



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

ACRSR-2224

November 17, 2006

The Honorable Dale E. Klein  
Chairman  
U. S. Nuclear Regulatory Commission  
Washington, DC 20555-0001

Subject: REPORT ON THE SAFETY ASPECTS OF THE LICENSE RENEWAL  
APPLICATION FOR THE PALISADES NUCLEAR POWER PLANT

Dear Chairman Klein:

During the 537<sup>th</sup> meeting of the Advisory Committee on Reactor Safeguards, November 1-3, 2006, we completed our review of the license renewal application for the Palisades Nuclear Plant (PNP) 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 July 11, 2006. During our review, we had the benefit of discussions with representatives of the NRC staff and the applicant, Nuclear Management Company, LLC (NMC). In addition, we had the benefit of input from the public. 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**

The programs established and committed to by the applicant to manage age-related degradation provide reasonable assurance that PNP 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 NMC application for renewal of the operating license for PNP should be approved. Continued operation during the entire period of extended operation is contingent on the resolution of the issues associated with three Time-Limited Aging Analyses (TLAAs) related to reactor pressure vessel (RPV) integrity.

## **BACKGROUND AND DISCUSSION**

PNP is a Combustion Engineering 2-loop pressurized water nuclear plant with a large, dry, ambient-pressure containment. PNP is located five miles south of South Haven, Michigan, on the eastern shore of Lake Michigan. The current power rating of the PNP

is 2566 MWt, for a gross electrical output of 767 MWe. PNP was originally licensed to operate on February 21, 1971. NMC requested renewal of the PNP operating license for 20 years beyond the current license term, which expires on February 20, 2011.

In the final SER, the staff documented its review of the license renewal application and other information submitted by NMC and obtained during the audit and 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 TLAAs requiring review.

The NMC application is largely consistent with NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," issued in July 2001. All deviations from the GALL Report are documented in the application. The applicant identified the SSCs that fall within the scope of license renewal and performed a comprehensive aging management review for these SSCs. Based on the results of this review, the applicant will implement 24 AMPs for license renewal including existing, enhanced, and new programs. In the final SER, the staff concluded that the applicant has appropriately identified the SSCs within the scope of license renewal and that the AMPs described by the applicant are appropriate and sufficient to manage aging of long-lived passive components that are within the scope of license renewal. We concur with this conclusion.

The staff conducted an inspection and an audit. The inspection verified that the scoping and screening methodologies are consistent with the regulations and are adequately reflected in the application. The audit verified the appropriateness of the AMPs and the aging management reviews. Based on the inspection and audit, the staff concluded that these programs are consistent with the descriptions contained in the NMC license renewal application. The staff also concluded that the existing programs, to be credited as AMPs for license renewal, are generally functioning well and that an implementation plan has been established in the applicant's commitment tracking system to ensure timely completion of the license renewal commitments.

During our meetings with the staff and the applicant, we discussed the adequacy of programs proposed by NMC to manage aging of certain components that are projected to exceed acceptance limits during the period of extended operation.

The applicant identified the systems and components requiring TLAAs and reevaluated them for 20 additional years of operation. As required by 10 CFR Part 54, the applicant must identify any exemptions granted under 10 CFR 50.12 which rely on a TLAA and

determine if that exemption should be continued for an additional 20 years of operation. No such exemption currently exists in the PNP licensing basis. The applicant reexamined 23 TLAAAs. All of these TLAAAs are valid, without restriction, for 20 more years of operation, except for three TLAAAs associated with reactor vessel neutron embrittlement, namely: reactor vessel upper shelf energy, reactor vessel pressurized thermal shock, and reactor vessel pressure-temperature curves. In each of these cases, PNP will exceed the acceptance limits prior to the end of the extended period of operation.

To analyze the reactor vessel neutron fluence for purposes of RPV integrity evaluations, the applicant uses the methodology described in WCAP-15353, which is consistent with Regulatory Guide 1.190.

The applicant began using low neutron leakage cores in 1988 to reduce the neutron embrittlement of the reactor vessel to extend the time before exceeding the acceptance limits. However, the applicant predicts that the following acceptance limits will be exceeded:

- Upper Shelf Energy limit – exceed in 2021.
- Reactor Vessel Pressurized Thermal Shock (PTS) screening criterion – exceed in 2014.
- Pressure-Temperature limit curves – expire in 2014.

The staff's confirmatory calculations show reasonable agreement with the applicant's findings.

Upper Shelf Energy Limit. The applicant predicts this criterion will be exceeded in 2021. Appendix G of 10 CFR 50 requires RPV beltline materials to have Charpy upper shelf energy values no less than 50 ft-lb in the transverse direction in the base metal and along a weld for weld material. However, in accordance with Appendix G, Charpy upper shelf energy values below 50 ft-lb may be acceptable if it is demonstrated that lower Charpy upper shelf energy values will provide margins of safety against fracture (ductile tearing) equivalent to those required by ASME Code, Section XI, Appendix G. Regulatory Guide 1.99 describes two acceptable methods for determining the upper shelf energy values for RPV beltline materials.

Because the reactor vessel upper shelf energy limit will be exceeded prior to the end of the extended period of operation, the applicant must provide an analysis in accordance with 10 CFR Part 50, Appendix G at least three years prior to exceeding the upper shelf energy limit.

PTS Screening Criterion. The applicant predicts the criterion for axial welds and plates will be exceeded in 2014. 10 CFR 50.61 provides the fracture toughness requirements for protecting reactor vessels from the effects of PTS events. The end of life reference temperature ( $RT_{PTS}$ ) value is the sum of a reference value for an unirradiated material, a shift in the reference value caused by exposure to high-energy neutron irradiation, and an additional margin to account for uncertainties.

If an applicant determines that the RPV will not meet the PTS screening criterion through the end of the facility's current license term, several actions must be taken. 10 CFR 50.61(b)(3), requires that an applicant implement a reasonably practicable flux reduction program in an effort to avoid exceeding the PTS screening criterion. If no reasonably practicable flux reduction program will meet this objective (as is true in the case of PNP) the applicant has several options. The applicant may submit a safety analysis in accordance with 10 CFR 50.61(b)(4) to demonstrate that the RPV can be operated beyond the 10 CFR 50.61 screening criterion. This safety analysis may include plant modifications. Such an analysis must be submitted three years prior to the time the RPV is projected to exceed the PTS screening criterion. In accordance with 10 CFR 50.61(b)(7), the applicant could propose to anneal the RPV in order to improve its material properties and permit continued operation. In accordance with 10 CFR 50.66, the applicant's thermal annealing plan would have to be submitted three years prior to when the facility's RPV is projected to exceed the PTS screening criterion.

Pressure-Temperature Limit Curves. Pressure-temperature limit curves are contained in the PNP technical specifications and are assessed against the limits in 10 CFR 50.60, Appendix G to 10 CFR 50, and Appendix G to Section XI of the ASME Code. The current pressure-temperature limits approved by the staff are valid beyond the current license term, but not through the extended period of operation. Based on the neutron fluence expected to be accumulated, the pressure-temperature limit curves will expire in 2014. Prior to entering the period of extended operation, the applicant must submit an amendment requesting a technical specification change and approval of new limits covering the period of extended operation beyond 2014.

The staff has concluded that the applicant has provided an adequate list of TLAAAs. Further, the staff has concluded that the applicant has met the license renewal rule by demonstrating that the TLAAAs have been projected to the end of the period of extended operation. In those cases where the current TLAAAs do not cover the entire period of extended operation, the applicant must provide additional information in a timely manner and submit a license amendment for a technical specification change to extend these three TLAAAs to cover the entire period of extended operation. We concur with the staff that the applicant has properly identified the applicable TLAAAs, reviewed the

associated analyses and licensing bases, and identified those instances where additional measures are needed to modify the TLAAs to cover the entire period of extended operation. We concur with the staff's conclusions and the resulting license conditions and commitments.

During our Plant License Renewal Subcommittee meeting on July 11, 2006, members of the Public provided comments and raised several questions. These comments and questions were recorded and are contained in the transcript of that meeting. The reference to the transcript that contains these comments and questions was provided to the Executive Director for Operations. Subsequently, the staff has responded to these questions and comments.

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 PNP. The programs established and committed to by NMC provide reasonable assurance that PNP 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. Continued operation during the entire period of extended operation is contingent on the resolution of the issues associated with three TLAAs related to RPV integrity. The NMC application for renewal of the operating license for PNP should be approved.

Sincerely,

**/RA/**

Graham B. Wallis  
Chairman

References:

1. Safety Evaluation Report Related to the License Renewal of the Palisades Nuclear Power Plant, September 2006.
2. Palisades Nuclear Power Plant - Application for Renewed Operating Licenses, March 22, 2005
3. Safety Evaluation Report with Open Items Related to the License Renewal of the Palisades Nuclear Power Plant, June 2006
4. Audit and Review Report for Plant Aging Management Reviews and Programs (AMPs) (AMRs) - Palisades Nuclear Power Plant, October 20, 2005
5. Palisades Nuclear Power Plant, Inspection Report 05000255/2005009, December 28, 2005
6. Memorandum dated September 13, 2006, from John T. Larkins, Executive Director, ACRS, to Luis A. Reyes, Executive Director for Operations, Subject: Questions Raised by Members of the Public During the ACRS Subcommittee Meeting on Palisades Nuclear Plant License Renewal Application
7. Regulatory Guide 1.99 Revision 2, Radiation Embrittlement of Reactor Vessel Materials, May 1988
8. Regulatory Guide 1.190, Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence, March 2001
9. Palisades Reactor Pressure Vessel Fluence Evaluation, WCAP-15353, January 2000