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NLS2012023
March 30, 2012

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

Subject: Response to 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)
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 February 29, 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 the Nebraska Public Power District (NPPD) to respond to a Nuclear Regulatory Commission Request for Additional Information (RAI) (Reference 1) related to the Cooper Nuclear Station License Amendment Request to revise the Technical Specifications Pressure/Temperature Limit Curves and Surveillance Requirements (Reference 2). This response is provided in Attachment 1. This attachment contains certain proprietary information owned by the Electric Power Research Institute, Inc. Per the affidavit provided in Enclosure 1, NPPD requests that Attachment 1 be withheld from public disclosure, in accordance with 10 CFR 2.390(a)(4). Attachment 2 contains a redacted version of the RAI response. As a result of responding to this RAI, certain necessary changes to Reference 2 were identified. Replacement pages are provided in Enclosure 2.

Should you have any questions regarding this submittal, please contact David Van Der Kamp, Licensing Manager, at (402) 825-2904.

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NRR

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

Executed on 3/30/12
(Date)

Sincerely,

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

/em

Attachments and Enclosures

cc: Regional Administrator w/ Attachment 2 and Enclosures
USNRC - Region IV

Cooper Project Manager w/ Attachments and Enclosures
USNRC - NRR Project Directorate IV-1

Senior Resident Inspector w/ Attachment 2 and Enclosures
USNRC - CNS

Nebraska Health and Human Services w/ Attachment 2 and Enclosures
Department of Regulation and Licensure

NPG Distribution w/o Attachments and Enclosures

CNS Records w/ Attachments and Enclosures

Enclosure 1

Affidavit from Electric Power Research Institute
Requesting Withholding of Proprietary Information Included In
"Cooper P-T Curve Revision"
Structural Integrity Associates Report No: 1100445.301
Revision 1, Project No: 1100445, August 2011

ELECTRIC POWER RESEARCH INSTITUTE

AFFIDAVIT

RE: Request for Withholding of the Following Proprietary Information Included In::

"Cooper P-T Curve Revision"
Structural Integrity Associates Report No: 1100445.301
Revision 1, Project No: 1100445, August 2011

I, David J. Modeen, being duly sworn, depose and state as follows:

I am the Director, External Affairs, Nuclear Sector at Electric Power Research Institute, Inc. whose principal office is located at 1300 W WT Harris Blvd, Charlotte North Carolina ("EPRI") and I have been specifically delegated responsibility for the above-listed report that contains EPRI Proprietary Information that is sought under this Affidavit to be withheld "Proprietary Information". I am authorized to apply to the U.S. Nuclear Regulatory Commission ("NRC") for the withholding of the Proprietary Information on behalf of EPRI.

EPRI requests that the Proprietary Information be withheld from the public on the following bases:

Withholding Based Upon Privileged And Confidential Trade Secrets Or Commercial Or Financial Information:

a. The Proprietary Information is owned by EPRI and has been held in confidence by EPRI. All entities accepting copies of the Proprietary Information do so subject to written agreements imposing an obligation upon the recipient to maintain the confidentiality of the Proprietary Information. The Proprietary Information is disclosed only to parties who agree, in writing, to preserve the confidentiality thereof.

b. EPRI considers the Proprietary Information contained therein to constitute trade secrets of EPRI. As such, EPRI holds the Information in confidence and disclosure thereof is strictly limited to individuals and entities who have agreed, in writing, to maintain the confidentiality of the Information. EPRI made a substantial economic investment to develop the Proprietary Information and, by prohibiting public disclosure, EPRI derives an economic benefit in the form of licensing royalties and other additional fees from the confidential nature of the Proprietary Information. If the Proprietary Information were publicly available to consultants and/or other businesses providing services in the electric and/or nuclear power industry, they would be able to use the Proprietary Information for their own commercial benefit and profit and without expending the substantial economic resources required of EPRI to develop the Proprietary Information.

c. EPRI's classification of the Proprietary Information as trade secrets is justified by the Uniform Trade Secrets Act which California adopted in 1984 and a version of which has been adopted by over forty states. The California Uniform Trade Secrets Act, California Civil Code §§3426 – 3426.11, defines a "trade secret" as follows:

> "'Trade secret' means information, including a formula, pattern, compilation, program device, method, technique, or process, that:
>
> (1) Derives independent economic value, actual or potential, from not being generally known to the public or to other persons who can obtain economic value from its disclosure or use; and

(2) is the subject of efforts that are reasonable under the circumstances to maintain its secrecy."

d. The Proprietary Information contained therein are not generally known or available to the public. EPRI developed the Information only after making a determination that the Proprietary Information was not available from public sources. EPRI made a substantial investment of both money and employee hours in the development of the Proprietary Information. EPRI was required to devote these resources and effort to derive the Proprietary Information. As a result of such effort and cost, both in terms of dollars spent and dedicated employee time, the Proprietary Information is highly valuable to EPRI.

e. A public disclosure of the Proprietary Information would be highly likely to cause substantial harm to EPRI's competitive position and the ability of EPRI to license the Proprietary Information both domestically and internationally. The Proprietary Information can only be acquired and/or duplicated by others using an equivalent investment of time and effort.

I have read the foregoing and the matters stated herein are true and correct to the best of my knowledge, information and belief. I make this affidavit under penalty of perjury under the laws of the United States of America and under the laws of the State of California.

Executed at 1300 W WT Harris Blvd being the premises and place of business of Electric Power Research Institute, Inc.

Date: August 4, 2011

David J. Modeen

(State of North Carolina)
(County of Mecklenburg)

Subscribed and sworn to (or affirmed) before me on this 4th day of August, 2011, by David J. Modeen, proved to me on the basis of satisfactory evidence to be the person(s) who appeared before me.

Signature Sherryl R. Stogner (Seal)

My Commission Expires 25 day of August, 2014

Attachment 2

Response to Request for Additional Information Regarding
License Amendment Request to Revise Technical Specification 3.4.9,
'RCS Pressure and Temperature (P/T) Limits'
Cooper Nuclear Station, Docket No. 50-298, DPR-46

(NON-PROPRIETARY)

The Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) regarding the P/T Limits License Amendment Request is shown in italics. The Nebraska Public Power District (NPPD) response to the RAI is shown in block font.

Request 1

1. *The proposed 32 EFPY P-T limits for all operating conditions, including pressure test conditions, are based, in part, on the adjusted Reference Temperature of Nil-Ductility Transition (adjusted RT_{NDT} (ART)) for the limiting RV beltline shell material at 32 EFPY. The NRC staff noted discrepancies among the various parts of the submittal regarding the limiting beltline shell ART value. Specifically, Section 3.3 of the LAR (page 5 of 11) states, in part, that "[t]he most limiting beltline material is the Lower Longitudinal Weld with an ART value of 103.5 °F." Cooper Calculation No. NEDC 07-048 (Enclosure to the LAR, page 5 of 7), states, in part, that "[t]he limiting beltline material has an ART value of 103.2°F and 123.5°F for 32 and 54 EFPY, respectively." Also, Structural Integrity Associates (SIA) Calculation Package 1100445.303 (Enclosure to the LAR, page 10 of 40) states, in part that, "the limiting beltline material is the Lower/Intermediate shell plate, which has an ART value of 105.8°F for 32 EFPY and 131.2°F for 54 EFPY."*

   a. *Please identify the correct limiting beltline shell material and corresponding ART value for this material at 32 EFPY.*

   b. *Please provide the inputs necessary for calculating this ART value, based on NRC Regulatory Guide (RG) 1.99, Revision 2, "Radiation Embrittlement of Reactor Vessel Materials," May 1988 (ADAMS Accession No. ML003740284), procedures (initial RT_{NDT}, Cu content, Ni content, chemistry factor calculations, 32 EFPY fluence, and margin term calculations).*

NPPD Response

The ART value from the SIA calculation was incorrectly transcribed to NEDC 07-048 and Page 5 of 10, Attachment 1 to the License Amendment Request (LAR). Revised pages are provided in Enclosure 2.

1.a. The limiting beltline shell material is the Lower Intermediate Shell Plate, Heat No. C2307-2, which has an ART of 105.8°F

1.b. Initial RT_{NDT} = -20°F
Cu content = [ ]
Ni content = [ ]
Chemistry factor = 258.3 (This value is found in BWRVIP-135, Revision 2, Page A-2-5. It utilizes the "best fit" calculational methodology described in RG 1.99, Rev. 2, Regulatory Position 2.1).
32 EFPY fluence = 1.41E+18 n/cm^2
Margin = $2(\sigma_I^2 + \sigma_\Delta^2)^{-2}$
$= 2(8.5^2 + 0)^{-2}$
$= 17.0$

Request 2

2. *The 32 EFPY P-T limits for core not critical and pressure test conditions are based, in part, on the fracture mechanics calculations for the limiting N16 instrument nozzle. Specifically, SIA Calculation Package 1100445.303 identifies the N16 nozzles as being located in the extended beltline region. The SIA calculation report (Enclosure to the LAR, page 6 of 40) states, in part, that, "[t]he nozzle material is not ferritic and does not need to be specifically evaluated. However, the effect of the [nozzle] penetration on the adjacent [RV beltline] shell must be considered." Accordingly, the SIA report documents P-T limit calculations for the limiting N16 nozzle based on thermal and pressure stress intensity factors, which are determined based on nozzle configuration/geometry and finite element analyses, and a 32 EFPY ART value of 52.4 °F.*

   a. *Please identify the RV beltline shell material which contains the N16 nozzle penetrations.*

   b. *Please confirm that a 32 EFPY ART value of 52.4 °F is the correct value for the RV plate with the embedded N16 nozzles.*

   c. *Please provide the inputs necessary for calculating this ART value, based on RG 1.99, Revision 2 procedures (initial RT_{NDT}, Cu content, Ni content, chemistry factor calculations, 32 EFPY fluence, and margin term calculations).*

NPPD Response

2.a. Nozzles N16A and B are located in lower intermediate Shell Plates C2407-1 and C2331-2. The shell material is SA533 grade B steel.

2.b. Shell Plate C2407-1 has a maximum ART of 62.8°F.
Shell Plate C2331-2 has a maximum ART of 90.0°F.

Considering the fluence at the elevation of the N16 nozzle, 52.4 °F is the ART for the limiting plate (C2331-2).

2.c. C2331-2 (Limiting Plate)
Initial RT_{NDT} = 10°F
Cu content = [ ]
Ni content = [ ]
CF = 118.5 This is a linear interpolation from RG 1.99, Rev. 2, Table 1.
32 EFPY fluence = 2.94E+17 n/cm^2
Margin = $2(\sigma_I^2 + \sigma_\Delta^2)^{-2}$
$= 2(10.6^2 + 0)^{-2}$
$= 21.2$

Request 3

3. *The proposed 32 EFPY P-T limits for heat-up and cool-down operations with the core not critical show a reduction in the minimum operating (bolt-up) temperature requirement from 80 °F (as specified in the current TS P-T limits) to 70 °F. While the NRC staff notes that the new minimum temperature requirement of 70 °F will continue to remain acceptable per the minimum temperature requirements specified in Table 1 of Appendix G, "Fracture Toughness Requirements," to Part 50 of Title 10 of the Code of Federal Regulations (10 CFR), the NRC staff could not find an explanation for the change. Please discuss the technical basis for the reduction in the minimum operating (bolt-up) temperature requirement.*

NPPD Response

Previous calculations conservatively added 60°F to the flange RT_{NDT} of 20°F. This conservatism is not a requirement of Appendix G. The bolt-up temperature was reduced to provide operational flexibility. The 70°F value provides margin to the minimum Reactor Building temperature of 65°F, and the moderator temperature of 68°F when performing a Technical Specification shutdown margin calculation.

Enclosure 2

Revised Pages to NLS2011015

Replace the following pages to NLS2011015:

Attachment 1, Page 5 of 11
Enclosure, Page 5 of 7

The RAMA methodology for neutron fluence has been benchmarked using experimental and numerical problems specified in RG 1.190. The results of the benchmark cases are documented in the Electric Power Research Institute report entitled "RAMA Fluence Methodology Benchmark Manual Evaluation of RG 1.190 Benchmark Problems." CNS RPV neutron fluence was calculated using RAMA methodology. Projected neutron fluence values are presented for two points in time: the end of cycle 25, and 32 EFPY. It was assumed in projecting the 32 EFPY fluences that cycle 25 was an equilibrium cycle and representative of future operating cycles including consideration of 24-Month Cycles. Thus, the incremental fluence change determined for cycle 25 was assumed to be constant which allows the fluence between cycle 25 and 32 EFPY to be estimated using linear interpolation for the purpose of evaluating the P/T curves. The calculation meets applicable industry standards and provides a reasonable estimate of the RPV beltline region neutron fluence. The calculation uses a methodology approved by the NRC.

The CNS Updated Safety Analysis Report (USAR) Section IV-2.7.2 describes the RPV Material Surveillance Test Program, which is used to periodically revalidate and update the P/T curves. The revised P/T curves were developed based on the results from the first and second vessel material surveillance capsules. Adjusted reference temperature (ART) values were developed for the RPV materials in accordance with RG 1.99 Revision 2, based on the current fluence data. The fluence was recalculated to incorporate the Appendix K power uprate and the renewal of the license for an additional 20 years. The most limiting beltline material is the Lower Longitudinal Weld with an ART value of 105.8 °F. The most limiting upper vessel material is at the feedwater nozzles.

The changes to the P/T limits provide margin to prevent brittle type fracture of the RPV. Three regions of the RPV were evaluated, the bottom head region, the beltline region, and the upper vessel region.

Revising the TS P/T limit curves and associated SRs as proposed does not affect assumptions in USAR accident analyses.

In summary, the proposed change is technically sound and continues to maintain the same level of safety as the current licensing basis.

4.0 REGULATORY SAFETY ANALYSIS

4.1 Applicable Regulatory Requirements/Criteria

Construction of CNS predated the 1971 issuance of 10 CFR 50, Appendix A, "General Design Criteria for Nuclear Power Plants." Appendix F, "Conformance to AEC Proposed General Design Criteria," of the CNS USAR discusses that CNS is designed to conform to the proposed general design criteria (GDC) published in the July 11, 1967, Federal Register, except where commitments were made to specific

PURPOSE:

The purpose of this calculation is to review Structural Integrity (SI) calculation 1100445.303, which develops the vessel pressure temperature (P-T) curves for the beltline for 32 and 54 effective full power years (EFPY). The calculation includes the 2% power uprate, which was implemented after RE24 and the proposed changed to a 24 month fuel cycle.

This calculation also reviews and accepts Structural Integrity (SI) calculation 1100445.304, which evaluates the Core Differential Pressure Nozzle. The evaluation shows that this nozzle is bounded by the lower head and, therefore, does not affect the P-T curves.

ASSUMPTIONS:

Assumptions are identified within the body of the attached SI calculation according to context and use. Obvious assumptions are identified as follows:

The calculation includes the 2% power uprate that was implemented after RE24. The adjusted reference temperature (ART) values were determined in accordance with Nuclear Regulatory Commission (NRC) Regulatory Guide 1.99, Revision 2 (DI 3). The limiting beltline material has an ART value of 105.8°F and 131.2°F for 32 and 54 EFPY, respectively. Non-beltline regions are not subjected to fluence in excess of 10E+17 n/cm^2; therefore, the RT_{NDT} values are valid substitutions for corresponding ART values. These values are considered to be the most appropriate for computation of updated P-T curves.

Vessel Dimensions and Fluid Properties
The inner radius of the cylindrical portion of the reactor pressure vessel (RPV) is 110.375 inches. The vessel shell base metal varies in thickness from 5.375 to 6.375 inches, with 5.375 the predominant base metal thickness in the beltline region. Therefore, 5.375 inches is the smallest thickness (i.e., bounding input for P-T calculations).

The normal water level in the RPV is 551.75 inches. The maximum potential water level in the RPV during the pressure test is 825.1875 inches.

The wall thickness in the lower head varies from 3.1875 inches, where it connects to the lower shell, to 6.8125 inches. The thicker section provides the reinforcement for the CRD penetrations.

The Feedwater nozzle penetration in the upper vessel is considered the limiting location for stress in this region. The nozzle inner diameter is 11.969 inches with an outside diameter of 23.0625 inches. The nozzle corner radius, both inside and outside, is 5½ in. and the thickness at the corner is also 5½ in.

The Heatup and Cooldown temperature rate-of-change assumed for the vessel metal for normal operation is 100°F/hr.

Pressure and Instrument Uncertainty
The pre-service system hydrostatic test pressure was 1,563 psig, which corresponds to 1.25 times the design pressure of 1,250 psig. This is consistent with previous calculations. The following are the results of the instrument uncertainty for CNS pressure and temperature measurements:

Reactor Vessel Metal Temperature is bounded by +/- 5°F

ATTACHMENT 3 LIST OF REGULATORY COMMITMENTS©[4]

Correspondence Number: NLS2012023

The following table identifies those actions committed to by Nebraska Public Power District (NPPD) in this document. Any other actions discussed in the submittal represent intended or planned actions by NPPD. They are described for information only and are not regulatory commitments. Please notify the Licensing Manager at Cooper Nuclear Station of any questions regarding this document or any associated regulatory commitments.

COMMITMENT	COMMITMENT NUMBER	COMMITTED DATE OR OUTAGE
None		