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UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, DC 20555 - 0001

February 14, 2013

The Honorable Allison M. Macfarlane
Chairman
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT: REPORT ON THE SAFETY ASPECTS OF THE LICENSE RENEWAL APPLICATION FOR LIMERICK GENERATING STATION, UNITS 1 AND 2

Dear Chairman Macfarlane:

During the 601st meeting of the Advisory Committee on Reactor Safeguards, February 7-8, 2013, we completed our review of the license renewal application (LRA) for Limerick Generating Station (LGS), Units 1 and 2 and the final Safety Evaluation Report (SER) prepared by the NRC staff. Our Plant License Renewal Subcommittee also reviewed this matter during its meeting on September 5, 2012. During these reviews, we had the benefit of discussions with representatives of the NRC staff and the applicant, Exelon Generation Company, LLC. We also had the benefit of the documents referenced.

RECOMMENDATION AND CONCLUSIONS

1. The programs established and committed to by the applicant to manage age-related degradation provide reasonable assurance that LGS Units 1 and 2 can be operated in accordance with their current licensing bases for the period of extended operation without undue risk to the health and safety of the public.

2. The Exelon Generation Company, LLC application for renewal of the operating licenses for LGS Units 1 and 2 should be approved.

3. This is the first LRA that was prepared based on Revision 2 of the Generic Aging Lessons Learned (GALL) Report. The applicant and the staff agree that the new guidance improved the efficiency of the review.

BACKGROUND AND DISCUSSION

LGS Units 1 and 2 are General Electric BWR/4 designs with Mark II containments. They are owned and operated by Exelon Generation Company, LLC. LGS is located on the east bank of the Schuylkill River in Limerick Township of Montgomery County, Pennsylvania and is approximately 4 miles down-river from Pottstown, 35 miles up-river from Philadelphia. LGS Units 1 and 2 both have a licensed power output of 3,515 megawatts thermal. Their current operating licenses expire on October 26, 2024, and June 22, 2029, respectively. Exelon Generation Company, LLC requested renewal of the operating licenses for LGS Units 1 and 2 for 20 years beyond the current license terms.

In the final SER, the staff documented its review of the LRA and other information submitted by the applicant or obtained from the staff audits and inspection at the plant site. This is the first license renewal application that was prepared based on Revision 2 of the GALL Report. The applicant and the staff agree that the new guidance improved the efficiency of the review.

The staff reviewed the completeness of the applicant's identification of the structures, systems, and components (SSCs) that are within the scope of license renewal; the integrated plant assessment process; the applicant's identification of the plausible aging mechanisms associated with passive, long-lived components; the adequacy of the applicants Aging Management Programs (AMPs); and the identification and assessment of time-limited aging analyses (TLAAs) requiring review.

In the LGS Units 1 and 2 license renewal application, the applicant identified the SSCs that fall within the scope of license renewal. For these SSCs, the applicant performed a comprehensive aging management review. Based on this review, the applicant has identified 45 programs that are needed to manage aging during the period of license renewal. Thirty-four of these programs are existing programs and 11 are new programs. Twenty-one of the existing programs required enhancements to conform with the GALL Report.

The applicant is also committed to an ongoing review of both plant-specific and industry operating experience to help ensure that the AMPs are effective in managing aging effects. An AMP may be enhanced or new AMPs developed, as appropriate, if it is determined that the effects of aging may not be adequately managed by the existing AMP.

The application either demonstrates consistency of the AMPs with the GALL Report or documents deviations to the approaches specified in the Report. The one exception to the GALL Report is associated with the reactor head closure stud bolting program. A preventive measure to reduce the potential for stress corrosion cracking for these components identified in the GALL Report is a limit on the yield strength of the bolting material to less than 150 ksi. Some of the studs for the Units 1 and 2 vessel heads are fabricated from materials with slightly higher yield stresses. The program is consistent with other aspects of preventive measures listed in the GALL Report; e.g., that an approved lubricant is applied to the studs and associated hardware. No recordable indications have been found in examinations of reactor head closure stud bolting components over the past 10 years, indicating that the current program has been effective in managing cracking. We have reviewed this exception and agree with the staff that it is acceptable.

The staff conducted two license renewal audits and an inspection at LGS. The audits verified the appropriateness of the scoping and screening methodology, aging management review, and associated AMPs. The site inspection verified that the license renewal requirements are appropriately implemented. Based on the audits, inspection, and staff reviews, the staff concluded in the final SER that the proposed activities will reasonably manage the effects of aging of SSCs identified in the application and that the intended functions of these SSCs will be maintained during the period of extended operation. We agree with this conclusion.

The Mark II containments at LGS Units 1 and 2 consist of 6- to 8-foot thick reinforced concrete structures with 250-mil thick metal liners which act as leakage barriers. The lower portion of the containment is filled with water, which is maintained close to neutral pH and below 90° F. It typically contains only trace amounts of chlorides (less than or equal to 2 parts per billion) and sulfates (less than or equal to 13 parts per billion). The metal liners at LGS Units 1 and 2 are carbon steel. An inorganic zinc coating is used to protect the carbon steel liner against corrosion from the water.

The environment and liner material in the LGS Units 1 and 2 containments are similar to those in Mark I torus shells. Literature results suggest that inorganic zinc coatings have a lifetime on the order of 15-20 years. Reactor operating experience is consistent with these results. At Duane Arnold and Cooper approximately 5% and 1.1%, respectively, of the liner areas have lost their protective coating. The corresponding losses at LGS Unit 1 and Unit 2 are 15.2% and 4.2%, respectively.

Measurements show that the average corrosion rate of unprotected carbon steel in the LGS environments is about 2 mils/year. Higher rates might occur under deposits where differential aeration cells could form and more aggressive local chemistries could be present. The staff cites literature results which suggest that a conservative estimate of the rates in such local areas could be up to 12 mils/year.

In most of the areas where corrosion has occurred, the total metal loss is less than 25 mils. There are areas of localized corrosion with depths of 50-125 mils. Because the thickness of the liner is much greater than actually required for structural integrity, integrity and leak tightness can be maintained with a loss of up to 125 mils of material over a large area and up to 187.5 mils over a local area (less than 2.5 inches in diameter).

The applicant intends to manage aging degradation of the coating and corresponding corrosion of the liner by enhanced in-service inspection based upon ASME Code Section XI, Subsection IWE and repair of the coating. Their existing ASME Code Section XI, Subsection IWE program will be enhanced to remove accumulated sludge in the suppression pool every refueling outage, to perform an examination of the submerged portion of the suppression pool at a maximum interval of four years (two refueling outages), and to use the results of the examination to implement a coating maintenance plan. Ultrasonic thickness measurements will be made on four areas of the liner that are affected by general corrosion to correlate with the loss of thickness measured using calibrated depth dial gauges. The criteria for the repair of the coating are based on conservative estimates of the corrosion rates possible in the suppression pool environment and will ensure integrity of the liner until the next inspection period.

Based on this enhanced AMP, the staff concludes that the applicant has demonstrated that the effects of aging of the containment coatings will be adequately managed so that the intended functions will be maintained consistent with the current licensing bases (CLB) for the period of extended operation. We concur with the staff's conclusion.

The staff has concluded that the applicant has demonstrated that the effects of aging at LGS Units 1 and 2 will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). We concur with this conclusion.

The applicant identified the systems and components requiring TLAAs and reevaluated them for the period of extended operation. The staff concluded that the applicant has provided an adequate list of TLAAs. Further, the staff concluded that the applicant has met the requirements of the License Renewal Rule by demonstrating that the TLAAs will remain valid for the period of extended operation, or that the TLAAs have been projected to the end of the period of extended operation, or that the aging effects will be adequately managed for the period of extended operation.

We agree with the staff that there are no issues related to the matters described in 10 CFR 54.29(a)(1) and (a)(2) that preclude renewal of the operating licenses for LGS. The programs established and committed to by Exelon Generation Company, LLC provide reasonable assurance that LGS Units 1and 2 can be operated in accordance with their CLB for the period of extended operation without undue risk to the health and safety of the public. The Exelon Generation Company, LLC application for renewal of the operating licenses for LGS should be approved.

Dr. J. Sam Armijo did not participate in the Committee's deliberations regarding this matter.

Sincerely,

/RA/

John W. Stetkar
Vice Chairman

References:

1. NRC Safety Evaluation Report Related to the License Renewal of Limerick Generating Station, Units 1 and 2, January 2013 (ML12354A349)

2. Exelon Generation Company, LLC, "Limerick Generating Station, Units 1 and 2 - License Renewal Application," June 22, 2011 (ML11179A101)

3. NRC Scoping and Screening Audit Report, December 9, 2011 (ML11342A205)

4. NRC AMP Audit Report, February 28, 2012 (ML12018A332)

5. NRC License Renewal Inspection Report 05000352/2012009 and 05000353/2012009, July 30, 2012 (ML12213A053)

6. NRC NUREG-1800, Revision 2, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," December 2010 (ML103409036)

7. NRC NUREG-1801, Revision 2, "Generic Aging Lessons Learned Report," December 2010 (ML103409041)

8. NRC Information Notice 2011-15, "Steel Containment Degradation and Associated License Renewal Aging Management Issues," August 1, 2011 (ML111460369)

9. Final License Renewal Interim Staff Guidance LR-ISG-2011-05, "Ongoing Review of Operating Experience," March 9, 2012 (ML12044A215)