



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

September 21, 2015

The Honorable Stephen G. Burns  
Chairman  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001

**SUBJECT:     REPORT ON THE SAFETY ASPECTS OF THE LICENSE RENEWAL  
                  APPLICATION FOR BYRON STATION UNITS 1 AND 2 AND BRAIDWOOD  
                  STATION UNITS 1 AND 2**

Dear Chairman Burns:

During the 627<sup>th</sup> meeting of the Advisory Committee on Reactor Safeguards (ACRS), September 9-12, 2015, we completed our review of the license renewal application for Byron Station Units 1 and 2 and Braidwood Station Units 1 and 2 and the final Safety Evaluation Report (SER) prepared by the NRC staff. Our Subcommittee on Plant License Renewal reviewed this matter during a meeting on December 3, 2014. During these reviews, we had the benefit of discussions with representatives of the NRC staff and Exelon Generation Company, LLC (Exelon, or the applicant). We also had the benefit of the documents referenced. This report fulfills the requirement of 10 CFR 54.25 that the ACRS review and report on all license renewal applications.

## **CONCLUSION AND RECOMMENDATION**

1. The established programs and commitments by Exelon to manage age-related degradation provide reasonable assurance that Byron Units 1 and 2 and Braidwood 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. Exelon's application for renewal of the operating licenses for Byron Units 1 and 2 and Braidwood Units 1 and 2 should be approved.

## **BACKGROUND**

This unique license renewal action consists of a combined review of two dual-unit nuclear power plants at two different locations approximately 100 miles apart. Each unit has similar nuclear steam supply systems and safety systems, but there are some site-specific differences in their balance of plant design features. Byron is located in north central Illinois, near the town of Byron, Illinois, and near the Rock River, approximately 95 miles northwest of Chicago, Illinois. Braidwood is located in northeastern Illinois, near the town of Braidwood, Illinois, and near the Kankakee River, approximately 60 miles southwest of Chicago, Illinois.

The NRC issued the Byron construction permit on December 31, 1975, and operating licenses on February 14, 1985 (Unit 1), and January 30, 1987 (Unit 2). The NRC issued the Braidwood construction permit on December 31, 1975, and operating licenses on July 2, 1987 (Unit 1), and May 20, 1988 (Unit 2). Each unit utilizes a Westinghouse four-loop pressurized water reactor (PWR) with a dry ambient containment. Sargent & Lundy was the architect-engineer for both stations.

Each unit was originally licensed for a power output of 3,600 MWt and has a current safety evaluation for 3,658 MWt. On June 23, 2011, Exelon requested an increase in licensed power for Byron and Braidwood Stations, Units 1 and 2, from 3,587 MWt to 3,645 MWt based on measurement uncertainty recapture. That power level increase was approved in 2013. The current licensed power output for each unit is about 3,645 MWt with a gross electrical output of approximately 1,260 MWe.

In this application, Exelon requests renewal of the operating licenses for Byron Units 1 and 2 and Braidwood Units 1 and 2 for a period of 20 years beyond the current expiration dates of midnight October 31, 2024 (Byron Unit 1), November 6, 2026 (Byron Unit 2), October 17, 2026 (Braidwood Unit 1), and December 18, 2027 (Braidwood Unit 2).

## **DISCUSSION**

In the final SER, dated July 2015, the staff documented its review of the license renewal application and other information submitted by the applicant and obtained through staff audits and inspections at the plant sites. The staff reviewed the completeness of the identification of structures, systems, and components (SSCs) that are within the scope of license renewal; the integrated plant assessment process; the identification of plausible aging mechanisms associated with passive, long-lived components; the adequacy of the Aging Management Programs (AMPs); and identification and assessment of Time-Limited Aging Analyses (TLAAs) requiring review.

Exelon's license renewal application identified the SSCs that fall within the scope of license renewal. The application demonstrates consistency with the Generic Aging Lessons Learned (GALL) Report (NUREG-1801, Revision 2) or documents and justifies deviations to the specified approaches in that report. Exelon will implement 45 AMPs for license renewal for Byron and 44 AMPs for Braidwood. The AMPs consist of 32 existing programs and 13 new programs for Byron and 32 existing programs and 12 new programs for Braidwood.

For the 13 new AMPs at Byron, 11 of the new programs are consistent with the GALL Report. One of these programs is for fuse holders which is not applicable for Braidwood. Byron also has two additional new programs that are consistent with exceptions.

For the 12 new AMPs at Braidwood, 10 of the new programs are consistent with the GALL Report. Two additional new programs at Braidwood are consistent with exceptions.

Each plant has 32 existing programs. At Byron, 5 are consistent, 20 are consistent with enhancements, 1 is consistent with exceptions, and 6 are consistent with enhancements and exceptions. At Braidwood, 4 are consistent, 20 are consistent with enhancements, 1 is consistent with exceptions, and 7 are consistent with enhancements and exceptions. No AMPs are plant specific.

The license renewal application includes ten exceptions to the GALL Report for Braidwood and nine exceptions for Byron. The Flux Thimble Tube Inspection AMP exception does not apply to Byron Station. We reviewed all of the exceptions (Reactor Head Closure Stud Bolting, Water Chemistry, PWR Vessel Internals, Steam Generators, Compressed Air Monitoring, Fire Water System, Flux Thimble Tube Inspection, Aboveground Metallic Tanks, Buried and Underground Piping, and ASME Section XI Subsection IWF component support inspection). We conclude that all of the GALL exceptions are acceptable.

The staff conducted license renewal audits and performed license renewal inspections at both Byron and Braidwood. The audits verified the appropriateness of the scoping and screening methodology for AMPs, the appropriateness of the aging management review, and the acceptability of the TLAAAs. The inspections verified that the license renewal requirements will be implemented appropriately. The inspections, and the reports of those inspections, are thorough. Based on the audits, the inspections, and the staff reviews related to this license renewal application, the staff concluded that the proposed activities will manage the effects of aging of the SSCs and that the intended functions of these SSCs will be maintained during the period of extended operation. The staff concluded that Exelon has demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis for the period of extended operation at Byron and Braidwood, as required by 10 CFR 54.21(a)(3). We concur with that conclusion.

Two important remaining open items were resolved between our Subcommittee meeting on December 3, 2014 and our final review. These items are control rod drive mechanism (CRDM) nozzle wear and environmentally assisted fatigue in Class 1 components.

#### CRDM Nozzle Wear

Exelon submitted an amendment to its license renewal application that identifies an inspection program for aging management of CRDM nozzle wear. The amendment indicated that the inspection program will be used prior to, and during, the period of extended operation to monitor the nozzle wear. By letter dated February 11, 2015, Exelon revised the application as proposed and provided detailed nondestructive examination procedures that it will implement to manage the CRDM nozzle wear. This commitment in the amendment resolves this open item.

#### Environmentally Assisted Fatigue (EAF) in Class 1 Components

Exelon compared components of various materials in their EAF evaluations. During the review, it was determined that the environmentally adjusted cumulative usage factor ( $CUF_{en}$ ) value of different materials may respond differently when the EAF analyses are being refined in the future. It was determined that the initial review did not demonstrate that the refinement of the

higher CUF<sub>en</sub> of one material would ensure the reduction of CUF<sub>en</sub> values for another material within the same transient section such that the selected leading location would remain appropriate and bounding. Exelon subsequently amended its commitments for the locations at Byron and Braidwood Stations, Units 1 and 2, that will be monitored for EAF in the period of extended operation. With the inclusion of three additional locations at each unit, the staff concluded that there is reasonable assurance that the bounding locations susceptible to EAF will be monitored. This commitment resolves this open item.

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 Byron and Braidwood. The established programs and commitments by Exelon provide reasonable assurance that Byron and Braidwood can be operated in accordance with their current licensing basis for the period of extended operation without undue risk to the health and safety of the public. The Exelon application for renewal of the operating licenses for Byron and Braidwood should be approved.

Sincerely,

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John W. Stetkar  
Chairman

## REFERENCES

1. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report Related to the License Renewal of Byron Station, Units 1 and 2, and Braidwood Station, Units 1 and 2," July 2015 (ML15182A051).
2. Exelon Generation Company, LLC, "Byron and Braidwood Stations License Renewal Application," May 29, 2013 (ML13155A387).
3. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with Open Items Related to the License Renewal of Byron Station, Units 1 and 2, and Braidwood Station, Units 1 and 2," October 2014 (ML14296A176).
4. U.S. Nuclear Regulatory Commission, "Braidwood Station, Units 1 and 2 NRC License Renewal Scoping, Screening, and Aging Management Inspection Report 05000456/2014009; 05000457/2014009," November 7, 2014 (ML14311A893).
5. U.S. Nuclear Regulatory Commission, "Byron Station Units 1 and 2 – NRC License Renewal Scoping, Screening, and Aging Management Inspection Report 05000454/2014008; 05000455/2014008," November 7, 2014 (ML14311871).
6. U.S. Nuclear Regulatory Commission, "Aging Management Programs Audit Report Regarding the Byron Station, Units 1 and 2, and Braidwood Station, Units 1 and 2," March 13, 2014 (ML14071A620).

7. U.S. Nuclear Regulatory Commission, "Scoping and Screening Methodology Audit Report Regarding the Byron Station, Units 1 and 2, and Braidwood Station, Units 1 and 2," May 14, 2014 (ML14050A304).
8. U.S. Nuclear Regulatory Commission, NUREG 1801, Revision 2, "Generic Aging Lessons Learned (GALL) Report," December 2010 (ML103409041).
9. U.S. Nuclear Regulatory Commission, NUREG-1800, Revision 2, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," December 2010 (ML103409036).
10. U.S. Nuclear Regulatory Commission, Regulatory Guide 1.188, Revision 1, "Standard Format and Content for Application to Renew Nuclear Power Plant Operating Licenses," September 2005 (ML082950585).

7. U.S. Nuclear Regulatory Commission, "Scoping and Screening Methodology Audit Report Regarding the Byron Station, Units 1 and 2, and Braidwood Station, Units 1 and 2," May 14, 2014 (ML14050A304).
8. U.S. Nuclear Regulatory Commission, NUREG 1801, Revision 2, "Generic Aging Lessons Learned (GALL) Report," December 2010 (ML103409041).
9. U.S. Nuclear Regulatory Commission, NUREG-1800, Revision 2, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," December 2010 (ML103409036).
10. U.S. Nuclear Regulatory Commission, Regulatory Guide 1.188, Revision 1, "Standard Format and Content for Application to Renew Nuclear Power Plant Operating Licenses," September 2005 (ML082950585).

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