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10 CFR 54

RS-03-232

December 12, 2003

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-001

Dresden Nuclear Power Station, Units 2 and 3
Facility Operating License Nos. DPR-19 and DPR-25
NRC Docket No. 50-237 and 50-249

Quad Cities Nuclear Power Station, Units 1 and 2
Facility Operating License Nos. DPR-29 and DPR-30
NRC Docket Nos. 50-254 and 50-265

Subject: Additional Information for the Review of the License Renewal Applications for Dresden Nuclear Power Station, Units 2 and 3 and Quad Cities Nuclear Power Station, Units 1 and 2

Reference: (1) Letter from J. A. Benjamin (Exelon Generation Company, LLC) to U. S. NRC, "Application for Renewed Operating Licenses," dated January 3, 2003

Exelon Generation Company, LLC (EGC) is submitting the additional information requested in email requests sent by Tae Kim (NRC) to EGC on October 14 and 23, 2003, and November 4 and 10, 2003. This additional information provides a response to questions regarding the Sections 2.4, 3.2, 3.5, 3.6, and 4.7, and Aging Management Programs sections of Reference 1 to support the NRC review.

Should you have any questions, please contact Al Fulvio at 610-765-5936.

A097
A098

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

Respectfully,

12/12/03
Executed on

Patrick R. Simpson
Patrick R. Simpson
Manager – Licensing

Attachment : Response to Request for Additional Information – LRA Sections 2.4, 3.2, 3.5, 3.6, and 4.7, and Aging Management Programs

cc: Regional Administrator – NRC Region III
NRC Senior Resident Inspector – Quad Cities Nuclear Power Station
NRC Senior Resident Inspector – Dresden Nuclear Power Station
Illinois Emergency Management Agency

Attachment

Response to Request for Additional Information

LRA Sections 2.4, 3.2, 3.5, 3.6, and 4.7, and Aging Management Programs

RAI 2.4-3 Supplemental Information Request

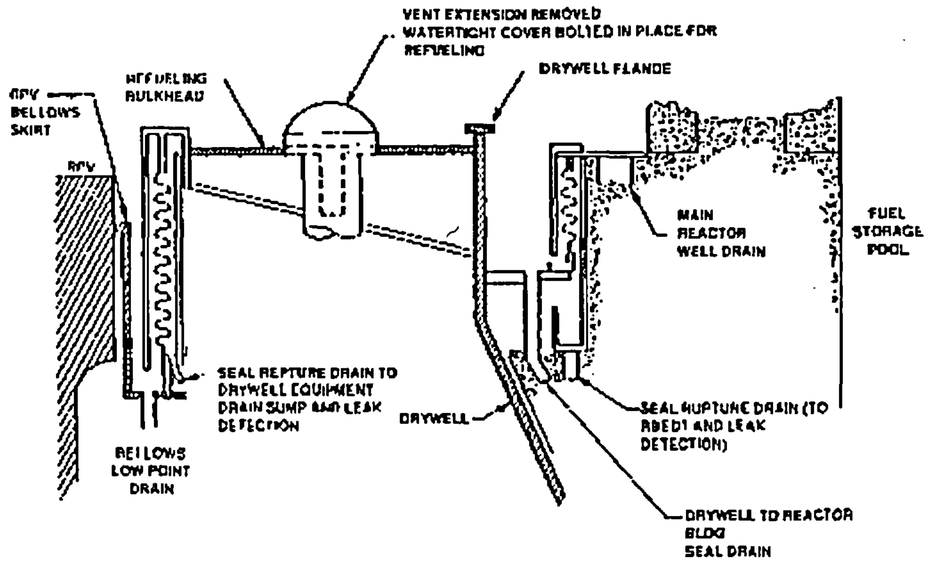
It is the staff's interpretation that the drywell-to-reactor building refueling seal and the RPV-to-drywell refueling seal are both brought into the license renewal scope by 10 CFR 54.4(a)(2). It is analogous to the seismic II/I requirements for license renewal. In this case, failure (leakage) of the non-safety components (refueling seals) has the potential to significantly degrade the function of the safety-related component (drywell). The staff's concern about the drywell-to-reactor building refueling seal is documented in Open Item 4.7.2.2-1, in the staff evaluation of the TLAA for Degradation Rates of Inaccessible Exterior Drywell Plate Surfaces.

From the applicant's response, it appears to the staff that leakage past the RPV-to-drywell refueling seal and subsequent discovery of this condition is not of great concern to the applicant. There apparently is no formalized procedure or requirement to check for leakage after flooding the reactor cavity. Water seepage past the moisture barrier at the steel/concrete juncture at the bottom on the inside of the drywell has the potential to initiate corrosion on the inside surface. Coupled with the known corrosive condition on the outside surface, continued demonstration of drywell structural adequacy would become more complex and uncertain.
The staff's position is that the RPV-to-drywell refueling seal is within the scope of license renewal and is subject to an aging management review. This is Open Item 2.4.1.2-1.

Response:

Exelon does not agree that performance of the drywell to refueling (DR) seals is a II over I issue. 10 CFR 54.4(a)(2) states, "All nonsafety-related systems, structures, and components whose failure could prevent satisfactory accomplishment of any of the functions identified in paragraphs (a)(1)(i), (ii), or (iii) of this section." A postulated failure of the DR seals can result in water intrusion into the annulus space around the drywell. This leakage can occur only during refueling outages when the reactor cavity is flooded to allow movement of fuel between the reactor and the fuel pool. However, water intrusion does not cause failure of the drywell's intended function. Any water leakage resulting from a postulated failure of the DR seals could not remain suspended in the annulus region for an indefinite period of time and would eventually be routed to the sandpocket area drains or would evaporate due to the heat generated in the drywell during operation. Regardless, Exelon will implement the drywell monitoring program outlined in the supplemental response 4.7.2.2-1 for the Dresden 3 drywell annulus areas to ensure that unacceptable corrosion is not occurring.

Leakage past the RPV-to-drywell refueling seal is collected and directly piped by design to the drywell equipment drain sump. Refer to the following drawing.



A high flow switch in the drain line to the equipment drain sump provides an alarm in the control room if flow >1 gpm is detected (there is an additional high level alarm on the sump itself). The annunciator response procedure directs actions to quantify/mitigate the leakage, since excessive flow through the drain line could eventually result in leakage into the drywell.

It should be noted that inspection of the condition of the drywell interior coating is periodically performed under approved procedures. In the extremely unlikely event of leakage through the RPV-to-drywell refueling seal sufficient to overwhelm the hard-piped drain system and enter the drywell, periodic inspection and maintenance of the coating will prevent corrosion that could eventually impact drywell structural adequacy. There is no operating experience of leakage through the RPV-to-drywell bellows ever bypassing the drain system.

<u>RAI 3.2-1 (b) Supplemental Information Request</u>

Previous Response:

.......*The population to be sampled includes: 1) carbon steel piping in the drywell and suppression chamber spray headers from the closed motor-operated spray valves, up to but not including the spray nozzles. Dresden and Quad Cities have brass/bronze spray nozzles, 2) HPCI and RCIC (Quad Cities only) turbine exhaust piping, 3) suppression chamber level gauge upper stop valve.* Note that there should have been references in Table 2.3.2-1, HPCI system, and Table 2.3.4-1, RCIC system, in the Piping and Fittings Component Group, to Aging Management References 3.2.1.3 and 3.2.1.5.

The staff requests that the applicant provide an explanation that will resolve the contradicting response provided in RAI 3.2-2, as well as the apparent contradiction between the responses to RAI 3.2-1(b) and RAI 3.2-2.

Response:

The inconsistency in the previous response to RAI 3.2-2 and between responses 3.2-1(b) and 3.2-2 is noted. This inconsistency will be resolved by revising LRA Tables 2.3.2-1 and 2.3.2-4 to include Aging Management References 3.2.1.3 and 3.2.1.5 for HPCI and RCIC piping and fittings.

RAI 3.2-2 Supplemental Information Request

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.

Previous Response:

LRA Table 3.2-1, Aging Management References 3.2.1.3 and 3.2.1.5, are not included in LRA Tables 2.3.2-1 and 2.3.2-4 as aging management references because NUREG 1801, Chapter V, does not address HPCI and RCIC carbon steel piping and fittings with an "air and steam up to 320C (608_F)(primarily air)" environment and with a loss of material aging effect due to general, pitting, and crevice corrosion. As such, a non-NUREG 1801 aging management reference was utilized. Table 2.3.2-1 (component group of "Piping and Fittings (Includes thermowells)") and Table 2.3.2-4 (component group of "Piping and Fittings (Quad Cities only)(includes rupture discs)") refer to Aging Management Reference 3.2.2.126 for a loss of material due to pitting and crevice corrosion. Aging Management Reference 3.2.2.126 should also have included the aging mechanism of general corrosion.

Potential Open Item

The response indicates that Aging Management References 3.2.1.3 and 3.2.1.5 are not applicable to HPCI and RCIC carbon steel components due to expected environments outside those addressed in NUREG 1801.

This appears to be in conflict with discussions provided in Section 3.2.1.1.3 and 3.2.1.1.5 that provide direct reference to HPCI and RCIC carbon steel piping and components addressed in NUREG 1801 that will be evaluated which states:

> 3.2.1.1 Further evaluation of aging management as recommended by NUREG-1801 for the engineered safety features systems
>
> *..An inspection in accordance with One-Time Inspection (B.1.23) of carbon steel piping most likely to experience a loss of material in the Dresden and Quad Cities safety relief discharge piping, Dresden and Quad Cities HPCI systems, Dresden LPCI (spray piping) system, Quad Cities RHR (spray piping), and the Quad Cities RCIC system that are exposed to a containment atmosphere environment (wet gas) will be performed.*

In addition, while the response noted above clearly states that "*LRA Table 3.2-1, Aging Management References 3.2.1.3 and 3.2.1.5, are not included in LRA Tables 2.3.2-1 and 2.3.2-4 as aging management references because NUREG 1801, Chapter V, does not address HPCI and RCIC carbon steel piping and fittings with an "air and steam up to 320□C (608□F)(primarily air)*" environment and with a loss of material aging effect due to general, pitting, and crevice corrosion", the applicants response to RAI 3.2-1(b) specifically noted, as follows, that there should have been references in Table 2.3.2-1, HPCI system, and Table 2.3.4-1, RCIC system (assumed to mean Table 2.3.2-4) in the Piping and Fittings Component Group, to Aging Management References 3.2.1.3 and 3.2.1.5):

Response:

The inconsistency in the previous response and between Responses 3.2-1(b) and 3.2-2 is noted. This inconsistency will be resolved by revising LRA Tables 2.3.2-1 and 2.3.2-4 to include Aging Management References 3.2.1.3 and 3.2.1.5 for HPCI and RCIC piping and fittings.

RAI 3.5-5 Supplemental Information Request

The staff's detailed evaluation of parts (a) through (f) of this RAI response is documented in DSER Section 4.7.2.2, TLAA for Degradation Rates of Inaccessible Exterior Drywell Plate Surfaces. The staff has identified Open Items 4.7.2.2-2 and 4.7.2.2-3, that require resolution before parts (a) through (f) of RAI 3.5-5 can be resolved. The staff finds the applicant's response to parts (g) and (h) of RAI 3.5-5 to be acceptable on the basis that it is consistent with the guidance provided in the GALL report for aging management of the inside surface of the embedded portion of the containment shell. RAI 3.5-5, parts (a) through (f) are unresolved, pending resolution of Open Items 4.7.2.2-2 and 4.7.2.2-3.

Response:

To resolve the Open Items, Exelon proposes that a monitoring program be instituted for the Dresden Unit 3 inaccessible annulus areas to ensure that potential corrosion does not occur. As previously described, Dresden Unit 3 is considered the limiting case for potential drywell corrosion among the four Dresden and Quad Cities units.

The program will consist of inspection of a sample of locations in the cylindrical and upper spherical areas of the drywell, using ultrasonic measurements of the drywell shell thickness made from accessible areas of the drywell interior. A minimum of four sample locations will be selected in each 90-degree quadrant of the drywell. At least one of the four sample locations will be performed in the spherical portion of the drywell below the annulus region in proximity to the location of the 1986 drywell liner fire.

A baseline inspection will be performed prior to the period of extended operation. A follow-up inspection consisting partly of the same locations and partly of variable locations will be conducted by the third refueling outage after the baseline inspection. Follow-up inspections of the same location will allow trending of wall thickness data. Variable locations will allow flexibility to ensure that wall thickness integrity is maintained during the period of extended operation. The follow-up inspection will be used to determine whether any corrosion is occurring and that any observed corrosion rate will not threaten drywell integrity during the extended 60-year plant life. The results of the inspections will undergo an engineering evaluation to determine if further follow-up inspections are warranted, or if more locations in the accessible drywell liner interior should be monitored.

These inspections will be added to LR program B.1.26, ASME Section XI, Subsection IWE, for Dresden 3.

<u>RAI 3.5-10 Supplemental Information Request</u>

Although the applicant's response is comprehensive, the staff requires additional information before it can complete its evaluation. (1) Both the fire and the significant water leakage past the drywell-to-reactor building refueling seal occurred at Dresden 3. The statement in response part (d) that "This foam is not typically exposed to leaking fluid." does not appear to be applicable to Dresden 3. The applicant needs to address the potential synergistic effects of both events on the condition of the drywell expansion foam, and whether agents corrosive to carbon steel and/or aggressive to concrete may have been generated. (2) In response part (e), the assessment that the structural integrity of the containment steel and the surrounding concrete have not been negatively impacted by the fire appears to be based on estimates of the maximum temperature to which they were exposed. The extent and duration of exposure to elevated temperatures is not identified; also, it is unclear whether actual inspection and/or material sampling was conducted to assess the steel and concrete condition after the fire. The applicant is requested to provide this additional information, to assist the staff in determining that structural integrity will be maintained through the period of extended operation. This is Open Item 3.5.2.4.1.2-1.

Response:

1. Exelon reviewed all available documentation on the evaluations that were performed after the fire. No information can be found that indicates that inspections or material sampling were conducted. Exelon provides the following information that was obtained from the two references listed below. To assess the potential for corrosion due to the effects of both the 1986 fire and the water used to extinguish it, sample tests were performed on water solutions of burnt polyurethane foam materials (Reference 1). No significant concentrations were found of chemicals hazardous to the steel shell. Water samples collected from the sand pocket drain lines supported this conclusion. The same samples indicated that chemical attack of the concrete was highly unlikely and that it would take more than 200 years for the concrete cover to deteriorate to the point where reinforcing steel could corrode. These samples are considered limiting for effects on the steel and concrete materials, since the refueling seal leakage was demineralized water rather than raw water from fire hose streams. The NRC safety evaluation of the Dresden 3 fire event (Reference 2) concluded that the adverse effects of potential corrosive products would pose no deleterious effects on either the steel liner or concrete shield wall.

2. The extent of exposure to the calculated bounding maximum temperature is discussed in the May 6, 1986 submittal pertaining to the fire (Reference 1). The duration of fire exposure is discussed in the same submittal. Material sampling of water exposed to the combustion products was performed as discussed in the response to part 1 of this supplemental question. Visual inspection of the drywell

interior was performed. The conclusion of this inspection was that the coating on the exterior side was intact based on the conditions of the interior primer in the area affected by the fire. The NRC safety evaluation (Reference 2) also concluded that the steel liner and concrete shield wall sustained no structural damage as a result of the fire.

References:

(1) Letter, Commonwealth Edison (D.L. Farrar) to NRC (RIII), "Dresden Station Units 3, Response to Inspection Report No. 50-249/86-006, NRC Docket No. 50-249," dated May 6, 1986, with attachment, "Evaluation for the Effects of the Dresden Unit 3 Polyurethane Fire."

(2) Safety Evaluation Report by the Office of Nuclear Reactor Regulation of the Expansion Gap Fire on January 20, 1986 at Dresden Station Unit 3, Docket No. 50-249, August 31, 1987.

RAI 3.6-4 Supplemental Information Request

As a result of the staff's RAI 3.6-4, on October, 3, 2003, the applicant provided a revision of this element as follows:" Accessible normally energized non-segregated bus duct internal components are visually inspected for insulator and bus bar insulation material surface anomalies, such as embrittlement, discoloration, cracking, chipping, or surface contamination. Internal components such as insulation material, bus duct support pieces, gaskets, insulating boots, taped connections, and bus bar sleeves are inspected. The visual inspections also check for evidence of water and dirt accumulation and presence of foreign material." The staff finds that the visual inspection of bus ducts, bus bars, and internal supports will provide an indication of aging effects. The staff can not determine whether the bolted connections of bus bars will remain functional for the period of extended operation because the program will not verify the bolted connections for proper torque.

Response:

Exelon believes based on standard industry practice that the original bolts used on the normally energized non-segregated bus duct are bronze bolts. However, no drawings exist that show the actual bolting material. During a vendor recommended modification in 1993, some of the original bolts were replaced with stainless steel bolts. Stainless steel is an Exelon approved bolting material for copper bus connections. Bronze and stainless steel bolts are ideal for use with copper bus because the bolting materials have nearly the same coefficients of thermal expansion as the copper bus bar. This prevents thermal stress from causing plastic deformation of the bolts, which is the primary cause of loose connections. EPRI TR104213 (Joint Maintenance and Application Guide) Table 7-4 shows no thermal stress for bronze or stainless steel bolts used with copper bus.

EPRI TR104213 Section 8.2 states the bolts should be inspected for evidence of overheating, signs of burning or discoloration, and indications of loose bolts. The bolts should not be retorqued unless the joint requires service or the bolts are clearly loose.

Exelon's response to RAI 3.6-4 states that accessible normally energized non-segregated bus duct internal components are visually inspected for insulator and bus bar insulation material surface anomalies, such as embrittlement, discoloration, cracking, chipping, or surface contamination. Internal components such as insulation material, bus duct support pieces, gaskets, insulating boots, taped connections, and bus bar sleeves are inspected. This inspection will verify that there are no insulation material surface anomalies, such as embrittlement, discoloration, cracking, chipping, and discoloration of the bus bar insulation material at the bolted connections. The absence of insulation material surface anomalies, such as embrittlement, discoloration, cracking, chipping, and discoloration, which would have been experienced from overheating of loose connections, provides positive indication that the bolted connections are not loose and therefore, the intended function of the bus duct will be maintained during the period of extended operation.

Exelon stated in aging management program B.2.2 (Periodic Inspection of Non-EQ, Non-Segregated Electrical Bus Ducts) that it has not experienced any bus bar insulation failures that would indicate that bolted connections have a credible aging mechanism. Additionally, there is no industry experience that indicates loosening of properly designed and installed bus bar bolted connections is an industry problem for bus duct that is not overloaded. The reference to SAND 96-0344 page 4-38 used in RAI 3.6-4 does not apply to bus bar bolting materials. This reference is related to cable system components and is not applicable to bus bar bolting. A review of the empirical data presented in SAND 96-0344 Section 3 shows only nine failures of medium voltage cable splices. None of the failures were due to thermal cycling; most were due to mechanical stress and failure of the insulation material. No empirical data is provided in SAND 96-0344 related to bus duct thermal cycling.

In summary, there is no plant or industry operating experience that shows that there is a credible aging mechanism pertaining to the normally energized non-segregated bus duct bus bar bolts; therefore, no aging management other than visual inspection is required.

RAI 3.6-7 Supplemental Information Request

In response to RAI 3.6-7, the staff is confused about items 3.6.2.4 and 3.6.2.5 in Table 3.6-2. Please provide clarification.

Response:

Two previous Exelon responses to RAI 3.6-7 and RAI 2.5-1 pertain to bus bar material and connections. RAI 3.6.7 addressed the switchyard bus and RAI 2.5-1 addressed the non-segregated bus ducts. In this response, Exelon proposes to provide a response that covers both previous RAI responses. This response supersedes Exelon's original responses to RAI 3.6-7 and RAI 2.5-1.

Exelon acknowledges that LRA tables 2.5-1 (Component Groups Requiring Aging Management - Electrical Commodities) and LRA table 3.6-2 (Aging management review results for the electrical and instrumentation and control components that are not addressed in NUREG-1801) should have included bus bar material and connections. The following aging reference will be added to cover bus bar material and connections. The response is divided into three separate topics. These are:

- Normally energized non-segregated bus ducts
- Switchyard buses

- Normally non-energized non-segregated bus duct

Normally energized non-segregated bus ducts

Aging Reference 3.6.2.4 is being added for the normally energized non-segregated bus ducts. The bus bars for this normally energized non-segregated bus duct are made of copper. The normally energized in-scope non-segregated bus ducts connect the Reserve Aux Transformer which is located in an outdoor environment to the 4160 Volt Essential Service Switchgear (ESS) which is located in an indoor environment. The associated ESS busses are Busses 13,14,23 and 24 for Quad Cities and 23, 24, 33 and 34 for Dresden. [The non-ESS 4160 Volt Switchgears 11,12,21 and 22 for Quad Cities, Switchgears 21,22,31 and 32 for Dresden Station and the associated bus ducts are out of scope, as they feed only out-of-scope equipment. These should have been shown out of scope in boundary diagram LR-DRE-E-2 and LR-QDC-E-2.] Justification for having no aging management of these normally energized non-segregated bus duct bus bar and connections is provided in Exelon's response to RAI 3.6-4 Supplemental Information Request.

Switchyard buses

Aging Reference 3.6.2.5 is being added for the aluminum switchyard buses located outdoors. For the ambient environmental conditions at Dresden and Quad Cities, no aging effects have been identified for the switchyard bus that could cause a loss of intended function for the extended period of operation. Therefore, there are no applicable aging effects for the switchyard bus.

At Dresden and Quad Cities, the switchyard bus consists of aluminum tube, aluminum conductors, and the necessary connections. Conductor connections are generally of the compression bolted category. The switchyard bus is located in an outdoor environment subject to ambient temperatures that normally range from –6 °F to + 93 °F (referenced in section 9.4 of the Dresden & Quad Cities UFSAR). Aluminum materials do not experience any appreciable aging effects in this environment. Additionally, connections are adequately designed and treated with corrosion inhibitors such as "No-oxide". For this reason, the switchyard bus is not susceptible to corrosion due to oxidation.

There are no credible sources of vibration that could result in fatigue or cracking of the switchyard buses at Dresden and Quad Cities stations. As such, vibration as an aging mechanism does not apply.

The technical justifications provide above for aging reference 3.6.2.5 were accepted by the NRC staff and documented in sections 3.9.3.1.1 and 3.9.3.1.2 of NUREG 1723, Safety Evaluation Report Related to the License Renewal of Oconee Nuclear Station.

Normally non-energized non-segregated bus duct

A new Aging Reference 3.6.2.6 is being added to address the non-energized non-segregated bus duct bus bars located in an indoor environment and are made of aluminum. The non-energized non-segregated bus ducts connect the Emergency Diesel Generators to the ESS buses. At Dresden only, a non-energized non-segregated bus duct connects two 4160 Switchgears together as a cross tie bus. This bus duct is also located in an indoor environment and is made of aluminum. See Exelon's response to

RAI B.2.2-1 Supplemental Information Request for the discussion on the adding of these non-energized non-segregated bus ducts to the B.2.2 (Periodic Inspection of Non-EQ, Non-Segregated Electrical Bus Ducts) aging management program.

Table 2.5-1 of LRA will be revised as follows to add the switchyard buses, the normally energized non-segregated bus ducts and the non-energized non-segregated bus ducts.

Table 2.5-1 Component Groups Requiring Aging Management Review-Electrical Commodities

Component	Component Intended Function	Aging Management Ref
Bus Bar and Connections (Normally Energized Non-Segregated Bus Ducts RAT Transf. to ESS 4160 Swgr.)	Electrical Continuity	3.6.2.4,
Bus Bar and Connections (Switchyard Buses)	Electrical Continuity	3.6.2.5
Bus Bar and Connections (Non-Energized Non-Segregated Bus Ducts EDG to 4160 Swgr. and 4160 Swgr cross tie)	Electrical Continuity	3.6.2.6

Table 3.6-2 of LRA will be revised as follows to add aging management references 3.6.2.4, 3.6.2.5, 3.6.2.6.

Table 3.6-2 Aging management review results for the electrical and instrumentation and control components that are not addressed in NUREG-1801

Ref No	Component Group	Material	Environment	Aging Effect/Mechanism	Aging Management Program	Discussion
3.6.2.4	Bus Bar and Connections (Normally Energized Non-Segregated Bus Ducts RAT Transf. to 4160 ESS Swgr.)	Copper	Indoor and outdoor environments	None	None	NUREG-1801 does not address Bus Bar and Connections. The copper bus bar and connections are located inside the enclosures that form the outer boundary of the segregated bus ducts. These segregated bus ducts are located partially inside the plant and partially outside the plant, and thus are exposed to both indoor and outdoor environments. However, the copper bar and connections are internal components of the bus ducts and are not exposed to weather, and thus are not subject to any aging effects.
3.6.2.5	Bus Bar and Connections (Switchyard Buses)	Aluminum	Outdoor environments	None	None	NUREG-1801 does not address Bus Bar and Connections. The plant outdoor environment is not subject to heavy industry air pollution or saline environment. Plant indoor and outdoor environments are not conducive to promoting aging degradation.
3.6.2.6	Bus Bar and Connections (Non-Energized Non-Segregated Bus Ducts EDG to 4160 Swgr. and 4160 Swgr cross tie)	Aluminum	Indoor environments	Loose Connections/Thermo cycling	Periodic Visual Inspection of Electrical Bus Duct Insulation B2.2	NUREG-1801 does not address Bus Bar and Connections The aluminum bus bar and connections are located inside the enclosures that form the outer boundary of the segregated bus ducts. These segregated bus ducts are located inside the plant and are exposed to indoor environments.

RAI 4.7.2.2-1 Supplemental Information Request

The staff reviewed the applicant's response to RAI 2.4-3 and believes that the water leakage through the drywell to refueling (DR) seal has two consequences: (1) potential corrosion of the steel shell between the straight portion of the drywell and the containment shield wall, and (2) corrosion of the steel shell in the sand pocket areas. Small amount of water leaks may be absorbed by the insulation in the annulus space and may not affect the sand cushion areas. However, this moisture accumulation could corrode the drywell shell plate. The applicant's TLAA only addresses the corrosion of the shell in the sand pocket areas. The steel shell in the annulus area is inaccessible for direct inspection. Managing the performance of the DR seal will minimize the potential for corrosion in both these areas.

Based on the above discussion, the staff requests the following additional information: (1) how the applicant is managing the potential corrosion of the drywell shell in the inaccessible annulus areas, and (2) Based on the operating experience (industry-wide and plant-specific) with the performance of the DR seal, this issue can be characterized as II over I issue (i.e. effects of a non-safety item on the safety-related components). Provide justification for not managing the DR seal as a preventive measure against corrosion of the drywell shell plate.

Response:

(1) Potential corrosion that could lead to wall thinning of the annulus areas of the drywell shell can be postulated based upon an assumption of moisture accumulation in the annulus space. However, Exelon has found no operating experience records supporting an assumption that water has actually accumulated in this area and that related wall thinning has actually occurred.

- Information Notice No. 86-99, which discusses degradation of the Oyster Creek steel containment in the sand pocket areas, says, "In the cylindrical portion of the drywell above the spherical portion, where minor corrosion was discovered and was thought to have originated mostly during construction, no significant wall thinning was detected."
- Dresden and Quad Cities have no operating experience that indicates any water accumulation in the cylindrical portion of the drywell annulus between the drywell shell and the concrete wall.
- Evaluations related to Generic Letter 87-05 are provided in Letter, Commonwealth Edison (W.E. Morgan) to NRC (NRR), "Dresden Station Units 2&3, Quad Cities Station Units 1&2, Supplemental Response to Generic Letter 87-05, NRC Docket Nos. 50-237/249 & 50-254/265," dated September 6, 1988. This letter documents the accumulation of water in the Dresden Units 2 & 3 sand pockets due to clogging of the drain lines. However, even with this water accumulation, no detrimental corrosion of the drywell steel plates at the sand pocket level was found.

Based on the operating experience records, Exelon believes no detrimental corrosion has or will occur on the exterior of the cylindrical portion of the drywell shell. Regardless, Exelon proposes that a monitoring program be instituted for the Dresden Unit 3 inaccessible annulus areas to ensure that potential corrosion does not occur. As previously described, Dresden Unit 3 is considered the limiting case for potential drywell corrosion among the four Dresden and Quad Cities units.

The program will consist of inspection of a sample of locations in the cylindrical and upper spherical areas of the drywell, using ultrasonic measurements of the drywell shell thickness made from accessible areas of the drywell interior. A minimum of four sample locations will be selected in each 90-degree quadrant of the drywell. At least one of the four sample locations will be performed in the spherical portion of the drywell below the annulus region in proximity to the location of the 1986 drywell liner fire.

A baseline inspection will be performed prior to the period of extended operation. A follow-up inspection consisting partly of the same locations and partly of variable locations will be conducted by the third refueling outage after the baseline inspection. Follow-up inspections of the same location will allow trending of wall thickness data. Variable locations will allow flexibility to ensure that wall thickness integrity is maintained during the period of extended operation. The follow-up inspection will be used to determine whether any corrosion is occurring and that any observed corrosion rate will not threaten drywell integrity during the extended 60-year plant life. The results of the inspections will undergo an engineering evaluation to determine if further follow-up inspections are warranted, or if more locations in the accessible drywell liner interior should be monitored.

These inspections will be added to LR program B.1.26, ASME Section XI, Subsection IWE, for Dresden 3.

(2) Exelon does not agree that performance of the drywell to refueling (DR) seals is a II over I issue. 10 CFR 54.4(a)(2) states, "All nonsafety-related systems, structures, and components whose failure could prevent satisfactory accomplishment of any of the functions identified in paragraphs (a)(1)(i), (ii), or (iii) of this section." A postulated failure of the DR seals can result in water intrusion into the annulus space around the drywell. However, water intrusion does not cause failure of the drywell's intended function. Any water leakage resulting from a postulated failure of the DR seals could not remain suspended in the annulus region for an indefinite period of time and would eventually be routed to the sandpocket area drains or would evaporate due to the heat generated in the drywell during operation. Regardless, Exelon will institute the drywell monitoring program outlined above for the Dresden Unit 3 annulus areas to ensure that unacceptable corrosion is not occurring.

RAI 4.7.2.2-02 Supplemental Information Request

The response to RAI 3.5-5 includes a Table showing the UT measurements of the Dresden 3 shell during the inspections performed in 1988, 1997, 1998, 2000, and 2002. The staff understands the applicant's logic in not performing periodic UT examination for the remaining three units provided the applicant has in-place surveillance program to periodically verify the performance of sand-pocket drains in all units. Also, the corrosion found in Dresden 3 (based on the Table) is within the 10% limit of Subsection IWE of the ASME code. The ¼ in limit established as an acceptance criterion is excessive (about

25% of the shell thickness). To get clarification of these concerns, the staff requests the following information:

1. It is not clear if the performance of sand drains is (and will be) monitored at every outage on all four Units, please clarify.
2. It is not clear if the engineering evaluation performed to set the ¼ in (below the nominal thickness of the shell) criterion incorporates the effects of discontinuities and stress concentration under all load combinations. Please provide a summary of the calculations performed.
3. Are the corroded steel areas recoated using proper procedures?

Response:

1. Dresden and Quad Cities conduct a surveillance of the drywell liner drains once per operating cycle to make sure that there is no leakage from the Drywell Liner Sand Pocket Drain Lines on all four units. The surveillance is conducted during refueling operations when the refueling cavity is flooded and the potential for water leakage exists. These surveillances are conducted under the direction of QCTS 0820-11, Surveillance of Dryer Separator pool, spent fuel pool, and drywell liner drains and DTS 1600-06, Drywell Liner Leakage Inspection. Both site procedures have been credited for aging management and are included under aging management program B.1.26, ASME Section XI, Subsection IWE.

   In response to a follow-up question from the staff, the Dresden inspection procedure currently includes steps to ensure the sand pocket drains are clear. A similar requirement will be added to the Quad Cities procedure.

2. As stated in the response to RAI 3.5-5(b), the reference to minimum required plate thickness of ¼" below nominal at the sand pocket region is based on information contained in Section 6.2.1.2.1.2 of the Dresden UFSAR. The calculation took the existing design loads and load combinations from the original certified containment vessel stress report generated by Chicago Bridge & Iron Company, and used those cases to calculate the minimum required thickness. Normal operating, refueling, and accident loads were included in the calculation using code case N-284 stress allowable limits.

3. As stated in the response to RAI 3.5-5(b), initial thickness measurements supported the conclusion that significant corrosion was not occurring in the drywell steel plate at the sand pocket region. All measurements to date at Dresden 3 have remained within the 10% limit below nominal of Subsection IWE of the ASME code (most measurements are still above nominal wall thickness). Evaluations performed following the fire in 1986 concluded that the zinc chromate primer coat on the outer shell surface was intact following the fire, and that no corrosion had taken place. No recoating activities have been performed on the drywell exterior. Any recoating activities performed on the drywell interior are performed using proper procedures. No recoating activities performed to date are related to corrosion of the sand pocket region.

RAI 4.7.2.2-03 Supplemental Information Request

A review of the UT measurement table provided as a part of the response to RAI 3.5-5 indicates that within two digits after the decimal points, there is no consistency in the measured results. Some measurements taken at the same locations (e.g., locations 157.5.1.1A and 202.5.1.1A) show increase in thicknesses in the subsequent years, after the 1988 measurements. To complete its review, the staff will need the following information regarding the measurements:

1. Provide the basis for selecting the locations at which UT measurements are taken. Clarify if the measurement locations indicated in the Table have shown visual evidence of corrosion, or if they are in close proximity to the corroded areas.

2. One location, 337.5.1.2B, shows gradually decreasing thickness, with a total reduction in thickness of 0.18 in. Although the minimum thickness is still close to the nominal thickness, clarify if this reduction indicates a 0.18 in. corrosion of the shell at that location between 1988 and 2002.

3. Verify that the nominal thicknesses of the drywell shells are the same for all four Units; i.e., 1.0625 inches.

4. Provide the permissible tolerances on the nominal shell thickness in the as-delivered condition. Indicate if records are available of the actual as-delivered shell thicknesses.

5. Provide a discussion of the accuracy of the UT measurements.

Response:

1. The UT measurements are taken at various locations around the floor of the Dresden Unit 3 drywell in the sand pocket region. This area was chosen in 1988 as the most likely area to experience potential corrosion due to the presence of moisture (Reference 1). The drywell floor is a poured concrete slab that fills the bottom portion of the steel enclosure to an elevation of 502'-4" (refer to elevation view of the containment sand pocket, Figure 6.2-9 of Dresden UFSAR). The slab was divided into sectors and measurement locations were selected at random within each sector. The process used a standard statistical sampling basis. Certain portions of the floor slab are inaccessible due to equipment mounted on the floor. These locations are therefore not part of the measurement population. This sampling approach was described in detail in Reference 1.

   The shell was made accessible for measurement by drilling 2-½ inch core holes in the concrete at 22 accessible measurement locations. The holes range in depth from one to three feet, and are capped during normal plant operation. The UT probe is inserted into each hole to provide the thickness measurement. No visual inspection of the shell is possible due to the slab inside the steel liner and the sand pocket outside the steel liner.

   Evaluations performed following the fire in 1986 concluded that the zinc chromate primer coat on the outer shell surface was intact following the fire, and that no corrosion had taken place.

2. The point in question had an abnormally high reading in the 1988 measurements. In the Reference 1 submittal, it was speculated that one non-standard plate section could have been substituted in the drywell shell, resulting in thickness measurements exceeding the nominal tolerance on the high side at some locations. However the recent measurements from 1997-2002 have been relatively consistent at all of these locations and do not provide indication of progressive wall thinning.

3. The drywell shell thickness varies throughout the structure. The nominal thickness of 1.0625 inches in the sand pocket region applies to Dresden, and bounds the Quad Cities nominal thickness of 1.25 inches in the same area.

4. No as-delivered thickness measurements are available. Based upon normal mill tolerances for 1-1/16" plate a range from 1.0525 inch to 1.1755 inch could be expected.

5. The initial UT measurements in 1988 were performed with an instrument calibrated to ± .020", using a carbon steel standard ranging in thickness from 0.25" to 2.0" (Reference 1). The instrumentation in use for current UT measurements should attain comparable accuracy. Per current Exelon ultrasonic measurement procedures, UT instrumentation for material thickness measurements is calibrated to an accuracy of 2%, which is the same accuracy that was used in 1988.

Reference:

(1) Letter, Commonwealth Edison (W.E. Morgan) to NRC (NRR), "Dresden Station Units 2&3, Quad Cities Station Units 1&2, Supplemental Response to Generic Letter 87-05, NRC Docket Nos. 50-237/249 & 50-254/265," dated September 6, 1988, with attachment, "Report on the Potential for Drywell Steel Degradation at the Sand Pocket, Dresden Units 2 and 3, Quad Cities Units 1 and 2," prepared by Sargent & Lundy, August 1988.

B.1.4 Supplemental Information Request

In response to RAI B.1.4, the applicant identifies the vessel ID attachment welds at the Dresden and Quad Cities plants but it does not include steam dryer holddown bracket attachment welds at Dresden Unit 3. Table 2-2 in BWRVIP-48 states that Dresden Unit 3 does have these welds. Confirm whether the steam dryer holddown bracket attachment weld at Dresden 3 is a furnace-sensitized weld that requires enhanced VT-1 in accordance with BWRVIP-48.

Response:

The steam dryer support brackets discussed in the response to RAI B.1.4 include the configuration for Dresden Unit 3. The steam dryer holddown bracket attachment weld described in Table 2-2 of BWRVIP-48 does not exist at Dresden Unit 3. Dresden Unit 3 is the same configuration as Dresden Unit 2 and Quad Cities Units 1 and 2.

RAI B.1.16 Supplemental Information Request

Although the applicant has elected to impose more restrictive acceptance standards for air dewpoint, particle size and hydrocarbons, the applicant needs to justify why AMP B.1.16 will not include the quality standard ANSI/ISA-S&.0.01-1996 as recommended in NUREG-1801.

Response:

The justification as to why AMP B.1.16 does not include the quality standard ANSI/ISA-A7.0.01-1996 is:

1. Exelon has a licensing commitment contained in the response to GL 88-14 that uses ANSI/ISA-S7.3-1975. (Memo, Commonwealth Edison to US NRC, Response to NRC Generic Letter 88-14, dated February 6, 1989.)
2. The acceptance criteria for air quality contained in ANSI/ISA-S7.3-1975 are more restrictive than the criteria contained in ISA-S7.0.01-1996 and provide better air quality then ISA-S7.0.01-1996.
3. 10 CFR 54.29(a) sets forth the standard for issuance of a renewal license to be that "actions have been identified and have been or will be taken ... such that there is reasonable assurance that the activities authorized by the renewal license will continue to be conducted in accordance with the CLB." Exelon's use of ANSI/ISA-S7.3-1975 to manage the aging effects is in accordance with the CLB.

In summary, the use of ANSI/ISA-S7.3-1975 in lieu of ISA-S7.0.01-1996 provides reasonable assurance that aging effects of compressed air system components will be managed such that the intended function of these components will be maintained during the period of extended operation.

RAI B.1.25 Supplemental Information Request

1) Staff would like additional information regarding the applicant's corrective actions relative to wall thickness being below design requirements, specifically the applicant should address why the inspection scope would not be increased to include other tanks subject to similar corrosion environments.

2) The operating experience indicates that failures occurred in both demineralized water and fire main piping. The fire main piping was later identified by the applicant as concrete asbestos pipe that was replaced with PVC - how is this experience relative to managing aging of buried piping and tanks fabricated of carbon steel or cast iron?

3) Was the concrete asbestos piping replaced in entirety with PVC? Was this material addressed as an exception to the GALL program? How will aging of concrete asbestos (if any remains) or PVC be addressed? What AMP addresses these materials?

4) The applicant indicates that a one-time inspection of buried fire protection system pipe will be used to assess corrosion of buried pipe. The applicant does not state what material (i.e., carbon steel) the fire main piping material is at the proposed inspection location. Since the applicant previously indicated that the fire main was

concrete asbestos pipe how does this inspection provide information relative to corrosion of buried carbon steel?

5) The applicant's RAI response also indicated that there have been failures of demineralized water lines. Explain why a one time inspection of the demineralized water line material will not be performed. Provide information detailing the failure mechanism of the demineralized water line and corrective action.

Response:

1) As stated in the previous RAI response, initially only one buried steel tank will be inspected at each site. The tank to be inspected will be selected from among the emergency diesel generator and SBO diesel generator fuel oil storage tanks because these are the only buried steel tanks at the Dresden and Quad Cities sites. If the tank's wall thickness is found to be below design requirements, the population of tanks inspected will be increased. The additional tank(s) to be inspected will be selected from the population of emergency diesel generator and SBO diesel generator fuel oil storage tanks that are subject to similar corrosion environments.

2) The operating experience evaluation associated with the AMP for Buried Piping and Tanks Inspection (B.1.25) noted that heightened awareness of acceptance criteria with regard to minor pressure losses during performance of the periodic flow tests may be useful in identifying leakage even though acceptable flow and pressure are present. Potential degradation of some of the replaced fire main piping was initially identified on the basis of periodic pressure drop testing; and results of pressure drop testing are more sensitive to piping flow characteristics than to piping materials of construction. Based on this consideration, the operating experience with asbestos cement piping (detecting failures based on pressure drop testing) is considered to be relevant to other buried pipe materials such as carbon steel, ductile iron and PVC.

3) Plant records do not provide clear documentation of the cause of failure for the asbestos cement piping that was replaced. However, the suspected cause is cracking caused by either ground shifting or heavy loads transported in the vicinity of the piping. The asbestos cement piping was not replaced in its entirety with PVC piping. Three segments of the original asbestos cement piping remain. These are shown on Dresden license renewal boundary diagram LR-DRE-M-23-1 at coordinates 8-C, 9-C, at coordinate 8-E, and at coordinates 8-D, 8-E; they are designated by pipe code "H3".

   PVC piping in the Fire Protection System is included in the LRA in Table 2.3.3-5 in the Component Group "Piping and Fittings." Aging Management References 3.3.2.39 and 3.3.2.158 in LRA Table 3.3-2 are applicable for the PVC pipe's external and internal surfaces, respectively. Placement of these aging management references in LRA Table 3.3-2 identifies the PVC piping as a non-GALL material. In LRA Table 3.3-2, the PVC piping is identified as having no aging effect because PVC is relatively unaffected by water, concentrated alkaline, and non-oxidizing acids, oils, and ozone. It will not be adversely affected by its external environment of soil and ground or by its internal environment of raw water. Because there is no aging effect, no aging management program is required.

   Non-GALL Aging Management References for asbestos cement piping should have been included in LRA Table 2.3.3-5 (Component Groups Requiring Aging

Management Review – Fire Protection System) and Table 3.3-2 (Aging management review results for the auxiliary systems that are not addressed in NUREG-1801). The internal environment of the asbestos cement pipe segments in the Fire Suppression System is "raw water". The external environment for the asbestos cement pipe segments in the Fire Suppression System is "soil and groundwater". Dresden's remaining asbestos cement piping is in a favorable environment, deeply buried so that it is not exposed to freezing/thawing cycles or to heat and stress. Dresden ground water test data shows that the below-grade environment is not aggressive with pH values between 7 to 9, chlorides 5 –to 30 ppm, and sulfates 10 to 30 PPM. These values are within the NUREG-1801 criteria with chlorides less than 500 ppm, sulfates less than 1500 ppm, and pH greater than 5.5. There are no known chemicals that adversely affect concrete in either the raw water or the soil and ground water environments. The piping was designed and installed to handle normal vehicle weights; and when heavy loads are moved in the vicinity of the piping, precautions are taken to avoid damaging the pipes. Potential aging effects associated with both interior and external environments are "increase in porosity and permeability, cracking, and loss of material (spalling, scaling)" due to aggressive chemical attack. In addition, the internal environment has the potential aging effect of "build up of deposits" due to biofouling. Based on Dresden's past operating experience which has had good success identifying Fire Suppression System piping degradation by use of periodic pressure and flow testing, Dresden manages the aging of the asbestos cement piping using the Fire Suppression System flow and pressure-drop tests which is included as part of Aging Management Program B.1.25 (Buried Piping and Tank Inspections).

The following is the revised LRA Table 2.3.3-5 (Component Groups Requiring Aging Management Review – Fire Protection System) that includes asbestos cement piping. (Aging Management References 3.3.2.311, 3.3.2.312 and 3.3.2.313 have been added to the list of Aging Management References originally identified for this line item.)

Component	Component Intended Function	Aging Management Ref
Piping and Fittings	Pressure Boundary	3.3.1.5, 3.3.1.16, 3.3.1.19, 3.3.1.20, 3.3.2.26, 3.3.2.30, 3.3.2.33, 3.3.2.34, 3.3.2.38, 3.3.2.39, 3.3.2.40, 3.3.2.131, 3.3.2.138, 3.3.2.144, 3.3.2.150, 3.3.2.153, 3.3.2.154, 3.3.2.157, 3.3.2.158, 3.3.2.300, 3.3.2.311, 3.3.2.312, 3.3.2.313

The following is the revised LRA Table 3.3-2 (Aging management review results for the auxiliary systems that are not addressed in NUREG- 1801) that includes asbestos cement piping.

Ref No	Component Group	Material	Environment	Aging Effect/Mechanism	Aging Management Program	Discussion
3.3.2.311	Asbestos Cement Piping	Concrete	Raw water	Increase in porosity and permeability cracking loss of material (spalling scaling)/ Aggressive chemical attack	Buried Piping and Tanks Inspection (B.1.25)	NUREG-1801 does not address asbestos cement piping in a raw water environment.
3.3.2.312	Asbestos Cement Piping	Concrete	Raw water	Buildup of deposit/ Biofouling	Buried Piping and Tanks Inspection (B.1.25)	NUREG-1801 does not address asbestos cement piping in a raw water environment.
3.3.2.313	Asbestos Cement Piping	Concrete	Soil and groundwater	Increase in porosity and permeability cracking loss of material (spalling scaling)/ Aggressive chemical attack	Buried Piping and Tanks Inspection (B.1.25)	NUREG-1801 does not address asbestos cement piping in a soil and groundwater environment.

4) Buried piping in the Fire Suppression System is either carbon steel, ductile iron, or (at Dresden, only) asbestos cement. Buried carbon steel and ductile iron piping in the Fire Suppression System are externally coated with a coal tar wrapping; however, plant records do not indicate whether all buried carbon steel piping in other systems is coated. The one-time inspection of buried fire main pipe is described under "Enhancements" in LRA Appendix B.1.25 (Buried Piping and Tanks Inspection). It is a visual inspection of the external surface of buried ductile iron piping to detect degradation of the pipe's protective coating or base metal. In addition, as part of AMP B.1.25 (Buried Piping and Tanks Inspection) Exelon's general procedure for Excavation, Trenching and Shoring has been revised to include a requirement that buried piping exposed during excavation is to be inspected by Engineering for coating degradation (if the pipe is coated) or corrosion (if the pipe is uncoated metal) and that appropriate corrective action be taken. This requirement, which is part of the normal work process for buried piping systems, provides the benefit of obtaining aging effect information during routine work activities and avoids the potential for pipe damage that might occur if piping were exposed for the sole purpose of an aging management inspection. This standing requirement for inspection of buried piping provides reasonable assurance that any trend for unacceptable age-related degradation of the exterior surface of buried carbon steel piping will be detected and corrected in a timely manner. A recent modification of buried Fire Suppression System piping at Quad Cities provided an opportunity for inspection and ultrasonic testing of a part of the pipe that was removed. The subject piping was 10" schedule 40 carbon steel wrapped with coal tar paper that had been buried in the early 1970's. The nominal wall thickness for this pipe is 0.365". The minimum and maximum wall thickness measurements were 0.320" and 0.400", respectively, indicating little effect of aging for a period of approximately 30 years.

5) Failure of the demineralized water lines was provided as an example of operating experience related to failure and repair of buried piping. This was provided as an example of buried pipe degradation that was detected before loss of piping system function. This failure occurred in 1985 in the transfer line from the make-up demineralizer to the clean demineralized water storage tank. Work records related to this pipe failure and repair note that a section of piping containing holes was located and replaced. No additional details that identify a specific failure mechanism are provided in the work records. This portion of demineralized water piping is not in scope for license renewal; as such, aging management or inspection of this portion of demineralized water system piping is not a requirement for license renewal.

<u>RAI B.2.2-1 Supplemental Information Request</u>

In response to RAI B.2.2-1, the applicant by a letter dated October 3, 2003, stated that there are non-segregated bus ducts within the scope of license renewal that are not normally energized. These are bus ducts connecting the diesel generator to the ESF busses and connecting safety related buses. They are included in section 2.5.1of the license renewal application. These are not normally energized and are energized only for technical specification surveillance or emergency activities. They are only energized for very short durations during normal plant operation and are located inside (Reactor/Turbine/Diesel Generator/HPCI) buildings where the environment is free from moisture, wind, and extreme ambient temperature differences. Therefore, thermal aging is not a concern for the bus duct insulators or sleeves. There are no other aging mechanisms applicable for these bus ducts. Periodic surveillance testing performed per technical specification verifies functionality of the bus ducts. Dresden and Quad Cities operating experience including experience from the non-segregated bus duct (Reserve Auxiliary Transformer to 4 KV Busses) inspections currently performed at Dresden and Quad Cities also confirm that no aging mechanisms apply for these bus ducts that would affect their intended function. Thermal cycling for bolted connections is a concern for these bus ducts. Additionally, humidity and moisture could be a problem for the deenergized bus ducts.

Response:

The non-segregated bus ducts connecting the Emergency Diesel Generators (EDG) to the ESF buses are not normally energized. When energized with the EDG at full load, the non-segregated bus ducts are loaded to only 33 % of the design capacity. The temperature rise effects due to energizing the non-segregated bus ducts are approximately 10 °C. The non-segregated bus ducts are designed for a temperature rise of 65 °C. Additionally, the non-segregated bus ducts are only energized for approximately 2 hours per month during the monthly diesel generator surveillance tests. This conservatively equates to less than one year of operation over the 60-year life of the non-segregated bus ducts.

The non-segregated bus duct connecting the safety buses is a cross-tie connection (Dresden only) that is not normally energized. This non-segregated bus duct is only energized during the once per 24-month surveillance test. This conservatively equal to less than one year of operation over the 60-year life of the non-segregated bus duct. Therefore, the temperature rise effects due to energizing the non-segregated bus duct are negligible.

The non-energized non-segregated bus duct bus bars are tubular aluminum with bolted joint connectors that are torqued to 65 ft. lbs. Each joint connector is filled around the bolts/nuts with Duxseal and then taped to provide a smooth surface. The available drawings do not indicate the bolting material. Exelon believes based on discussion with the vendor that the bolts are zinc plated high strength steel or stainless steel. The vendor manual states that under normal operating conditions, no internal maintenance is required on the bus ducts. Additionally, EPRI TR104213 Section 8.2 states the bolts should be inspected for evidence of overheating, signs of burning or discoloration, and indications of loose bolts. The bolts should not be retorqued unless the joint requires service or the bolts are clearly loose. Exelon believes that there are no credible aging effects concerning bus duct bolted connections that require management. However, Exelon will include these bus ducts in the B.2.2 (Periodic Inspection of Non-EQ, Non-Segregated Electrical Bus Ducts) inspection program to inspect 10 % of the bus bar insulation splice material at the bolted connections for surface anomalies, such as embrittlement, discoloration, cracking, chipping, or surface contamination. The absence of insulation material surface anomalies, such as embrittlement, discoloration, cracking, chipping, and discoloration provides positive indication that the bolted connections are not loose and therefore, the intended function of the bus duct will be maintained during the period of extended operation. This inspection will verify that there are no insulation material surface anomalies, such as embrittlement, discoloration, cracking, chipping, and discoloration of the bus bar insulation splice material at the bolted connections. The initial baseline inspections will be completed prior to the beginning of the period of extended operation. Follow-up inspections will be performed on a frequency not to exceed once every ten years. If degradation is found that could adversely effect the intended function of the bus bar, inspections will be expanded appropriately to determine the extent of condition.

As stated in the original response to RAI B.2.2-1, these bus ducts are located inside the Reactor, Turbine, Diesel Generator, and HPCI buildings where the environment is free from moisture, wind and extreme ambient temperature differences. Humidity and moisture is not a credible aging effect that required management.