and 3.2.1.5 are not included in Tables 2.3.2-1 and 2.3.2-4 as the AMR links.

RAI 3.2-3

LRA Table 3.2-2, Items 3.2.2.40 and 3.2.2.42, define loss of material from galvanic corrosion as an aging effect/mechanism for heat exchanger for the defined material and environment. The referenced AMPs in Table 3.2-2, Water Chemistry (B.1.2), Selective Leaching of Materials (B.1.24), and Heat Exchanger Test and Inspection Activities (B.2.6), for this component grouping, as described in Appendix B of the LRA, do not address the management of the aging effects loss of material due to galvanic corrosion. Industry experience has shown that loss of material from galvanic corrosion is typically managed utilizing specifically designed aging

management programs. Provide justification for the adequacy of the specified AMPs' ability to manage aging of the HPCI heat exchangers due to galvanic corrosion.

RAI 3.2-4

LRA Table 3.2-1, Item 3.2.1.8, lists drywell and suppression chamber spray system nozzles and flow orifices as components to be subject to the aging effect of plugging of nozzles and flow orifices due to general corrosion. The applicant states that Dresden and Quad Cities have brass/bronze spray nozzles, while GALL specifies carbon steel material for this component group. This would seem to imply that Item 3.2.1.8 is applicable to only flow orifices. However, the applicant did not provide the plant-specific AMR results for the flow orifices in Item 3.2.1.8, including the required "Further Evaluation" as recommended for this GALL item. In addition, in LRA Tables 2.3.2-1 through 2.3.2-11, the staff was not able to identify Item 3.2.1.8 as a link for the flow orifices. In Table 2.3.2.1, where the only flow orifice components are identified, the applicant provides Table 3.2-1, Items 3.2.1.2 and 3.2.1.4, and Table 3.2-2, Item 3.2.2.137, as links. The applicant is requested to explain the above stated discrepancies in the Application.

RAI 3.2-5

In LRA Table 2.3.2-6, Items 3.2.2.22, 3.2.2.23, and 3.2.2.30 were identified as AMR links for RHR dampeners (Quad Cities only). In all items, stainless steel is listed as the material of construction. Items 3.2.2.22 and 3.2.2.23 identify air, moisture, and humidity as the external environment, whereas air is identified as environment for Item 3.2.2.30. Explain the effects of environmental temperature, of less than 100 °C (212 °F) vs. greater than 100 °C (212 °F), as indicated in Items 3.2.2.22 and 3.2.2.23, respectively, on the AMR review for the dampeners. Also provide the basis for having identified loss of material as an aging effect due to pitting and crevice corrosion in Item 3.2.2.30, but not in Items 3.2.2.22 and 3.2.2.23.

RAI 3.2-6

LRA Table 2.3.2-6 identifies an AMR link of 3.2.2.14 for the external surfaces of carbon steel piping and fittings (Quad Cities only), exposed to a containment nitrogen environment. Provide justification for the determination that a containment nitrogen environment is not conducive to promoting aging degradation.

RAI 3.2-7

LRA Table 2.3.2-8 identifies Item 3.1.1.1 as a AMR link for closure bolting in the Standby Liquid Control System. The applicant states in Item 3.1.1.1 that further evaluation of cumulative fatigue is described in LRA Section 3.1.1.1.1. LRA Section 3.1.1.1.1, Cumulative Fatigue Damage BWR/PWR, states that no fatigue analysis exists for reactor coolant pressure boundary valves or valve closure bolting. NUREG 1801 states that fatigue is a time-limited aging analysis (TLAA) to be performed for the period of extended operation. Justify why no TLAA was performed for reactor coolant pressure boundary valves or closure bolting in accordance with NUREG 1801.

RAI 3.2-8

The applicant states in LRA Section 2.3.2.10 that Dresden and Quad Cities design basis documents treat the Automatic Depressurization System (ADS) relief valves and associated

piping, solenoids, pressure controllers and position switches as components of the main steam system. These mechanical components of the ADS subject to an aging management review are, therefore, included as components of the main steam system in the Application. In LRA Table 3.4-2, Item 3.4.2.51, under Discussion, the applicant states that NUREG-1801 does not address crevice and pitting corrosion of stainless steel valves in a treated water environment. Under Aging Effect/Mechanism of Item 3.4.2.51, however, crack initiation and growth/stress corrosion cracking and intergranular stress corrosion cracking are identified as aging effects/mechanisms requiring management, in a 288 ^{o}C steam environment. Clarify whether these valves, identified in Item 3.4.2.51, apply to ADS system. Also, explain the above discrepancies found and provide the correct AMR review results.

RAI 3.2-9

In LRA Table 2.3.2-11, Item 3.2.1.12 is identified as an AMR link for valves in the ATWS system. The aging effect/mechanism identified for Item 3.2.1.12 is wall thinning due to flow-accelerated corrosion, with Flow-Accelerated Corrosion (B.1.11) identified as an AMP. The applicant identifies exceptions to Flow-Accelerated Corrosion in LRA Section 3.2.1.2.1, where it states, "Flow accelerated corrosion is an applicable aging mechanism for the Quad Cities HPCI steam line drains. However, carbon steel components in the ATWS, isolation condenser, core spray, LPCI (Dresden only), RHR (Quad Cities only), primary containment and suppression pool piping, HPCI (except as previously noted) and RCIC (Quad Cities only) systems are not susceptible to flow accelerated corrosion and do not require aging management." Clarify the above discrepancy for the AMR for valves in ATWS system, and verify that the aging effect/mechanism of wall thinning due to flow-accelerated corrosion, as addressed in Item 3.2.1.12, is applicable to the ATWS system.

Section 3.3 Aging Management of Auxiliary Systems

The following RAIs (RAI 3.3-1 through 3.3-9) are applicable to more than one specific SSC in the auxiliary systems.

RAI 3.3-1

Metals and alloys that are in contact with different, more cathodic metals or alloys in the presence of an electrolyte fluid may be subjected to the aging effect of loss of material from galvanic corrosion. Many system/components of the auxiliary system described by various items in Table 3.3-2 of the LRA have materials/environment combinations to which loss of material from galvanic corrosion may be an applicable aging effect/mechanism. The specific system/components and materials/environment combinations that may be subjected to galvanic corrosion as well as applicable parts of Table 3.3-2 of the LRA are discussed below:

For some components in the refueling equipment system and the HVAC - main control room system, the applicant does not include loss of material due to galvanic corrosion as an aging effect/mechanism that requires management for the period of extended operation. For example, for the refueling equipment system, Table 3.3-2, reference numbers 3.3.2.74, 75, and 76 identified loss of material due to crevice and pitting corrosion for stainless steel components and the loss of material due to general and pitting corrosion for aluminum components as aging effects and mechanisms in a chemically treated oxygenated water environment, but does not include loss of material due to galvanic corrosion for this environment. Also for Air Handlers

Heating/Cooling (CR HVAC) with a pressure boundary intended function, Table 2.3.3-7 identified the Aging Management Ref No 3.3.1.5 in Table 3.3-1and the Ref No 3.3.2.11 in Table 3.3-2 as the applicable aging management program identifiers. It does not include loss of material due to galvanic corrosion as an applicable aging effect/mechanism. However, the staff noted that for some components in the HVAC - diesel generator building (air handler component described in Ref No 3.3.2.14 in Table 3.3-2) the applicant includes loss of material due to galvanic corrosion as an aging effect/mechanism that requires management for the period of extended operation. Provide the technical basis, including plant operating experience for determining whether loss of material due to galvanic corrosion is an applicable aging effect/mechanism for the applicable components included in the auxiliary system.

Aluminum and aluminum alloys components may experience galvanic corrosion when in contact with dissimilar materials while exposed to moisture and humidity environments, especially with the presence of contaminants and water (condensation from moist air). However, in Table 3.3-2, Ref No 3.3.2.126 of the LRA, the applicant identifies only loss of material due to general and pitting corrosion as plausible aging effects for aluminum components exposed to moist air. In Table 3.3-2, Ref No 3.3.2.21 of the LRA, the applicant concludes that there is no aging effect on aluminum components of the air handlers heating/cooling system exposed to air, moisture, and humidity environments. Provide technical basis for not including loss of material due to galvanic corrosion as an applicable aging effect.

Similarly in Ref. No 3.3.2.49 in Table 3.3-2 of the LRA, the applicant states that aluminum-zinc alloy duct in an environment consisting of warm, moist air experience no aging effect. However, if these aluminum components are attached to ducts used to transport cold air, surface condensation may occur and lead to galvanic corrosion of these components. Provide justification for not including loss of material due to galvanic corrosion as an aging effect/mechanism that requires management for the period of extended operation.

Cast iron and carbon steel components in raw water environment may be subjected to loss of material from galvanic corrosion if they are in contact with different metallic materials. Clarify whether this is an applicable aging effect/ mechanism for these components in the ultimate heat sink. If so, provide the applicable AMP. If not, provide the basis including applicable operating experience.

Clarify whether any part of the external surface of carbon steel, brass or bronze components of the carbon dioxide system in an air, moisture, humidity environment are in contact with different metallic components and specify whether loss of material due to galvanic corrosion is an applicable aging effect. If so, provide the applicable AMP(s).

For the plant heating system, cast iron, carbon steel, and copper, brass or bronze components in saturated steam/condensate environment may be subjected to loss of material from galvanic corrosion if they are in contact with more cathodic metallic materials. Clarify whether this is an applicable aging effect/aging mechanism for these components in the plant heating system. If so, provide the applicable AMP. If not, provide the basis including applicable operating experience.

For components in the service water system described with item 3.3.2.208 of Table 3.3-2 of the LRA for the material/environment of cast iron/raw, untreated salt water or fresh water the applicant has listed loss of material/galvanic corrosion as an applicable aging effect/aging mechanism. But in item 3.3.2.179 loss of material/galvanic corrosion is not included as an

applicable aging effect/ mechanism for the same material/environment. Clarify whether the cast iron components described in item 3.3.2.179 are susceptible to loss of material due to galvanic corrosion. Susceptible locations may include parts of the component that are in contact with different metallic materials. If so, specify the applicable AMP. If not, provide technical basis including applicable operating experience.

RAI 3.3-2

For HVAC - main control room system, shutdown cooling system, and control rod drive hydraulic system, the applicant identifies in Ref No 3.3.2.130 of Table 3.3-2 the material environment combination and applicable aging effects on components of NSR vents or drains, piping and valves. The description in Ref No 3.3.2.130 lists “Loss of material/corrosion” as Aging Effect/Mechanism for carbon steel, stainless steel, brass or bronze components in an environment of “Air, moisture, humidity and leaking fluid.” However, the applicant does not specifically identify which type of corrosion is responsible for the loss of material. It should be noted that the adequacy of aging management programs to manage the aging effect of loss of materials due to corrosion may depend on correctly identifying the type of corrosion responsible. For example the appropriate susceptible locations for inspection (in One-Time Inspection AMP (B.1.23)) for general, crevice, galvanic and pitting corrosion may not be the same. Provide a specific description of the types of corrosion responsible for the aging effect of loss of materials for these systems and components so that the staff is able to evaluate the aging management of these systems and components. In addition, in the One-Time Inspection AMP (B.1.23), which is credited with managing the aging effects on these components, the applicant states that this AMP will inspect a sample of the NSR vents or drains, piping and valves in the shutdown cooling system (Dresden only) and the control rod drive hydraulic system for general, crevice, galvanic, and pitting corrosion. Provide the criteria for selecting these samples including susceptible locations for inspections.

RAI 3.3-3

Carbon steel and stainless steel components exposed to moist gas (moist nitrogen) or moist air environment may experience aging effects of loss of material due to general (for carbon steel only), pitting, and crevice corrosion (for both carbon steel and stainless steel) when pollutants such as oxygen, SO_2, NO_x, or CO are present in the moist air, particularly when the humidity is greater than 60%. However, in Table 3.3-2, item Ref No 3.3.2.27 (for carbon steel), and item Ref No 3.3.2.40 (for stainless steel) of the LRA, the applicant concludes that no aging effects are identified for the external surfaces of the carbon steel and stainless steel piping and fittings, accumulators, dampeners, filters/strainers, flow elements, pumps, orifices, rupture discs, tanks, tubing, and valves components exposed to either the containment nitrogen gas environment or air, moisture, humidity environment because these components “are not subject to any viable aging mechanism in the absence of aggressive chemical species.” Provide information on whether the pollutants such as oxygen, NO_x, SO_2, or CO are present and if so, to what extent in the containment gas or air, moisture, humidity environments to justify the conclusions in Table 3.3-2, items Ref No 3.3.2.27 and 3.3.2.40.

The LRA does not identify any aging effect for stainless steel, brass or bronze components in “the air, moisture, and humidity < 100 °C environment” for components in the containment atmosphere monitoring system. The staff notes that the LRA identifies stainless steel components in apparently similar environments (such as warm moist air, wet gas, and moist

containment atmosphere in items Ref No 3.3.2.166, 3.3.2.299, 3.3.2.195) as being subjected to loss of materials from pitting and crevice corrosion. Clarify the differences.

RAI 3.3-4

Aluminum and aluminum alloys components may experience general, pitting, and crevice corrosion when exposed to moisture and humidity environments, especially with the presence of contaminants and water (condensation from moist air). However, in Table 3.3-2, Ref No 3.3.2.126 of the LRA, the applicant identifies only loss of material due to general and pitting corrosion as plausible aging effects for aluminum components exposed to moist air. In Table 3.3-2, Ref No 3.3.2.21 of the LRA, the applicant concludes that there is no aging effect on aluminum components of the air handlers heating/cooling system exposed to air, moisture, and humidity environments.

Explain why different conclusions on aging effect were arrived in Table 3.3-2, Ref No 3.3.2.21 and Ref No 3.3.2.126 for the same material/environment combination.

Provide technical basis for not including loss of material due to crevice corrosion as an applicable aging effect.

Clarify if there is any condensate on the aluminum fins of cooling coils. If so, provide technical basis for the conclusion in Table 3.3-2, Ref No 3.3.2.21 of the LRA.

RAI 3.3-5

In LRA Table 3.3-2, Ref No 3.3.2.18, the applicant states that high strength low alloy steel closure bolting components in the outdoor ambient conditions are subject to aging effects of loss of material due to general corrosion and wear. However, the applicant does not include crack initiation and growth due to SCC or other mechanisms as applicable aging effect/mechanisms. Provide technical basis for not including this aging effects/mechanisms.

RAI 3.3-6

Loss of material due to general, pitting, and crevice corrosion may be an applicable aging effect on carbon steel components exposed to chemically treated demineralized water. However, in Table 2.3.3-17, Table 2.3.3-18, and Table 3.3-2, Ref No 3.3.2.68, Ref No 3.3.2.137, 3.3.2.267 of the LRA, loss of material due to general, pitting, and crevice corrosion was not identified as an applicable aging effect/aging mechanism on carbon steel components exposed to chemically treated demineralized water < 90 ^{o}C. Provide the technical basis for not including this aging effect/mechanisms from the aging management review. If loss of materials due to general, pitting, and crevice corrosion are applicable aging effect/mechanisms, provide information on the AMP(s) that can adequately manage the identified aging effect.

RAI 3.3-7

In numerous system/structure/component scoping tables in Section 2.3.3 of the LRA, the applicant uses Ref No 3.3.1.5 of Table 3.3-1 to describe the aging management of various in-scope components of the auxiliary systems. In Ref No 3.3.1.5 of Table 3.3-1 the applicant stated that the applicable AMPs are plant-specific and further evaluation of loss of material due to general, microbiologically influenced, pitting, and crevice corrosion is described in Section

3.3.1.1.7 of the LRA. The staff reviewed Section 3.3.1.1.7 of the LRA and determined that the following additional information is needed to complete its review:

(a) In order to understand how the aging will be managed for the corrosion mechanisms addressed in Section 3.3.1.1.7 of the LRA, the staff needs a better description how the cited programs will be used to manage the various corrosion mechanisms for the components included in this LRA Section. For each component that uses Reference 3.3.1.5 (which refers to LRA Section 3.3.1.1.7), clarify which specific AMP(s) is applicable for managing the specific corrosion mechanism, and explain how the AMP(s) manage that corrosion mechanism.

(b) The LRA indicates that either the Structure Monitoring Program (B.1.30) or the Bolting Integrity (B.1.12) and the Structure Monitoring Program (B.1.30) programs will be used for managing the aging effects on non-structural components in the service water system. These components include orifices, piping and fittings, piping and fittings attached support, strainer bodies, thermowells, and valves. The Structure Monitoring Program (B.1.30), as described in the LRA, is consistent with GALL program XI.S6, which is specific to structural steel. If the Structure Monitoring Program (B.1.30) is used, explain how the program is used for non-structural carbon steel components. The Bolting Integrity (B.1.12) program, as described in the LRA, is consistent with GALL program XI.M18 (with exceptions), which is specific to bolting and bolted joints. The Bolting Integrity (B.1.12) program description also states that non-safety component inspections rely on detection of visible leakage during preventative maintenance and routine observation activities. If the Bolting Integrity (B.1.12) program is used, explain how the program is used for non-bolting-related inspections. If leakage detection is employed, explain how the AMP manages the aging effects so that the intended functions of the in-scope components will be maintained.

RAI 3.3-8

A one-time inspection program may be used to verify the effectiveness of the Water Chemistry program. However, in Table 3.3-2 Ref No 3.3.2.120, Ref No 3.3.2.186 and Ref No 3.3.2.257 of the LRA, the applicant credited the Water Chemistry (B.1.2) with managing the aging effects on components exposed to demineralized water with temperature ranges of 25 to 288 °C but without one-time inspection. Although the Selective Leaching of Materials (B.1.24) program, which is used in conjunction with the Water Chemistry (B.1.2) program in Ref No 3.3.2.120, has a one-time inspection component, the one-time inspection component in Selective Leaching of Materials (B.1.24) program is designed only to detect the presence of the dealloying of the materials. It is not designed to be a general purpose one-time inspection. Provide technical basis for why a one-time inspection program is not needed to augment the Water Chemistry (B.1.2) program for managing the identified aging effects.

RAI 3.3-9

Items 3.3.2.300 and 3.3.2.29 in table 3.3-2 of the LRA are used by the applicant to describe the AMR of many components in the auxiliary systems. In these items general corrosion on external surfaces is managed with the Bolting Integrity Program (B.1.12). The staff notes that the Bolting Integrity AMP states: “The program consists of visual inspections for external surface degradation that may be caused by loss of material or cracking of the bolting, or by an adverse environment.” This suggests that in this AMP only the bolting material will be inspected

for aging degradation. The description in item 3.3.2.300 and 3.3.2.29 includes many non-bolting components. Provide an explanation (including the acceptance criteria and inspection interval) of the way the Bolting Integrity Program (B.1.12) is used to manage general corrosion on external surfaces of non-bolting components such as piping, valves, mufflers, and others.

3.3.2.4.1 Refueling Equipment

RAI 3.3.2.4.1

Table 3.3-2, Ref No 3.3.2.74 identifies the loss of material due to pitting corrosion for stainless steel components in a chemically treated oxygenated water environment. It does not however, identify crack initiation and growth due to stress corrosion cracking (SCC) as a plausible aging effect/mechanism even though the same environmental conditions generally exist for pitting corrosion as for SCC. Provide justification for not including crack initiation and growth due to SCC as an aging effect/mechanism that requires management for the period of extended operation.

3.3.2.4.2 Shutdown Cooling System (Dresden only)

RAI 3.3.2.4.2

In LRA Table 3.3-2, item Ref No 3.3.2.293, the applicant indicates that stainless steel valves in the shutdown cooling system are exposed to saturated air and subject to aging effect of loss of material due to pitting and crevice corrosion. However, valves are the only component type that are identified as exposed to saturated air environment in the shutdown cooling system. Clarify if there are any other associated components such as piping, pipe fittings, tubing, and tube fittings in the Shutdown Cooling System that may be exposed to the same environment and hence subject to the same aging effects. If so, specify the applicable AMPs.

3.3.2.4.3 Control Rod Drive Hydraulic System

RAI 3.3.2.4.3

Copper and copper alloy components exposed to moist air environment may experience aging effects of loss of material due to pitting and crevice corrosion, especially when the humidity is at 60% or higher and/or with the presence of pollutants such as Oxygen, SO_2, NOx, and NH_4. In LRA Table 3.3-2, item Ref No 3.3.2.23 and 3.3.2.34, the applicant concludes that no aging effects were identified for the external surfaces of copper tanks and accumulators and the external surfaces of brass or bronze valves in the control rod drive hydraulic system exposed to the moisture and humidity air environment because "The plant indoor environment is not an aggressive wetted environment conducive to promoting aging degradation of brass or bronze (3.3-2, Ref No 3.3.2.23) or copper (3.3.2.34) components." Provide the technical basis (including the level of humidity and the level of pollutants) for this conclusion.

3.3.2.4.4 Reactor water cleanup system

RAI 3.3.2.4.4

(a) What is the difference between the environment of moist air and (air, moisture, and humidity < 100 ^oC (212 ^oF)) as stated by applicant in Table 3.3-2, p. 3-141 and p. 3-96 respectively of the LRA? In the former case the applicant stated that loss of materials due to pitting and crevice corrosion for stainless steel components is an applicable aging effect and that One-Time Inspection (B.1.23) is the applicable aging management program. In the latter environment stainless steel components are claimed by the applicant to have no applicable aging effect. Justify the different conclusions drawn in terms of the combination of components/materials/environment/applicable aging effects.

(b) In NUREG-1801 (Vol II, Chapter VII, Section E4) carbon steel components in auxiliary systems such as piping and fittings and pump casing in oxygenated water environment are addressed. Applicable aging effect is loss of materials and fatigue. For loss of materials the recommended AMP is Chapter XI M2 "Water Chemistry" augmented by verification of the effectiveness of the chemistry control. NUREG-1801 suggests that for these cases the detection of aging effects is to be further evaluated. In Table 3.3-2 (p. 3-116, item 3.3.3-140) of the LRA the applicant states that NUREG- 1801 does not address carbon steel components in oxygenated water environment. Clarify this statement using the above information provided by NUREG-1801.

3.3.2.4.6 Emergency diesel generator and auxiliaries

RAI 3.3.2.4.6

(a) In Table 2.3.3-6, page 2-119, Aging Management Ref. 3.3.1.7 refers to piping and fitting (and attached support) and valve (and attached support). Aging Management Ref. 3.3.1.7 credits Fuel Oil Program and One-time Inspection for managing the aging effect of the fuel oil tank and day tank. The AMPs are not related to piping, fitting and valves. On other hand, the tanks group in Table 2.3.3-6 does not include Aging Management Ref. 3.3.1.7 that links to the Fuel Oil Program and One-time Inspection. Provide clarification of the discrepancy.

(b) Cracking is identified as aging effect of Brass or Bronze valves exposed to chemical treated demineralized water in the Aging Management Ref 3.3.2.258 in Table 2.3-6. Loss of material is, however, not identified as aging effect. Provide justification on not identifying loss of material as aging effect for brass or bronze valves exposed to chemical treated demineralized water.

3.3.2.4.7 HVAC - Main Control Room

RAI 3.3.2.4.7

The relevant conditions could exist in the treated water environment of the HVAC - main control room for crack initiation and growth due to stress corrosion cracking (SCC) to occur in carbon steel components. However, this aging effect/mechanism was only addressed for heat exchanger tubes in the auxiliary systems aging management review. Provide justification for

not including crack initiation and growth due to SCC in carbon steel components other than heat exchanger tubes in a treated water environment.

3.3.2.4.8 HVAC – Reactor Building

RAI 3.3.2.4.8

Loss of material due to selective leaching maybe an applicable aging effect for copper alloy components exposed to saturated air environment where water condensation on the surfaces of these components may occur. However, in LRA Table 3.3-2, Ref No 52, 242, and 262, loss of material due to selective leaching was not identified as an applicable aging effect for copper alloy components in saturated air. Provide technical basis for not including this aging effect from aging management review.

3.3.2.4.9 ECCS Corner Room HVAC

RAI 3.3.2.4.9

Normally Heating, Ventilation, and Air-Conditioning systems contain elastomer materials in hose connection seals, duct seals, flexible collars between ducts and fans, rubber boots, etc. For some plant designs, elastomer components are also used as vibration isolators to prevent transmission of vibration and dynamic loading to the rest of the system. The aging effects on those elastomer components are hardening and loss of material. However, no elastomer component is identified for the ECCS Corner Room HVAC in Table 2.3.3-9 of the LRA. Clarify if there is any elastomer component in the ECCS Corner Room HVAC.

3.3.2.4.11 Station Blackout System (diesels and auxiliaries)

RAI 3.3.2.4.11

(a) Loss of material due to selective leaching may be an applicable aging effect for cast iron components in moist air and humidity environment, especially when there is water condensation on the surfaces of these components. However, in LRA Table 3.3-2, Ref No 55, loss of material due to selective leaching was not identified as an applicable aging effect for cast iron components in moist air. Provide technical basis for not including this aging effect from aging management review.

(b) Loss of material due to pitting and crevice corrosion is a plausible aging effect on stainless steel exposed to chemically treated and demineralized water environment. However, in Table 2.3.3-11 of the LRA, the applicant did not identify any loss of material aging effect on the stainless steel components exposed to chemically treated and demineralized water environment. Provide technical basis for not including this applicable aging effect.

3.3.2.4.12 Diesel Generator Cooling Water System

RAI 3.3.2.4.12

(a) LRA table 3.3-2, ref. 3.3.2.16 identifies loss of material from erosion or flow accelerated corrosion (FAC) as applicable aging effects/mechanisms. Open-cycle cooling water

system AMP B.1.13 is identified as the applicable AMP. Clarify whether erosion or FAC is the applicable aging mechanism for components in the diesel generator cooling water system identified in table 2.3.3-12 in the LRA. If erosion is the applicable aging mechanism and not FAC state so explicitly in the LRA. Otherwise address the following issue. Flow accelerated corrosion (FAC) AMP B.1.11 is used to manage wall-thinning due to FAC. A key component in that AMP is the use of analytical evaluations to predict and determine the critical locations for detecting, monitoring, and inspection of FAC. Clarify the role of analytical evaluations in the AMP Open-Cycle Cooling Water System (B.1.13). If analytical evaluation is not a component in the Open-Cycle Cooling Water System B.1.13 AMP, justify its absence and the resulting effectiveness of the AMP in managing the aging effect of loss of material due to FAC.

(b) NUREG-1800 Section 3.3.2.2.11 states that loss of material due to general, pitting and crevice corrosion and MIC could occur in the underground piping and fittings in the open-cycle cooling water system. Dresden UFSAR Section 9.5.5 states that the remaining part of the system's piping and valves traverse to and from the missile-protected diesel and reactor buildings via a reinforced concrete tunnel that runs below ground. Clarify if there is any underground piping in the diesel generator cooling water system that is buried or inaccessible. If buried or inaccessible piping does exist, explain how such piping will be managed for loss of material during the period of extended operation.

3.3.2.4.13 Diesel Fuel Oil System

<u>RAI 3.3.2.4.13</u>

(a) NUREG-1800 Section 3.3.2.2.11 states that loss of material due to general, pitting and crevice corrosion and MIC could occur in the underground piping and fittings in the diesel fuel oil system. LRA Table 2.3.3-13 references 3.3.1.5, 3.3.1.7, 3.3.2.29 and 3.3.2.139 for managing piping and fittings. None of these AMR references include an aging management program for buried piping in the diesel fuel oil system. LRA AMP B.1.25 identifies a one-time visual inspection of the external surface of a buried piping section, but the system is not identified. LRA section 3.3.1.1.14 indicates that a buried section of fire mains is included in the Buried Piping and Tanks Inspection AMP. Explain how buried piping in the Diesel Fuel Oil System will be managed, including the justification based on operating experience.

(b) Filters and strainers are included in Table 2.3.3-13 as passive components with a filter function. Table 3.3-1 ref. 3.3.1.7 identifies loss of material due to general, pitting and crevice corrosion, MIC and biofouling as an aging effect for filters and strainers in the diesel generator fuel oil system. The Fuel Oil Chemistry Program and One-Time Inspection are credited for managing the aging effect. Explain how the fuel oil chemistry program and one-time inspection manage biofouling in the filter and strainer elements. For example, how do these programs provide for inspection and replacement of filters or cleaning strainers and at what frequency to assure that they are performing their filter function? Also clarify if filter elements are considered replaceable or long-lived passive components.

3.3.2.4.15 Carbon Dioxide System

RAI 3.3.2.4.15

(a) In item 3.3.2.260 of Table 3.3-2 of the LRA for the material/environment of brass or bronze/dry gas the applicant has listed no applicable aging effect. In the discussion column the applicant explained that "A moisture free gaseous environment (nitrogen) is not conducive to promoting aging degradation of brass or bronze components." Clarify whether dry carbon dioxide should be included in this discussion. Otherwise explain the applicability of this discussion to the carbon dioxide system.

In item 3.3.2.212 of Table 3.3-2 of the LRA the applicant identifies an environment of dry gas for the tank component of the carbon dioxide system. In section 2.3.3.15 (p. 2-144) of the LRA the applicant describes part of the Cardox unit as a liquid carbon dioxide tank. Resolve the apparent discrepancy between a dry gas environment and liquid carbon dioxide.

(b) The applicant identified no aging effect for carbon steel, or brass or bronze components in a dry gas environment. Dry carbon dioxide is not a degrading environment for carbon steel, or brass or bronze components. But carbon steel components may be sensitive to the presence of moisture in the carbon dioxide environment. Moisture may induce corrosion and corrosion -erosion. Clarify the degree of dryness of the carbon dioxide environment. Specify the activities in place to verify and maintain the degree of dryness of the carbon dioxide environment necessary to minimize aging degradation of carbon steel components during the period of subsequent operation including after periods in which carbon dioxide needs to be replenished or refilled.

3.3.2.4.16 Service Water System

RAI 3.3.2.4.16

The AMR of this system specifies References 3.3.2.208 and 3.3.2.179 for cast iron components in raw water. Reference 3.3.2.208 includes galvanic corrosion as a mechanism for loss of material, but Reference 3.3.2.179 does not. Clarify whether the components covered by Reference 3.3.2.179 (pump casings) are also susceptible to galvanic corrosion and provide the applicable aging management program(s).

3.3.2.4.19 Demineralized Water Makeup System

RAI 3.3.2.4.19

Loss of material due to pitting and crevice corrosion may be an applicable aging effect on aluminum components exposed to outdoor ambient conditions or cast iron exposed to treated water. However, in Table 3.3-2, Ref No 3.3.2.22, the applicant identified loss of material due to pitting corrosion as the only aging effect/mechanism on the aluminum components exposed to outdoor ambient conditions and in Table 3.3-2, Ref No 3.3.2.182, the applicant identifies only loss of materials due to selective leaching as the applicable aging effect/mechanism on cast iron exposed to treated water. Provide the technical basis for the not including the aging effect of loss of material due to crevice corrosion and/or pitting corrosion from the AMR.

3.3.2.4.21 Containment Cooling Service Water System (Dresden only)

RAI 3.3.2.4.21

(a) The Aging Management Ref No 3.3.2.8 and 3.3.2.9 in Table 2.3.3-21 deal with air handlers. The applicant identified loss of material and cracking as applicable aging effects for the components on the tube side exposed to raw water and credited Open-Cycle Cooling Water System (B.1.13) with managing these aging effects. No aging effect is identified for the components on the shell side exposed to warm moist air. Provide justification for not identifying any aging effects for the components on the shell side exposed to warm moist air, especially if there is condensation on the tubes.

(b) The AMR of this system specifies References 3.3.2.208 and 3.3.2.179 for cast iron components in raw water. Reference 3.3.2.208 includes galvanic corrosion as a mechanism for loss of material, but Reference 3.3.2.179 does not. Clarify whether the components covered by Reference 3.3.2.179 (pump casings) are also susceptible to galvanic corrosion and provide the applicable aging management program(s).

3.3.2.4.22 Ultimate Heat Sink

RAI 3.3.2.4.22

(a) Loss of materials from erosion and flow blockage from biofouling, silting and corrosion product buildup may also be applicable aging effects/aging mechanisms for some cast iron components in raw water environment. Clarify whether these are applicable aging effects/aging mechanisms for these components in the ultimate heat sink. If so, provide the applicable AMP(s). If not, provide the basis for not including erosion and flow blockage as applicable aging effect/aging mechanisms, including applicable operating experience.

(b) In table 2.3.3-22 and in item 3.3.2.28 of Table 3.3-2 of the LRA for the material/environment of carbon steel components encased in concrete the applicant has stated that there is no applicable aging effect. Good design and construction practices are necessary to prevent steel corrosion in an environment of being embedded in concrete. Provide specifics of the design and construction practices used for the carbon steel components encased in concrete in the ultimate heat sink, including applicable standards and operating experience.

3.3.2.4.23 Fuel Pool Cooling and Filter Demineralizer System (Dresden only)

RAI 3.3.2.4.23

NUREG 1801 identifies loss of material due to corrosion is an aging effect for shell side components (shell and access cover, channel head and tubes) of heat exchanger of fuel pool cooling and cleanup system exposed to close-cycle cooling water. Provide justification for not identifying any aging effect for the shell side components of the heat exchanger of the fuel pool cooling and filter demineralizer system in LRA Table 2.3.3-23.

3.3.2.4.24 Plant Heating System

RAI 3.3.2.4.24

(a) Loss of materials from selective leaching may be an applicable aging effect/aging mechanism for cast iron and brass components in saturated steam/condensate as well as air, moisture, humidity, and leaking fluid environments, if stagnant liquids are present in these environments. Clarify whether these are applicable aging effects/aging mechanisms for these components in the plant heating system (including applicable operating experience) and provide appropriate AMP(s), if applicable.

Loss of materials from selective leaching may be an applicable aging effect/aging mechanism for cast iron and brass components in saturated steam/condensate as well as air, moisture, humidity, and leaking fluid environments if stagnant liquids are present in these environments. Clarify whether these are applicable aging effects/aging mechanisms for these components in the plant heating system. Provide the applicable AMP(s) or the basis not including these aging effects (including applicable operating experience).

(b) In item 3.3.3.214 in table 3.3-2 of the LRA the applicant describes the aging management of the carbon steel tank component in the plant heating system using the AMP one-time inspection (B.1.23). Clarify whether all parts of the tank(s) are accessible to inspection. If not, clarify the aging management of the inaccessible parts of the tank(s) component of the plant heating system.

3.3.2.4.27 Drywell Nitrogen Inerting System

RAI 3.3.2.4.27

In Table 3.3-2, Ref No 124 of the LRA, the applicant identified carbon steel material exposed to warm, moist air as subject to aging effect of loss of material due to pitting and crevice corrosions. However, in Ref No 273 for the same material/environment combination, the applicant identifies loss of material due to general, pitting, and crevice as applicable aging effect. Clarify why different AMR results were arrived for components with the same material/environment combinations.

3.3.2.4.28 Safe Shutdown Makeup Pump System (Quad Cities only)

RAI 3.3.2.4.28

LRA Table 2.3.3-28 includes filters/strainers with a filter function and references 3.3.1.19 in section 3.3. It appears that reference 3.3.1.19 applies to fire protection rather than the safe shutdown makeup pump system and this reference does not indicate how the filter function is managed. LRA section 2.3.3.28 indicates that the evaluation boundary includes the safe shutdown room cooler and its associated piping from the service water system (evaluated with the service water system). If the strainer screens in the safe shutdown makeup pump system (such as the safe shutdown room cooler strainer) are evaluated with the service water system in table 3.3-1 ref. 3.3.1-15 which credits the B.1.13 AMP, please so clarify and include in Table 2.3.3-28. If the filters/strainers in the safe shutdown makeup pump system are not evaluated with the service water system, clarify how the strainer screens are managed. If the pump

suction strainers (shown in boundary diagram LR-QDC-M-70) are temporary start-up strainers that are replaced by a spool piece once in operation, so clarify. If these suction strainers are permanent, identify their appropriate AMR reference.

Section 3.4 Aging Management of Steam and Power Conversion System

RAI 3.4-1 (General)

Table 3.4-1, "Aging Management Programs Evaluated in NUREG-1801 that are Relied On for License Renewal for the Steam and Power Conversion System," Ref No 3.4.1.8, page 3-150, refers to the open-cycle cooling water system in the component column. This appears to be a typo in that Ref No 3.4.1.7 also refers to the open-cycle cooling water system. The AMP for Ref No 3.4.1.8 is the Closed-Cycle Cooling Water System (B.1.14). Verify that the components of Ref No 3.4.1.8 is associated with the open-cycle cooling water system or revise Table 3.4-1.

3.4.1 Main Steam System

RAI 3.4.1-1

Table 3.4-2, Ref No 3.4.2.51, page 3-161, the Discussion does not agree with the Aging Effect/Mechanism. The Discussion addresses crevice and pitting corrosion in a treated water environment, while the Aging Effect/Mechanism addresses crack initiation and growth/stress corrosion cracking and intergranular stress corrosion cracking in a 288 ^{o}C steam environment. Verify that the Aging Effect/Mechanism should be Loss of material/Pitting and crevice corrosion in a treated water environment or include the BWR Stress Corrosion Cracking AMP as an AMP and correct the Discussion column for Ref No 3.4.2.51.

RAI 3.4.1-2

Table 2.3.4-1, for component groups piping and fittings, rupture disks, thermowells, and vacuum breakers refer to Aging Management Ref. 3.2.1.3 of Table 3.2-1. The discussion column of 3.2.1.3 refers to Section 3.2.1.1.3 of the LRA. Section 3.2.1.1.3 does not address the main steam system. Verify that Aging Management Ref 3.2.1.3 is applicable to the main steam system, revise Section 3.2.1.1.3 of the LRA to address the main steam system, or delete the reference in Table 2.3.4-1.

RAI 3.4.1-3

For flexible hoses in the main steam system, the LRA uses Ref. No. 3.4.2.18, which addresses flexible hoses made of elastomers of neoprene and similar materials, in a containment nitrogen environment, and no aging effects. Environmental conditions such as temperature and radiation can affect the aging of neoprene and similar materials. Clarify the environment with respect to temperature, radiation levels, and time when the containment is not or has not been inerted, to justify that the neoprene hoses do not require aging management.

3.4.3 Condensate and Condensate Storage System

RAI 3.4.3-1

Table 3.4-2, Ref No 3.4.2.2, page 3-154, lists high strength low alloy steel closure bolting in outdoor ambient conditions are subject to the aging effects/mechanism loss of material/general corrosion and wear. NUREG 1801, Chapter VIII H.2-a&b, however, lists carbon steel low alloy steel closure bolting, in air, moisture, humidity and leaking fluid environments are subject to the aging effects of loss of material due to general corrosion and crack initiation and growth due to cyclic loading and/or stress corrosion cracking, as is all other closure bolting in the steam and power conversion systems referenced in the LRA (See Table 3.4-2, Ref No 3.4.1.6, page 3-150, of the LRA). Provide justification for excluding the aging effects of loss of material due to general corrosion and crack initiation and growth due to cyclic loading and/or stress corrosion cracking for Ref No 3.4.2.2 closure bolting or revise Table 3.4.2 of the LRA.

3.4.4 Main Condenser

RAI 3.4.4-1

Table 2.3.4-4, page 2-193 of the LRA lists the component group of the main condenser hotwells, false floor (includes hatches) and refers to the aging management reference number 3.4.2.27 in Table 3.4-2, pages 3-154 to 3-162 of the LRA. In Table 3.4-2, Reference Number 3.4.2.27, the component group includes the main condenser waterboxes, hatches; however, it does not include hotwells or false floors. Verify that Reference Number 3.4.2.27 should include the hotwells and false floors within its component group or revise Table 2.3.4-4 of the LRA.

RAI 3.4.4-2

Table 2.3.4-4, page 2-193 of the LRA lists the component group of the main condenser tubes, tubesheets (includes hatches) and refers to the aging management Reference Numbers 3.4.2.25 and 3.4.2.26 in Table 3.4-2, pages 3-154 to 3-162 of the LRA. In Table 3.4-2, the component group for Reference Numbers 3.4.2.25 and 3.4.2.26 includes the main condenser tubes, and tubesheets; however, it does not include hatches. Verify that Reference Numbers 3.4.2.25 and 3.4.2.26 should include hatches within its component group or revise Table 2.3.4-4 of the LRA.

RAI 3.4.4-3

The AMR for the main condenser does not identify any aging mechanisms that require management. However, the material/environment combinations include carbon steel in steam, carbon steel in raw water, stainless steel in raw water, and carbon steel in air, moisture, and humidity <100°C. All of these material/environment combinations are subject to aging effects that may require management. Provide justification for the conclusion that the components in the main condenser do not require aging management.

3.5 Aging Management of Containments, Structures and Component Supports

RAI 3.5-1

In LRA Section 3.5, on page 3-163, it is stated that:

> "The aging management reviews for this section have incorporated the proposed NRC guidance provided in Enclosure 2 to the letter from Christopher I. Grimes, Chief, Licensing and Standardization Branch, Office of Nuclear Reactor Regulation, to Mr. Alan Nelson, Nuclear Energy Institute, "Proposed Staff Guidance on the Position of the GALL Report Presenting One Acceptable Way to Manage Aging Effects for License Renewal," dated November 23, 2001. Table 3.5-1 incorporates revisions provided in Enclosure 2 to this letter."

The staff believes that the applicant intended to reference a different letter that has the same date and from/to, entitled "Proposed Revision of Chapters II and III of Generic Aging Lessons Learned (GALL) Report on Aging Management of Concrete Elements." Enclosure 2 to this letter documents the revisions to the SRP and GALL report, to clarify aging management of concrete. The applicant is requested to verify that the staff is correct.

RAI 3.5-2

In LRA Section 3.0, under the heading "Operating Experience," it is stated that:

> "A review of plant-specific operating experience was conducted to identify aging effects requiring management. Industry-wide operating experience since the preparation of NUREG-1801 was also reviewed to identify aging effects requiring management. These reviews concluded that the aging effects identified by plant-specific and industry-wide operating experience were consistent with those identified in NUREG-1801. On-going review of plant-specific and industry operating experience is performed in accordance with corrective action programs and operating experience programs."

The applicant has not identified the source material utilized in the plant-specific operating experience review or in the industry-wide operating experience review. The applicant is requested to submit details of its operating experience review, including the time frame covered by the review, the information sources used, and any key findings that led to exclusion of aging effects identified in NUREG-1801.

RAI 3.5-3

For Groups 1-3, 5-9 Class I structures, the applicant states in LRA Section 3.5.1.1.1 that reduction in foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundation are not applicable to Dresden and Quad Cities and no aging management is required. Dresden and Quad Cities evaluations of Information Notices 97-11 and 98-26 concluded that no porous materials were used. The Dresden and Quad Cities licensing basis does not include a program to monitor concrete for settlement nor is a de-watering system in place. Dresden and Quad Cities structures are founded on rock or natural compacted soil and there is no documented change in groundwater conditions or history of settlement.

In LRA Table 3.5-1, Ref. No. 3.5.1.25 and 3.5.1.26, the applicant credits Structures Monitoring (B.1.30) for managing aging due to settlement and erosion of porous concrete subfoundation, and indicates "Consistent with NUREG-1801." This appears to be inconsistent with the further evaluations presented in LRA Section 3.5.1.1.1. The applicant is requested to clarify this apparent inconsistency.

RAI 3.5-4

For Groups 1-5 structures, the applicant states in LRA Section 3.5.1.1.2 that reduction of strength and modulus due to elevated temperature is not applicable for Dresden and Quad Cities concrete structures and no aging management is required since Dresden and Quad Cities normal operating temperatures are less than 150 °F general and are less than 200 °F local. The staff requests the applicant to (1) clarify whether the local concrete temperature or the local ambient air temperature was compared to the 200 °F limit; and (2) describe what provisions exist to ensure that the concrete surrounding hot piping penetrations does not exceed 200 °F.

RAI 3.5-5

LRA Section 3.5.1.1.3 provides information on the aging management review of loss of material due to corrosion in inaccessible areas of the steel containment shell for both Dresden and Quad Cities. The staff requests the following additional information regarding this review:

(a) How was it determined that Dresden Unit 3 had more leakage in the drywell sand pocket area than Dresden Unit 2 and Quad Cities?

(b) Define the quantitative basis for concluding that " significant corrosion was not occurring" in Dresden Unit 3.

(c) What is the technical basis for concluding that corrosion in the sand pocket area is insignificant at Dresden Unit 2 and Quad Cities?

(d) What controls exist on all four units to limit future leakage into the sand pocket areas and how will the leakage be monitored?

(e) What were the results of the augmented inspection of the sand pocket area for Dresden Unit 3, which was scheduled for the second half of 2002?

(f) How often will the augmented UT inspection of the sand pocket area be conducted for Dresden Unit 3, and what is the basis for not conducting similar inspections for Dresden Unit 2 and Quad Cities?

(g) It is stated that a general visual inspection of the moisture barrier at the junction of the steel drywell shell and the concrete floor is performed once each inspection period in accordance with the B.1.26 AMP. Is the inspection conducted each inspection period for all four units? If not, explain why not.

(h) Confirm that the concrete floor inside the drywell of all four units (1) meets "the requirements of ACI 318-63 and the guidance of ACI 201.2R-77" and (2) "is monitored for penetrating cracks that provide a path for water seepage in accordance with

Structures Monitoring Program (B.1.30)." This is the staff's interpretation of the fourth paragraph of LRA Section 3.5.1.1.3. If this interpretation is incorrect, please explain.

RAI 3.5-6

Based on information provided in LRA Section 2.4 and referenced UFSAR sections, stainless steel expansion bellows are utilized in (1) primary containment mechanical penetrations; (2) vent line-to-suppression chamber connections; (3) the reactor vessel-to-drywell refueling seal; and (4) the drywell-to-reactor building refueling seal. The LRA specifically identifies the containment penetration and vent line bellows. The refueling seals and bellows are not specifically identified in the LRA. In SER Section 2.4, the staff has requested additional information about the refueling seals, in order to understand how the applicant has evaluated the seals for license renewal.

The staff recognizes that loss of material due to general corrosion is not an applicable aging effect for stainless steel. However, stainless steel bellows and associated dissimilar metal welds are potentially susceptible to cracking due to SCC, when exposed to certain environmental conditions. Degradation of stainless steel bellows has occurred at nuclear power plants; consequently, close attention to loss of intended functions(s) is warranted.

In the LRA Section 3.5.1.1.5, the applicant indicates that the stainless steel bellows at Dresden and Quad Cities do not require augmented aging management beyond general visual examination conducted under IWE Examination Category E-A and Appendix J leak rate testing. The staff position is that the potential for cracking exists; that a crack would not be detected by a general visual examination (i.e., VT-3) before intended function is compromised; and that more detailed examination (e.g., IWE 1992 Examination Categories E-B and E-F) is warranted.

To complete its evaluation of the applicant's conclusion that augmented inspection of stainless steel bellows and associated dissimilar metal welds is not necessary at Dresden and Quad Cities, the staff needs additional plant-specific information. The applicant is requested to submit the following information for all four (4) units covered by this LRA:

(a) A detailed description of plant-specific operating experience for all stainless steel bellows (including any not within the scope of license renewal that serve a similar function in a similar environment), identifying all specific incidences of degradation, how degradation was detected, the root cause, corrective actions taken, and current inspection procedures.

(b) The environment (temperature, pressure, humidity, presence of aggressive agents) to which stainless steel bellows are exposed, both on a continuing basis and on a periodic or intermittent basis.

(c) Identification of the applicable aging effects requiring management for stainless steel bellows at Dresden and Quad Cities.

(d) The detailed technical basis, including identification of supporting reference material, for concluding that Appendix J leak rate testing and IWE Examination Category E-A general visual inspection are sufficient for managing aging of stainless steel bellows.

RAI 3.5-7

With regard to the discussion in LRA Section 3.5.1.1.6 concerning loss of material in Drywell Radial Beam Lubrite Baseplates, the staff requests the following additional information:

(a) Describe the prior operating experience of the torus saddle support lubrite baseplates and under what program have they been inspected? Are lubrite baseplates used at any other locations in Dresden and Quad Cities? If so, what has been the operating experience?

(b) The torus saddle support lubrite baseplates are covered under GALL Item III B1.3.2-a and it is expected that they would be managed by ASME Section XI, Subsection IWF. This GALL item is part of LRA Table 3.5-1, Ref. No. 3.5.1.31, which states that Dresden and Quad Cities is consistent with GALL, with one exception. The only exception discussed in LRA Table 3.5-1 for this item pertains to aging of downcomer bracing. Explain why aging management of loss of material due to galvanic corrosion, lock-up or wear of the torus saddle support lubrite baseplates will be performed by One-Time Inspection (B.1.23) and not by ASME Section XI, Subsection IWF (B.1.27).

(c) What is the sample size for the inspection of the torus saddle support lubrite baseplates that will be used to confirm the condition of the inaccessible drywell radial beam lubrite baseplates?

(d) Confirm that all radial beam lubrite baseplates inside the drywell are inaccessible and explain the conditions that make them inaccessible.

(e) Discuss the environments that the torus saddle support lubrite baseplates and the drywell radial beam lubrite baseplates are exposed to and explain why they are considered to be similar.

RAI 3.5-8

The “Discussion” column of LRA Table 3.5-1, Ref. No. 3.5.1.20 states that “Dresden and Quad Cities do not use stainless steel lined, carbon steel tanks as evaluated in NUREG-1801, line III.A8.2-a.” The staff notes that NUREG-1801, line III A8.2-a addresses loss of material due to corrosion for unlined carbon steel tanks, and that NUREG-1801, line III A8.2-b addresses stainless steel liners in steel tanks. The “Discussion” column of LRA Table 3.5-1, Ref. No. 3.5.1.28 states that “Dresden and Quad Cities do not use steel tanks lined with stainless as identified in NUREG-1801, line III.A8.2-b.”

Based on the information provided in LRA Table 3.5-1, the staff cannot determine (1) whether any unlined carbon steel tanks are included in the license renewal scope; and (2) if so, where the aging management review results are located in the LRA. The applicant is requested to identify any unlined carbon steel tanks in the license renewal scope; and, if applicable, describe the aging management review and the credited aging management programs.

RAI 3.5-9

LRA Section 3.5.1.2.9 discusses an exception to GALL for evaluation of the ECCS Suction Header identified under Ref. Nos. 3.5.1.12 and 3.5.1.14 in LRA Table 3.5-1. The applicant

states that this item is evaluated with GALL item V.D2.1-a, with the results presented in Ref. Nos. 3.2.1.2 and 3.2.1.4 in LRA Table 3.2-1. LRA Table 3.2-1 references Water Chemistry (B.1.2) and One-time Inspection (B.1.23) as the aging management programs for these items. It is the staff's position, as discussed in GALL item II.B1.1.1-a, that aging of the ECCS suction header should be managed by ASME Section XI, Subsection IWE. The applicant is requested to (a) explain why the ECCS Suction Header was evaluated as part of the ECCS piping and not as part of the containment, and (b) submit a detailed technical basis demonstrating that an equivalent level of safety is achieved with the applicant's approach, when compared to Subsection IWE requirements.

RAI 3.5-10

In LRA Table 3.5-2, Ref No. 3.5.2.8 "Drywell Expansion Foam," the applicant references a plant-specific TLAA that is described in LRA Section 4.7.4. The polyurethane drywell expansion foam installed on the outside of the containment was originally evaluated for hardening due to radiation exposure assuming a 40-year operating life. As discussed in Section 6.2.1.2.1.1 of the Dresden UFSAR, this foam has caught on fire twice in Dresden Unit 3 (January 20, 1986 and June 4, 1988). The staff requests the applicant to submit the following information for all four units:

(a) Describe any other instances of fires or other degradation experiences related to the drywell expansion foam;

(b) Describe the programs and procedures put in place to prevent future fires in the drywell expansion foam. If none, explain why they are not necessary;

(c) Describe any investigations that determined whether there was any significant change in material properties due to the fires, or other operating experiences, that would prevent the foam from performing its intended function. If none, explain the technical basis for concluding that there has been no change in material properties;

(d) Identify all the environments that the expansion foam may be exposed to, including leaking water, and discuss what effect each environment may have on the material properties of the foam.

(e) Concerning the January 26, 1986 fire, it is stated in Dresden UFSAR Section 6.2.1.2.1.1 that "The polyurethane in the gap burned for several hours resulting in a postulated upper bounding temperature of 500 degree F for both the steel containment and the primary containment shield wall." It is also stated that, "Structural integrity of both the concrete and containment steel were determined not to be impaired to perform as designed in the event of a design basis accident (DBA)." Concerning the June 4, 1988 fire, it was determined that "this fire was bounded by the analyses conducted for the 1986 fire and no further analyses were conducted." Provide a detailed technical basis demonstrating that the evaluation of the concrete and containment steel for the effects of the fires remains valid for the period of extended operation.

RAI 3.5-11

For Group 6 Structures (Water-Control Structures), LRA Section 3.5.1.2.5 states that loss of material due to abrasion and cavitation of concrete in accessible areas is managed by RG

1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants (B.1.31). The applicant further states that Dresden and Quad Cities water flow velocity (3.68 fps) is less than the industry abrasion erosion threshold velocity of 4 fps, and also less than the industry cavitation threshold velocity of 25 fps; and concludes that loss of material due to abrasion and cavitation of concrete in inaccessible areas is not applicable and no aging management is required. As discussed under GALL Item III A6.1-h, the staff expects that for Group 6 Structures (Water-Control Structures), loss of material due to abrasion and cavitation of reinforced concrete in a flowing water environment will be managed by the RG 1.127 program. This applies to all concrete: exterior above and below grade; foundation; interior slab. The applicant is requested to provide the following information: (1) clarify what is meant by "accessible" and "inaccessible" areas for all Group 6 components, (2) identify the reference for the stated industry abrasion erosion and cavitation threshold velocities, and (3) provide the technical basis for the reported Dresden and Quad Cities water flow velocity.

(It is noted that clarification of the scope of Group 6 components at Dresden and Quad Cities is the subject of staff RAI 2.4-7.)

RAI 3.5-12

For Group 6 Structures (Water-Control Structures), LRA Section 3.5.1.2.6 indicates that cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel of concrete is managed by RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants (B.1.31) only for accessible areas. Similarly, LRA Section 3.5.1.2.7 indicates that increase in porosity and permeability, cracking, and loss of material (spalling, scaling) due to aggressive chemical attack of concrete is managed by RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants (B.1.31) only for accessible areas. LRA Sections 3.5.1.2.6 and 3.5.1.2.7 indicate that aging management is not required for these aging effects/mechanisms in inaccessible areas, based on the following considerations: (1) Dresden and Quad Cities ground water test data obtained during construction, the 1980's, 1990's, and 2000's shows that the below-grade environment is not aggressive based on NUREG-1801 criteria, with chlorides less than 500 ppm, sulfates less than 1500 ppm, and pH greater than 5.5; (2) examination of representative samples of below-grade concrete, when excavated for any reason, is included as part of the Structures Monitoring Program (B.1.30.); and (3) to ensure conditions are maintained throughout the period of extended operation, the Structures Monitoring Program (B.1.30) will be enhanced to include monitoring of below grade water chemistry to demonstrate that the environment remains non-aggressive.

As indicated in GALL Items III A6.1-d and e, for Group 6 Structures (Water-Control Structures), these aging effects/mechanisms are managed by the RG 1.127 program for all concrete. In the special case of water-control structures, the applicant's technical bases for excluding inaccessible areas from aging management may only be applied to interior concrete and above-grade concrete. The ultimate heat sink raw water is considered aggressive by its nature, and all concrete exposed to it needs to be managed for these aging effects/mechanisms. The applicant is requested to provide the following additional information: (a) define "inaccessible areas" as it relates to the subject aging effects/mechanisms in water-control structures; specifically discuss whether below-grade and below-water concrete in water-control structures is being excluded from aging management; and (b) if applicable, submit a detailed technical justification for not managing aging of below-grade/below water concrete in water-control structures, in light of past industry operating experience indicating there is a significant potential for degradation.

(It is noted that clarification of the scope of Group 6 components at Dresden and Quad Cities is the subject of staff RAI 2.4-7.)

RAI 3.5-13

LRA Section 3.5.1.2.10 discusses an exception to GALL for XI.M18, "Bolting Integrity" identified under Ref. No. 3.5.1.32 of LRA Table 3.5-1. The applicant states that Dresden and Quad Cities recirculation piping loop component supports inside the containment have ASTM 193 Grade B7 high strength low alloy steel bolting, which will be managed by ASME Section XI, Subsection IWF (B.1.27). The applicable GALL item number is III.B.1.1.2-a, which identifies XI.M18, "Bolting Integrity," as an acceptable aging management program for high strength low-alloy steel bolts (yield strength>150 ksi) used in NSSS component supports. The applicant is requested to provide the following information:

(a) It is stated in LRA Section 3.5.1.2.10 that "the specification for ASTM 193 Grade B7 lists minimum yield strength of 105 ksi, with no upper yield strength installed. " Clarify what is meant by the phrase "no upper yield strength installed."

(b) Verify that the actual yield strengths of the Dresden and Quad Cities recirculation piping loop component support bolting do not exceed 150 ksi.

(c) Clarify whether other Class 1, 2, 3 and MC component supports use high strength low-alloy steel bolts. If so, describe the materials used and the corresponding aging management program.

RAI 3.5-14

LRA Section 3.5.1.2.11 discusses an exception to GALL for the aging management program XI.S3, "ASME Section XI, Subsection IWF." This exception is identified under Ref. No. 3.5.1.31 of LRA Table 3.5-1. The applicant proposes to manage aging of downcomer bracing by inspections performed under the applicant's aging management program ASME Section XI, Subsection IWE (B.1.26). The applicable GALL item number is III.B1.3.1-a, which identifies ASME Section XI, Subsection IWF as an acceptable aging management program for support members. The staff requests the applicant to (1) describe any inspections and schedules that would be required under Subsection IWF, that will not be performed under the applicant's proposed use of Subsection IWE, and (2) provide the technical bases for any deviations from the requirements of Subsection IWF.

RAI 3.5-15

LRA Table 3.5-2, Ref No. 3.5.2.5 "Clevis Pins" identifies three different component groups (torus columns, vent systems and ESF lines), two materials (carbon steel and stainless steel), and three environments (submerged in torus grade water, inside and outside containment). For each of the three different component groups, at both Dresden and Quad Cities, the applicant is requested to (1) identify all aging effects/mechanisms that were evaluated for each combination of material and environment, including those not requiring aging management; and (2) submit the technical basis for each aging management conclusion.

RAI 3.5-16

LRA Table 3.5-2, Ref No. 3.5.2.14 "Support Members," states that stainless steel pipe support stanchions are used on the recirc piping 28" lines at Dresden and Quad Cities. ASME Section XI, Subsection IWF (B.1.27) is credited to manage the stainless steel support members, inside or outside containment, for loss of material due to pitting and crevice corrosion. LRA Table 3.5-2, Ref No. 3.5.2.15 "Thermowells," states that stainless steel thermowells are installed in the torus. ASME Section XI, Subsection IWE is credited to manage the stainless steel/dissimilar metal welds for thermowells, inside or outside containment, for loss of material due to general galvanic pitting and crevice corrosion. For both the stainless steel pipe support stanchions and the thermowells, the applicant is requested to: (1) describe the location of all the stainless steel components and identify the specific environments to which they are exposed; (2) identify all aging effects/mechanisms that were evaluated, including those not requiring aging management, and provide the technical basis for each conclusion; and (3) discuss the technical basis for the selection of the aging management program used to manage the applicable aging effects.

RAI 3.5-17

LRA Table 3.2-2 (Ref Nos: 3.2.2.79, 3.2.2.80 and 3.2.2.81) states that Water Chemistry (B.1.2) and One-Time Inspection (B.1.23) will be used to manage loss of material/pitting and crevice corrosion in carbon and stainless steel support members submerged in 25-288 degree C (77-550 degree F) demineralized water. The Water Chemistry program will also be used to manage cracking/stress corrosion cracking in stainless steel support members submerged in the same environment. In order to complete the aging management review, the staff requests the applicant to submit the following information:

(a) Identify the specific supports covered by references 3.2.2.79, 3.2.2.80 and 3.2.2.81 and the plant-specific operating experience.

(b) Explain why ASME Section XI, Subsection IWF is not credited for aging management of these supports.

(c) Explain the number, type and location of the supports that will be included in the one-time inspection.

(d) Explain why the supports covered by reference 3.2.2.80 are not included in the one-time inspection.

Section 4.3 Metal Fatigue of the Reactor Vessel, Internals, Structures and Component Supports

RAI 4.3.0

(a) As noted in NRC Information Notice 2002-26, "Failure of Steam Dryer Cover Plate After a Recent Power Uprate," dated September 11, 2002, Quad Cities (Unit 2) experienced a failure of steam dryer cover plate in March 2002 following implementation of the 17.8% power uprate of the Unit. One piece of the dryer cover plate had fallen onto the separator; another piece was found in the dryer; a third piece had lodged in the A main steam line flow venturi (upstream of the main steam isolation valves); and several other

pieces had been swept down the A main steam line downstream of the MSIVs into a turbine stop valve strainer. It was reported, however, that there was no apparent damage other than minor scratches and gouges to the main steam nozzle and piping.

On June 12, 2003, inspections of the steam dryer at Quad Cities Unit 2 identified the following: (1) through-wall cracking (about 90-inches in length) in the vertical and horizontal outer hood plate, (2) one vertical and two diagonal internal braces detached on the outer hood, (3) one severed vertical internal brace on the outer hood, and (4) three cracked tie bars on top of the dryer.

While components such as steam dryer and steam separator are non-safety related, the staff is concerned that failure of these components (as experienced at Quad Cities Unit 2) could potentially impact other safety related components. Please provide additional information regarding potential impact of non-safety related component failure (such as steam dryer or steam separator) on safety related components based on this recent operating experience, and the applicant's determination whether these components are within the scope of license renewal in accordance with 54.4(a)(2).

(b) Dresden Units 2 and 3, and Quad Cities Units 1 and 2 have recently implemented 18% power uprates. The same four units are currently being considered for license renewal. How has the applicant considered or examined the potential synergistic effects of large power uprates and plant aging (for those SSCs within the scope of license renewal)? Please describe your evaluation and provide the results.

RAI 4.3.1

(a) This section refers to a re-analysis that was performed for reactor vessel cumulative usage factors (CUF) as a part of the extended power uprate (EPU) implementation at the Dresden and Quad Cities plants. Provide a reference to an NRC safety evaluation, indicating review and acceptance, of the Extended Power Uprate implementation at the Dresden and Quad Cities plants.

(b) This section states that a re-analysis was performed under the EPU on the feed water nozzles along with the modifications to reduce or eliminate the causes. This revised analysis included the appropriate effects from rapid thermal cycling that were attributed to the original cause of cracking in the feedwater nozzles. Both Dresden and Quad Cities also follow the improved BWR Owners Group inspection and management methods.

- Provide a reference to "the improved BWR Owners Group inspection and management methods," and a reference to a staff safety evaluation indicating staff review and acceptance.

- Provide clarification of the context in which these methods are applied with respect to the EPU.

RAI 4.3.2.2

(a) Provide justification why vibration levels due to conditions such as increased core flow or single recirculation loop operation do not cause concerns for fatigue of jet pump riser braces or other internal components at Dresden 3 and Quad Cities 1 and 2, similar to those at Dresden 2.

(b) In the Analysis section, provide an explanation of the term “maximum extended load line limit analysis (MELLA) region.”

RAI 4.3.3.3

This section of the TLAA indicates that the design analyses (fatigue analysis of the isolation condenser) remain valid for the extended period of operation. Aging Management Program B.1.34 states that, as an enhancement to the metal fatigue of reactor coolant pressure boundary aging management program, “the program will provide for tracking of fatigue stress cycles for the Dresden isolation condenser.” Provide an explanation/justification as to why this statement does not conflict with the disposition stated in this section.

RAI 4.3.4

The disposition of this TLAA indicates that Exelon will perform plant-specific calculations for Dresden and Quad Cities for the locations identified in NUREG/CR 6260 for older BWRs, except for a limiting Class 1 location in a feedwater line. Provide the following additional information: (a) state where the limiting Class 1 feedwater piping location will be identified; and (b) provide the calculated cumulative usage factors for these locations.

RAI 4.6

This section of the TLAA indicates that in the absence of hydrodynamic loads, fatigue is not a concern in containment design except at penetrations or other stress concentration areas. The plant unique analysis (PUA) did not re-evaluate the drywell, drywell penetrations, or process penetration bellows, all of which are attached to the drywell. Provide the basis for not evaluating the drywell penetrations, or process penetration bellows for fatigue under the PUA.

RAI 4.6.2

The analysis section “SRV Discharge Line-Vent Line Penetrations (“Sleeves”) and the associated sections of the SRV Discharge Lines” states that the fatigue analysis of these MC components considered two separate cases in order to identify bounding analysis. Case 1 considered all 220 SRV actuations as single-valve actuations, to maximize the number of cycles of full-range |Ta- Tb| stress. Provide an explanation of the “full-range |Ta- Tb|” term.

RAI 4.7.2.3

The Analysis section states that the existing design calculation for the modified strainer support flanges assumes a corrosion loss of 4 mils/year for 33 years which is not sufficient to encompass the entire period of extended operation.

(a) State the nature of this design calculation, what was calculated and explain how the

corrosion loss of 4 mils/year was included in the calculations.

(b) Provide the basis for the assumed corrosion rate of 4 mils/year for 33 years.

(c) State the corrective measures that will be taken in the event that the revised galvanic corrosion calculation indicates an unacceptable wall thickness prior to the end of the 60-year licensed operating period.

B.1.13 Open-Cycle Cooling Water System

RAI B.1.13

(a) The following exception to NUREG-1801 is stated in LRA AMP B.1.13: “NUREG-1801 indicates that program testing and inspections are performed annually and during refueling outages. The Dresden and Quad Cities open-cycle cooling water system aging management program activities provide for adjustment of inspection intervals due to specific inspection results as stated in the response to GL 89-13." Clarify that these adjustments are in accordance with the information provided in GL 89-13 concerning a routine inspection and maintenance program and section D, “frequency of testing and maintenance,” in GL 89-13, Supplement 1.

(b) LRA AMP B.1.13 identifies enhancements which include the statement, "The program will provide for inspection of cooling water pump internal linings, additional heat exchangers and sub-components, inspection of external surfaces of various submerged pumps and piping." Identify the specific additional heat exchangers and sub-components that are to be inspected and the inspection frequency. Provide the technical basis, including operating experience for the inspection frequency.

(c) LRA AMP B.1.13 identifies enhancements which include the statement, "The program will provide for new periodic component inspections in the pump vaults that have a high humidity/moisture environment." Specify the inspection frequency and its technical basis, including operating experience.

(d) LRA AMP B.1.13 states in part that “the open-cycle cooling water system aging management activities have detected aging degradation and implemented appropriate corrective actions to maintain system and component intended functions...” This operating experience suggests that the preventive actions prescribed in this AMP may not be as effective as expected. Provide justifications on the effectiveness of the preventive actions based on the plant operating experience, with consideration of Information Notice 94-03.

(e) The operating experience section of AMP B.1.13 states in part that “Engineering evaluations have resulted in various specific component and programmatic enhancements and correction actions. In addition, program assessments have been reviewed for heat sink performance.” Describe the appropriate corrective actions made and the operating experience since these corrective actions were implemented. In addition, provide the results on the assessment for the heat sink performance review in regard to the adequacy of this AMP.

(f) LRA AMP B.1.13 states in part that "The open-cycle cooling water AMP... provides for managing loss of material aging degradation on the outside surfaces... by condition monitoring of the accessible external surfaces of components in moist air (indoor) or submerged (raw water) environments." However, this AMP does not address managing the loss of material on inaccessible outside surfaces. Provide an explanation of how the loss of material aging effects on the outside surfaces in inaccessible locations is managed for the period of extended operation. Indicate to what extent eddy current testing is used.

(g) LRA Table 3.3-2 credits the Open-Cycle Cooling Water System (AMP B.1.13) for managing galvanic corrosion.

- Identify any preventive measures used to minimize the effects of galvanic corrosion in heat exchangers such as sacrificial anodes or internal coatings and indicate if inspections verify that they are performing their intended function.

- Ref. 3.3.2.208 of Table 3.3-2 of the LRA for the material/environment of cast iron/raw, untreated salt water or fresh water identifies loss of material/galvanic corrosion as an applicable aging effect/aging mechanism. The Open-Cycle Cooling Water System (B.1.13) is identified as the applicable AMP. LRA AMP B.1.13 states in part that "With enhancements the open-cycle cooling water system aging management program is consistent with the ten elements of the aging management program XI.M20, "Open-Cycle Cooling Water System," specified in NUREG-1801" with exceptions. The staff notes that loss of material due to galvanic corrosion is location-dependent. Adequate aging management may need to target susceptible locations for inspection and testing. Clarify whether the inspection and testing described in the AMP "Open-Cycle Cooling Water System" (B.1.13) are targeted or opportunistic with respect to managing loss of material due to galvanic corrosion. If the testing/inspection are opportunistic, justify the adequacy including any applicable operating experience. If the testing/inspection are targeted, provide the targeting criteria and their technical basis.

B.1.14 Closed-Cycle Cooling Water System

RAI B.1.14

(a) LRA AMP B1.14 states that closed-cycle cooling water system activities have detected aging degradation, and engineering evaluations have resulted in various specific component and programmatic corrective actions. This operating experience suggests that the preventive actions prescribed in this AMP may not be as effective as expected. Further, in the operating experience section, the AMP states, "engineering evaluations have resulted in various specific component and programmatic corrective actions." Describe the appropriate corrective actions made, and the operating experience since these corrective actions were implemented.

(b) LRA Table 3.3-2 (Ref. No. 3.3.2.105, 3.3.2.107, 3.3.2.109, 3.3.2.111, 3.3.2.116) credits the Closed-Cycle Cooling Water System (B.1.14) for managing galvanic corrosion. Identify any preventive measures used to minimize the effects of galvanic corrosion in heat exchangers such as sacrificial anodes or internal coatings. Indicate if inspections verify that preventive measures are performing their intended function.

B.1.15 Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling System

RAI B.1.15

Table 3.3-1, Ref No 3.3.1.14 identifies the aging management program (AMP), Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems (B.1.15) as the applicable aging management program to manage loss of material due to general corrosion and wear in the refueling system cranes for the period of extended operation. This AMP, with enhancements, claims consistency with the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program, XI.M23 in NUREG-1801 with the exception that it does not review the number and magnitude of lifts as in element 3 of XI.M23. The reason for the exception is because administrative controls assure "... that only allowable loads are handled and fatigue failure of structural elements is not expected." The AMP also states that a time-limited aging analysis concludes that there are no fatigue concerns for the period of extended operation. Provide justifications to demonstrate how the administrative control is adequate in lieu of tracking of the number and magnitude of lifts as in element 3 of GALL XI.M23.

The description of B.1.15 also states that the enhancements, specific inspections for rail wear and proper crane travel on rails as well as specific inspections for corrosion of crane structural components, are scheduled to be implemented prior to the period of extended operation. Provide an explanation of the statement in the Operating Experience section of B.1.15 which indicate that this program has been successful in the past at Dresden and Quad Cities if the proposed enhancements to the AMP (which are the primary attributes of XI.M23) have not yet been implemented. Also, provide a statement that clarifies that these enhanced inspections will be conducted on a routine basis as in element 4 of XI.M23.

Provide an explanation of how the conclusion that there are no fatigues concerns for the period of extended operation can be achieved without a fatigue analysis that considered the number and magnitude of lifts.

B.1.16 Compressed Air Monitoring

RAI B.1.16

(a) NUREG-1801, XI.M24, "Compressed Air Monitoring," is based on GL 88-14; IN 81-38; IN 87-28; IN 87-28S1; INPO SOER 88-01; EPRI-108147; ASME OM-S/G-1998, Part 17; ISA-S7.0.01-1996; and EPRI 7079. LRA B.1.16 states that the applicant's Compressed Air Monitoring program activities are consistent with Dresden/Quad Cities responses to GL88-14 and ISA-S7.0.01-1975 and that enhancements include inspection of instrument air distribution piping based on EPRI-108147. Since the applicant's program is not based on all the references included in NUREG-1801, explain why each of these references were not included in the development of the applicant's program and how the applicant's program can be considered consistent with NUREG-1801 without basing the program on these references.

(b) In LRA Table 3.3.2, item 3.3.2.262, the applicant states that brass or bronze valve components in the control rod drive hydraulic system are subject to aging effect of loss

of material due to pitting and crevice corrosion and these aging effects will be managed by the Compressed Air Monitoring AMP (B.1.16). It is not readily apparent to the staff how this AMP will adequately manage the aging effect of loss of material due to corrosion, corrosion product build-up, or dirt build-up for brass or bronze valve components in the control rod drive hydraulic system. Provide explanation.

B.1.21 Fuel Oil Chemistry

RAI B.1.21

(a) For the second exception item, the LRA AMP B.1.21 states: “NUREG-1801 indicates that ASTM D1796 standard should be used to analyze fuel oil for water and sediment. The Dresden and Quad Cities programs use ASTM D2709 as specified by ASTM D975 for analysis of grades 1-D and 2-D fuel used at the stations.” Both ASTM standards (D1796 and D2709) are referenced in the GALL Fuel Oil Chemistry (Chapter XI.M30 Fuel Oil Chemistry) program for the determination of water and sediment content in diesel fuel oil. The GALL AMP neither excludes the use of the ASTM D2709 standard nor does it include ASTM D1796 as the only applicable standard. The staff notes that based on a review of both standards, D2709 is appropriate for D 975 Grades 1D and 2D fuel oil. Per D2709, D1796 is appropriate for higher viscosity fuel oil. Please provide a basis for the statement in the LRA “NUREG-1801 indicates that ASTM D1796 standard should be used to analyze fuel oil for water and sediment," and indicate whether this item constitutes an exception to GALL, or only a clarification.

(b) For the third exception item, LRA AMP B.1.21 states: “NUREG-1801 indicates that ASTM D2276 (modified), which provides field monitoring, should be used to analyze fuel oil for particulate content. The Dresden and Quad Cities programs use ASTM D5452 as the preferred method of analysis.” ASTM D2276 is concerned with testing from a line sample whereas D5452 applies to lab filtration of a sample. D5452 may be appropriate if the sample does not come from a flowing stream. Clarify the origin of the fuel oil samples to be analyzed. Provide technical basis for the use of ASTM D5452 as the preferred method of analysis for fuel oil content analysis.

(c) For the fifth exception item, LRA AMP B.1.21 states: “NUREG-1801 discusses the need to add stabilizers and corrosion inhibitors to diesel fuel oil. Quad Cities does not add stabilizers because grade 1-D low sulfur fuel oil is used and stored fuel is periodically sampled and analyzed for quality. Dresden and Quad Cities do not add corrosion inhibitors because fuel storage tank bottoms are periodically sampled and analyzed for corrosion products in accordance with ASTM D4057 and ASTM D2709.” Provide justification that the periodic sampling is representative. For example, a description of the sampling method, number of samples and specific location may provide some indication of the representation. In addition, justify the effectiveness of the bottom sample procedure and apparatus in sampling corrosive particles (sediment) if they exist.

(d) For the sixth exception item, LRA AMP B.1.21 states: “NUREG-1801 indicates that fuel oil tanks should be sampled for water, biological activity, and particulate on a periodic basis... The Dresden and Quad Cities emergency diesel generator fuel oil day tanks do not have the capability of being sampled. As an alternative, Dresden and Quad Cities sample for water and sediment from the bottom of the associated storage tanks quarterly and particulate from the fuel transfer pump discharge line on a monthly basis

in accordance with approved procedures." The staff finds sampling from the bottoms of the associated tanks and discharge lines of the fuel oil transfer pumps may not accurately reflect the quality of the oil in the oil tanks and the adverse impact on the internal of the oil tanks caused by the degradation of oil quality because: (1) sample results from the bottoms of the associated tanks may not be able to accurately reflect the quality of the oil in the day tanks because it depends on how often the fuel oils in these two types of tanks are exchanged or refreshed; and (2) the fuel oil samples from the discharge lines of the fuel oil transfer pumps may have already being filtered by filters in the suction head or fuel line. Provide technical explanations that address these two concerns. The staff also notes that based on the guidance in Regulatory Guide 1.137 and EPRI NP-6314, day tanks should be checked for water monthly, as a minimum, and after each operation of the diesel where the period was 1 hour or longer. Therefore, provide justification as to why the day tanks are not sampled.

(e) The purpose of monitoring and trending fuel oil sample results is to provide for timely detection of conditions conducive to corrosion of the internal surface of the diesel fuel oil tank before the potential loss of its intended function. However, in the last item of the exceptions, LRA AMP B.1.21 states: "NUREG-1801 indicates that fuel oil sample results should be monitored and trended. At Dresden, the results of analysis of new fuel oil are reviewed for acceptability, but are not trended. In the event the quantitative oil acceptance criteria in plant procedures are approached or exceeded the fuel oil is restored to within the limits or an action request or condition report is initiated." The staff finds that the applicant's approach may not be able to provide timely detection of the conditions conducive to corrosion because actions will not be taken before the quantitative oil criteria is approached or exceeded. Corrosion on the internal of the fuel tank may have already been significant when this condition is reached. Provide technical explanations that address this concern.

(f) LRA AMP B.1.21 indicates that the diesel fuel oil storage tanks are periodically cleaned and inspected for evidence of internal corrosion and that an enhancement will provide for inspection of the fuel oil storage tank interiors. Section 3.3.1.1.8 also indicates that UT examination of the lower portion will be performed. Provide information that provides more specific UT locations, the inspection interval and operating history.

(g) The UFSAR supplement does not include criteria for fuel monitoring identified in LRA AMP B.1.21, such as specific ASTM standards. For example, specific ASTM standards are identified in NUREG-1800 Table 3.3-2. Provide a revised UFSAR supplement which includes specific ASTM standards applied in AMP B.1.21.

(h) LRA AMP B.1.21 identifies operating experience which includes plugging of fuel filters and drain lines. This operating experience suggests that the fuel oil chemistry program was not effective in preventing or detecting contamination and corrosion products at an early stage. Indicate what corrective actions have been implemented to prevent recurrence of these events. In addition, indicate if filters and strainer elements in the fuel oil system are periodically inspected to further assess the effectiveness of the fuel oil chemistry program.

B.1.23 One-Time Inspection

RAI B.1.23-1

The applicant states that 10 CFR 54.4(a)(2) components (i.e. non-safety related affecting safety related) receive a one-time, internal, visual inspection for general, crevice, galvanic, and pitting corrosion. Based on this statement, the applicant's aging management methodology for 10 CFR 54.4(a)(2) components is not clear. Clarify: (1) if aging of 10 CFR 54.4(a)(2) components is managed only by the one-time inspection program only or is the one-time inspection program used to augment other aging management programs for these components, and (2) if any 54.4(a)(2) components are managed only by the one-time inspection program, describe the aging effects and justify use of the one-time inspection to manage these aging effects.

RAI B.1.23-2

GALL Program XI.M32, "One-Time Inspection," is designed to verify the effectiveness of an aging management program (such as the water chemistry program) at preventing aging effects, or to otherwise confirm the absence of an aging effect. One-time inspections address concerns about the potential long incubation period for certain aging effects on structures and components. One-time inspections confirm that either an aging effect is indeed not occurring, or an aging effect is occurring very slowly such that it will not affect the component or structure intended function.

In many portions of the LRA, the One-Time Inspection program (B.1.23) is credited as the only applicable aging management program for components where aging would be expected unless there is a program designed to manage aging. However, the LRA does not credit a corresponding program that would manage aging and thus support the use of a one-time inspection. Examples include components exposed to various steam, water, and oil environments, where proper chemistry controls are necessary to preclude aging. For these examples, a water chemistry program precludes corrosion for piping internal and the One-Time Inspection program provides verification that this aging effect is not occurring or is occurring very slowly.

Also, in many portions of the LRA, the One-Time Inspection Program is used for material/environment combinations where aging degradation is expected to occur. Periodic inspections are more appropriate for these situations.

a) For the following mechanical system links (systems), the One-Time Inspection program must be accompanied by an appropriate program to prevent the aging from occurring. Either provide an accompanying program to prevent aging (i.e., a chemistry program), or justify the use of a one-time inspection for these items.

   Reactor Coolant System:

   - 3.1.2.9 (Reactor Recirculation)
   - 3.1.2.12 (Reactor Recirculation)
   - 3.1.2.21 (Reactor Recirculation)
   - 3.1.2.27 (Reactor Recirculation)
   - 3.1.2.45 (Reactor Recirculation)

Engineering Safety Features:

- 3.2.2.2 (Reactor Core Isolation Cooling, HPCI)
- 3.2.2.8 (Reactor Core Isolation Cooling, HPCI)
- 3.2.2.32 (Reactor Core Isolation Cooling, HPCI)
- 3.2.2.33 (HPCI)
- 3.2.2.34 (HPCI)
- 3.2.2.35 (Reactor Core Isolation Cooling, Containment Isolation Components & Primary Containment Piping)
- 3.2.2.36 (Reactor Core Isolation Cooling, Containment Isolation Components & Primary Containment Piping)
- 3.2.2.37 (Reactor Core Isolation Cooling, Containment Isolation Components & Primary Containment Piping)
- 3.2.2.59 (Reactor Core Isolation Cooling, HPCI
- 3.2.2.65 (HPCI)
- 3.2.2.71 (Reactor Core Isolation Cooling, HPCI)
- 3.2.2.73 (Reactor Core Isolation Cooling)
- 3.2.2.84 (Reactor Core Isolation Cooling)
- 3.2.2.86 (HPCI)
- 3.2.2.92 (LPCI, Core Spray, HPCI)
- 3.2.2.103 (HPCI)
- 3.2.2.105 (RHR, HPCI)
- 3.2.2.110 (Reactor Core Isolation Cooling, HPCI)
- 3.2.2.121 (Reactor Core Isolation Cooling, HPCI)
- 3.2.2.130 (Reactor Core Isolation Cooling, HPCI)
- 3.2.2.131 (Reactor Core Isolation Cooling)
- 3.2.2.132 (HPCI)
- 3.2.2.133 (Reactor Core Isolation Cooling, HPCI)
- 3.2.2.135 (Reactor Core Isolation Cooling, HPCI)

Auxiliary Systems:

- 3.3.2.2 (Plant Heating System)
- 3.3.2.60 (Emergency Diesel Generator and Auxiliaries, Station Blackout)
- 3.3.2.135 (Station Blackout)
- 3.3.2.136 (Station Blackout)
- 3.3.2.139 (Standby Liquid Control, Emergency Diesel Generator and Auxiliaries, Station Blackout, Diesel Fuel Oil)
- 3.3.2.142 (Plant Heating)
- 3.3.2.148 (Station Blackout)
- 3.3.2.156 (Station Blackout)
- 3.3.2.162 (Station Blackout)
- 3.3.2.177 (Emergency Diesel Generator and Auxiliaries, Station Blackout)
- 3.3.2.181 (Plant Heating)
- 3.3.2.187 (Emergency Diesel Generator and Auxiliaries)
- 3.3.2.197 (Plant Heating)
- 3.3.2.214 (Plant Heating)
- 3.3.2.224 (Emergency Diesel Generator and Auxiliaries, Station Blackout)
- 3.3.2.235 (Emergency Diesel Generator and Auxiliaries)

- 3.3.2.240 (Emergency Diesel Generator and Auxiliaries)
- 3.3.2.243 (Plant Heating)
- 3.3.2.249 (Emergency Diesel Generator and Auxiliaries, Station Blackout)
- 3.3.2.252 (Plant Heating)
- 3.3.2.263 (Plant Heating)
- 3.3.2.269 (Emergency Diesel Generator and Auxiliaries, Station Blackout)
- 3.3.2.271 (Plant Heating)
- 3.3.2.282 (Plant Heating)
- 3.3.2.290 (Emergency Diesel Generator and Auxiliaries, Station Blackout)

Steam and Power Conversion Systems:

- 3.4.2.16 (Turbine Oil System)
- 3.4.2.29 (Main Turbine and Auxiliaries)
- 3.4.2.32 (Turbine Oil System)
- 3.4.2.36 (Main Turbine and Auxiliaries)
- 3.4.2.37 (Turbine Oil System)
- 3.4.2.43 (Turbine Oil System)
- 3.4.2.48 (Main Turbine and Auxiliaries)
- 3.4.2.50 (Turbine Oil System)
- 3.4.2.55 (Main Turbine and Auxiliaries)

b) For the following mechanical system links (systems), the aging effects are expected to occur, so that periodic inspection may be more appropriate than a one-time inspection. Provide justification for the use of the One-Time Inspection program for these items.

Reactor Coolant System:

- 3.1.2.19 (Head Spray, Nuclear Boiler Instrumentation, Reactor Vessel Head Vent, Reactor Recirculation)
- 3.1.2.22 (Reactor Recirculation)
- 3.1.2.48 (Reactor Recirculation)
- 3.1.2.51 (Reactor Recirculation)

Engineering Safety Features:

- 3.2.2.55 (Standby Liquid Gas Treatment, LPCI, RHR, Isolation Condenser, Reactor Core Isolation Cooling, Containment Isolation Components and Primary Containment Piping, Core Spray, HPCI)
- 3.2.2.62 (LPCI, Containment Isolation Components and Primary Containment Piping)
- 3.2.2.74 (Containment Isolation Components and Primary Containment Piping)
- 3.2.2.87 (Containment Isolation Components and Primary Containment Piping)
- 3.2.2.99 (Reactor Core Isolation Cooling, HPCI)
- 3.2.2.108 (Standby Gas Treatment, Containment Isolation Components and Primary Containment Piping)
- 3.2.2.112 (Containment Isolation Components and Primary Containment Piping)
- 3.2.2.113 (LPCI, Containment Isolation Components and Primary Containment Piping, Core Spray)
- 3.2.2.114 (Standby Gas Treatment)

- 3.2.2.126 (Reactor Core Isolation Cooling, HPCI)
- 3.2.2.127 (Standby Gas Treatment)
- 3.2.2.128 (Reactor Core Isolation Cooling, HPCI)

Auxiliary Systems:

- 3.3.2.55 (Emergency Diesel Generator and Auxiliaries, Station Blackout)
- 3.3.2.64 (Station Blackout, Containment Atmosphere Monitoring)
- 3.3.2.65 (Emergency Diesel Generator and Auxiliaries)
- 3.3.2.66 (Emergency Diesel Generator and Auxiliaries, Station Blackout)
- 3.3.2.67 (Containment Atmosphere Monitoring)
- 3.3.2.130 (Standby Liquid Control, Shutdown Cooling, Control Rod Drive Hydraulic, Reactor Water Cleanup, Emergency Diesel Generator and Auxiliaries, HVAC - Main Control Room, Diesel Generator Cooling Water, Process Sampling, Reactor Building Closed Cooling Water, Makeup Demineralizer, Residual Heat Removal Service Water, Plant Heating, Containment Atmosphere Monitoring)
- 3.3.2.145 (Fuel Pool Cooling and Filter Demineralizer)
- 3.3.2.146 (Control Rod Drive Hydraulic)3.3.2.149 (Station Blackout)
- 3.3.2.167 (Control Rod Drive Hydraulic)
- 3.3.2.199 (Fuel Pool Cooling and Filter Demineralizer)
- 3.3.2.216 (Emergency Diesel Generator and Auxiliaries, Station Blackout)
- 3.3.2.228 (Drywell Nitrogen Inerting)
- 3.3.2.229 (Plant Heating)
- 3.3.2.255 (Containment Atmosphere Monitoring)
- 3.3.2.256 (Emergency Diesel Generator and Auxiliaries, Station Blackout)
- 3.3.2.274 (Control Rod Drive Hydraulic)
- 3.3.2.281 (Service Water)
- 3.3.2.296 (Control Rod Drive Hydraulic)
- 3.3.2.299 (Containment Atmosphere Monitoring)

Steam and Power Conversion Systems:

- 3.4.2.30 (Main Steam, Feedwater)

B.1.26 ASME Section XI, Subsection IWE

RAI B.1.26

In LRA Appendix B.1.26, the applicant describes its “ASME Section XI, Subsection IWE” aging management program, as consistent with the ten elements of program XI.S1 specified in NUREG-1801 (GALL report), but with a number of exceptions. For each exception, the applicant references a current Relief Request granted by the staff.

The staff position is that current Relief Requests granted by the staff have no bearing on License Renewal commitments, because the basis for the relief request and the period of time during which the relief request is applicable generally will not carry over to the period of extended operation. Consequently, for license renewal the staff expects a commitment to IWE and supplemental requirements consistent with 10 CFR 50.55a. The staff notes that 10 CFR 50.55a was updated in 2002 to include the 1998 edition with the 1999 and 2000 Addenda of Subsection IWE, with the additional requirements of paragraphs (b)(2)(ix) (A), (B), and (F)

through (I).

Therefore, the applicant is requested to (1) describe the extent of its commitment to the IWE requirements specified in the most recent issuance of 10 CFR 50.55a; (2) specifically identify any exceptions taken to these requirements, for the extended period of operation; and (3) submit a detailed technical basis for each exception taken.

B.1.27 ASME Section XI, Subsection IWF

RAI B.1.27

In LRA Appendix B.1.27, the applicant describes its "ASME Section XI, Subsection IWF" aging management program, as consistent, with enhancements, with the ten elements of program XI.S3 specified in NUREG-1801 (GALL report). In its description, the applicant specifically states that "The program is implemented through station procedures, which provide for visual examination of inservice inspection Class 1, 2, and 3 supports in accordance with the requirements of ASME Section XI, Subsection IWF, 1989 Edition and Code Case N-491-1." Inspection of Class MC supports is identified as an "enhancement" that is "scheduled for implementation prior to the period of extended operation."

The staff considers the applicant's program to be consistent with GALL, except for the element of "Scope." GALL presents a generic evaluation of IWF, an existing mandated program for inspection of ASME Class 1, 2, 3, and MC supports. The applicant's existing IWF program is NOT consistent with GALL in that it does not include the inspection of Class MC supports. The staff's acceptance of IWF (or any other existing program) for aging management during the license renewal period is substantially based on the assumption that the components covered by the scope of the existing program are being periodically inspected during the current licensing term and any problems affecting performance of intended function(s) have been detected and corrected.

Therefore, the staff requests the applicant to describe the plant-specific operating experience for the aging of Class MC supports in terms of: (1) the current inspection method, frequency, scope, and acceptance criteria; and (2) any observed degradation and subsequent corrective actions taken to manage the aging of these components.

B.1.30 Structures Monitoring Program

RAI B.1.30

LRA Appendix B.1.30 describes the "Structures Monitoring Program" as consistent, with enhancements, with the ten elements of program XI.S6 specified in NUREG-1801 (GALL report). In its description of the program and the enhancements, the applicant makes several statements that need clarification before the staff can complete its evaluation. Therefore, the applicant is requested to submit the following additional information:

(a) The LRA states that "The program will provide for visual inspections of structures and components not included in the ASME Section XI, Subsection IWF (B.1.27) aging management program." Is this statement intended to encompass component supports not covered by IWF? Please clearly define the scope of structures and components encompassed by this statement.

(b) The last item under "Enhancement" states that "The program will extend inspection criteria to the structural steel, concrete, masonry walls, equipment foundations, and component support sections of the program to provide consistency with NUREG-1801 component supports." The staff is unable to interpret the meaning of this enhancement. Please describe in detail the structures and structural components included in this enhancement; the associated aging effects in need of aging management; the inspection methods to be used, and the acceptance criteria to be applied.

B.1.31 RG 1.127- Inspection of Water-Control Structures Associated with Nuclear Power Plants

RAI B.1.31

In LRA Appendix B.1.31, the applicant describes its "RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants" aging management program, and asserts that, with enhancements, it is consistent with the ten elements of program XI.S7 specified in NUREG-1801 (GALL report). In its description, the applicant states that this program "is part of the structures monitoring program and consists of procedures that provide for condition monitoring of structural steel elements and concrete."

Based on the applicant's description of this aging management program, it is not readily apparent to the staff that it is consistent with the ten elements of GALL XI.S7. The staff cannot determine whether this is an existing program, and cannot identify the specific structures and structural components, environments, and aging effects that are managed by this program. In RAI 2.4-7, the staff has questioned the apparent omission from the scope of license renewal of many structures that appear to be essential elements of the ultimate heat sinks at Dresden and Quad Cities. These structures are typically monitored using the guidance in RG 1.127, and for license renewal should be included in the scope of an aging management program consistent with GALL XI.S7.

To complete its evaluation of this aging management program, the staff requests the applicant to submit the following additional information:

(a) Clarify whether the program described in LRA Appendix B.1.31 is an existing program. If so, explain what structures and structural components, environments, and aging effects are currently inspected under this program at Dresden and Quad Cities. If not, explain how the condition of water-control structures is currently monitored at Dresden and Quad Cities.

(b) Describe the plant-specific operating experience with regard to the inspection of all essential structural elements of the ultimate heat sink, including (as applicable) the intake and discharge canals and on-site ponds.

(c) Under the first "Enhancement", the applicant states that "The program will provide for monitoring of crib house concrete walls and slabs with an opposing side in contact with river water and the Quad Cities discharge canal weir." Clarify whether the sides of the crib house concrete wall and slabs that are exposed to raw water are inspected under this program? If not, explain why not. Also, verify that the underwater surfaces of the Quad Cities discharge canal weir are inspected under this program, or explain why they are not.

(d) Under the second "Enhancement", the applicant states that "Procedures will be revised to emphasize inspecting for structural integrity of concrete and steel components and identify specific types of components to be inspected." Describe the procedures that already exist and provide a more detailed description of the revisions that will be made.

(e) Describe any additional enhancements to this program that may be required as a result of the response to staff RAI 2.4-7, related to the scope of water-control structures that serve an intended function for license renewal.

B.1.32 Protective Coating Monitoring and Maintenance Program

RAI B.1.32

LRA Appendix B.1.32 describes the “Protective Coating Monitoring and Maintenance Program,” as consistent, with enhancements, with the ten elements of program XI.S8 specified in NUREG-1801 (GALL report). In order to complete its evaluation, the staff requests the applicant to submit the following information:

(a) It is the staff’s understanding that this program is being credited for prevention/mitigation of loss of material due to corrosion of steel structural components inside containment, including the accessible inside surfaces of the containment drywell and torus. In addition, it is the staff’s understanding that this program augments, but does not replace, inspections conducted under IWE, IWF, and structures monitoring program. Please confirm that these understandings are correct, or provide additional explanatory information to clarify the scope and purpose of the Protective Coating Monitoring and Maintenance Program.

(b) Does the scope of this program include monitoring and maintenance of anti-corrosion coatings applied to the sand pocket region of the drywell? If not, what program monitors the condition of these coatings?

(c) In the third paragraph under “Operating Experience,” the LRA states “Inspections of drywell steel at Quad Cities have not identified any significant coating or corrosion problems requiring repair of the torus.” Please clarify what is meant by this statement.

B.1.34 Metal Fatigue of Reactor Coolant Pressure Boundary

RAI B.1.34

The application states that, with enhancement, the metal fatigue of reactor coolant pressure boundary aging management program is consistent with the ten elements of aging management program X.M1, “Metal Fatigue of Reactor Coolant Pressure Boundary,” specified in NUREG-1801. The program will use the EPRI-licensed program “Fatigue-Pro,” and is scheduled to be implemented prior to the period of extended operation. The program will encompass all locations with 40-year CUFs expected to exceed 0.4.

(a) Provide clarification explaining how “Fatigue-Pro” and the aging management program will account for the cumulative fatigue usage factors at the selected monitoring locations prior to the implementation for the period of extended operation.

(b) One of the enhancements consists of providing for tracking of fatigue stress cycles for the Dresden isolation condenser. Verify that this enhancement is applicable to both Isolation condensers at Dresden.

(c) Provide a list, or a reference in the Dresden and Quad Cities UFSAR, of the transients defined and implemented in the Metal Fatigue of Reactor Coolant Pressure Boundary aging management program software.

B.1.36 Boraflex Monitoring (Quad Cities only)

RAI B.1.36

In the Aging Management Review Aid Table 2.4-2, the applicant stated that the Boraflex neutron-absorbing sheets in the reactor building exposed to chemically treated oxygenated water and subject to reduction of neutron-absorbing capacity due to Boraflex degradation are managed by the Boraflex Monitoring AMP with NUREG 1801, Item VII.A2.1-a as a reference. NUREG-1801, XI.M22, states that the AMP includes trending the results from the silica analysis in the spent fuel pool water using the EPRI RACKLIFE predictive code or its equivalent on a monthly, quarterly, or annual basis (depending on the Boraflex panel condition). However in B.1.36, the applicant stated that the evaluation is performed every two years. Clarify this statement and provide technical basis from this apparent divergence from NUREG-1801 guidelines.

B.2.3 Periodic Inspection of Ventilation System Elastomers

RAI B.2.3

(a) In the second paragraph of the Description section, the applicant stated "The improved program for periodic inspection of ventilation system elastomers provides routine inspection of certain elastomers in ventilation systems in accordance with plant procedures and predefined tasks." Elastomer wear and degradation of elasticity are functions of material composition, dynamic load, environment, and time. All elastomer components with the same material composition/dynamic load/environment will roughly have the same degree of aging. Provide information on what are the "certain elastomers" and technical basis for selecting these "certain elastomers."

(b) Element 1, Scope of Activity, states that Exelon may elect to periodically replace certain ventilation system elastomer and RTV seals instead of inspecting them and that periodic replacement will be evaluated on a case-by-case basis. Provide specific information such as replacement frequency, replacement criteria and the associated technical basis, including applicable operating experience about the proposed periodic replacement. Describe how the variable combinations of material composition, dynamic load, and environment will be weighed in determining the frequency of inspection.

(c) Element 4, Detection of Aging Effects, of this AMP does not contain a statement that the inspection will be conducted by qualified personnel, or reference to authoritative criteria to detect hardening or cracking due to elastomer degradation or loss of material due to wear. Address this deficiency.

(d) Element 6, Acceptance, does not refer to an acceptance criterion to evaluate indications related to hardening or cracking due to elastomer degradation or loss of material due to wear. Address this deficiency.

(e) The “Periodic Inspection of Ventilation System Elastomers” AMP states in LRA Section B.2.3 under element 2, Preventive Actions, that the inspections provide condition monitoring to detect degradation prior to a loss of function. The staff notes that elastomers may crack, harden, or lose strength due to relative motion between vibrating equipment, exposure to warm moist air, temperature changes, oxygen, and/or radiation. Clarify if the elastomer components are also used at D/QCNPS as vibration isolators to prevent transmission of vibration and dynamic loading to the rest of the system. If these isolators degrade, vibration and subsequent dynamic loads applied to the ductwork and fasteners cannot be eliminated. Provide the frequency of the subject inspection described in LRA Section B.2.3 for the applicable elastomer components, including a discussion of the operating history to demonstrate that the applicable aging degradations will be detected prior to the loss of their intended function.

(f) The “Periodic Inspection of Ventilation System Elastomers” AMP states in LRA Section B.2.3 under element 3, Parameters Monitored/Inspected, that the condition of elastomers used in ventilation systems will be determined by visual inspection. Describe how this visual inspection will be conducted in inaccessible areas.

(g) The “Periodic Inspection of Ventilation System Elastomers” AMP states in LRA Section B.2.3 under element 10, Operating Experience, that both Dresden and Quad Cities have experienced leaks in ventilation systems due to deterioration of or damage to elastomers, including flexible boots and access door seals and gaskets. The leaks were found and corrected in a timely manner and did not result in a loss of function of the ventilation system train. Discuss how the program has been modified to avoid seepage or leakage through boots, seals, and gaskets.

B.2.4 Periodic Testing of Drywell and Torus Spray Nozzles

RAI B.2.4

(a) Section B.2.4 of the LRA provides information for the periodic testing of drywell and torus spray nozzles as an aging managing program. Since the applicant did not specify the frequency of the testing and/or monitoring, it is requested that the applicant provide this additional information.

(b) In Section B.2.4 of the LRA, the applicant stated that the test procedures contain acceptance criteria that require that flow be observed from and through each individual drywell and torus spray nozzle. The applicant is requested to elaborate on the acceptance criteria, including, but not limited to, definition of acceptable flow or acceptable percentage of full flow.

(c) In Section B.2.4 of the LRA, the applicant stated that drywell nozzles are tested with compressed air, and torus nozzles are tested with water to verify that the drywell and torus spray nozzles are free from plugging that could result from corrosion product buildup from upstream carbon steel piping. The applicant is requested to explain how the flow tests will reveal the degree of component degradation due to general corrosion.

The applicant is also requested to describe how the aging effect of general corrosion for the upstream carbon steel piping will be adequately managed.

(d) In Section B.2.4 of the LRA, the applicant stated that in 2000, a 1" x 3" block of wood was found lodged in a spray nozzle subsequent to a spray test. Although this is not an age-related problem, the applicant is requested to discuss corrective actions that have been taken (i.e., procedural controls) to avoid the recurrence of such incident.

B.2.5 Lubricating Oil Monitoring Activities

RAI B.2.5

(a) In the attribute of Parameters Monitored or Inspected, the applicant stated that the parameters monitored by the program include viscosity, total acid number, total base number, rotary bomb oxidation test, water demulsability, particle count, fuel and combustion byproducts, sediment, water, anti-foaming characteristics, whole particle counting, air release and emission spectrum. The applicant also stated that the parameters monitored by the program depend on oil type and type of service. Loss of material due to general, crevice, and pitting corrosion and cracking are applicable aging effects for lubricating oil cooler components in a lubricating oil environment at locations containing water or contaminants such as chloride ions. Are water, moisture, and chloride ions monitored for all types of oil and service? If not, provide justification for not including these parameters in monitoring.

(b) In the attribute of Acceptance Criteria, the applicant stated that normal, alert, and fault levels have been established for the various chemical and physical properties, wear metals, additives, and contaminant levels based on information from oil manufacturers, equipment manufacturers, and industry guidelines, for the specific oil type and application. The applicant also stated that the program maintains contaminant and parameter limits within the application-specific limits. Because presence of water and contaminants such as chloride ions in the lubricating oil can cause corrosion and SCC, explain the acceptance criteria of water, moisture, and contaminants such as chloride ions.

(c) In element 10, Operating Experience, the applicant states “Lubricating oil sampling and analysis have detected particulate or water contamination (or both) in lubricating oil systems. In some cases these events resulted in systems being declared inoperable until repaired, and until the oil was flushed or replaced. Operating experience has produced procedure and program changes, which have improved the effectiveness of lubricating oil testing and inspection activities.” Describe the corrective actions made and the operating experience since these corrective actions were implemented.