



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

ACRSR-2091

September 16, 2004

The Honorable Nils J. Diaz
Chairman
U.S. Nuclear Regulatory Commission
Washington, DC 2005-0001

**SUBJECT: REPORT ON THE SAFETY ASPECTS OF THE LICENSE RENEWAL
 APPLICATION FOR THE DRESDEN 2 AND 3 AND QUAD CITIES 1 AND 2
 NUCLEAR POWER STATIONS**

Dear Chairman Diaz:

During the 515th meeting of the Advisory Committee on Reactor Safeguards, September 9-11, 2004, we completed our review of the license renewal application for Dresden Units 2 and 3 and Quad Cities Units 1 and 2 Nuclear Power Stations and the final Safety Evaluation Report (SER) prepared by the NRC staff. Our Plant License Renewal Subcommittee also reviewed this matter during a meeting on April 14, 2004. During our review, we had the benefit of discussions with representatives of the NRC staff and Exelon Generation Company, LLC (Exelon). We also had the benefit of the documents referenced.

RECOMMENDATIONS AND CONCLUSION

1. With the inclusion of the conditions in Recommendations 2 and 3, the application for license renewal for Dresden Units 2 and 3 and Quad Cities Units 1 and 2 should be approved.
2. The staff should require that, prior to entering the period of extended operation, Exelon conduct an evaluation to ensure that operating experience at extended power uprate (EPU) levels is properly addressed by the aging management programs. The staff should review and approve this evaluation.
3. The steam dryers should be included in the scope of license renewal for Dresden and Quad Cities.
4. The staff should develop guidance to apply Recommendations 2 and 3 to future boiling water reactor (BWR) license renewal applications.

BACKGROUND AND DISCUSSION

This report fulfills the requirement of 10 CFR 54.25, which states that the ACRS review and report on all license renewal applications. Dresden Units 2 and 3 and Quad Cities Units 1 and 2 are General Electric BWR/3 plants, with Mark 1 containments. Exelon requested renewal of their operating licenses for 20 years beyond the current license terms, which expire on December 22, 2009, for Dresden Unit 2 and January 12, 2011, for Dresden Unit 3, and

December 14, 2012, for both Quad Cities units. The Dresden units were designed with isolation condensers for core isolation cooling whereas the Quad Cities units have the more typical reactor core isolation cooling system. The Dresden units have a separate shutdown cooling system whereas Quad Cities units have the more typical arrangement in which shutdown cooling is achieved as an operational mode of the residual heat removal system.

Dresden Units 2 and 3 share the site and surrounding areas with Unit 1, a dual-cycle BWR that has been placed in a safe storage condition until Units 2 and 3 are ready for decommissioning. Unit 1 systems, structures, and components (SSCs) which support the operation of Units 2 and 3 are included in the scope of license renewal.

The final SER documents the staff's review of the information submitted by Exelon, including commitments that were necessary to resolve open items identified by the staff in the initial SER. The staff reviewed the completeness of the applicant's identification of 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; and the identification and assessment of time-limited aging analyses (TLAAs) requiring review.

The staff also conducted several inspections at Exelon's engineering offices and at the Dresden and Quad Cities sites to verify the adequacy and implementation of the methodology described in the application. During our Plant License Renewal Subcommittee meeting on April 14, 2004, the staff presented a well structured and effective overview of its inspections and audits.

Dresden and Quad Cities have been approved for an EPU to 2957 MWt. The EPU increased power output by 17% at both Dresden units and 17.8% at both Quad Cities units. Shortly after operating at the EPU level, Quad Cities Unit 2 experienced unexpected high moisture carryover, which was caused by a damaged steam dryer. The applicant repaired the dryer and the unit was returned to service. Shortly thereafter, similar damage was identified in Unit 1 and then again in Unit 2. The applicant has since chosen to operate Quad Cities Units 1 and 2 at pre-EPU power levels until the root cause of the dryer damage can be determined.

Dresden and Quad Cities have limited operating time at the EPU levels and during that period, several problems believed to be associated with the EPU have occurred at Quad Cities. Most notable is the steam dryer damage, but other problems with limit and pressure switches have also occurred. After operation at the higher power level (2957 MWt), but prior to entering the period of extended operation, the staff should require that the applicant conduct an evaluation of operating experience at all four units and at other plants operating at EPU levels, to ensure that this experience has been properly addressed by the aging management programs. The staff should review and approve this evaluation.

Such an evaluation should be required of all license renewal applicants that plan to operate during the license renewal period at EPU levels that are substantially higher than experienced in the bases supporting their license renewal applications. Such an evaluation is consistent with the intent of 10 CFR 54.17(c) that substantial operating experience be reflected in the bases supporting the license renewal application. Current operating experience at EPU levels is limited and an understanding of the impact of operation at such levels on plant components is only now beginning to develop. A recent BWR Owners Group (BWROG) survey of EPU plants has identified component failures, potential decreases in time between failures, unexpected

increases in component wear, and a significant number of events, which are all directly attributable to EPU. It is therefore important that the staff require, after sufficient plant-specific operating experience is available at the EPU level but before entering the period of extended operation, that license renewal applicants ensure applicable operating experience at EPU levels has been properly addressed by aging management programs. The staff should also provide guidance in this area.

During our review, we questioned why certain SSCs were not included in the scope and, in all but one case, the applicant provided appropriate justification for the exclusions. That case was the steam dryers at these plants. Although the dryers are not safety related, structural failure at Quad Cities caused pieces to pass down the main steamlines and some of these pieces were found on the turbine stop valve screens. These pieces passed through the Main Steam Isolation Valves (MSIVs), which are safety related components, and could have caused these valves to fail to operate properly. Since the MSIVs are safety related, this meets the criteria for inclusion of the steam dryers in the scope of license renewal in accordance with 10 CFR 54.4(a)(2). The steam dryers at Dresden and Quad Cities should be included in scope even if an analysis demonstrates that future failures are unlikely. Further, steam dryers for all BWRs seeking license renewal should be within scope based on 10 CFR 54.4(a)(2). The staff should develop guidance on this topic so that the NRC position on this matter is clearly understood by the industry.

The applicant performed a comprehensive aging management review of all SSCs that are within the scope of license renewal. The application describes 48 aging management programs for license renewal, which include existing, augmented, and new programs. As with other applicants, we encouraged Exelon to establish a schedule for implementing license renewal commitments well ahead of the beginning of the license renewal period to preclude placing an unreasonable demand on applicant and NRC resources.

Aging degradation of reactor vessel internals has been an ongoing problem in BWRs. The applicant has committed to programs developed by the BWR Vessel and Internals Project (BWRVIP) to manage these problems. We questioned if the clamping device installed in 1995 to mitigate core shroud cracking had been evaluated for the period of extended operation. The applicant has committed to follow the BWRVIP-76 program, as approved by the staff, to manage aging effects on the core shroud and other hardware. The staff is currently reviewing this program and will evaluate the adequacy of the recommended inspection intervals in light of the accumulating evidence of fluence, strength, and surface effects on cracking of (for example) 316L and the lack of comparable data for XM-19 and X750.

In 1994, Dresden experienced a failure due to corrosion of the carbon steel piping to the instrument air receiver. We questioned whether this corrosion was an ongoing aging effect. The staff responded that this piping has been replaced with stainless steel and that the air receiver was replaced with one having epoxy coating applied to the interior. The moisture separator drain trap was also modified. These modifications should reduce moisture accumulation and corrosion. The applicant has also instituted a periodic blowdown program and no subsequent failures have occurred.

In the license renewal application, Exelon has identified the components that are supported by TLAA. Their review of the TLAA shows that the analyzed components have sufficient margin to operate for the period of extended operation.

We reviewed the Reactor Vessel Upper Shelf Energy for limiting plates and welds for all four units. All are acceptable for the period of extended operation, including the most limiting weld at Quad Cities Unit 2, which was found acceptable based on a plant-specific equivalent margins analysis. We are satisfied with the staff's review of the applicant's data and calculations.

The staff is currently reviewing BWRVIP-116, "BWR Integrated Surveillance Program Implementation for License Renewal." The applicant has agreed to a license condition to notify the NRC, before entering the period of extended operation, of their decision to implement either the staff-approved BWRVIP integrated surveillance program (ISP) or a staff-approved plant-specific ISP.

On the basis of our review of the final SER, we agree with the staff's conclusion that all open and confirmatory items have been appropriately closed. We also concur with all three license conditions requiring the applicant to take certain actions before beginning the period of extended operation.

With the inclusion of commitments to perform an evaluation of operating experience at the EPU levels before entering the period of extended operation and to include steam dryers in the scope of license renewal, the application for license renewal for Dresden Units 2 and 3 and Quad Cities Units 1 and 2 should be approved.

Sincerely

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Mario V. Bonaca
Chairman

References:

1. U.S. Nuclear Regulatory Commission, "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," July 2004.
2. Exelon Generation Company, "License Renewal Application for Dresden Nuclear Power Station (DNPS), Units 2 and 3, and Quad Cities Nuclear Power Station (QCNPS), Units 1 and 2," January 2003.
3. U.S. Nuclear Regulatory Commission, "Safety Evaluation Report with Open Items Related to the License Renewal of the Dresden Nuclear Power Station, Unit 2 and 3 and Quad Cities Nuclear Power Station, Unit 1 and 2." February 2004.
4. U.S. Nuclear Regulatory Commission Inspection Reports 50-237,249/03-04 and 50-254,265/03-04, NRC License Renewal Scoping/Screening Inspection Report, September 15, 2003.
5. U.S. Nuclear Regulatory Commission Inspection Report 50-237,249/03-10, NRC Aging Management Program Inspection Report, December 5, 2003.
6. U.S. Nuclear Regulatory Commission Inspection Report 50-254,265/03-14, NRC Aging Management Program Inspection Report, December 5, 2003.
7. Electric Power Research Institute, "BWR Vessel and Internals Project BWR Core Shroud Inspection and Flaw Evaluation Guidelines (BWRVIP-76)," January 2000.
8. Electric Power Research Institute, "BWRVIP-116: BWR Vessel and Internals Project Integrated Surveillance Program (ISP) Implementation for License Renewal," July 2003.

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7. Electric Power Research Institute, "BWR Vessel and Internals Project BWR Core Shroud Inspection and Flaw Evaluation Guidelines (BWRVIP-76)," January 2000.
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