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NLS2012062
September 10, 2012

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555-0001

Subject: Response to Request #2 for Additional Information Re: License Amendment Request to Revise Technical Specification 3.4.9, "RCS Pressure and Temperature (P/T) Limits" (TAC NO. ME7324)
Cooper Nuclear Station, Docket No. 50-298, DPR-46

References:

1. Letter from Lynnea E. Wilkins, U.S. Nuclear Regulatory Commission, to Brian J. O'Grady, Nebraska Public Power District, dated August 10, 2012, "Cooper Nuclear Station – Request for Additional Information Re: License Amendment Request to Revise Technical Specification 3.4.9, 'RCS Pressure and Temperature (P/T) Limits' (TAC No. ME7324)"

2. Letter from Brian J. O'Grady, Nebraska Public Power District, to U.S. Nuclear Regulatory Commission, dated September 22, 2011, "License Amendment Request to Revise Technical Specification Pressure/Temperature Limit Curves and Surveillance Requirements" (NLS2011015)

Dear Sir or Madam:

The purpose of this letter is for Nebraska Public Power District (NPPD) to submit a response to a request for additional information (RAI) from the Nuclear Regulatory Commission (NRC) (Reference 1). The RAI requested information in support of NRC's review of a license amendment request (LAR) for the Cooper Nuclear Station (CNS) facility operating license to revise Technical Specification Pressure/Temperature Limit Curves and Surveillance Requirements (Reference 2).

Responses to the specific RAI questions are provided in the Attachment. Two regulatory commitments are made in Response #2 to resubmit the curves without the analysis of the P/T nozzles by September 30, 2012 as a supplement to this LAR. Then later, after NRC approval of the generic methodology for nozzles, NPPD will submit another LAR to revise the curves considering the nozzles.

The information submitted by this response to the RAI does not change the conclusions or the basis of the no significant hazards consideration evaluation provided with Reference 2.

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NRR

If you have any questions concerning this matter, please contact David Van Der Kamp, Licensing Manager, at (402) 825-2904.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on 9/10/12
(date)

Sincerely,

Brian J. O'Grady
Vice President – Nuclear and
Chief Nuclear Officer

/em

Attachment: Response to Nuclear Regulatory Commission Request for Additional Information Re: Technical Specification 3.4.9, "RCS Pressure and Temperature (P/T) Limits" (TAC NO. ME7324)

cc: Regional Administrator w/ attachment
USNRC - Region IV

Cooper Project Manager w/ attachment
USNRC - NRR Project Directorate IV-1

Senior Resident Inspector w/ attachment
USNRC - CNS

Nebraska Health and Human Services w/ attachment
Department of Regulation and Licensure

NPG Distribution w/o attachment

CNS Records w/ attachment

Attachment

Response to Nuclear Regulatory Commission Request for Additional Information Re: Technical Specification 3.4.9, "RCS Pressure and Temperature (P/T) Limits" (TAC NO. ME7324)

Cooper Nuclear Station, Docket No. 50-298, DPR-46

NRC Question #1

The regulations in Title 10 of the Code of Federal Regulations (10 CFR) Part 50, Appendix G, "Fracture Toughness Requirements," state, in part, that

> *This appendix specifies fracture toughness requirements for ferritic materials of pressure-retaining components of the reactor coolant pressure boundary of light water nuclear power reactors to provide adequate margins of safety ...*

In addition, 10 CFR Part 50, Appendix G, paragraph IV.A states, in part, that

> *The pressure-retaining components of the reactor coolant pressure boundary that are made of ferritic materials must meet the requirements of the ASME Code [American Society of Mechanical Engineers Boiler and Pressure Vessel Code], supplemented by the additional requirements set forth below [paragraph IV.A.2, "Pressure-Temperature Limits and Minimum Temperature Requirements"] ...*

Therefore, 10 CFR Part 50, Appendix G requires that P-T limits be developed for the entire reactor coolant pressure boundary (RCPB), consisting of ferritic RCPB materials in the reactor vessel (RV) beltline (neutron fluence $\geq$ 1 x 10^{17} n/cm^2, E> 1 MeV), as well as ferritic RCPB materials not in the RV beltline (neutron fluence < 1 x 10^{17} n/cm^2, E> 1 MeV).

P-T limit calculations for ferritic RCPB components that are not RV beltline shell materials, may define curves that are more limiting than those calculated for the RV beltline shell materials. This may be due to the following factors:

a. *RV nozzles, penetrations, and other discontinuities have complex geometries that may exhibit significantly higher stresses than those for the RV beltline shell region. These higher stresses can potentially result in more restrictive P-T limits, even if the reference temperature (RT_{NDT}) for these components is not as high as that of RV beltline shell materials that have simpler geometries.*

b. *Ferritic RCPB components that are not part of the RV may have initial RT_{NDT} values, which may define a more restrictive lowest operating temperature in the P-T limits than those for the RV beltline shell materials.*

Please describe how the P-T limit curves, and the methodology used to develop these curves considered all RV materials (beltline and non-beltline) and the lowest service temperature of all ferritic RCPB materials, consistent with the requirements of 10 CFR Part 50, Appendix G.

Response #1

Nebraska Public Power District (NPPD) calculates the fluence for the reactor vessel plates and welds in accordance with the BWRVIP RAMA code for 32 effective full power years (EFPYs). Then we develop Adjusted Reference Temperature (ART) and Reference Temperature Shift (ΔRT_{NDT}) values for the reactor pressure vessel plates and welds exposed to fluences greater than 1.0×10^{17} n/cm^2 in accordance with Regulatory Guide 1.99, Revision 2.

The analyzed Reactor Pressure Vessel (RPV) wall's local fracture toughness, at the postulated flaw location (1/4t), is determined from considerations of initial RT_{NDT}, local fluence, margins, and chemical composition. The ART is used to determine the fracture toughness described in ASME Code, Section XI, Appendix G.

Vessel nozzles are generally incorporated into P/T curve calculations using stress distributions from Finite Element Analyses and applying them to geometry specific fracture mechanics models. The feedwater nozzle (upper vessel region) and core differential pressure (CDP) nozzle require this type of analysis due to the bounding transients they experience and/or stress concentration effects. The core differential pressure CDP nozzle (bottom head region) is analyzed because it is the limiting discontinuity in the thin portion of the bottom head.

The feedwater nozzle is the bounding component in the upper vessel because it is a stress concentrator (essentially a hole in a plate) and because it typically experiences more severe thermal transients compared to the rest of the upper vessel region. A two-dimensional finite element model of the feedwater nozzle is created as described in Section 2.0 of the calculation. The stress distribution acting normal to the postulated ¼ thickness crack (or hoop stress distribution) due to a 1,000 psig unit pressure is obtained along a limiting path in the nozzle-to-RPV blend radius. Pressure stress coefficients are used to calculate the applied pressure stress intensity factor.

The material property values contained in the BWRVIP ISP are incorporated in the calculation where appropriate. The material properties documented in the calculation are considered to be the most recent based on the review of references and are considered to be most appropriate values for computation of ΔRT_{NDT} and ART. Since neither the feedwater nozzle nor the CDP nozzle experience fluences greater than 1.0×10^{17} n/cm^2, there is no calculation of ART for them.

In addition to the above, it is also recognized that P/T limits generated for the RPV also are considered to cover all portions of the Reactor Coolant System (RCS) piping. There are at least four reasons why the RPV P/T limits are considered to adequately bound fracture toughness requirements for the RCS piping: (1) the RPV is irradiated (thereby experiencing material degradation due to neutron embrittlement) whereas the RCS piping is not, (2) the philosophy behind the design codes used to evaluate the design of the RPV and piping generally recognize that the RPV is more limiting than the RCS piping from a structural standpoint, (3) much of the RCS piping is austenitic stainless steel, which has ductile behavior and does not experience the fracture concerns that ferritic material experiences, and (4) stresses are typically higher in the thicker-walled RPV than in the thin-walled RCS piping, which is less than 2.5 inches in thickness.

More detail on the calculation methodology can be found in Structural Integrity Associates calculation 1100445.303, Revision 0, "Revised P/T Curve Calculation", which was included in the submittal.

NRC Question #2

Linear Elastic Fracture Mechanics (LEFM) evaluation of the N16 Water Level Instrument Nozzles: The licensee's LAR submittal, which includes Structural Integrity Associates (SIA) calculation package 1100445.303, provides a reference to the generic LEFM methodology used for calculating the applied stress intensity factor values for the N16 instrument nozzles. For Cooper, the N16 nozzles define part of the bounding beltline region P-T curves at low temperatures.

The generic LEFM methodology for boiling-water reactor instrument nozzles, provided in SIA Report No. 0900876.401, Revision 0, "Linear Elastic Fracture Mechanics Evaluation of General Electric Boiling Water Reactor Water Level Instrument Nozzles for Pressure-Temperature Curve Evaluation," November 2011 (ADAMS Accession No. ML 11325A074), is currently under review by NRC staff. Please provide an alternate methodology for the stated instrument nozzles.

Response #2

NPPD will resubmit the curves without the analysis of the P/T nozzles by September 30, 2012. Since there is no currently approved methodology for addressing the instrument nozzles in the beltline region of a Boiling Water Reactor, NPPD will commit to providing new P/T curves after the generic methodology is approved, but before the end of 2016 (prior to exceeding 32 EFPY).

LIST OF REGULATORY COMMITMENTS

The following table identifies those actions committed to by Nebraska Public Power District in this document. Any other actions discussed in this submittal are provided for information purposes and are not considered to be regulatory commitments.

COMMITMENT/COMMITMENT NO.	TYPE (Check one)		SCHEDULED COMPLETION DATE
	ONE-TIME ACTION	CONTINUING COMPLIANCE	
NPPD will resubmit the curves without the analysis of the P/T nozzles. [NLS2012062-01]	X		September 30, 2012
Since there is no currently approved methodology for addressing the instrument nozzles in the beltline region of a Boiling Water Reactor, NPPD will commit to providing new P/T curves after the generic methodology is approved, but before the end of 2016 (prior to exceeding 32 EFPY. [NLS2012062-02]	X		December 31, 2016