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

Subject: Response to Request for Additional Information Regarding Commitment for License Renewal

References:
1. Letter from T. Hanley (Exelon Generation Company, LLC) to U.S. NRC, "License Renewal – Commitment Change in Accordance with NEI 99-04," dated May 18, 2012
2. Letter from H. M. Jones (U.S. NRC) to M. J. Pacilio (Exelon Generation Company, LLC), "Quad Cities Nuclear Power Station, Units 1 and 2: Request for Additional Information Regarding Change to Commitment for License Renewal (TAC Nos. ME8961 and ME8962)," dated October 22, 2012

In Reference 1, Exelon Generation Company, LLC (EGC) submitted information to clarify commitments regarding visual examinations credited for identifying aging effects. In Reference 2, the NRC requested additional information that is required to complete the review. In response to this request, EGC is providing the attached information.

There are no regulatory commitments contained in this letter. Should you have any questions concerning this letter, please contact Mr. Kenneth M. Nicely at (630) 657-2803.

Respectfully,

Patrick R. Simpson
Manager – Licensing

Attachment: Response to Request for Additional Information

cc: NRC Regional Administrator, Region III
NRC Senior Resident Inspector, Quad Cities Nuclear Power Station

ATTACHMENT
Response to Request for Additional Information

NRC Request

Provide justification that the methods used for license renewal visual examinations outside of Code examinations will be effective in detecting aging. For each of the affected programs discussed in the May 18, 2012, letter, include details on the visual examination work instructions (e.g. illumination, examination distance, examination coverage, acceptance criteria) that demonstrate that the staff's conclusions that relied on VT-1 or VT-3 examinations remain valid. In addition, state the qualifications for personnel involved in writing work instructions, interpreting results, establishing acceptance criteria, and developing and qualifying procedures related to the non-Code inspections.

Response

The affected programs discussed in the May 18, 2012, letter (Reference 1) are:

B.1.23 One Time Inspection

B.1.24 Selective Leaching

B.2.8 Periodic Inspection of Plant Heating Steam

B.2.9 Periodic Inspection of Components Subject to Moist Environments

Section A: Overview

The primary focus of the visual examinations used in these programs is to identify aging effects that need to be evaluated for potential impact during the 20 year period of extended operation (PEO). This includes conditions where the aging effects may not presently have an impact, including effects well below any Code related criteria. For this reason the visual examinations were performed by personnel qualified to perform Code examinations, using instructions aligned with the specific aging effects of concern. Information related to the effectiveness of visual examinations that generally applies to all four programs is described below. Program specific information is described in the next section, Section B.

Visual Examination Work Instructions and Qualifications of Personnel Involved:

A non-destructive examination (NDE) Level III individual qualified/certified in VT-1 and VT-3 examinations worked with engineering personnel to generate work order package instructions, degradation descriptions, acceptance criteria, and report forms in lieu of procedures. This approach was taken because the examinations were not governed by American Society of Mechanical Engineers (ASME) Section XI requirements and were not applicable to the existing VT procedures. The examinations were specifically tailored to focus on identifying aging effects that could require ongoing management during the 20 year PEO. Work instructions were appropriate to capture the examination results based on the criteria provided for non-code related aging management programs (AMPs) through the license renewal process. In each case, the work instructions included acceptance criteria specific to the degradation mechanism that was being assessed.

The training, qualification, and certification of the Level II or Level III VT (VT-1 and VT-3) examiner who performed the examination supports their ability to identify the evidence of aging as required by the AMP from the acceptance criteria specific to the degradation mechanism in each work order. Their qualification ensures that they have experience in identifying degradation visually, have appropriate vision acuity, and are trained in establishing appropriate lighting and resolution to ensure that the aging effect can be identified. Since the examiner was required to identify all evidence of aging effects, no interpretation or evaluation by the individual was required. For these examinations, engineering personnel had the responsibility to evaluate the conditions identified by the examiner through the station Corrective Action Program. Given this responsibility, an engineer accompanied the examiner to the field for the majority of the inspections. Once the inspections required to be completed prior to the PEO were finished, the AMP owner reviewed the results to confirm that either: (1) the one time inspections confirmed that no aging effects require ongoing management, or (2) appropriate ongoing inspections are established to manage the effects of aging during the PEO. The results of this review were documented in the applicable AMP results binder.

Examination report forms and work package instructions were developed by a qualified Level III examiner certified in VT-1 and VT-3 examination methods in conjunction with the license renewal team and engineering personnel to ensure that the relevant aging effects would be identified and documented. Where appropriate, criteria within the License Renewal Safety Evaluation Report (i.e., Reference 3) were also verified by engineering personnel during development of the work instruction steps. If the instruction steps and/or the examination report form required revision, engineering personnel and the Level III examiner provided the necessary oversight to assure alignment with the License Renewal Safety Evaluation Report.

Examinations were completed using personnel certified in VT-1 and VT-3 requirements. Prior to examinations performed by VT certified personnel, a pre-job brief was conducted by a Level II or Level III examiner familiar with the license renewal process. Although the examinations were not governed by ASME Section XI requirements, the Level II or Level III examiner addressed items during the pre-job briefs that would typically be covered for ASME Section XI examinations, such as:

- Review of the database for Level II or Level III certification in VT-1 or VT-3, as applicable, to the examination (i.e., no Level I examiners were used);
- Maximum direct examination distance requirement versus remote;
- Minimum illumination requirement;
- Use of white-light meter and/or use of test card (i.e., illumination card);
- Review color photographs of specific degradation examples from document 'EPRI – Aging Assessment Field Guide – #1007933, Final Report December 2003'; and
- Appropriate safety precautions.

Evidence of the examination results in accordance with the standardized acceptance criteria were recorded in the completed work package. The forms used for recording observations were developed to be consistent with ASME Section XI forms used at the station, but were modified to ensure that the component and aging effects of interest were appropriately captured. VT examination results were reviewed by a certified VT examiner or engineer as appropriate to the component and relevant degradation mechanism/aging effect. Notations of degradation

described in the examination report were entered into the station Corrective Action Program by generation of an Issue Report (IR).

Section B: Program Specific Information Related to the Effectiveness of Visual Examinations

B.1.23 One Time Inspection:

As noted in License Renewal Safety Evaluation Report (i.e., Reference 3) Section 3.0.3.10, this program is consistent with the ten elements of AMP XI-M32, "One-Time Inspection," specified in the GALL report (i.e., Reference 4). Element 3, "Parameters Monitored/Inspected," notes: The program monitors parameters directly related to the degradation of a component. For Quad Cities Station the One Time Inspection program was separated into 11 sections based on factors such as materials of construction, and system boundaries. A description of how the parameters directly related to component degradation was included in the examination work instructions. A summary of this information for the three sections of program B.1.23 described in the May 18, 2012, letter (i.e., Reference 1) is provided below.

One Time Inspection – Ventilation Systems: The aging effect of concern for these inspections is loss of material due to general, crevice or pitting corrosion. Work instructions included sign off hold points for both the VT-3 qualified inspector and the engineer to document if the inspection noted evidence of general, crevice or pitting corrosion. If such evidence was present, the instructions noted that an IR was required, and provided space to document the IR number generated. The work instructions included reference to a document providing an expanded definition of general, crevice or pitting corrosion and a discussion of how these conditions are detected using visual inspections. The inspection results were documented on a form similar to that used for ASME Code VT-3 inspections, but modified for ventilation component inspections to reinforce the importance of inspecting both internal and external duct surfaces, and to prioritize inspection of components associated with ventilation drip pans since they are likely locations to show early signs of aging.

One Time Inspection – Compressed Gas Systems: Similar to the ventilation system inspections, the aging effect of concern for these inspections is loss of material due to corrosion. Work instructions included sign off hold points for both the VT-3 qualified inspector and the engineer to document if the inspection noted evidence of general, crevice or pitting corrosion. If such evidence was present, the instructions noted that an IR was required, and provided space to document the IR number generated. The work instructions included reference to a document providing an expanded definition of general, crevice or pitting corrosion and a discussion of how these conditions are detected using visual inspections. These inspections were performed in concert with approved valve inspection procedures, so inspection results were documented on a combination of the License Renewal Visual Inspection templates, and Valve Inspection forms associated with the maintenance procedure. The work instructions also contained contingency steps to determine wall thickness using mechanical measurements or ultrasonic testing if loss of material was detected.

One Time Inspection – SBLC Chemistry Verification: The aging effect of concern for these inspections is cracking in stainless steel components in the Standby Liquid Control (SBLC) system. These inspections validate that the water chemistry controls in place have been

effective in managing the effects of aging. This inspection was completed concurrent with scheduled SBLC pump overhauls when interior and exterior surfaces of the pump casing were accessible for inspection. Similar to the ventilation and compressed gas system inspections noted above, SBLC inspection work instructions included sign off hold points for both the VT-3 qualified inspector and the engineer to document if the inspection noted evidence of general, crevice or pitting corrosion. If such evidence was present, the instructions noted that an IR was required, and provided space to document the IR number generated. The work instructions included reference to a document providing an expanded definition of general, crevice or pitting corrosion and a discussion of how these conditions are detected using visual inspections. The results of the inspection were documented on a work instruction template that included the eight attributes used in the ASME Code inspections for pump surfaces (i.e., Cracks, Wear, Corrosion, Erosion, Physical Damage, Loose/Missing Parts, Debris in Component, Integrity of Bolting and Welds).

Once all of the one time inspections were completed, the AMP owners reviewed the results and documented their conclusions regarding the need for ongoing aging management during the PEO in an AMP results binder. In all cases the inspection results confirmed that ongoing aging management actions are not required.

B.1.24 Selective Leaching:

As noted in License Renewal Safety Evaluation Report (i.e., Reference 3) Section 3.0.3.11 this program consists of numerous one-time inspections to determine if selective leaching of materials is occurring. The program is consistent with GALL AMP XI.M33, "Selective Leaching of Materials," (i.e., Reference 4) with the exception that the programs provide for visual examination and do not include hardness testing. Components that exhibit visual indications of selective leaching will receive further examination or evaluation, which may include non-destructive testing or other examinations that provide definitive results regarding the presence of selective leaching. This may include removal of specific components for examination under microscope.

Similar to the B.1.23 inspections described in the previous section, work instructions for selective leaching inspections included sign off hold points for both the VT qualified inspector (in this case VT-1 qualification) and the engineer to document if the inspection noted evidence of selective leaching. If such evidence was present, the instructions noted that an IR was required, and provided space to document the IR number generated. The work instructions included reference to a document providing an expanded definition of selective leaching, including a discussion of dezincification in brass components, or graphitization of gray cast iron. Instructions provided direction to ensure that the surface area was cleaned and accessible for examination. The inspection results were documented on a form specific to selective leaching inspections which included the material type inspected, the aging environment, and the method of surface removal used.

The completed inspections confirmed that selective leaching was not occurring. This included an inspection where the initial visual inspection indicated a potential for selective leaching, but when the component was removed and sent for further testing, micrographic analysis provided definitive proof that selective leaching was not in progress.

B.2.8 Periodic Inspection of Plant Heating Steam

This new periodic program has been implemented to inspect components in the Plant Heating system once before the end of the current operating term and periodically at intervals not to exceed once every five years during the PEO. As noted in License Renewal Safety Evaluation Report (i.e., Reference 3) Section 3.3.2.3.7, the program will include inspections for cracking, loss of material, or other evidence of aging for Plant Heating system components that are within the scope of license renewal.

The aging effect of concern for these inspections is loss of material due to corrosion, or cracking that could result in through wall leakage which could potentially affect other license renewal scope equipment in proximity to steam heating components. Work instructions include sign off hold points for both the VT-3 qualified inspector and the engineer to document if the inspection noted evidence of general, crevice or pitting corrosion. If such evidence was present, the instructions note that an IR is required, and provides space to document the IR number generated. The work instructions include reference to a document providing an expanded definition of general, crevice or pitting corrosion and a discussion of how these conditions are detected using visual inspections. The work instructions also contained contingency steps to determine wall thickness using mechanical measurements or ultrasonic testing if loss of material were detected. The results of the inspection are documented on a work instruction template that includes the eight attributes used in the ASME Code VT-3 inspections (i.e., Cracks, Wear, Corrosion, Erosion, Physical Damage, Loose/Missing Parts, Debris in Component, Integrity of Bolting and Welds).

The main differences between the one time inspection programs and this ongoing program to inspect heating steam components are listed below.

1. Inspection instructions are included in model work orders to ensure that key inspection elements are maintained for subsequent five year inspections.

2. Pre-defines (i.e., periodic preventive maintenance tasks) track completion of inspections and include references to the associated commitment tracking numbers. This ensures that future changes to inspection instructions do not inappropriately impact alignment with license renewal commitments.

3. The use of pre-defines also makes previous inspection results readily available for comparison to new inspection results.

B.2.9 Periodic Inspection of Components Subject to Moist Environments

This new periodic program has been implemented as described in License Renewal Safety Evaluation Report (i.e., Reference 3) Section 3.0.3.18, to manage the loss of material for stainless steel, carbon steel, cast iron, aluminum, copper, brass, and bronze components and degradation (e.g., such as elastomer hardening or cracking) of flexible hoses located in moist environments and subject to wetting conditions. Ultrasonic and visual inspections will be performed on selected carbon steel and cast iron components as representative samples for all materials managed by this program since these materials have a greater susceptibility to loss of material.

The aging effect of concern for these inspections is loss of material due to general corrosion, pitting and crevice corrosion. Similar to previously described programs, B.2.9 includes work instructions with sign off hold points for both the VT-3 qualified inspector and the engineer to document if the inspection noted evidence of general, crevice or pitting corrosion. If such evidence was present, the instructions note that an IR is required, and provides space to document the IR number generated. The work instructions include reference to a document providing an expanded definition of general, crevice or pitting corrosion and a discussion of how these conditions are detected using visual inspections. Inspections performed by VT-3 qualified inspectors are documented on a work instruction template that includes the eight attributes used in the ASME Code VT-3 inspections (i.e., Cracks, Wear, Corrosion, Erosion, Physical Damage, Loose/Missing Parts, Debris in Component, Integrity of Bolting and Welds).

Some of the differences between this program and those previously described are:

1. Periodic performance of ultrasonic testing thickness measurements are required and not limited to use as a contingency action based on visual inspection results; and

2. Work Orders for visual inspection of flex hoses include specific steps to check for degradation effects particular to these components, such as:

    - Loose, broken, bulged or worn braid;
    - Deformation of the hose, such as kinks or twists;
    - Corrosion; and
    - Signs of rubbing or mechanical wear.

As this is an ongoing program, elements for Periodic Inspection of Components Subject to Moist Environments include the following.

1. Inspection instructions in model work orders to ensure that key inspection elements are maintained for subsequent inspections.

2. Pre-defines track completion of inspections and include references to the associated commitment tracking numbers. This ensures that future changes to inspection instructions do not inappropriately impact alignment with license renewal commitments.

3. The use of pre-defines also make previous inspection results readily available for comparison to new inspection results.

Section C: Conclusion

The information described above provides justification that the methods used for license renewal visual examinations will be effective in:

1. **Early identification of aging effects.** The use of a certified VT examiner qualified and experienced in identifying aging effects such as general, crevice or pitting corrosion ensures that these conditions will be accurately identified. Work instructions that provide information on the aging effect of concern supplement the inspector qualifications to provide greater

assurance that the inspections are effective at identifying aging effects before degradation impacts component function. As described in Section B, this included:

- Applying the same eight attributes used for Code inspections of pump and valve internals, when performing aging management inspections on similar components for the AMPs. This practice meets the AMP requirements which typically specify corrosion and/or cracking inspections, and includes additional requirements (e.g., physical damage, missing parts, debris, etc.). This practice is consistent with the Code inspections performed by the certified VT examiners, and while not required by the License Renewal commitments could provide information useful to support equipment reliability.

- In cases where aging management inspections were performed on components that are not typically included in Code inspections (e.g., ventilation duct work, flex hoses), component specific inspection instructions were included to note age sensitive areas in ventilation components or degradation mechanisms for flex hoses.

2. **Proper evaluation and resolution of aging effects.** Review of inspection results by an engineer who understands potential long term impact of aging ensures that these effects are properly addressed. Documenting the resolution of aging effects within the Corrective Action Program drives the necessary organizational response, including long term resolution and extent of condition, which is supported by the collegial review of corrective action products by personnel in Operations, Maintenance, and Engineering.

These actions provide assurance that the effects of aging on equipment in the scope of the renewed license will be managed in a manner that preserves the current licensing basis.

References

1. Letter from T. Hanley (Exelon Generation Company, LLC) to U.S. NRC, "License Renewal – Commitment Change in Accordance with NEI 99-04," dated May 18, 2012

2. Letter from H. M. Jones (U.S. NRC) to M. J. Pacilio (Exelon Generation Company, LLC), "Quad Cities Nuclear Power Station, Units 1 and 2: Request for Additional Information Regarding Change to Commitment for License Renewal (TAC Nos. ME8961 and ME8962)," dated October 22, 2012

3. NUREG-1796, "Safety Evaluation Report Related to the License Renewal of the Dresden Nuclear Power Station, Units 2 and 3 and Quad Cities Nuclear Power Station, Units 1 and 2," dated October 2004

4. NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," dated April 2001