UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

April 24, 2014

Mr. Michael P Gallagher
Vice President, License Renewal Projects
Exelon Generation Company, LLC
200 Exelon Way
Kennett Square, PA 19348

SUBJECT: REQUESTS FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE LIMERICK GENERATING STATION, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION (TAC NOS. ME6555 AND ME6556)

Dear Mr. Gallagher:

By letter dated June 22, 2011, Exelon Generation Company, LLC submitted an application pursuant to Title 10 of the *Code of Federal Regulations* (CFR) Part 54, to renew the operating license NPF-39 and NPF-85 for Limerick Generating Station, Units 1 and 2, for review by the U.S. Nuclear Regulatory Commission (NRC) staff. The staff is reviewing the information contained in the license renewal application and has identified, in the enclosure, areas where additional information is needed to complete the review.

These requests for additional information, outlined in Enclosure 1, were discussed with Christopher Wilson, and a mutually agreeable date for the response is within 30 days from the date of this letter. If you have any questions, please contact me at 301-415-1427 or e-mail Richard.Plasse@nrc.gov.

Sincerely,

Richard A. Plasse, Project Manager
Projects Branch 1
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket Nos. 50-352 and 50-353

Enclosure:
Requests for Additional Information

cc w/encl: Listserv

April 24, 2014

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Vice President, License Renewal Projects
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Requests for Additional Information

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SUBJECT: REQUESTS FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE LIMERICK GENERATING STATION, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION (TAC NOS. ME6555 AND ME6556).

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LIMERICK GENERATING STATION, UNITS 1 AND 2
LICENSE RENEWAL APPLICATION
REQUESTS FOR ADDITIONAL INFORMATION

RAI 3.0.3.3.1-1

Background:

By letter dated March 12, 2014, Exelon provided its analysis and impacts to the Limerick License Renewal Application (LRA) for LR-ISG-2012-02, Section A, Recurring Internal Corrosion. The letter states that Exelon identified recurring internal corrosion in several raw water systems managed by the Open-Cycle Cooling Water System program and in a portion of the fire water system managed by the Fire Water System program. For the Open-Cycle Cooling Water System program the letter concludes that the previously documented enhancements to the program detect the presence of and minimize the susceptibility to recurring internal corrosion. For the Fire Water System program, the letter states that the program will be enhanced to perform additional wall thickness measurements to address recurring internal corrosion.

Issue:

For components managed by the Open-Cycle Cooling Water System program, the identification of certain flaws can be addressed through the application of ASME Code Case N-513-3, "Evaluation Criteria for Temporary Acceptance of Flaws in Moderate Energy Class 2 or 3 Piping, Section XI, Division I." The considerations for applying this approach include augmented volumetric examinations to assess the degradation of the affected system, which typically consists of an initial sample of the five most susceptible locations and additional samples whenever other flaws are detected in any subsequent samples. Based on this, the staff agrees that the previous enhancements to the Open-Cycle Cooling Water System program are adequate to address recurring internal corrosion in those systems managed by that program.

However, since the ASME Code Case does not apply to fire water system piping, there does not appear to be comparable guidance for conducting augmented inspections of additional samples if further piping degradation is detected during the inspections for the new enhancement of the Fire Water System program.

Request:

For the new enhancement of the Fire Water System program to perform annual wall thickness measurements at five selected locations in carbon steel piping associated with the backup diesel fire pump, clarify whether inspections of additional samples will be performed if these wall thickness measurements reveal indications of piping degradation. As applicable, provide details of the additional samples that will be performed or justification that additional samples are not needed to address degradation of the affected system.

ENCLOSURE

RAI 3.0.3.3.3-1

Background:

Changes to the license renewal application to address LR-ISG-2012-02, "Aging Management of Internal Surfaces, Fire Water Systems, Atmospheric Storage Tanks, and Corrosion Under Insulation," were described in a letter dated March 12, 2014. This letter stated that the backup water storage tank, which backs up the fire water supply, would remain in the scope of its Aboveground Metallic Tanks program. The Aboveground Metallic Tanks program includes biennial external inspections of the backup water storage tank.
LR-ISG-2012-02 AMP XI.M27, "Fire Water System", includes the recommendations in NFPA 25 Section 9.2.5.5 that the exterior insulated surfaces and support structure of fire water storage tanks be inspected on an annual basis.

Issue:

While the staff does not take issue with the backup water storage tank remaining in the scope of the Aboveground Metallic Tanks program, external tank inspections for this program are not conducted as frequently as recommended in LR-ISG-2012-02 AMP XI.M27 (reference NFPA 25 Section 9.2.5.5). No basis was provided for the less frequent inspections than recommended in LR-ISG-2012-02 AMP XI.M27.

Request:

State the basis for why inspection of the backup water storage tank external insulated surfaces on a biennial basis is sufficient to provide reasonable assurance that the current licensing basis intended functions of the tank will be met during the period of extended operation. Alternatively, revise the Aboveground Metallic Tanks program to be consistent with LR-ISG-2012-02 AMP XI.M27.

RAI 3.0.3.3.3-2

Background:

Changes to the license renewal application to address LR-ISG-2012-02, "Aging Management of Internal Surfaces, Fire Water Systems, Atmospheric Storage Tanks, and Corrosion Under Insulation," were described in a letter dated March 12, 2014. This letter stated that the backup water storage tank is internally coated and it sits on a compacted oil-treated sand bed.
LR-ISG-2012-02 AMP XI.M27, "Fire Water System", includes the recommendations in NFPA 25 Sections 9.2.6 and 9.2.7 that the internal surfaces of coated tanks be inspected every 5 years, and the inspections should include: detection of pitting, corrosion, and local or general failure of the interior coating. It also recommends that tanks on ring-type foundations with sand in the middle should be inspected for evidence of voids beneath the floor. It further recommends that if loss of material or loss of coating integrity is detected, adhesion testing, dry film thickness measurements, ultrasonic test (UT) thickness readings, wet-sponge testing, and vacuum box testing of the seams should be conducted.
The Aboveground Metallic Tanks program includes internal surface visual inspections of the backup water storage tank conducted every five years and UT measurements of the tank bottom within five years prior to entering the period of extended operation and every five years

thereafter. If no tank bottom plate material loss is identified after the first two UT inspections, the volumetric inspections will be performed whenever the tank is drained during the period of extended operation. As amended, the program was further enhanced to:

- Perform visual inspections of the Backup Water Storage Tank wetted and non-wetted internal surfaces.

- Require that tank internal inspections be performed within five years prior to entering the period of extended operation and every five years thereafter

- Require nondestructive examination of the tank bottom where visual inspection identifies pitting or general corrosion to below nominal wall thickness and to determine remaining wall thickness where bare metal has been exposed.

- Require that where pitting and general corrosion to below the nominal wall thickness occurs or any coating failure occurs in which bare metal is exposed, additional inspections and tests are performed, including adhesion testing of the coating in the vicinity of the coating failure and nondestructive examination to determine remaining wall thickness where bare metal has been exposed. In addition, adhesion testing shall be performed in the vicinity of blisters even though bare metal may not be exposed.

Issue:

The staff noted that not all of the testing and inspections recommended by LR-ISG-2012-02 (reference NFPA 25 Sections 9.2.6 and 9.2.7) have been addressed by the enhancements to the Aboveground Metallic Tanks program.

Request:

State the basis for how it can be concluded that the backup water storage tank will meet its current licensing basis intended functions without conducting: (a) inspections for evidence of voids beneath the floor and (b), dry film thickness measurements, wet-sponge testing, and vacuum box testing of the seams if loss of material or loss of coating integrity is detected. Alternatively, revise the Aboveground Metallic Tanks program to be consistent with LR-ISG-2012-02 AMP XI.M27.

RAI 3.0.3.3.3-3

Background:

Changes to the license renewal application to address LR-ISG-2012-02, "Aging Management of Internal Surfaces, Fire Water Systems, Atmospheric Storage Tanks, and Corrosion Under Insulation," were described in a letter dated March 12, 2014. The letter stated that:

- Air flow testing of dry pipe preaction spray headers to confirm no obstructions to flow will be conducted at a frequency of every three years.

- Air flow testing of open deluge nozzles to confirm no plugged nozzles will be conducted at a frequency of every three years.

- Water flow testing of transformer deluge nozzles to confirm no obstructions to flow will be conducted. The main power and auxiliary transformers are tested on a refueling cycle frequency and other transformer deluge systems are tested every three years. NFPA 25 Section 10.3.4.3, as modified by LR-ISG-2012-02 AMP XI.M27 Table 4a, recommends that spray nozzle discharge patterns be observed on a refueling outage interval to ensure that there are no obstructions to the discharge patterns.

  Issue:

  The staff noted that the 3-year inspection frequencies exceed a refueling outage interval. The staff also noted that a basis was not provided for the longer inspection intervals (e.g., plant-specific operating experience, alternative testing).

  Request:

  State the basis for the longer inspection intervals associated with the operational testing of certain fixed water spray systems. Alternatively, revise the Fire Water System program to be consistent with LR-ISG-2012-02 AMP XI.M27.

RAIs 3.0.3.4-1

Background:

Based on its review of the response to RAI 3.0.3-1 dated March 14, 2014, the staff noted the following items:

1. The response states that galvanized portions of the fire water system (transformer deluge system piping) are not subject to unanticipated or accelerated corrosion of the base metal due to coating holidays due to the sacrificial zinc-based coating.

2. The response states that galvanized portions of the plant drainage system (normal waste, oily waste, sanitary waste, and storm drain piping) are not subject to accelerated corrosion of the base metal due to coating holidays. However, the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program, as amended by letter dated March 12, 2014 (review of LR-ISG-2012-02), will be used to manage the aging effect of loss of material, which is an indication of the loss of coating, in galvanized plant drainage system piping exposed to a waste water environment.

   As amended by letter dated March 12, 2014, the periodic representative sample of each material, environment, and aging effect combination for the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program can consist of inspecting components in a more severe environment.

   The GALL Report definition of galvanized steel states, "[i]n the presence of moisture, galvanized steel is classified under the category 'Steel'."

3. The response to RAI 3.0.3-1 did not state an upper limit on the period of time prior to a subsequent internal coating inspection for the reactor enclosure cooling water (RECW) heat exchangers, main control room (MCR) chiller condensers, and circulating water system piping;

and the response did not incorporate this limit into the Open-Cycle Cooling Water System program, updated final safety analysis report (UFSAR) supplement, and Commitment No. 12. The response also states that the RECW heat exchangers are within the scope of the rule under 10 CFR 54.4(a)(2) for spatial interaction only.

4. In regard to the Emergency Diesel Generator Diesel Oil Storage Tanks, the response to RAI 3.0.3-1 states:

   One tank was identified as having two areas of chipped coating in the bottom section of the sump which exposed the carbon steel substrate. A technical evaluation was performed by the site coating coordinator to evaluate the as-found coating defects. The coating damage was evaluated to be mechanical damage and not age related degradation. Only a small amount of surface rust staining was visible on the exposed carbon steel. Significant rusting would not be expected since current fuel oil chemistry practices limit the amount of water, sediment, and particulate contamination collected in the tank. The edges of the damaged coating were scraped to sound coating, re-inspected, and found to have satisfactory adhesion. Several smaller chips were also identified on the sump side walls. Due to the nature of the defects, coating repair was not required. The technical evaluation concluded that the tank could be returned to service without recoating these areas where the coating had been chipped and that the inspection frequency of 10 years was still appropriate. Additionally, minor coating deficiencies were identified in three other tanks. These conditions were within acceptance criteria. However, baseline inspections will occur in the 10-year period prior to the period of extended operation. The frequency of subsequent inspections will be established based on the baseline inspections.

5. In regard to the reactor core isolation cooling system (RCIC) turbine bearing pedestals and high pressure coolant injection system (HPCI) turbine bearing pedestals and oil reservoir, the response to RAI 3.0.3-1 states that the Lubricating Oil Analysis program will be used to manage loss of coating integrity. It also states that failure of the coatings in the RCIC turbine bearing pedestals and HPCI turbine bearing pedestals and oil reservoir could result in unanticipated or accelerated corrosion of the base metal. It further states that the RCIC turbine bearing pedestals and HPCI turbine bearing pedestals and oil reservoir coating will receive a baseline visual inspection within 10 years prior to the period of extended operation (PEO) and the frequency of subsequent inspections will be established based on the baseline inspections.

6. The response to RAI 3.0.3-1 states that certification to conduct VT-3 to a minimum of Level II including documented orientation in performing coating surveillance would be adequate to conduct inspection of safety-related coatings.

7. The response to RAI 3.0.3-1 states that, in the event the initial inspection of the emergency diesel generator diesel oil storage tanks and MCR chiller condensers is not performed by an ANSI N45.2.6 inspector and the coating condition is considered suspect or requires coating repair, then a qualified N45.2.6 inspector will perform a detailed inspection and oversee/inspect coatings recoats, touch-ups, or repair activities; and that this level of qualification will continue through the PEO for these inspections.

   LRA Sections A.2.1.12, A.2.1.20, A.2.1.27, B.2.1.12, B.2.1.20, B.2.1.27, and Commitment Nos. 12, 20, and 27 contain similar wording.

8. The response to RAI 3.0.3-1 states the examiners currently performing service water side inspections of the RECW heat exchangers are qualified to engineer certification guides, which include knowledge of EPRI TR-1019157 and a knowledge objective requirement to describe the inspection of coatings in heat exchangers. The response also states that this level of qualification will continue through the PEO.

9. The response to RAI 3.0.3-1 states that: (a) the as-found condition of coatings is documented in inspection reports or in completion remarks in the inspection work order; (b) the results of previous inspections are used to determine changes in the condition of the coating over time.

10. The response to RAI 3.0.3-1 did not provide specific acceptance criteria related to coating degradation.

11. The response to RAI 3.0.3-1 states that currently the Site Coating Coordinator (not qualified in accordance with ASTM D-7108, "Standard Guide for Establishing Qualifications for a Nuclear Coatings Specialist") provides oversight of safety-related coating activities and evaluates coating deficiencies. Enhancement No. 1 and Commitment No. 37 of the Protective Coating Monitoring and Maintenance Program, states that the position of Nuclear Coatings Specialist will be created prior to the period of extended operation. This individual will be qualified to ASTM D-7108.

Issue:

1. The staff acknowledges that the zinc-based coating would act as a sacrificial anode; however, there have been instances in the industry where the sacrificial coating has been consumed and the base metal subsequently corroded. It is not clear to the staff how the presence of sufficient coating to prevent unanticipated or accelerated corrosion of the base metal due to coating holidays will be demonstrated.

2. It is not clear to the staff whether the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program representative sample would consist of uncoated steel pipe in lieu of galvanized pipe in verifying the inspection locations for steel piping exposed to waste water. The staff noted that, depending on the characteristics of the waste water environment (e.g., alternating wetting and drying), portions of the galvanized piping may be most susceptible to corrosion; although alternatively, it could be viewed as not susceptible due to the galvanic coating.

3. Based on the response to RAI 3.0.3-1, "the frequency of subsequent inspections will be established based on the baseline inspections," the staff cannot conclude what inspection interval will be used for the RECW heat exchangers, MCR chiller condensers, and circulating water system piping. In the Issue discussion of RAI 3.0.3-1, Part 2, the staff stated its position on coating inspection frequencies. In summary, depending on previous inspection results, subsequent inspections should be no longer than 6 years and could be as low as every other refueling outage interval.

   The staff has concluded that alternatives to the inspection frequencies stated in draft LR-ISG-2013-01 are supported by the fact that: (a) it would not be expected that the nonsafety-related service water system would contain chemical compounds that could cause unanticipated or accelerated corrosion of the base material if coating degradation resulted in exposure of the

base metal and (b) the RECW Heat Exchangers are in scope for 10 CFR 54.4(a)(2) spatial interaction only. However, before the staff can evaluate the acceptability of the alternative inspection frequencies, the staff has two concerns:

- It is not clear to the staff whether the coated components are located in the vicinity of uncoated components that could cause a galvanic couple to exist.

- The staff does not know whether the corrosion allowance used for the RECW heat exchangers assumed that the component was not coated.

4. The staff recognizes that an area of minor coating damage that has been characterized as not being age-related and where physical inspections demonstrate that there is sound coating and satisfactory adhesion in the vicinity of the degradation may warrant the extended inspection frequencies of GALL Report AMP XI.M30, "Fuel Oil Chemistry" (at least once every 10 years). However, the response and program changes did not discuss other critical considerations for allowing a longer inspection interval than recommended in Table 4a when small areas of degraded coatings is detected including: (a) demonstration that sufficient wall thickness is available to ensure that the current licensing basis function of the tank can be met; (b) alternative indications that leakage is occurring (e.g., level instrumentation); and (c) the factors to be used by the applicant to determine if loose coatings could transport.

   In addition, the statement "[t]he frequency of subsequent inspections will be established based on the baseline inspections," appears to conflict with the specific inspection frequency specified in the Fuel Oil Chemistry program and Table 4a.

5. The response states that failure of the coatings could result in unanticipated or accelerated corrosion of the base metal and yet it also states that degraded coatings are removed and the uncoated substrate is not recoated. The response states that the internal coatings are inspected on a refueling outage basis; however, it also states that the frequency of subsequent inspections will be established based on the baseline inspections. The response to 3.0.3-1 did not state an upper limit on the period of time prior to subsequent internal coating inspections, and the response did not incorporate this limit into the Lubricating Oil Analysis program, UFSAR supplement, and Commitment No. 27.

6. In regard to using a VT-3 Level II qualified examiner to conduct safety-related coating inspections, the staff noted that ASME Code Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," Subarticle IWA-2300, "Qualification of Nondestructive Personnel," and ASTM D-4537, "Standard Guide for Establishing Procedures To Qualify and Certify Personnel Performing Coating Work Inspection in Nuclear Facilities," contain similar vision testing and educational requirements. However, given that VT-3 examinations are associated with determining the general mechanical and structural condition of components and their supports, providing a "documented orientation in performing coating surveillance" lacks sufficient specificity for the staff to conclude that the orientation is equivalent to ASTM D-4537 Section 9, "Examination." In addition, it is unclear to the staff whether a VT-3 Level II qualified examiner will have 3 or 6 months (depending on their education level) experience in coating inspection activities.

7. It is not clear to the staff why initial inspections that are not conducted by an ANSI N45.2.6 inspector would be credited as a baseline inspection. It is also not clear whether the statement

"this level of qualification" refers to ANSI N45.2.6 qualified individuals or those without ANSI N45.2.6 qualifications.

8. As amended, LRA Sections A.2.1.12 and B.2.1.12, and Commitment No. 12, do not include a requirement for the inspectors that conduct service water side inspections of the RECW heat exchangers to have knowledge of EPRI TR-1019157 and a knowledge objective requirement to describe the inspection of coatings in heat exchangers. Without these requirements being included in the program, it is unclear to the staff whether they will be incorporated into plant-specific training documents during the period of extended operation.

9. The staff noted that the RAI response did not state whether a pre-inspection review of the previous two inspections is conducted that includes reviewing the results of inspections and any subsequent repair activities, and the qualification level of the individual completing the inspection reports or completion remarks in the inspection work order. As a result, it is unclear to the staff whether the appropriate information will be reviewed prior to determining inspection locations and conducting the inspections.

10. In regard to acceptance criteria for coating inspections, the staff noted that the RAI response did not state which precursors to coating failures would be considered not acceptable (e.g., peeling, delamination). The staff also noted that the RAI response did not state the extent of blistering that would be found acceptable.

11. It is not clear to the staff whether an individual qualified to ASTM D-7108 will evaluate the results of the baseline coating inspections conducted prior to the period of extended operation. It is also not clear to the staff whether testing or examination will be conducted to ensure that the extent of repaired or replaced coatings encompasses sound coating material.

Request:

1. State how it will be demonstrated that an adequate amount of the zinc-based coating remains intact throughout the period of extended operation to prevent unanticipated or accelerated corrosion of the galvanized portions of the fire water system.

2. State whether the steel and galvanized steel portions of the plant drainage system (normal waste, oily waste, sanitary waste and storm drain piping) would be treated as two separate populations when determining a representative sample for the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program. If not, state the criteria for selecting inspection locations that gives assurance that galvanized piping exposed to aggressive environments (e.g., alternating wetting and drying) will have an adequate number of inspection to ensure the presence of sufficient coating to prevent unanticipated or accelerated corrosion.

3. State the maximum interval of subsequent coating inspections, and incorporate the inspection interval into the Open-Cycle Cooling Water System program, UFSAR supplement and Commitment No. 12 for the RECW heat exchangers, MCR chiller condensers, and circulating water system piping. In addition, for the RECW heat exchangers:

   - State whether the coated portions of the RECW heat exchangers are located in the vicinity of uncoated components that could cause a galvanic couple to exist.

- State whether the corrosion allowance used for the RECW heat exchangers assumed that the component was not coated. If not, state the basis for why the maximum interval between coating inspections could not result in sufficient loss of material to potentially challenge the current licensing basis intended function of these heat exchangers.

4. State the basis for the periodicity of inspections for the emergency diesel generator diesel oil storage tank coatings if the prior inspection detects peeling, delamination, blisters, rusting, or unacceptable cracking and flaking.

   Where small areas of degraded coatings are detected and the inspection interval will be greater than every other refueling outage interval, state: (a) the type of degradation that will be allowed (e.g., rusting, cracking, chipped coating); (b) what physical inspections will be conducted; (c) how sufficient wall thickness will be demonstrated; (d) available alternative indications that leakage is occurring; and (e) the factors to be used to determine that loose coatings would not transport.

   State the intent of the wording, "[t]he frequency of subsequent inspections will be established based on the baseline inspections," in relation to the 10-year inspection intervals in the Fuel Oil Chemistry program and Table 4a.

   Include appropriate changes to the Fuel Oil Chemistry program, UFSAR supplement and Commitment No. 20.

5. State the basis for not recoating areas where the coating has been removed. In addition, state the maximum interval to subsequent coating inspections and incorporate the inspection interval into the Lubricating Oil Analysis program, UFSAR supplement and Commitment No. 27.

6. Provide a sufficient level of detail related to the orientation in performing coating surveillances provided to inspectors for the staff to independently conclude that the orientation is consistent with ASTM D-4537 Section 9; and (b) state whether VT-3 Level II qualified examiners will have 3 or 6 months (depending on their education level) experience in coating inspection activities.

7. For the Open-Cycle Cooling Water System, Fuel Oil Chemistry, and Lubricating Analysis programs, state the basis for why inspections conducted by individuals who do not have an ANSI N45.2.6 qualification should be credited as a baseline inspection; and clarify the intent of the statement, "this level of qualification."

8. Amend LRA Sections A.2.1.12 and B.2.1.12, and Commitment No. 12, to state that the inspectors that conduct service water side inspections of the RECW heat exchangers have knowledge of EPRI TR-1019157 and a knowledge objective requirement to describe the inspection of coatings in heat exchangers.

9. State the qualification level of the individual completing the inspection reports or completion remarks in the inspection work order. Make appropriate changes to the applicable programs, UFSAR supplement, and Commitments.

10. State which precursors to coating failures would be considered not acceptable and the extent of blistering that would be found acceptable. Make appropriate changes to the applicable programs, UFSAR supplement, and Commitments.

11. State: (a) whether an individual qualified to ASTM D-7108 will evaluate the results of the baseline coating inspections conducted prior to the PEO; and (b) whether testing or examination will be conducted to ensure that the extent of repaired or replaced coatings encompasses sound coating material. Make appropriate changes to the applicable programs, UFSAR supplement, and Commitments.