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10 CFR 50
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RS-15-194

August 6, 2015

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

LaSalle County Station, Units 1 and 2
Facility Operating License Nos. NPF-11 and NPF-18
NRC Docket Nos. 50-373 and 50-374

Subject: Response to NRC Requests for Additional Information, Set 6, dated July 7, 2015 related to the LaSalle County Station, Units 1 and 2, License Renewal Application (TAC Nos. MF5347 and MF5346)

References:

1. Letter from Michael P. Gallagher, Exelon Generation Company LLC (Exelon), to NRC Document Control Desk, dated December 9, 2014, "Application for Renewed Operating Licenses"

2. Letter from Jeffrey S. Mitchell, US NRC to Michael P. Gallagher, Exelon, dated July 7, 2015, "Requests for Additional Information for the Review of the LaSalle County Station, Units 1 and 2 License Renewal Application – Set 6 (TAC Nos. MF5347 and MF5346)"

In Reference 1, Exelon Generation Company, LLC (Exelon) submitted the License Renewal Application (LRA) for the LaSalle County Station (LSCS), Units 1 and 2. In Reference 2, the NRC requested additional information to support staff review of the LRA.

Enclosure A contains the responses to this request for additional information.

Enclosure B contains updates to sections of the LRA (except for the License Renewal Commitment List) affected by the responses.

Enclosure C provides an update to the License Renewal Commitment List (LRA Appendix A, Section A.5). There are no other new or revised regulatory commitments contained in this letter.

If you have any questions, please contact Mr. John Hufnagel, Licensing Lead, LaSalle License Renewal Project, at 610-765-5829.

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

Executed on 08-06-2015

Respectfully,

Michael P. Gallagher

Michael P. Gallagher
Vice President - License Renewal Projects
Exelon Generation Company, LLC

Enclosures: A: Responses to Set 6 Requests for Additional Information
B: LSCS License Renewal Application Updates
C: LSCS License Renewal Commitment List Updates

cc: Regional Administrator – NRC Region III
NRC Project Manager (Safety Review), NRR-DLR
NRC Project Manager (Environmental Review), NRR-DLR
NRC Project Manager, NRR-DORL- LaSalle County Station
NRC Senior Resident Inspector, LaSalle County Station
Illinois Emergency Management Agency - Division of Nuclear Safety

Enclosure A

Responses to Requests for Additional Information related to various sections of the LaSalle County Station (LSCS) License Renewal Application (LRA)

RAI B.2.1.24-1
RAI B.2.1.24-2
RAI 3.2.2.1.1-1
RAI 3.1.2.2.1-1
RAI 4.2.7-1
RAI 4.3.2-1
RAI 4.3.3-1

RAI B.2.1.24-1

Background:

Generic Aging Lessons Learned (GALL) Report aging management program (AMP) XI.M36, “External Surfaces Monitoring of Mechanical Components,” as modified by License Renewal Interim Staff Guidance (LR-ISG) LR-ISG-2012-02, “Aging Management of Internal Surfaces, Fire Water Systems, Atmospheric Storage Tanks, and Corrosion Under Insulation,” program element 4, “detection of aging effects,” recommends that “[t]ightly adhering insulation is considered to be a separate population from the remainder of insulation installed on in-scope components. The entire population of in-scope piping that has tightly adhering insulation is visually inspected for damage to the moisture barrier with the same frequency as for other types of insulation inspections.”

License renewal application (LRA) Section B.1.24 states in the Program Description section that “the program does not require removal of tightly-adhering insulation that is impermeable to moisture unless there is evidence of damage to the moisture barrier. Instead, the program includes visual inspection of the entire accessible population of piping and components during each 10-year period of the period of extended operation.”

Issue:

The staff has identified a difference between the GALL Report AMP and the applicant’s program. The applicant’s program states that it will inspect the “entire accessible population” of the “tightly-adhering insulation” components, instead of the “entire population” as stated in the GALL Report AMP. It is not clear to the staff what criteria were used to identify components as “accessible” and the basis for the acceptability of not inspecting inaccessible insulation. In addition, the staff lacks sufficient information to complete its review of this issue because it does not know the material type and environment (e.g., radiation) of the tightly adhering insulation in inaccessible locations.

Request:

Explain the criteria used in establishing categories of the “accessible” population and justify program adequacy if only the “accessible” population is inspected. In addition, state the insulation material type and environment for the inaccessible insulation.

Exelon Response:

We have reviewed all of the tightly adhering insulation locations, and confirmed that there is no insulation in these locations that would be considered inaccessible. As stated in GALL Report AMP XI.M36, as modified by LR-ISG-2012-02, the External Surfaces Monitoring of Mechanical Components program will perform visual inspections of the entire population of in-scope piping that has tightly adhering insulation. Based on this review, the use of the word “accessible” in the LRA was unnecessary. LRA Appendix B, Section B.2.1.24 is revised as shown in Enclosure B to remove this word.

RAI B.2.1.24-2

Background:

GALL Report AMP XI.M36, as modified by LR-ISG-2012-02, program element 4, "detection of aging effects," recommends that "[f]or all outdoor components (except tanks) and any indoor components exposed to condensation (because the in-scope component is operated below the dew point), inspections are conducted of each material type (e.g., steel, stainless steel, copper alloy, aluminum) and environment (e.g., air-outdoor, moist air, air accompanied by leakage) where condensation or moisture on the surfaces of the component could occur routinely or seasonally."

LRA Section B.1.24 states in the Program Description section that "[i]nspections are conducted for each external environment where condensation or moisture on the surfaces of the component could occur routinely or seasonally."

Issue:

It is not clear to the staff that "each external environment" will include each material type and environment as provided in the GALL Report AMP.

Request:

Explain what "each external environment" refers to. Justify and provide a basis if any material/environment combination will be exempted.

Exelon Response:

The phrase "external environments" refers to the two environments that are the concern of GALL Report AMP XI.M.36, as modified by LR-ISG-2012-02, for corrosion under insulation; specifically, outdoor air and indoor air, where condensation may occur because the component is operated below the dew point. These two environments are identified in the LRA Section 3 AMR Tables as "Air – Outdoor (External)" and "Condensation (External)". Inspections for corrosion under insulation will include all material/environment combinations, and, therefore, no material/environment combinations will be exempted.

LRA Appendix B, Section B.2.1.24 is revised as shown in Enclosure B to provide this clarification that inspections will be conducted for all material/environment combinations.

RAI 3.2.2.1.1-1

Background:

LRA Section B.2.1.11, "Bolting Integrity," states that submerged bolting will be visually inspected for loss of material and loss of preload as enhancements to the program. Examples of submerged bolting are in the emergency core cooling system (ECCS) suction strainers, diesel fire pump suction screens, and Lake Screen House traveling screens.

The parameters monitored or inspected of AMP XI.M18, "Bolting Integrity," are based on inspecting bolted connections for leakage on a frequency of at least once per refueling cycle. LRA Section B.2.1.11 states that the inspection frequencies for submerged bolting are as follows:

- ECCS and reactor core isolation cooling (RCIC) suction strainers in the suppression pool - during each inservice inspection (ISI) interval
- Service water diver safety barriers and diesel fire pump suction screens - during maintenance activities
- Lake Screen House traveling screens framework - during each refuel cycle

Issue:

It is unclear to the staff whether visual inspections for submerged bolting will consist of inspecting the bolt head only, or if a representative sample of bolts will be removed and the shank inspected. If visual inspections are only performed on the head of the bolt, loss of material in the shank region or loss of preload of the bolt might not be recognized.

The staff also noted that the inspection frequency coupled to ISI intervals for the ECCS and RCIC suction strainers is not consistent with that of the inspection frequency for AMP XI.M18. LRA Section B.2.1.11 does not provide a defined inspection frequency for the service water diver safety barrier and diesel fire pump suction strainer bolting.

It is unclear to the staff that loss of material and loss of preload for submerged bolting will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis during the period of extended operation, as required by Title 10 of the *Code of Federal Regulations*, Part 54.21(a)(3).

Request:

1. Justify the inspection parameters, such as removal of the bolt to permit inspections of the shank portion of the bolting, for the visual inspections of submerged bolting, and whether a representative sample will be removed and inspected.

2. Justify the inspection frequency in the LRA for visual inspections of submerged bolting, other than that associated with the lake screen house traveling screen framework.

Exelon Response:

1. GALL Report AMP XI.M18 provides recommendations for accessible pressure retaining bolting. The bolting on the ECCS and RCIC suction strainers, service water diver safety barriers, diesel fire pump suction screens, and the lake screen house traveling screens framework are submerged non-pressure retaining bolting. Even though GALL Report AMP XI.M18 does not specifically address non-pressure retaining bolting, this aging management program was concluded to be adequate to manage loss of material and loss of preload for this specific bolting. Therefore, as further described below, the aging management of this specific bolting was included in the Bolting Integrity aging management program as enhancements 4, 5, and 6 in the LRA.

   100 percent of accessible surfaces of these specific submerged non-pressure retaining bolts will be visually inspected by divers during each inspection. For safety purposes, design purposes, and to limit the potential for foreign material intrusion, LaSalle does not plan to de-tension these specific bolts during the inspections. Additional basis for the adequacy for these enhanced inspections are discussed below.

   <u>ECCS and RCIC Suction Strainer Bolting</u>

   The bolting on the ECCS suction strainers was originally torqued to 800 foot-pounds followed by "staking" of the nuts to prevent loosening in accordance with the design requirements. The bolting on the RCIC suction strainers was originally torqued to 125 foot-pounds followed by "staking" of the nuts to prevent loosening in accordance with the design requirements. Among other methods, "staking" may be accomplished by purposefully distorting the threads beyond the nut or spot welding the nut to the bolt. This provides a physical mechanism which prevents the nut from becoming loose. The existing diver inspection procedure will be enhanced to include a requirement to verify that the nuts continue to be "staked" by physical manipulation to ensure that the nuts are not loose. Destructively removing the "staking" mechanism to ensure preload is not necessary. Therefore, visually inspecting that the nuts remain "staked" and are hand tight is adequate to ensure this specific bolting is not loose and has not lost preload.

   The existing diver inspection procedure will be enhanced to require visual inspection of the bolt heads, nuts, threaded bolt shank beyond the nut, where accessible. Additionally, the geometry of these bolted connections allow for the inspection of a portion of the bolt shanks between the flange connecting the strainer and the suction piping. Given the material and environment combination (stainless steel in treated water) and since surfaces exposed to the treated water environment are leading indicators for loss of material, these visual inspections are representative and provide an indication of the condition of the inaccessible surfaces of these specific bolts and nuts and are, therefore, adequate to detect loss of material without removal of the bolts.

Service Water Diver Safety Barriers and Diesel Fire Pump Suction Screen Bolting

The bolting on the service water diver safety barriers and diesel fire pump suction screens are fabricated from steel material and are subject to a raw water environment. The existing diver inspection procedure will be enhanced to require the divers to physically manipulate the bolts or nuts to ensure they are not loose. Ensuring that the nuts and bolts are hand tight is an adequate inspection to ensure this bolting is not loose and has not lost preload. In addition, a loose bolt or nut could be an indication that the bolt shank has experienced loss of material.

For bolting on the service water diver safety barriers the studs and nuts, where accessible, will be visually inspected for loss of material. For bolting on the diesel fire pump suction screens the bolt heads will be visually inspected for loss of material. The bolt shanks on the diesel fire pump suction screens are threaded into the pump suction bell and are not visually accessible without removing the bolts. Since surfaces exposed to the raw water environment are a leading indicator for loss of material, these visual inspections are representative and provide an indication of the condition of the inaccessible surfaces of the safety barrier studs and the fire pump suction screen bolts and therefore, are adequate to detect loss of material without removal of the studs or bolts.

Lake Screen House Traveling Screens Framework Bolting

The bolting on the Lake Screen House traveling screens framework is subject to a raw water environment. This bolting is fabricated from steel. For these bolts, existing diver inspection procedures will be enhanced to require the divers to physically manipulate associated nuts to ensure they are not loose. Detensioning these nuts to verify preload could potentially challenge the structural stability of the traveling screens. Ensuring that the nuts are hand tight is an adequate inspection to ensure that this bolting is not loose and has not lost preload. In addition, a loose nut could be an indication that the bolt shank has experienced loss of material.

Existing diver procedures will be enhanced to require divers to visually inspect accessible portions of the lake screen house traveling screens framework bolting. The geometry of these bolted connections allow for divers to visually inspect portions and manipulate the bolts and associated nuts from inside the traveling screen. Because of tight clearances between the traveling screens and the surrounding intake concrete walls, the bolt heads on the outside of the traveling screens cannot be accessed. Since surfaces exposed to the raw water environment are leading indicators for loss of material, these visual inspections are representative and provide an indication of the condition of the inaccessible surfaces of the lake screen house traveling screens framework bolting and therefore, are adequate to detect loss of material without removal of the studs or bolts.

For non-submerged pressure retaining bolts, AMP XI.M18, “Bolting Integrity” recommends system walkdowns to detect leakage from pressure retaining joints. Leakage is an indication that the bolting on the pressure retaining joints have degraded

due to loss of material or loss of preload. Since bolting on the ECCS and RCIC suction strainers, service water diver safety barriers, diesel fire pump suction screens, and Lake Screen House traveling screens framework are not pressure retaining, this GALL recommendation to inspect for leakage is not relevant. However, physically verifying that the bolting is hand tight is considered more effective for loss of preload and visually inspecting representative bolting surfaces is a more appropriate inspection for loss of material.

2. The basis for the inspection frequency of submerged bolting, other than that associated with the Lake Screen House traveling screen framework is discussed below.

   <u>ECCS and RCIC Suction Strainer Bolting</u>

   Existing repetitive tasks, which will be enhanced to include diver inspection of all ECCS and RCIC suction strainer submerged bolting, are scheduled at least once each 10-year ISI Interval.

   GALL Report AMP XI.M18 includes periodic visual inspections of pressure retaining bolted connections at least once per refueling cycle. The premise of this methodology is that the inspection locations are accessible. GALL Report AMP XI.M18 does not specifically address inaccessible submerged components. GALL Report recommendations for inaccessible components in other AMPs include opportunistic inspections that are performed when components are made accessible during maintenance. GALL Report AMP XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components” (as revised by LR-ISG-2012-02) also recommends that a representative sample of a minimum of 20 percent of the components, with a maximum of 25, be inspected every ten (10) years to ensure that each material, environment, and aging effect combination is addressed.

   Given that these bolts are fabricated from stainless steel, are subject to a treated water environment, and are “staked” so that they cannot become loose, the inspection of accessible surfaces of 100 percent of ECCS and RCIC suction strainer submerged bolting every 10-year ISI Interval is considered to be adequate. As a point of comparison, ASME Section XI, Tables IWB 2500-1, IWC 2500-1, and IWD 2500-1 Examination Categories B-G-1, B-G-2, C-D, and D-A, respectively, require visual examination of pressure retaining bolts and welded attachments once each 10-year ISI Interval.

   <u>Service Water Diver Safety Barriers and Diesel Fire Pump Suction Screens</u>

   Existing repetitive tasks, which will be enhanced to include diver inspection of all service water diver safety barriers and diesel fire pump suction screen submerged bolting, are scheduled every refueling outage. This frequency is consistent with GALL Report AMP XI.M18, “Bolting Integrity” recommendations.

LRA Appendix A, Section A.2.1.11 and LRA Appendix B, Section B.2.1.11 are revised as shown in Enclosure B. LRA Appendix A, Section A.5, Commitment 11, is revised as shown in Enclosure C.

RAI 3.1.2.2.1-1

Background:

LRA Table 3.1.2-3 provides the applicant's summary of the aging management review for the reactor vessel internals system. LRA Table 4.3.4-1 provides the bounding cumulative usage factor (CUF) values for the reactor vessel internal components that have been analyzed for fatigue.

Issue:

LRA Table 4.3.4-1 provides the CUF values for the access hole cover and the core differential pressure and liquid control line, implying that these components are subject to cumulative fatigue damage. These two components are also included in LRA Table 3.1.2-3. However, LRA Table 3.1.2-3 does not include cumulative fatigue damage as an aging effect requiring management for either of these components.

Request:

Justify why cumulative fatigue damage is not included as an aging effect requiring management in LRA Table 3.1.2-3 for the access hole cover and the core differential pressure and liquid control line components, or revise LRA Table 3.1.2-3 to include this effect for these components.

Exelon Response:

LRA Table 3.1.2-3, "Reactor Vessel Internals", is revised to include cumulative fatigue damage as an aging effect requiring management for the Access Hole Cover and the Core Plate Differential Pressure and Liquid Control Line.

An extent of condition review was performed to verify that all in scope reactor internal components listed in LRA Table 4.3.4-1, which are evaluated in LRA Table 3.1.2-3, "Reactor Vessel Internals" or LRA Table 3.1.2-2, "Reactor Vessel", include cumulative fatigue damage as an aging effect requiring management. One additional inconsistency between LRA Table 4.3.4-1 and LRA Table 3.1.2-3 was identified. LRA Table 3.1.2-3 is also revised to include cumulative fatigue damage for the Control Rod Guide Tube as an aging effect requiring management.

LRA Table 3.1.2-3 is revised as discussed above, as shown in Enclosure B.

RAI 4.2.7-1

Background:

LRA Section 4.2.7 addresses a time-limited aging analysis (TLAA) on reactor pressure vessel reflood thermal shock analysis.

Issue:

LRA Section 4.2.7 does not clearly address all parameters used in the applicant's analysis. The staff needs additional information to clarify the adequacy of the applicant's analysis.

Request:

As discussed above, provide the following information:

1. Orientation, shape, and maximum size of the bounding flaw which is postulated for the limiting locations of reactor vessel and nozzle.
2. Structural factor used for Service Level C (Emergency) conditions if Service Level C conditions are applicable as a bounding condition for the analysis.
3. Method used to calculate neutron fluence attenuation through reactor vessel component thickness if neutron fluence attenuation is considered.

Exelon Response:

1. The orientation, shape, and maximum size of the bounding initial reactor vessel beltline shell flaws are as follows:

    - For beltline shells following a postulated main steam line break event, the postulated flaw is a semi-elliptical surface flaw with a length-to-depth ratio of six (6), oriented normal to the direction of maximum stress. For the range of wall thickness applicable to the LSCS beltline shells, the maximum flaw depth is 5.2 percent of the wall thickness, per ASME Code Section XI, Table IWB-3510-1.

    - For beltline shells following a postulated recirculation line break event, the postulated flaw is a semi-elliptical surface flaw, and both axial and circumferential flaws are evaluated. The evaluation considers various flaw aspect ratios, with the lateral flaw length assumed to be a small multiple of the flaw depth. For the range of wall thickness applicable to the LSCS beltline shells, the maximum flaw depth is 5.2 percent of the wall thickness, per ASME Code Section XI, Table IWB-3510-1.

The orientation, shape, and maximum size of the bounding initial reactor vessel beltline nozzle flaw is as follows:

- For beltline nozzles following a postulated main steam line break, the postulated flaw is conservatively assumed to be an edge-cracked plate. The maximum acceptable flaw size is 5.2 percent of the wall thickness, per ASME Code Section XI, Table IWB-3512-1.

2. The ASME Code Section XI flaw evaluation rules given in IWB-3600 are used to select structural factors appropriate for evaluation of Service Level C conditions. Therefore, a required structural factor of 1.414 is used for evaluation of Service Level C conditions, consistent with ASME Section XI, Subsection IWB-3612(b).

3. Fluence attenuation through the reactor vessel component thickness is computed in accordance with Regulatory Guide 1.99, Revision 2, Regulatory Position 1.1, using the following equation:

$$f = f_{surf}\, e^{-0.24x}$$

where f = fluence at depth x through the vessel wall,

f_{surf} = inside surface (0T) fluence, and

x = depth into the vessel wall measured from the inside surface.

RAI 4.3.2-1

Background:

LRA Section 4.3.2 describes two categories of license renewal systems that were designed in accordance with American Society of Mechanical Engineers (ASME) Section III, Class 2 or 3 or American National Standards Institute (ANSI) B31.1 requirements:

1. systems that are attached to ASME Section III, Class 1 piping and are affected by the same thermal and pressure transients as the Class 1 systems

2. systems that are affected by different thermal and pressure cycles related to their specific operations

The first category includes the portions of the following systems: Residual Heat Removal, High Pressure Core Spray, Low Pressure Core Spray, Reactor Core Isolation Cooling, Reactor Water Cleanup, Control Rod Drive, Main Steam, Feedwater, and Condenser and Air Removal. The systems in the second category include portions of the Reactor Core Isolation Cooling, Fire Protection, and Diesel Generator and Auxiliary systems.

For both groups of non-Class 1 piping, the applicant states that the 60-year projections for the transients will not exceed 7,000 cycles, and therefore, the stress range factors originally selected for the components within these systems remain applicable for the period of extended operation. These allowable stress calculations meet the requirements for a TLAA, and the applicant dispositioned them in accordance with 10 CFR 54.21(c)(1)(i).

Issue:

LRA Tables 4.3.1-1 and 4.3.1-2 provide the 60-year cycle projections for the transients associated with the Class 2 and 3 and ANSI B31.1 piping in the Reactor Coolant System and Auxiliary Systems. The applicant stated that the systems in the first category experience the same thermal and pressure transients included in these tables. However, the applicant did not provide the applicable transient information for the second category of systems. The staff requires additional clarification on the transients and 60-year projections for these systems to verify that the cycle limits and the original allowable stress calculations will remain valid for the period of extended operation.

Request:

1. Identify the ASME Section III, Class 2 or 3 or ANSI B31.1 systems that are affected by different thermal and pressure cycles than the ones included in LRA Tables 4.3.1-1 and 4.3.1-2, including the Reactor Core Isolation Cooling, Fire Protection, and Diesel Generator and Auxiliary systems.

2. For each of the identified systems:

   a) provide the transients used in the allowable stress calculations,

   b) provide the projected 60 year cycle count for each of these transients, and

c) justify that the TLAA remains valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

Exelon Response:

1. A review of all in scope ASME Class 2 and 3 and ANSI B31.1 piping systems identified that the following portions of in scope systems are affected by different thermal and pressure cycles than the ones included in LRA Tables 4.3.1-1 and 4.3.1-2:

   - Reactor Core Isolation Cooling (RCIC) System - piping components between the RCIC turbine and the suppression pool and between the normally-closed steam admission valve and the RCIC turbine
   - Fire Protection System - piping components associated with the diesel-driven fire pumps (DDFP) engine exhaust
   - Diesel Generator and Auxiliaries System - piping components associated with the emergency diesel generators (EDG) engine exhaust

2. RCIC System - The RCIC System ASME Section III, Class 2 piping components between the RCIC turbine and the suppression pool and between the normally-closed steam admission valve and the RCIC turbine are not directly connected to Class 1 piping, and are affected by different thermal and pressure cycles than the ones included in LRA Tables 4.3.1-1 and 4.3.1-2. Refer to LR Boundary Drawings LR-LAS-M-101, Sheet 1 and LR-LAS-M-147, Sheet 1 for Units 1 and 2, respectively.

   a) The RCIC System piping components between the RCIC turbine and the suppression pool and between the normally-closed steam admission valve and the RCIC turbine experience a thermal transient whenever the RCIC turbine is placed in service and later shutdown, including the Transients 9b and 17 within LRA Tables 4.3.1-1 and 4.3.1-2. As stated in LRA Section 4.3.2, an operational review was performed to determine the number of times that the RCIC turbine has been placed in service in the past and to project the total number of cycles that will occur through the period of extended operation. This includes cycles during pre-operational testing and periodic surveillance testing that results in RCIC turbine operation, and operational cycles where the RCIC System operates in response to plant transients.

   b) The review conservatively assumed that 25 RCIC turbine cycles occurred during station pre-operational testing. To project the number of RCIC turbine cycles in support of surveillance testing, the procedures performed to meet the surveillance requirements were reviewed to identify the frequency of procedure performance and the number of RCIC turbine cycles each time the procedure is performed. The review projected an average of 11 RCIC turbine cycles per year resulting in a total of 660 RCIC turbine cycles, per Unit, due to periodic surveillance testing during the 60-year period. A total of 253 operational RCIC System injections are projected on Unit 1 and 247 RCIC System injections are projected on Unit 2, as shown in the "Adjusted 60-Year Projected Cycles" column in LRA Tables 4.3.1-1 and 4.3.1-2, Transients 9b and 17. This results in a total of 938 RCIC turbine cycles for Unit 1 and 932 cycles for Unit 2.

c) Since the 60-year projected cycle count for these transients is well below 7,000 cycles, the stress range reduction factor selected for these piping components remains applicable, and the TLAA remains valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

Fire Protection System - The ANSI B31.1 exhaust piping components from the diesel-driven fire pump (DDFP) diesel engines are affected by thermal and pressure cycles, are not directly attached to the Class 1 piping, and are therefore affected by different thermal and pressure cycles than the ones included in LRA Tables 4.3.1-1 and 4.3.1-2. Refer to LR Boundary Drawing LR-LAS-M-71, Sheet 1.

a) These piping components experience a thermal transient each time the DDFP engine starts in response to demand for the associated fire water pump to operate and is later shutdown. The DDFPs are operated to satisfy surveillance testing requirements and to support operational demands. Since the Fire Protection System is typically placed in service during unit construction, it is assumed that the DDFPs were placed in service five years prior to Unit 1, in 1978. They will be required to remain in service until the end of the period of extended operation for Unit 2 in 2042. Therefore a 65-year period is assumed. As stated in LRA Section 4.3.2, a review was performed to determine the number of cycles that have occurred in the past and to project the total number of cycles that will occur through the period of extended operation. This includes DDFP engine runs during pre-operational testing, plant operational cycles, and periodic cycles in support of surveillance testing.

b) The review conservatively assumed that 100 runs of each engine occurred during station pre-operational testing. Due to redundancy of the sources of water to the fire water headers, it is conservatively projected that each DDFP operates two times per year for a total of 130 cycles to support their operational functions. DDFP operation in support of maintaining the fire water header pressure is very infrequent since the DDFPs operate to maintain fire header pressure only when the two motor-driven jockey fire pumps fail to maintain fire header pressure and the motor-driven intermediate jockey fire pump does not start. The DDFPs also operate wherever there is significant flow demand on the fire water system to extinguish a fire, which is a very infrequent event. Therefore, two demands per year for DDFP operation is conservative. To project the number of DDFP engine runs in support of surveillance testing, the procedures performed to meet the surveillance requirements were reviewed to identify the frequency of procedure performance and the number of engine runs each time the procedure is performed. This review projected that each DDFP runs an average of 20 times per year, resulting in 1,300 engine runs over the 65-year period. In summary, 100 pre-operational engine runs are assumed; 1,300 engine runs are projected to meet surveillance requirements; and 130 engine runs are projected in support of operational demands through the 65-year period for a total of 1,530 cycles for each diesel engine.

c) Since the 65-year projected cycle count for these transients is well below 7,000 cycles, the stress range reduction factor selected for these piping components remains applicable, and the TLAA remains valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

Diesel Generator and Auxiliaries (DGA) System - The ASME Section III, Class 3 and ANSI B.31.1 exhaust piping from the Emergency Diesel Generator (EDG) diesel engines are affected by thermal and pressure cycles, are not directly attached to the Class 1 piping, and are therefore affected by different thermal and pressure cycles than the ones included in LRA Tables 4.3.1-1 and 4.3.1-2. Refer to LR Boundary Drawings LR-LAS-M-83, Sheets 1, 2, and 3.

a) These piping components experience a thermal transient each time the EDG engine starts and is then shutdown. The EDGs are operated to satisfy surveillance testing requirements and to support operational demands. As stated in LRA Section 4.3.2, a review was performed to determine the number of cycles that have occurred in the past and to project the total number of cycles that will occur through the period of extended operation. This includes EDG engine runs during pre-operational testing, plant operational cycles, and periodic cycles in support of surveillance testing.

b) The review conservatively assumed that 100 runs of each engine occurred during station pre-operational testing. The EDGs operate upon a loss-of-coolant accident or loss of offsite power, which occur very infrequently, such that that those number of cycles are insignificant relative to the number of cycles experienced to support surveillance testing requirements. It is conservatively projected that each EDG operates two times per year to support operational demand due to a loss of offsite power. To project the number of EDG engine runs in support of surveillance testing, the procedures performed to meet the surveillance requirements were reviewed to identify the frequency of procedure performance and the number of engine runs each time the procedure is performed. This review projected an average of 20 engine runs per year, which was expected to result in a conservative estimate since some engine runs can be credited to satisfy multiple surveillance requirements. Input from the LSCS EDG system manager indicates that the average number of engine runs per year is 15 during recent years, which validates that this projection is conservative. In summary, 100 pre-operational engine runs are assumed; 120 engine runs are projected in support of operational demands; and 1,200 engine runs are projected to meet surveillance requirements through the 60-year period for a total of 1,420 cycles for each diesel engine.

c) Since the 60-year projected cycle count for these transients is well below 7,000 cycles, the stress range reduction factor selected for these piping components remains applicable, and the TLAA remains valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

RAI 4.3.3-1

Background:

LRA Section 4.3.3 states that for each Class 1 piping system or subsystem in the environmental fatigue evaluation, the applicant determined the most limiting location for each wetted material type based on the location with the highest ASME Code CUF value. The LRA further states that, in some cases, one Class 1 piping location was evaluated because the analysis represents another piping location that is bounded. The applicant defined the criteria for determining a bounded location as: a) must be affected by the same transients as the analyzed location, b) must have a lower ASME Code CUF than the analyzed location, and c) must be made from the same material or, if of a different material, the bounded material must have a lower F_{en} value than the bounding material.

LRA Table 4.3.3-3, Note 12 states that stainless steel location 376IJ in the N7 head spray nozzle bounds the carbon steel location 10A in the reactor core isolation cooling piping system for Unit 1.

Issue:

The staff noted that in order to have a meaningful comparison of CUF values to determine the most limiting component (or leading location) by using the highest CUF value, it is important that the CUFs were assessed similarly (e.g., amount of rigor in calculating CUF) and used the same fatigue curves in ASME Code, Section III, Appendix I. The staff noted that through the course of plant operation it is possible that CUF values for specific components were possibly re-evaluated as part of power uprates, generic letters, bulletins, etc. to different editions of ASME Code, Section III and with varying levels of rigor when compared to the fatigue evaluations performed for the plant's original design.

The staff also noted that LRA Table 4.3.3-3, Note 12 states that environmental fatigue analysis for the stainless steel location 376IJ is provided in LRA Table 4.3.3-1. The staff noted that location 376IJ is provided in LRA Table 4.3.3-2, which provides the environmental fatigue analysis results for Unit 2. The staff is unclear on either: a) which component in LRA Table 4.3.3-1 the note is referencing, or b) how a component in Unit 2 can bound a piping component in Unit 1 for consideration of environmentally-assisted fatigue.

Request:

1. Confirm that the CUFs that were compared with each other in a system to identify the location with the highest CUF value were assessed similarly (e.g., amount of rigor in calculating CUF) and used the same fatigue curves in ASME Code, Section III, Appendix I to provide a meaningful comparison. If not, provide the basis for ranking or comparing the CUFs to one another to provide an appropriate method for screening and determining a leading/limiting location.

2. Clarify which reactor pressure vessel component bounds the carbon steel location 10A from LRA Table 4.3.3-3. If the bounding component is a component in Unit 2, justify how a component or piping component can be used to bound components in different units for consideration for environmentally-assisted fatigue.

3. Identify any additional locations where a different material type was bounded by the limiting location(s) within a system and provide the system, locations, and materials that have been compared and bounded. For the carbon steel location 10A in LRA Table 4.3.3-3 and and any additional locations, justify that this comparison of environmentally-adjusted CUF values between different materials within a reactor pressure vessel component or piping system for the consideration of environmentally-assisted fatigue is appropriate or valid.

Exelon Response:

This response will initially provide some background information that will help clarify the inputs and assumptions used to justify that the environmental fatigue analysis of the N7 Head Spray Nozzle Outer Flange is bounding for the Unit 1 and Unit 2 RCIC piping systems and involves selection of a limiting location (i.e., node) of a different material. In addition, there is an incorrect Node number that will be corrected in LRA Table 4.3.3-2. Node 376IJ is the limiting inside surface location evaluated in the current licensing basis (CLB) ASME Code analysis of the N7 Head Spray Nozzle Outer Flange. This exact same location was identified as Node 366 in the environmental fatigue analysis performed for this component, so Table 4.3.3-2 should have identified Node 366, similar to LRA Table 4.3.3-1 for Unit 1. This section supports the response to Request 2 and the second part of Request 3 associated with the RCIC system environmental fatigue analyses. Then the first part of Request 3 will be addressed to describe other cases where an environmental fatigue analysis of one material was determined to bound another material. These initial responses will serve as examples that will help clarify the overall evaluation process described in the response to Request 1 that is provided at the end.

<u>RCIC System Environmental Fatigue Analysis Basis:</u>

1. There are separate CLB ASME Section III, NB-3600 fatigue analyses for the Unit 1 and Unit 2 carbon steel RCIC piping systems. The highest CUF value in the Unit 1 RCIC piping analysis is 0.912 at Node 10A. The highest CUF value in the Unit 2 RCIC piping analysis is 0.837 at Node 10A. In each of the analyses, Node 10A is located at the dissimilar metal weld joining the carbon steel piping elbow to the stainless steel N7 Head Spray Nozzle Outer Flange.

2. There is one CLB ASME fatigue analysis of the stainless steel N7 Head Spray Nozzle Outer Flange that is common to both Unit 1 and Unit 2. It is an ASME Section III, NB-3200 analysis that includes a finite element model that was used to permit evaluations of inside and outside surface locations. Node 376IJ is located on the inside surface and it has the limiting ASME CUF value of 0.91.

3. Since the carbon steel elbow is welded to the stainless steel flange, these components are exposed to the same transients. For the Unit 1 RCIC piping system, the limiting location selected for environmental fatigue analysis was determined by comparing the 0.91 CUF value for Node 376IJ in the common ASME Section III, NB-3200 analysis of the stainless steel N7 Head Spray Nozzle Outer Flange, to the 0.912 CUF value for Node 10A in the NB-3600 analysis of the Unit 1 carbon steel RCIC piping. Since a) the CUF values were approximately equal, b) the bounding F_{en} multiplier computed for stainless steel at this location is 11.07, which is higher than the bounding F_{en} multiplier

computed for carbon steel, which is 8.39 for this location, and c) the NB-3200 analysis is more rigorous than the NB-3600 analysis, Node 376IJ of the N7 Head Spray Nozzle Outer Flange was selected as the limiting location for the Unit 1 RCIC system. LRA Table 4.3.3-3 Note 12 is revised as shown in Enclosure B to clarify the basis for selecting the N7 Head Spray Nozzle Outer Flange Node 376IJ as the limiting location for Unit 1.

4. For Unit 2, the limiting location selected for environmental fatigue analysis was determined by comparing the 0.91 CUF value for Node 376IJ in the NB-3200 analysis of the common stainless steel N7 Head Spray Nozzle Outer Flange to the 0.837 CUF value for Node 10A in the NB-3600 analysis of the Unit 2 carbon steel RCIC piping. Since a) the CUF value for Node 376IJ is higher than the CUF value for Node 10A, b) the bounding F_{en} multiplier computed for stainless steel at this location is 11.07, which is higher than the bounding F_{en} multiplier computed for carbon steel, which is 8.18 for this location, and c) the NB-3200 analysis is more rigorous than the NB-3600 analysis, Node 376IJ of the N7 Head Spray Nozzle Outer Flange was selected as the limiting location for the Unit 2 RCIC system. LRA Table 4.3.3-4 Note 16 is revised as shown in Enclosure B to clarify the basis for selecting the N7 Nozzle Outer Flange Node 376IJ as the limiting location for Unit 2.

5. The license renewal environmental fatigue analysis prepared for the N7 Head Spray Nozzle Outer Flange includes a new ASME Section III, NB-3200 stress analysis for inside surface Node 366 that uses a finite element model. Node 366 in the environmental fatigue analysis is at the exact same location as Node 376IJ in the CLB ASME analysis. A CUF and F_{en} multiplier were computed using the environmental fatigue analysis methodology from NUREG/CR-6909. This environmental fatigue analysis is applicable to the Unit 1 and Unit 2 N7 Head Spray Nozzle Outer Flange, which bounds the remaining components of the N7 Head Spray Nozzle for each unit, and it is also bounding for the Unit 1 and Unit 2 RCIC piping systems. LRA Tables 4.3.3-1 and 4.3.3-2 are referring to the same environmental fatigue analysis of Node 366 of the N7 Head Spray Nozzle Outer Flange, with the Node correction noted above.

<u>Response to Request 2</u>

2. For Unit 1, Node 376IJ in the CLB ASME fatigue analysis of the stainless steel N7 Head Spray Nozzle Outer Flange bounds Node 10A of the Unit 1 carbon RCIC piping system listed in LRA Table 4.3.3-3. The evaluation of Node 366 in the environmental fatigue analysis of the N7 Head Spray Nozzle Outer Flange is bounding for the Unit 1 carbon steel RCIC system piping. Node 366 in the environmental fatigue analysis is at the exact same location as Node 376IJ in the CLB ASME analysis.

   For Unit 2, Node 376IJ in the CLB ASME fatigue analysis of the stainless steel N7 Head Spray Nozzle Outer Flange bounds Node 10A of the Unit 2 carbon steel RCIC piping system listed in LRA Table 4.3.3-4. The evaluation of Node 366 in the environmental fatigue analysis of the N7 Head Spray Nozzle Outer Flange is bounding for the Unit 2 carbon steel RCIC system piping. Node 366 in the environmental fatigue analysis is at the exact same location as Node 376IJ in the CLB ASME analysis.

Response to Request 3

3. In addition to the RCIC system comparisons associated with Node 10A, there were other cases where there are stainless steel and carbon steel components present within the system and the environmental fatigue analysis prepared for the stainless steel component was determined to bound the carbon steel components, as described below. In each of these cases, since the CLB ASME CUF values were determined by NB-3600 fatigue analyses using the same set of fatigue curves and similar transients, the results are comparable.

   For Unit 1, the Reactor Recirculation system, RHR Supply and Return system, and Reactor Water Cleanup system are interconnected and subjected to similar transients. The highest stainless steel and carbon steel CLB ASME CUF values, location, and bounding F_{en} multiplier are provided for each system in Table 1, below. Based on the information in Table 1, the highest ASME CUF and bounding F_{en} multiplier is RHR Supply and Return stainless steel Node 55, which was selected as the limiting location for the stainless steel and carbon steel components in the Reactor Recirculation system, RHR Supply and Return system, and Reactor Water Cleanup system. It should be noted that the limiting location for the Reactor Recirculation Piping 1RR-01 listed in LRA Table 4.3.3-3 is being corrected as presented in Enclosure B.

Table 1

System	ASME CUF – highest location		Bounding F_{en} Multiplier	
	Stainless steel	**Carbon steel**	**Stainless steel**	**Carbon steel**
RHR Supply and Return (1RH-01)	**0.954** (Node 55)	0.663 (Node 295B - SS to CS weld)	**11.07** (Node 55)	6.40 (Node 295B – SS to CS weld)
Reactor Recirculation (1RR-01)	0.595 (Node Y71)	0.673 (Node 302)	11.07 (Node Y71)	6.40 (Node 302)
Reactor Water Cleanup (1RT-05)	None	0.012 (Data Point 10)	Not Applicable	6.40 (Data Point 10)

   For Unit 2, the RHR Supply and Return system was evaluated separately. The stainless steel and carbon steel CLB ASME CUF values, locations, and bounding F_{en} multiplier are provided in Table 2, below. The RHR Supply and Return system stainless steel Node 55 was selected as the limiting location for the stainless steel and carbon steel components within the RHR Supply and Return system based on the highest ASME CUF and bounding F_{en} multiplier.

   The Unit 2, Reactor Recirculation system and the Reactor Water Cleanup system are interconnected and subjected to similar transients and evaluated together. The stainless steel and carbon steel CLB ASME CUF values, locations, and bounding F_{en} multiplier are provided for each system in Table 2, below. The Reactor Recirculation system stainless steel Node B390 was selected as the limiting location for the stainless steel and carbon steel components within the Reactor Recirculation system and Reactor Water Cleanup system based on the highest ASME CUF and bounding F_{en} multiplier. It

should be noted that the material listed in LRA Table 4.3.3-4 for Reactor Water Cleanup Suction Piping Node 830 is being corrected as presented in Enclosure B.

Table 2

	ASME CUF – highest location		**Bounding F_{en} Multiplier**	
System	**Stainless steel**	**Carbon steel**	**Stainless steel**	**Carbon steel**
RHR Supply and Return (2RH-01)	**0.912** (Node 55)	0.657 (Node 295B)	**11.07** (Node 55)	5.90 (Node 295B)
Reactor Recirculation (2RR-01)	**0.716** (Node B390)	0.418 (Node 455)	**11.07** (Node B390)	5.90 (Node 455)
Reactor Water Cleanup (2RT-05)	None	0.036 (Node 830)	Not Applicable	5.90 (Node 830)

Each of the CLB ASME CUF values in the tables are based on comparable NB-3600 stress reports. Once the highest CLB ASME CUF value within the stress reports applicable to the system was determined, a comparison was made between the bounding F_{en} values for each of the materials. If the location with the highest CLB ASME CUF value also had the highest bounding F_{en} value determined for the system, it was considered a leading location. Each of the limiting locations selected met this acceptance criterion. Therefore, the limiting piping locations selected for environmental fatigue analysis and determined to be bounding of other piping locations within the piping systems were selected based upon a sound methodology using comparable or conservative inputs.

Updates to LRA Tables 4.3.3-3 and 4.3.3-4 and associated notes are provided in Enclosure B.

Response to Request 1

1. The CUF values that were compared to determine the limiting locations were obtained from the CLB Class 1 fatigue analyses, which were prepared in accordance with the ASME Code fatigue curves invoked in the applicable Edition and Addenda of the ASME Code listed in the design specifications for the components. The Class 1 piping systems were initially designed in accordance with the requirements of ANSI B31.7- 1969 – Class 1 requirements. Subsequent piping fatigue analyses were prepared in accordance with the 1971 Edition of ASME Section III, which invoked Subsection NB-3600 requirements for Class 1 piping. ANSI B31.7 and NB-3600 apply the same rules for determining the effects of cyclic loading (fatigue). The design specifications required the design of the components to consider cyclic loading that would result from a set of design transients postulated to occur during the life of the plant. The RPV transients are listed in LRA Tables 4.3.1-1 and 4.3.1-2 for the reactor vessels. The thermal transients used in the design and fatigue analysis of the ASME Code Class 1 piping and components are based on the transients listed in UFSAR Table 3.9-24, which were derived from those established for the RPV nozzles. Other reactor coolant pressure boundary lines which connect to these major lines were assumed to have identical transients. Therefore, the

CLB fatigue analyses were prepared using the same set of fatigue curves and same set of design transients.

For License Renewal, the initial comparison of CLB ASME CUF values for determining limiting locations in Class 1 piping were made between locations within the same stress report for a given subsystem; thus the same inputs and methodology apply to each location. Next, the limiting CUF values from the various piping subsystems were compared to each other to determine the limiting location for the overall piping system. Within these analyses, there were cases where specific locations had been reanalyzed to account for modifications and power uprates. These revised analyses were also prepared in accordance with ASME Section III, Class 1 fatigue design requirements using the same set of fatigue curves and the same design transients as the CLB stress reports. Therefore, the CUF values from the revised analyses are directly comparable to those in the CLB stress reports.

Comparisons of locations within piping systems are based on comparable ASME NB-3600 stress reports. Once the highest CLB ASME CUF value within the stress reports applicable to the system was determined, a comparison was made between the bounding F_{en} values for each of the materials. If the location with the highest CLB ASME CUF value also had the highest bounding F_{en} value determined for the system, it was considered a leading location. Each of the limiting locations selected met this acceptance criterion. Therefore, the limiting piping locations selected for environmental fatigue analysis and determined to be bounding of other piping locations within the piping systems were selected based upon a sound methodology using comparable and conservative inputs.

Some of the Class 1 piping systems connect to a reactor pressure vessel nozzle assembly. In some cases, a component analyzed within the attached nozzle assembly was determined to bound the piping system since these components are affected by the same transients, as was the case for the RCIC system piping discussed above. ASME Section III, NB-3600 provides simplified design requirements for piping components that provide conservative results. Some of the nozzle analyses were prepared in accordance with ASME Section III, NB-3200 requirements. These rules permit a more detailed analysis of applied loads and stresses, which result in a more accurate, but less conservative (more rigorous) analysis. A limiting location was selected for each wetted material evaluated in the NB-3200 analysis that was evaluated for environmental fatigue.

In conclusion, the methods used to determine limiting locations provide meaningful comparisons that considered differences in material types and in analytical rigor of the fatigue analyses of the components such that the resulting environmental fatigue analyses are bounding of the systems and components as specified in the LRA Tables 4.3.3-1 through 4.3.3-4.

LRA Tables 4.3.3-2, Table 4.3.3-3 and Notes, and Table 4.3.3-4 and Notes are revised as shown in Enclosure B.

Enclosure B

LSCS License Renewal Application Updates
Resulting from the Response to the following RAIs:

RAI B.2.1.24-1
RAI B.2.1.24-2
RAI 3.2.2.1.1-1
RAI 3.1.2.2.1-1
RAI 4.3.3-1

Notes:

- Updated LRA Sections and Tables are provided in the same order as the RAI responses contained in Enclosure A.
- To facilitate understanding, portions of the original LRA have been repeated in this Enclosure, with revisions indicated. Previously submitted information is shown in normal font. Changes are highlighted with ***bolded italics*** for inserted text and ~~strikethroughs~~ for deleted text.

As a result of the responses to RAI B.2.1.24-1 and RAI B.2.1.24-2 provided in Enclosure A of this letter, the Program Description sub-section of LRA Appendix B, Section B.2.1.24 beginning on page B-106 of the LRA is revised as shown below:

B.2.1.24 External Surfaces Monitoring of Mechanical Components

Program Description

The External Surfaces Monitoring of Mechanical Components aging management program is a new condition monitoring program that directs visual inspections of external surfaces of components be performed during system inspections and walkdowns. The program consists of periodic visual inspection of metallic and elastomeric components such as piping, piping components, ducting, and other components within the scope of license renewal exposed to air–indoor uncontrolled, air–outdoor, and condensation environments. The program manages the aging effects of cracking, hardening and loss of strength, loss of material, and reduced thermal insulation resistance of metallic and elastomeric materials through visual inspection of external surfaces for evidence of loss of material, cracking, and changes in material properties. When appropriate for the component and material, visual inspections are supplemented by physical manipulation to detect hardening and loss of strength of elastomers.

The External Surfaces Monitoring of Mechanical Components program includes visual inspection of the metallic jacketing on thermal insulation to ensure that the jacketing is performing its function to protect the insulation from damage, such as in-leakage of moisture that could reduce the thermal resistance of the insulation.

The program includes periodic representative inspection of outdoor insulated components except tanks; and indoor insulated components and tanks where the process fluid temperature is below the dew point. The inspections require removal of insulation to detect loss of material due to corrosion under the insulation. These inspections will be conducted during each 10-year period of the period of extended operation. The representative sample includes 20 percent of the piping length or 20 percent of the surface area for components other than piping for each material type. Alternatively, 25 components or 25 one-foot axial length sections of piping may be inspected for each material type. Inspections are conducted for each ~~external~~ ***material and*** environment ***combination*** where condensation or moisture on the surfaces of the component could occur routinely or seasonally.

For indoor tanks, the representative inspection includes 20 percent of the surface area or 25 one-square-foot sections. The inspection areas will be distributed to include tank domes, sides, near bottoms, at points where structural supports or instrument nozzles penetrate the insulation and where water is most likely to collect.

If the initial representative inspection verifies no loss of material beyond that which could have been present during initial construction, then subsequent inspections will consist of inspection of the external surface of the insulation for indications of damage or evidence of water intrusion through the insulation to the component surface. If insulation damage or evidence of water intrusion through the insulation is identified, then periodic inspection of the component surface under the insulation will continue.

The program does not require removal of tightly-adhering insulation that is impermeable to moisture unless there is evidence of damage to the moisture barrier. Instead, the program includes visual inspection of the entire ~~accessible~~ population of piping and components during each 10-year period of the period of extended operation.

Materials of construction inspected under this program include aluminum, carbon steel, ductile cast iron, elastomers, gray cast iron, galvanized steel, and stainless steel. Examples of components this program inspects are piping and piping elements, ducting, heat exchangers, tanks, pumps, compressors, insulation jacketing, and other components. The parameters monitored by visual inspection for metallic components will include evidence of rust, corrosion, and material wastage; leakage from or onto external surfaces; worn, flaking, or oxide-coated surfaces; corrosion stains, deterioration, or damage of thermal insulation; cracking, flaking, and blistering of protective coatings; and leakage for detection of cracks on the external surfaces of stainless steel components exposed to an outdoor air environment. The parameters monitored by visual and tactile inspections for elastomeric components will include surface cracking, crazing, scuffing, dimensional change (e.g. “ballooning” and “necking”); discoloration; exposure of internal reinforcement for reinforced elastomers; and hardening as evidenced by a loss of suppleness during manipulation where the component and material are appropriate for manipulation.

Inspections, with the exception of inspections performed to detect corrosion under insulation, are performed at a frequency not to exceed one refueling cycle. This frequency accommodates inspections of components that may be in locations that are normally only accessible during outages. Surfaces that are not readily visible during plant operations and refueling outages are inspected when they are made accessible and at such intervals that would ensure the components' intended functions are maintained. Inspections performed to detect corrosion under insulation will be conducted during each 10-year period of the period of extended operation.

Any visible evidence of degradation will be evaluated for acceptability of continued service. Acceptance criteria will be based upon component, material, and environment combinations. Deficiencies will be documented and evaluated under the corrective action program.

The external surfaces of components that are buried are inspected via the Buried and Underground Piping (B.2.1.28) program. The external surfaces of aboveground tanks are inspected via the Aboveground Metallic Tanks (B.2.1.18) program. This program does not provide for managing aging of internal surfaces. The new External Surfaces Monitoring of Mechanical Components program will be implemented prior to the period of extended operation.

As a result of the response to RAI 3.2.2.1.1-1 provided in Enclosure A of this letter, the Enhancements subsection of LRA Appendix A, Section A.2.1.11 on page A-16 of the LRA is revised as follows:

A.2.1.11 Bolting Integrity

The Bolting Integrity aging management program will be enhanced to:

4. Perform ~~visual~~ inspection of submerged bolting for the emergency core cooling systems (ECCS) and reactor core isolation cooling system (RCIC) suction strainers in the suppression pool for loss of material and loss of preload during each ISI inspection interval.

5. Perform ~~visual~~ inspection of submerged bolting for the service water diver safety barriers and diesel fire pump suction screens for loss of material and loss of preload ~~during maintenance activities~~***each refuel interval***.

6. Perform ~~visual~~ inspection of submerged bolting for the Lake Screen House traveling screens framework for loss of material and loss of preload each refuel interval.

As a result of the responses to RAI 3.2.2.1.1-1 provided in Enclosure A of this letter, the Enhancements subsection of LRA Appendix B, Section B.2.1.11 on page B-56 of the LRA is revised as shown below:

B.2.1.11 Bolting Integrity

Enhancements

4. Perform ~~visual~~ inspection of submerged bolting for the emergency core cooling systems (ECCS) and reactor core isolation cooling (RCIC) system suction strainers in the suppression pool for loss of material and loss of preload during each ISI inspection interval. **Program Elements Affected: Parameters Monitored/Affected (Element 3), Detection of Aging Effects (Element 4)**

5. Perform ~~visual~~ inspection of submerged bolting for the service water diver safety barriers and diesel fire pump suction screens for loss of material and loss of preload ~~during maintenance activities~~***each refuel interval***. **Program Elements Affected: Parameters Monitored/Affected (Element 3), Detection of Aging Effects (Element 4)**

6. Perform ~~visual~~ inspection of submerged bolting for the Lake Screen House traveling screens framework for loss of material and loss of preload each refuel interval. **Program Elements Affected: Parameters Monitored/Affected (Element 3), Detection of Aging Effects (Element 4)**

As a result of the response to RAI 3.1.2.2.1-1 provided in Enclosure A of this letter, LRA Table 3.1.2-3 on pages 3.1-83, 3.1-88, and 3.1-89 of the LRA is revised to add new line items as shown below:

Table 3.1.2-3 Reactor Vessel Internals (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Core Shroud and Core Plate: Access Hole Cover (Welded Covers)	Direct Flow	Nickel Alloy	Reactor Coolant and Neutron Flux	Cracking	BWR Vessel Internals (B.2.1.9)	IV.B1.R-94	3.1.1-29	E, 2
					Water Chemistry (B.2.1.2)	IV.B1.R-94	3.1.1-29	B
				Loss of Material	BWR Vessel Internals (B.2.1.9)	IV.B1.RP-26	3.1.1-43	E, 2
					Water Chemistry (B.2.1.2)	IV.B1.RP-26	3.1.1-43	B
		Stainless Steel	Reactor Coolant and Neutron Flux	Cracking	BWR Vessel Internals (B.2.1.9)	IV.B1.R-97	3.1.1-103	A
					Water Chemistry (B.2.1.2)	IV.B1.R-97	3.1.1-103	B
				Cumulative Fatigue Damage	***TLAA***	***IV.B1.R-53***	***3.1.1-3***	***A, 1***
				Loss of Material	BWR Vessel Internals (B.2.1.9)	IV.B1.RP-26	3.1.1-43	E, 2
					Water Chemistry (B.2.1.2)	IV.B1.RP-26	3.1.1-43	B

Table 3.1.2-3 Reactor Vessel Internals (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Jet Pump Assemblies: Inlet Riser and Brace, Holddown Beam, Diffuser, Tailpipe, Wedges, and Repair Components	Direct Flow	X-750 alloy	Reactor Coolant and Neutron Flux	Loss of Material	Water Chemistry (B.2.1.2)	IV.B1.RP-26	3.1.1-43	B
					BWR Vessel Internals (B.2.1.9)			F, 5
				Loss of Preload	TLAA			H, 4
Reactor Vessel Internals Components: Control Rod Drive Guide Tube	Structural Support to maintain core configuration and flow distribution	Cast Austenitic Stainless Steel (CASS)	Reactor Coolant	Cracking	BWR Vessel Internals (B.2.1.9)	IV.B1.R-104	3.1.1-102	A
					Water Chemistry (B.2.1.2)	IV.B1.R-104	3.1.1-102	B
				Loss of Fracture Toughness	BWR Vessel Internals (B.2.1.9)	IV.B1.RP-220	3.1.1-99	A
				Loss of Material	BWR Vessel Internals (B.2.1.9)	IV.B1.RP-26	3.1.1-43	E, 2
					Water Chemistry (B.2.1.2)	IV.B1.RP-26	3.1.1-43	B
		Stainless Steel	Reactor Coolant and Neutron Flux	Cracking	BWR Vessel Internals (B.2.1.9)	IV.B1.R-104	3.1.1-102	C
					Water Chemistry (B.2.1.2)	IV.B1.R-104	3.1.1-102	D
				Cumulative Fatigue Damage	***TLAA***	***IV.B1.R-53***	***3.1.1-3***	***A, 1***
				Loss of Material	BWR Vessel Internals (B.2.1.9)	IV.B1.RP-26	3.1.1-43	E, 2
					Water Chemistry (B.2.1.2)	IV.B1.RP-26	3.1.1-43	B
Reactor Vessel Internals Components: Core Plate DP/SLC Line	Direct Flow	Stainless Steel	Reactor Coolant and Neutron Flux	Cracking	BWR Vessel Internals (B.2.1.9)	IV.B1.R-99	3.1.1-103	C
					Water Chemistry (B.2.1.2)	IV.B1.R-99	3.1.1-103	D

Table 3.1.2-3 Reactor Vessel Internals (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Reactor Vessel Internals Components: Core Plate DP/SLC Line	Direct Flow	Stainless Steel	Reactor Coolant and Neutron Flux	***Cumulative Fatigue Damage***	***TLAA***	***IV.B1.R-53***	***3.1.1-3***	***A, 1***
				Loss of Material	BWR Vessel Internals (B.2.1.9)	IV.B1.RP-26	3.1.1-43	E, 2
					Water Chemistry (B.2.1.2)	IV.B1.RP-26	3.1.1-43	B
Steam Dryers	Structural Integrity	Stainless Steel	Reactor Coolant	Cracking	BWR Vessel Internals (B.2.1.9)	IV.B1.RP-155	3.1.1-101	A
						IV.B1.R-104	3.1.1-102	C
					Water Chemistry (B.2.1.2)	IV.B1.R-104	3.1.1-102	D
				Loss of Material	BWR Vessel Internals (B.2.1.9)	IV.B1.RP-26	3.1.1-43	E, 2
					Water Chemistry (B.2.1.2)	IV.B1.RP-26	3.1.1-43	B
Top Guide	Structural Support to maintain core configuration and flow distribution	Stainless Steel	Reactor Coolant and Neutron Flux	Cracking	BWR Vessel Internals (B.2.1.9)	IV.B1.R-98	3.1.1-103	A
					Water Chemistry (B.2.1.2)	IV.B1.R-98	3.1.1-103	B
				Cumulative Fatigue Damage	TLAA	IV.B1.R-53	3.1.1-3	A, 1
				Loss of Material	BWR Vessel Internals (B.2.1.9)	IV.B1.RP-26	3.1.1-43	E, 2
					Water Chemistry (B.2.1.2)	IV.B1.RP-26	3.1.1-43	B

As a result of the response to RAI 4.3.3-1 provided in Enclosure A of this letter, LRA Table 4.3.3-2 on LRA page 4-84 is revised as follows:

Table 4.3.3-2
LSCS Unit 2 - (CB&I) Reactor Pressure Vessel (RPV) Environmental Fatigue Analysis Results

RPV Component	Node	Material	60-year 6909 CUF	6909 F_{en}	60-year CUF_{en}
N4 Feedwater Nozzle - Nozzle Blend Radius - (note 2)	Node 1065	Low Alloy Steel	0.1945	5.02	0.9758
N5 Low Pressure Core Spray Nozzle – Safe End-to-Piping Weld - (note 4)	Point 22	Nickel Alloy	0.3679	2.51	0.9239
N5 Low Pressure Core Spray Nozzle – Thermal Sleeve - (note 4)	Point 16	Stainless Steel	0.0433	3.50	0.1515
N6 RHR/LPCI Nozzle - Safe End - (note 5)	Point 3	Nickel Alloy	0.1090	2.97	0.3237
N6 RHR/LPCI Nozzle - Safe End-to-Piping Weld - (note 5)	Point 1	Carbon Steel	0.0459	4.00	0.1834
N6 RHR/LPCI Nozzle - Forging - (note 5)	Point 20	Low Alloy Steel	0.0345	3.73	0.1286
N6 RHR/LPCI Nozzle - Nozzle-Vessel Intersection - (note 5)	N/A	Low Alloy Steel	0.1945	5.02	0.9758
N6 RHR/LPCI Nozzle – Thermal Sleeve - (note 5)	Point 17	Stainless Steel	0.0357	5.63	0.2011
N7 Head Spray Nozzle – Outer Flange	Node ~~376IJ~~***366***	Stainless Steel	0.4527	2.21	0.9986
N9 Jet Pump Instrument Nozzle	N/A	Low Alloy Steel	N/A	N/A	Bounded by N1 Recirc. Outlet Nozzle (note 7)
N10 CRD Return Nozzle – Safe End	Point 23	Stainless Steel	0.0915	9.26	0.8473
N10 CRD Return Nozzle – Nozzle/Vessel Intersection	N/A	Low Alloy Steel	0.1945	5.02	0.9758
N11 Core ΔP Nozzle	N/A	Nickel Alloy	0.1933	3.75	0.7245

As a result of the response to RAI 4.3.3-1 provided in Enclosure A of this letter, LRA Table 4.3.3-3, and Notes 11, 12, and 13 on page 4-87 of the LRA are revised as follows:

Table 4.3.3-3
LSCS Unit 1 - Class 1 Piping System Environmental Fatigue Analysis Results

Piping System	Location	Node	Material	60-Year 6909 CUF	F_{en}	CUF_{en}
Reactor Recirculation Piping 1RR-01 - (note 3)	~~SW Coupling~~ ***Socket Weld***	~~1071~~ ***302***	~~Stainless Steel~~ ***Carbon Steel***	N/A	N/A	Bounded by 1RH-01 Piping (note 11)
Low Pressure Core Spray Injection Piping 1LP-01 - (note 4)	RPV Nozzle	5	Carbon Steel	0.105	8.36	0.878
High Pressure Core Spray Injection Piping 1HP-01 - (note 4)	RPV Nozzle	5	Carbon Steel	0.019	8.37	0.159
RHR Supply and Return Piping 1RH-01 - (note 5)	Valve End	55	Stainless Steel	0.308	3.04	0.937
Feedwater 1FW-01 - (note 6)	RPV Safe End	A100	Carbon Steel	0.413	1.89	0.776
Standby Liquid Control (SLC) 1SC-02	Elbow	70	Stainless Steel	0.226	2.08	0.471
Reactor Core Isolation Cooling 1RI-03	6" Sch 160 LR Elbow	10A	Carbon Steel	N/A	N/A	Bounded by RPV N7 Head Spray Nozzle Outer Flange (note 12)
Reactor Water Cleanup Piping 1RT-05	***Center Line Run Pipe Branch Connection***	***Data Point 10***	***Carbon Steel***	***N/A***	***N/A***	***Bounded by 1RH-01 Piping (note 13)***

~~**Note 11:** The stainless steel location 1071 in analysis 1RR-01 has an ASME CUF value of 0.173, which is bounded by the stainless steel location 55 in analysis 1RH-01 which has an ASME CUF value of 0.954. Therefore, the environmental fatigue analysis for the 1RH-01 piping system bounds the 1RR-01 piping system.~~

Note 11: The carbon steel Node 302 in analysis 1RR-01 has an ASME CUF value of 0.673, which is bounded by the ASME CUF value of 0.954 for the stainless steel Node 55 in analysis 1RH-01. Since the ASME CUF value is higher and since the F_{en} multiplier for stainless steel is higher than the multiplier for carbon steel, the environmental fatigue analysis for the 1RH-01 piping system bounds the 1RR-01 piping system.

~~**Note 12:** The carbon steel location 10A in analysis 1RI-03 has an ASME CUF value of 0.912, which is the same as the ASME CUF value of 0.912 applicable for stainless steel location 376IJ in the N7 Head Spray Nozzle analysis. Since the F_{en} multipliers for stainless steel are higher than those for carbon steel, the environmental fatigue analysis for the N7 Head Spray nozzle provided in Table 4.3.3-1 bounds the 1RI-03 piping system.~~

Note 12: The carbon steel Node 10A in analysis 1RI-03 has an ASME CUF value of 0.912, based upon an ASME NB-3600 fatigue analysis. This carbon steel pipe elbow is welded to the stainless steel N7 Head Spray Nozzle Outer Flange that has an ASME CUF value of 0.91 for Node 376IJ that is based upon an ASME NB-3200 analysis with a finite element model. Since the degree of rigor is higher for the NB-3200 analysis and since the F_{en} multiplier for stainless steel is higher than the F_{en} multiplier for carbon steel in this system, the stainless steel flange Node 376IJ was selected as the limiting location. The environmental fatigue analysis for Node 366 of the stainless steel Unit 1 N7 Head Spray nozzle provided in LRA Table 4.3.3-1 bounds the Unit 1 carbon steel RCIC piping system. Node 366 in the environmental fatigue analysis is the same inside surface location as Node 376IJ in the CLB ASME fatigue analysis.

Note 13: The carbon steel Node 10 in analysis 1RT-05 has an ASME CUF value of 0.012, which is bounded by the ASME CUF value of 0.954 for the stainless steel Node 55 in analysis 1RH-01. Since the ASME CUF value is higher and since the F_{en} multiplier for stainless steel is higher than the multiplier for carbon steel, the environmental fatigue analysis for the 1RH-01 piping system bounds the 1RT-05 piping system.

As a result of the response to RAI 4.3.3-1 provided in Enclosure A of this letter, LRA Table 4.3.3-4 and Notes 15, 16, and 17 on LRA pages 4-88 and 4-89 are revised as follows:

Table 4.3.3-4
LSCS Unit 2 - Class 1 Piping System Environmental Fatigue Analysis Results

Piping System	**Location**	**Node**	**Material**	**6909 CUF**	**6909 F_{en}**	**CUF_{en}**
Reactor Recirculation Piping - 2RR-01 - (note 3)	SW Half Coupling	B390	Stainless Steel	0.2866	3.36	0.9625 ***(note 17)***
Low Pressure Core Spray Injection Piping - 2LP-01 - (note 4)	RPV Nozzle Safe End	Node 5	Carbon Steel	N/A	N/A	Bounded by RPV N5 LPCS Nozzle (note 13)
High Pressure Core Spray Injection Piping – 2HP-01 (note 4)	RPV Nozzle Safe End	Data Point 5	Carbon Steel	N/A	N/A	Bounded by the RPV N16 HPCS Nozzle Safe End-to-Piping Weld (note 14)
RHR Supply and Return Piping - 2RH-01 - (note 5)	Valve End	55	Stainless Steel	0.2004	2.98	0.5969
Feedwater Piping - 2FW-02 - (note 6)	Half Coupling	A113	Carbon Steel	0.4180	1.88	0.7858
Reactor Water Cleanup Suction Piping 2RT-05	Valve End	830	~~Stainless Steel~~ ***Carbon Steel***	N/A	N/A	Bounded by 2RR-01 Reactor Recirculation Suction Piping (note 15)
Standby Liquid Control (SLC) Piping – 2SC-01C	Elbow	320	Stainless Steel	0.1300	2.08	0.2704
Reactor Core Isolation Cooling Piping - 2RI-03	6” Sch 120 Short Radius Elbow	Data Point 10A	Stainless Steel and Carbon Steel	N/A	N/A	Bounded by RPV N7 nozzle (note 16)

Note 15: The ***carbon steel*** ~~stainless steel location~~ ***Node*** 830 in analysis 2RT-05 has an ASME CUF value of ~~0.035~~***0.036***, which is bounded by the ASME CUF value of 0.716 for the stainless steel Node B390 in analysis 2RR-01. Since the ***ASME*** CUF value is higher and since the F_{en} multiplier for stainless steel is higher than the multiplier for carbon steel, the environmental fatigue analysis for the 2RR-01 piping system bounds the 2RT-0***5***~~1~~ piping system.

~~**Note 16:** Node 10A in analysis 2RI-03 is a bi-metallic weld (the two materials are SA-182 F304 stainless steel and SA-106B carbon steel), with an ASME CUF value of 0.837, which is bounded by the ASME CUF value of 0.912 for stainless steel location 376IJ in the N7 Head Spray Nozzle analysis. Since the CUF value is higher and since the F_{en} multiplier for stainless steel is higher than the multiplier for carbon steel, the environmental fatigue analysis for the N7 Head Spray nozzle provided in Table 4.3.3-2 bounds the 2RI-03 piping system.~~

Note 16: The carbon steel Node 10A in analysis 2RI-03 has an ASME CUF value of 0.837, based upon an ASME NB-3600 fatigue analysis. This carbon steel pipe elbow is welded to the stainless steel N7 Head Spray Nozzle Outer Flange that has an ASME CUF value of 0.91 for Node 376IJ that is based upon an ASME NB-3200 analysis with a finite element model. Since the degree of rigor is higher for the ASME NB-3200 analysis and since the F_{en} multiplier for stainless steel is higher than the F_{en} multiplier for carbon steel in this system, the stainless steel flange Node 376IJ was selected as the limiting location. The environmental fatigue analysis for Node 366 of the stainless steel Unit 2 N7 Head Spray nozzle provided in LRA Table 4.3.3-2 bounds the Unit 2 carbon steel RCIC piping system. Node 366 in the environmental fatigue analysis is the same inside surface location as Node 376IJ in the CLB ASME fatigue analysis.

Note 17: There are stainless steel and carbon steel components present within the Unit 2 Reactor Recirculation piping subsystem 2RR-01. The stainless steel component with the highest ASME CUF value within the system is Node B390, which has a CUF value of 0.716. The carbon steel component with the highest ASME CUF value is Node 455, which has an ASME CUF value of 0.418. Since the ASME CUF value is higher for stainless steel Node B390 and since the F_{en} multiplier for stainless steel is higher than the F_{en} multiplier for carbon steel in this system, Node B390 was selected as the limiting location within this system and the environmental fatigue analysis for stainless steel Node B390 is bounding for the carbon steel and stainless steel components within the system.

Enclosure C

LSCS License Renewal Commitment List Updates

This Enclosure identifies commitments made in this document and is an update to the LSCS LRA Appendix A, Table A.5 License Renewal Commitment List. Any other actions discussed in the submittal represent intended or planned actions. They are described to the NRC for the NRC's information and are not regulatory commitments.

Changes to the LSCS LRA Appendix A, Table A.5 License Renewal Commitment List are as a result of the Exelon response to the following RAI:

RAI 3.2.2.1.1-1

Notes:

- New or updated commitments are shown in the same order as the related RAI responses contained in Enclosure A.
- To facilitate understanding, relevant portions of the previously submitted License Renewal Commitment List have been repeated in this Enclosure, with revisions indicated. Previously submitted information is shown in normal font. Changes due to this submittal are highlighted with ***bolded italics*** for inserted text and ~~strikethroughs~~ for deleted text.

As a result of the response to RAI 3.2.2.1.1-1 provided in Enclosure A of this letter, LRA, Appendix A, Section A.5, Commitment 11, shown on page A-62 of the LRA is revised as shown below:

A.5 License Renewal Commitment List

NO.	PROGRAM OR TOPIC	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE
11	Bolting Integrity	Bolting Integrity is an existing program that will be enhanced to: 1. Provide guidance to ensure proper specification of bolting material, lubricant and sealants, storage, and installation torque or tension to prevent or mitigate degradation and failure of closure bolting for pressure-retaining bolted joints. 2. Prohibit the use of lubricants containing molybdenum disulfide on pressure-retaining bolted joints. 3. Minimize the use of high strength bolting (actual measured yield strength equal to or greater than 150 ksi) for pressure-retaining bolted joints in portions of systems within the scope of the Bolting Integrity program. High strength bolting (regardless of code classification) will be monitored for cracking in accordance with ASME Section XI, Table IWB-2500-1, Examination Category B-G-1. 4. Perform ~~visual~~ inspection of submerged bolting for the emergency core cooling systems (ECCS) and reactor core isolation cooling (RCIC) system suction strainers in the suppression pool for loss of material and loss of preload during each ISI inspection interval. 5. Perform ~~visual~~ inspection of submerged bolting for the service water diver safety barriers and diesel fire pump suction screens for loss of material and loss of preload ~~during maintenance activities~~***each refuel interval***. 6. Perform ~~visual~~ inspection of submerged bolting for the Lake Screen House travelling screens framework for loss of material and loss of preload each refueling interval.	Program to be enhanced prior to the period of extended operation. ***Inspection schedule identified in commitment.***	Section A.2.1.11 ***Exelon Letter RS-15-194 08/06/2015***