



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

January 7, 2011

The Honorable Gregory B. Jaczko  
Chairman  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001

**SUBJECT:     REPORT ON THE SAFETY ASPECTS OF THE LICENSE RENEWAL  
                  APPLICATION FOR THE KEWAUNEE POWER STATION**

During the 578<sup>th</sup> meeting of the Advisory Committee on Reactor Safeguards, December 2-4, 2010, we completed our review of the license renewal application for the Kewaunee Power Station (KPS) and the Safety Evaluation Report (SER) prepared by the NRC staff. Our Plant License Renewal Subcommittee also reviewed this matter during its meeting on August 18, 2010. During these reviews, we had the benefit of discussions with representatives of the NRC staff and the applicant, Dominion Energy Kewaunee, Inc. (DEK). We also had the benefit of the documents referenced. This report fulfills the requirements of 10 CFR 54.25 that the ACRS review and report on all license renewal applications.

#### **CONCLUSION AND RECOMMENDATION**

1. The programs established and committed to by the applicant to manage age-related degradation provide reasonable assurance that KPS can be operated in accordance with its licensing basis for the period of extended operation without undue risk to the health and safety of the public.
  
2. The application for the renewal of the operating license of KPS should be approved.

#### **BACKGROUND AND DISCUSSION**

KPS is a 2-loop pressurized water reactor of Westinghouse design with a dry, ambient containment. KPS operates at a licensed power output of 1,772 megawatt-thermal. DEK requested renewal of the KPS license for 20 years beyond the current license term, which expires on December 21, 2013. In the SER, the staff documented their review of the license renewal application and other information submitted by the applicant or obtained during three staff audits and a two-week inspection conducted at the plant site. The staff reviewed the completeness of the applicant's identification of 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 applicant's Aging Management Programs (AMPs); and the identification and assessment of time-limited aging analyses (TLAAs) requiring review.

The applicant identified the SSCs that fall within the scope of license renewal and performed an aging management review for these SSCs. The applicant will implement 34 AMPs for license renewal. Thirteen AMPs are consistent with the guidance in the Generic Aging Lessons Learned (GALL) Report, seven are consistent with exceptions, eight are consistent with enhancements, five are consistent with both enhancements and exceptions, and one is plant-specific. We reviewed the plant-specific program and the AMP exceptions to the GALL Report, and we agree with the staff that they are acceptable.

The applicant identified the systems and components requiring TLAAAs and reevaluated them for the period of extended operation. The staff concluded that the applicant has provided an acceptable list of TLAAAs, as defined in 10 CFR 54.3. Furthermore, the staff concluded that in all cases the applicant has met the requirements of the License Renewal Rule by demonstrating that the TLAAAs will remain valid for the period of extended operation, or the TLAAAs have been projected to the end of the period of extended operation, or the aging effects will be adequately managed for the period of extended operation. We concur with the staff conclusion that the TLAAAs have been properly identified and that the required criteria will be met for the period of extended operation.

The staff conducted three license renewal audits and one inspection at KPS. The audits verified the appropriateness of the aging management review, scoping and screening methodology, and associated AMPs. The inspection examined the scoping and screening of non-safety related SSCs and verified the adequacy of the guidance, documentation, and implementation of selected AMPs. The audit and inspection teams also performed independent examinations of KPS condition reports to confirm that plant-specific operating experience has been adequately addressed during the AMP development and implementation processes. Based on the audits and inspections, the staff concluded in the SER that the proposed activities will adequately manage the 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.

KPS steam generators have divider plates fabricated from Alloy 600. DEK credits its Primary Water Chemistry Program (PWCP) to manage cracking due to primary water stress corrosion cracking (PWSCC) for Alloy 600 steam generator divider plates exposed to reactor coolant. Significant cracking due to PWSCC has been identified in some European steam generator divider plates, even with proper primary water chemistry.

The staff noted that the PWCP alone may not be effective in managing the aging effect of cracking due to PWSCC divider plates. In order to address the staff concerns, the applicant has committed to participate in ongoing industry efforts related to the divider plate cracking issue. Recognizing that the industry resolution is still under development, the applicant will assess the condition of the divider plate assembly in each steam generator by inspection during the period of extended operation, in a time period consistent with the detection of potential PWSCC cracks, and with appropriate examination techniques. We agree with the staff that the applicant has demonstrated that the effects of aging for these components will be adequately managed.

The staff is concerned that for Alloy 600 tubesheet cladding, autogenous welds may not have sufficient PWSCC resistance, even when tubes are made of Alloy 690. The applicant has committed to developing a plan prior to the period of extended operation, to exercise one of two options: 1) Perform an analytical evaluation of the tube-tubesheet region to establish the technical basis for this boundary being maintained even if cracked, and to demonstrate that the weld is not needed for reactor coolant pressure boundary integrity; or 2) Perform a one-time inspection of a representative number of welds in each steam generator. If cracking is identified, cracks will be evaluated or repaired and aging management inspections will be performed for the remaining life of the steam generators. We agree with the staff that this plan should be effective in managing this aging issue.

The applicant has chosen to address environmentally assisted fatigue by demonstrating that the cumulative usage factor (CUF) at the most sensitive locations will remain below 1.0 throughout the period of extended operation, considering both mechanical and environmental effects. Analyses were performed by the applicant. These analyses showed that the CUF at all analyzed locations will remain below 1.0 throughout the period of extended operation. However, the staff challenged the methodology used by the applicant because this methodology does not consider the full stress state on the component. At the request of the staff, the applicant performed additional analyses. These analyses confirmed that the CUF will not exceed 1.0 during the period of extended operation. The applicant also restricted consideration of environmental effects to those locations identified in NUREG/CR-6260. The staff requested that the applicant review its design to confirm that these are the most limiting locations in its plant. The applicant agreed with this request. We concur with this process.

Following issuance of the SER, the applicant submitted commitments that expand the scope and means to detect aging effects in several license renewal programs. The most significant are those summarized below.

The staff has identified industry operating experience which indicates that power cables energized to 480V and higher can experience failures where extended exposure to moisture is a contributing factor. The Inaccessible Medium Voltage Cable Program in Revision 1 to the GALL Report does not recommend testing for inaccessible cables energized to less than 2kV and does not require testing of inaccessible cables that are not normally energized. Although KPS has not experienced any 480V to 35kV power cable failures due to aging, DEK has addressed the staff's concerns by expanding the scope of the Medium Voltage Power Cable Program to include all inaccessible 480V to 2kV power cables, energized and not. This expanded scope of cable monitoring is consistent with the draft Final Revision 2 of the GALL Report we recently reviewed.

The staff has concluded that external visual inspections do not provide adequate assurance that cracking is not present at the internal radius of socket welds in Class 1 small bore piping systems. There are currently no approved industry standard methods or qualified techniques to

perform volumetric examinations of these welds. The KPS operating experience indicates that cracking has not occurred in any small bore socket welds. Nevertheless, in addition to visual inspections, DEK will perform volumetric examinations of ten Class 1 socket welds for the period of extended operation. If no industry demonstrated technique is available at the time of inspection, the applicant will perform destructive examinations of at least five socket welds in lieu of volumetric examinations. These commitments provide reasonable assurance that this issue will be adequately addressed.

The staff has noted a number of recent industry events involving leakage from buried and underground piping and tanks within the scope of license renewal. KPS has never experienced a piping failure of in-scope piping; but the circulating water, fire protection, and diesel fuel oil systems have a significant amount of buried piping. Buried steel piping is coated, and recent inspections of excavated fire protection and diesel generator fuel oil piping demonstrate that coatings are in very good condition, with appropriate backfill. The applicant has committed to continue to periodically inspect components in a vault below grade. KPS will maintain availability of cathodic protection of the buried portions of the circulating water system and 400 feet of buried fuel oil piping at least 90 percent of the time. National Association of Corrosion Engineers (NACE) surveys of cathodic protection will be conducted during the period of extended operation. Visual inspections will be performed on portions of all buried piping and one of the three fuel oil storage tanks within each 10 year period starting 10 years prior to the period of extended operation. The staff has concluded that, with these enhancements, the proposed program will adequately monitor and manage the aging of buried piping and tanks. We agree with this conclusion.

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 license for KPS. The programs established and committed to by DEK provide reasonable assurance that KPS can be operated in accordance with its current licensing basis for the period of extended operation without undue risk to the health and safety of the public. The DEK application for renewal of the operating license for KPS should be approved.

Sincerely,

*/RA/*

Said Abdel-Khalik  
Chairman

References:

1. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report Related to the License Renewal of Kewaunee Power Station," November 2010 (ML103090024)
2. Letter from David A. Christian, dated August 12, 2008, "Dominion Energy Kewaunee, Inc. (DEK) Kewaunee Power Station Application for Renewed Operating License" (ML082341020)
3. Letter from Ann Marie Stone dated November 12, 2009, "Kewaunee Power Station - NRC License Renewal Scoping, Screening, and Aging Management Inspection Report 05000305/2009007" (ML093160727)
4. Letter from Samuel Hernandez dated August 12, 2009, "AMP Audit Report Regarding the Kewaunee Power Station License Renewal Application" (ML091900449)
5. Letter from Samuel Hernandez dated December 14, 2009, "Work Control Process Aging Management Program Audit Report Regarding the Kewaunee Power Station License Renewal Application" (ML093260003)
6. Letter from Samuel Hernandez dated July 13, 2009, "Scoping and Screening Audit Report Regarding the Kewaunee Power Station License Renewal Application" (ML091900081)
7. Letter from J. Alan Price dated October 20, 2010, "Dominion Energy Kewaunee, Inc. Kewaunee Power Station Supplemental Information for the Review of the Kewaunee Power Station License Renewal Application" (ML102930573)
8. Letter from J. Alan Price dated November 9, 2010, "Dominion Energy Kewaunee, Inc. Kewaunee Power Station Supplemental Information for the Review of the Kewaunee Power Station License Renewal Application" (ML103130472)
9. Letter from J. Alan Price dated November 23, 2010, "Dominion Energy Kewaunee, Inc. Kewaunee Power Station Supplemental Information for the Review of the Kewaunee Power Station License Renewal Application" (ML103270580)
10. Memorandum from B. Pham dated December 17, 2010, "Advisory Committee Reactor Safeguards Review of the Kewaunee Power Station License Renewal Application – Safety Evaluation Report (ML103500555)

References:

1. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report Related to the License Renewal of Kewaunee Power Station," November 2010 (ML103090024)
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Letter to the Honorable Gregory B Jaczko, Chairman, NRC, from Said Abdel-Khalik, Chairman, ACRS, dated January 7, 2011

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