Entergy

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PNP 2013-028

October 21, 2013

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

SUBJECT: Palisades Nuclear Plant 10 CFR 50 Appendix G Equivalent Margins Analysis

Palisades Nuclear Plant
Docket 50-255
License No. DPR-20

REFERENCES:
1. Palisades Nuclear Plant, Application for Renewed Operating License, dated March 22, 2005 (ADAMS Accession No. ML050940446)
2. Palisades Nuclear Plant, License Amendment Request for Primary Coolant System Pressure-Temperature Limits, dated March 7, 2011 (ADAMS Accession No. ML110730082)

Dear Sir or Madam:

In the Palisades Nuclear Plant (PNP) license renewal application (Reference 1), Nuclear Management Company (NMC), the former license holder for PNP, committed to submit an equivalent margins analysis (EMA) for Nuclear Regulatory Commission (NRC) approval at least three years before any reactor vessel beltline material Charpy upper-shelf energy (USE) decreases to less than 50 ft-lb, in accordance with 10 CFR 50 Appendix G, Section IV, "Fracture Toughness Requirements."

The EMA is to demonstrate that material predicted to possess Charpy USE values less than 50 ft-lb will provide margins of safety against fracture equivalent to those required by Appendix G of Section XI of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code.

As documented in the PNP license amendment request for primary coolant system pressure-temperature limits (Reference 2), a plate material and a weld material in the PNP reactor vessel traditional beltline region are predicted to drop below the Appendix G 50 ft-lb screening criterion prior to the PNP end-of-license-extension

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(EOLE). The lower shell (LS) plate material, D-3804-1, is predicted to drop below the screening criterion in December 2016 and the intermediate shell (IS) to LS circumferential weld material, 9-112 (heat no. 27204), is predicted to drop below the criterion in November 2027.

As documented in WCAP-17403-NP (Attachment 1), the Charpy USE of an upper shell (US) plate material, D-3802-3, in the reactor vessel extended beltline region is predicted to remain above the 50 ft-lb Appendix G screening criterion at EOLE when considering an initial Charpy USE value based on a curve-fit of the available Charpy V-Notch data. However, this material is predicted to drop below the Appendix G screening criterion, to 47.5 ft-lb at EOLE, when considering an initial Charpy USE value based only on the available 95% shear Charpy V-Notch data for this material.

The remaining beltline and extended beltline materials in the reactor vessel are projected to maintain above the Charpy USE screening criterion of 50 ft-lb at EOLE.

The results of the fluence calculations for the extended beltline region materials of the PNP reactor vessel are provided in Table E-2 of WCAP-15353 – Supplement 2 – NP (Attachment 2). Supplement 2 was generated to address the neutron fluence experienced by materials located in the extended beltline regions above and below the reactor core that were not included in either Revision 0 of WCAP-15353 or in Supplement 1 of that report.

In accordance with 10 CFR 50 Appendix G, this letter transmits for NRC review and approval the EMA report WCAP-17651-NP (Attachment 3) for the two traditional beltline and one extended beltline reactor vessel materials discussed above. Extended beltline US plate material D-3802-3 was analyzed due to the possibility that it may fall below the 50 ft-lb limit if future operation includes higher flux levels, longer operating cycles, or changes to the reactor internals. The analysis of the three materials used the equivalent margins methodology specified in ASME Code Section XI, Division 1, Appendix K, "Assessment of Reactor Vessels with Low Upper Shelf Charpy Impact Energy Levels," and concluded that all three of the reactor vessel materials are acceptable.

The work described herein was performed in accordance with industry and NRC accepted practices.

The extended beltline regions of the reactor pressure vessel with EOLE neutron fluence (E > 1.0 MeV) greater than 1.0 E+17 n/cm^2 have been included in the extended beltline evaluation in WCAP-17403-NP (Attachment 1). Figure 1-2 of the evaluation illustrates the boundary of the extended beltline region with neutron fluence in excess of 1.0 E+17 n/cm^2. It is noted that the neutron fluence for the inlet and outlet nozzles remain below 1.0 E+17 n/cm^2 at EOLE. The evaluation of these regions concluded that the materials are predicted to remain below the pressurized thermal shock screening criteria and the traditional beltline materials remain limiting. Also, all adjusted

reference temperature values are predicted to remain below those contained in the analysis of record, so the pressure-temperature limit curves and low temperature overpressure protection (LTOP) setpoint limit curve continue to be governed by the traditional beltline materials.

The fluence evaluation in WCAP-15353 – Supplement 2 – NP (Attachment 2) used to assess the material properties is compliant with Regulatory Guide 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence." Previous PNP reactor pressure vessel neutron fluence evaluation submittals have been reviewed and approved by the NRC as being consistent with the requirements of Regulatory Guide 1.190. The methodology used for the WCAP-15353 fluence evaluation is detailed in

- WCAP-14040-NP-A, Revision 4, "Methodology Used to Develop Cold Overpressure Mitigating System Setpoints and RCS Heatup and Cooldown Limit Curves," and

- WCAP-16083-NP-A, Revision 0, "Benchmark Testing of the FERRET Code for Least Squares Evaluation of Light Water Reactor Dosimetry,"

which have been previously reviewed and approved by the NRC.

The EMA in WCAP-17651-NP is based upon ASME Code Section XI, Division 1, Appendix K, but has been supplemented with additional criteria specified in Regulatory Guide 1.161, "Evaluation of Reactor Pressure Vessels with Charpy Upper-Shelf Energy Less Than 50 Ft-Lb," for material fracture toughness, transients, and fracture toughness resistance (J-R) model restrictions on sulfur content.

The USE values in the EMA have been matched to the proper orientation of the plate material. For axial flaws, the USE value for the lateral transverse "strong" orientation in the vessel wall has been used. Similarly, for circumferential flaws, the USE value for the transverse-lateral "weak" orientation has been used. In addition, the initial longitudinal USE values have been reduced to 65 percent per NUREG-0800 Branch Technical Position 5-3, "Fracture Toughness Requirements," to approximate the transverse "weak" direction.

Per Regulatory Guide 1.161, three additional cooldown transients at 100 °F/hr, 400 °F/hr, and 600 °F/hr have been considered in the EMA.

As discussed in the EMA, extended beltline plate material D-3802-3 and traditional beltline plate material D-3804-1 have sulfur content in excess of the J-R model 0.018 weight percent limitation. Additional analysis has been conducted using available information for the V-50 plate in NUREG/CR-5265, "Size Effects on J-R Curves for A 302-B Plate," to demonstrate that the PNP reactor vessel high sulfur plate materials

remains below the measured very conservative lower bound V-50 A-302 B plate J-R data.

Attachments 1, 2 and 3 contain no proprietary information.

ENO requests approval of the enclosed EMA by October 21, 2014.

Summary of Commitments

This letter contains no new commitments and no revisions to existing commitments. This letter completes the following commitment:

"NMC will submit an equivalent margins analysis, completed in accordance with 10 CFR 50 Appendix G Section IV.A.1, for NRC approval, at least three years before any reactor vessel beltline material upper shelf energy decreases to less than 50 ft-lb."

I declare under penalty of perjury that the foregoing is true and correct. Executed on October 21, 2013.

Sincerely,

ajv/jse

Attachments:
1. Westinghouse WCAP-17403-NP, Revision 1, "Palisades Nuclear Power Plant Extended Beltline Reactor Vessel Integrity Evaluation"
2. Westinghouse, WCAP-15353 – Supplement 2 – NP, Revision 0, "Palisades Reactor Pressure Vessel Fluence Evaluation"
3. Westinghouse WCAP-17651-NP, Revision 0, "Palisades Nuclear Power Plant Reactor Vessel Equivalent Margins Analysis"

cc: Administrator, Region III, USNRC
Project Manager, Palisades, USNRC
Resident Inspector, Palisades, USNRC