Nebraska Public Power District
Always there when you need us

50.90

NLS2013065
July 3, 2013

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

Subject: Response to Request for Additional Information Regarding Core Plate Hold Down Bolt Stress Analysis
Cooper Nuclear Station, Docket No. 50-298, DPR-46

Reference:
1. Letter from Lynnea E. Wilkins, U.S. Nuclear Regulatory Commission, to Oscar A. Limpias, Nebraska Public Power District, dated May 24, 2013, "Cooper Nuclear Station – Request for Additional Information Re: Core Plate Hold Down Bolt Stress Analysis (TAC No. ME9550)"

2. Letter from David W. Van Der Kamp, Nebraska Public Power District, to U.S. Nuclear Regulatory Commission, dated January 16, 2012, "Completion of License Renewal Commitment NLS2009100-1 (Revision 1)" (NLS2012002)

Dear Sir or Madam:

The purpose of this letter is for the Nebraska Public Power District (NPPD) to respond to the subject Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) (Reference 1). These RAIs were issued in regards to the Core Plate Rim Bolt Analysis provided in Reference 2. Attachment 1 provides the proprietary responses, and Attachment 2 provides a non-proprietary version of the RAI responses. On behalf of General Electric Hitachi (GEH), NPPD requests that Attachment 1 be withheld from public disclosure in accordance with 10 CFR 2.390. The address for GEH is:

3901 Castle Hayne Road
Wilmington, NC 28401

There are no commitments made in this submittal.

Should you have any questions concerning this matter, please contact Dave Bremer, Cooper Nuclear Station (CNS) License Renewal Implementation Project Manager, at (402) 825-5673.

COOPER NUCLEAR STATION
P.O. Box 98 / Brownville, NE 68321-0098
***Telephone:** (402) 825-3811 / **Fax:** (402) 825-5211*
www.nppd.com

A001
NRR

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

Executed on 07/03/13
(Date)

Sincerely,

Oscar A. Limpias
Vice President – Nuclear and
Chief Nuclear Officer

OAL/wv

Attachments: 1. Response to Request for Additional Information Regarding Core Plate Hold Down Bolt Stress Analysis (Proprietary)

2. Response to Request for Additional Information Regarding Core Plate Hold Down Bolt Stress Analysis (Non-Proprietary)

Enclosure: Proprietary Affidavit for RAI Responses

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

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

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

NPG Distribution w/o Attachments or Enclosure

CNS Records w/ Attachments and Enclosure

Attachment 2

Response to Request for Additional Information Regarding
Core Plate Hold Down Bolt Stress Analysis (Non-Proprietary)

The Nuclear Regulatory Commission (NRC) request for additional information (RAI) contained two sets of questions, one non-proprietary and one proprietary regarding the Cooper nuclear Station (CNS) Core Plate Hold Down Bolt Stress Analysis. Both sets are responded to in this attachment. To distinguish the question numbering, the non-proprietary RAIs will be given an "NP-" designator, and the proprietary RAIs will be given a "P-" designator. The questions are shown in italics. The Nebraska Public Power District (NPPD) response to the supplemental request is shown in block font. Redacted information is denoted by double brackets ([[ ]]).

NRC Request – *Question NP-1*

The example stress analysis provided in the Boiling Water Reactor Vessel and Internals Project (BWRVIP)-25, "BWR Core Plate Inspection and Flaw Evaluation Guidelines," is based on an elastic finite element analysis of the core plate and core plate hold down bolts. The information provided in NEDC-33674P, Revision 0, does not state what type of analysis was performed to demonstrate that the CNS core plate hold down bolts (core plate bolts) will remain structurally adequate throughout the PEO, considering a potential loss of preload. Please confirm that the stress analyses performed in NEDC-33674P are consistent with the approach assumed in BWRVIP-25 (i.e., elastic finite element analysis).

NPPD Response

The stress analysis performed in NEDC-33674P was not based on finite element analysis (as explained in the subsequent RAI responses), but is still consistent with the approach used in BWRVIP-25, Appendix A, (differences are listed in Section 8.1 of the report) and uses linear elastic calculations.

NRC Request – *Question NP-2*

Section 2.0 of NEDC-33674P notes that a portion of the CNS plant-specific data was not available for this analysis and, subsequently, scaled data from Appendix A of BWRVIP-25 was used in lieu of plant-specific data. Please state what CNS plant-specific data was not available and what corresponding data was used from BWRVIP-25. Further, please provide a technical justification demonstrating that the alternative data provides a sound basis for determining that the core plate bolts will remain structurally adequate during the PEO.

NPPD Response

Scaling was only performed for initial calculations and qualitative comparisons. All CNS-specific data required for the evaluation (and creation of Table 8-1) were available and the

results do not depend on any scaled data. Details regarding the scaling that was performed for comparison calculations are described below.

In BWRVIP-25, Appendix A, Scenario 2, the force exerted on the highest-loaded aligner pin was determined from Finite Element Analysis (FEA) and the pure shear was calculated for this aligner pin (see the Question NP-4 Response for additional detail). From this, one can calculate the percentage that this aligner pin resists compared to the total horizontal load (the other pins taking the remainder).

The CNS evaluation did not utilize a plant-specific finite element model (it was not necessary). Therefore, it was not possible to obtain the force on the highest-loaded aligner pin in the same manner as the BWRVIP-25, Appendix A, example. For comparison purposes only, the CNS evaluation initially utilized the same percentage as the Appendix A example to determine the force on the highest-loaded pin. However, because of the difference in aligner pin geometry and its questionable effect on the validity of FEA-scaling, the calculation was updated as described in Section 7.2.2 of the evaluation (and the Question NP-4 Response below). This was more conservative and did not depend on scaled results. Therefore, the results of the CNS evaluation do not depend on scaling, which was only used during initial calculations and qualitative comparisons.

NRC Request – *Question NP-3*

Section 7.1 of NEDC-33674P discusses the preload which was accounted for in the CNS core plate bolt stress analyses. This section notes that the original preload for each bolt was 300 plus or minus 25 foot-pound force (ft-lbf). However, no references are provided regarding the basis for this value. Please provide the basis for the value of the preload assumed in this analysis.

NPPD Response

The reference for the value of preload is from Note 5 in General Electric Hitachi (GEH) drawing (197R576, Revision 9). Both the minimum and maximum values of preload were used during the analysis, reduced by fluence and thermal relaxation as described in Sections 6.7 and 6.8 of the report.

NRC Request – *Question NP-4*

Section 8.1 of NEDC-33674P notes that the analysis performed for CNS core plate bolts calculate the shear loads on the core plate aligner pins using a different method than that used in BWRVIP-25 due to the variance in aligner pin configurations. Please describe the method used to calculate the shear loads for the CNS core plate aligner pins and provide a technical justification for this deviation from BWRVIP-25, which demonstrates that the alternative method provides an accurate means to evaluate the shear stresses imposed on the aligner pins.

NPPD Response

The aligner pin configuration of CNS (Figures NP-4.1 and NP-4.2) is different than the plant used in the BWRVIP-25, Appendix A, example (Figure NP-4.3). Both include four assemblies and resist load mainly in shear. However, the CNS aligner pins are horizontal instead of vertical. For both configurations, the most limiting direction of applied horizontal load will engage at least three of the four aligner pin assemblies (in Scenario 2, all the horizontal load is assumed to be taken by the aligner pins).

In the BWRVIP-25, Appendix A, calculation, the maximum horizontal load on a single pin was [[ ]] (by FEA calculation) out of approximately [[ ]] total horizontal load. The ratio of worst pin load to the total horizontal load is [[ ]]. The aligner pin diameter of that example was [[ ]]. The maximum pure shear of one pin was calculated, [[ ]]. The three remaining pins resisted the rest of the load.

For CNS, the horizontal load is [[ ]]. Using the same ratio of pin load to total load as the BWRVIP-25, Appendix A, calculation [[ ]] resulted in a shear stress of [[ ]]. However, due to the difference in aligner pin configuration, it was ultimately decided to use non-scaled results. Therefore, a more conservative calculation was performed [[ ]], as shown in Table 8-1 of NEDC-33674P.

Figure NP-4.1

[[

]]

Figure NP-4.2: CNS Aligner Pin Lug Configuration

[[

]]

Figure NP-4.3: BWRVIP-25, Appendix A, Aligner Pin Configuration

[[

]]

NRC Request – *Question NP-5*

Section 8.1 of NEDC-33674P provides the results of the stress analyses of the CNS core plate bolts for three distinct scenarios. For each scenario, the bolt stress levels were compared against applicable allowable stress values prescribed by the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), depending on the service level considered (i.e., Normal, Upset, Emergency or Faulted). The construction of the core plate results in an uneven distribution of the resultant horizontal and vertical loads supported by the core plate bolts. However, the results presented in Section 8.1 of NEDC-33674P do not specify whether these results apply to the limiting CNS core plate bolt(s). Please confirm that the results presented in this section of NEDC-33674P correspond to the limiting core plate bolt(s) (i.e., those which support the greatest horizontal and/or vertical loads) and demonstrate that these limiting core plate bolt(s) meet the applicable ASME Code allowable stress values. If the results presented in NEDC-33674P do not correspond to the limiting core plate bolts, please present the results of the stress analyses for the limiting core plate bolt(s) which demonstrate that the stresses induced in the limiting core plate bolts meet the applicable ASME Code allowable stress values.

NPPD Response

The evaluation supporting NEDC-33674P did not calculate individual core plate bolt stresses, which would have required the development of a finite element model or very detailed hand calculations. This detail was unnecessary. Rather, a conservative alternative approach was used that determined the average stress values, consistent with the example presented in BWRVIP-25, Appendix A, and also consistent with industry practice when demonstrating ASME Code compliance for linear elastic analyses. Using the BWRVIP-25, Appendix A, approach provided conservative results which bounded the individual bolt stresses, assuring the actual individual bolt stresses are below the ASME Code allowable stress values. This approach provides reasonable and conservative assurance that all bolts will meet all postulated design basis loading conditions. The CNS evaluation applied the same methodology as BWRVIP-25, Appendix A, by using the average stress for the core plate bolt analysis. This is explained in more detail in the following paragraphs.

Figure A-3 in BWRVIP-25, Appendix A, shows a specious variation in core plate bolt force. Variation does exist [[ ]]. However, this figure only depicts forces from externally-applied vertical loads. The total load in a core plate bolt is the fluence- and thermally-relaxed preload plus only a portion of the external loads. Figure A-3 does not include the internal force due to preload and assumes the entirety of the external load is carried by the bolts. If the example's [[ ]] internal force due to preload were added to the bolts, the [[ ]] maximum variation in bolt vertical force as compared to the average would be reduced by more than half. This, however, still assumes all of the external load transfers to the bolts.

Joint-to-fastener participation effects were not included in Figure A-3 [[ ]] Realistically, the majority of the externally-applied vertical load will go into reducing the clamping force on the clamped components (the core plate rim in this case) with a smaller portion going into increasing

the force in the fastener (the core plate bolt). [[ ]] Therefore, the already-reduced variation discussed in the above paragraph will be further reduced. This will bring the variation of bolt force for the BWRVIP-25, Appendix A, example down [[ ]], such that the total bolt force is lower than that used in the P_m calculation. For CNS, the variation is even smaller because [[ ]]

Ergo, in Scenarios 1 and 3, the average bolt force used in the BWRVIP-25, Appendix A, example and in the CNS evaluation is greater than the realistic maximum (including the location variation) total bolt force when participation effects are considered.

NRC Request – *Question P-1*

[[ ]]

NPPD Response

A fast neutron fluence evaluation was performed by TransWare Enterprises, Inc. for CNS using the BWRVIP Radiation Analysis Modeling Application (RAMA) methodology. The analysis was accepted by NPPD via NEDC 07-033, Revision 1C1 (Note: NEDC 07-032 referenced in the GEH analysis is a typographical error that should have stated NEDC 07-033). The RAMA methodology has been reviewed by the NRC and subsequently given generic approval for determining fast neutron fluence in BWR pressure vessels[1] and vessel internal components that include the core shroud and top guide[2]. An axial fluence profile for the peak core support plate rim bolt was calculated for energy >1 MeV at the end of the CNS extended design life of 54 Effective Full Power Years.

The peak rim bolt was determined to reside at the 37.5-degree location. The rim bolt has a height of about 25.5 inches, extending from approximately 177.59 inches to 203.09 inches relative to vessel zero. The evaluation predicted the fluence to range from a value of 1.63E+20 n/cm^2 near the top of the bolt (closest to the fuel) to 1.15E+17 n/cm^2 near the bottom of the bolt (farthest from the fuel).

NRC Request – *Question P-2*

[[ ]]

---

[1] See letter from William H. Bateman (NRC) to Bill Eaton (BWRVIP), dated May 13, 2005, regarding the Safety Evaluation of BWRVIP-114, -115, -117, and -121, and TWE-PSE-001-R-001.

[2] See letter from Matthew A. Mitchell (NRC) to Rick Libra (BWRVIP), dated February 7, 2008, regarding the Safety Evaluation of BWRVIP-145.

NPPD Response

The fluence range on which the BWRVIP-25 loss of preload range was based is 0 n/cm2 (all relaxation due to thermal effects) to 8E19 n/cm2 (E>1 MeV).

NRC Request – *Question P-3*

[[ ]]

NPPD Response

NPPD performed Visual Test (VT)-3 examinations in Reload (RE)19 (Spring 2000) from the top side of the bolts on forty-eight (48) bolts with no recordable indications.

In 2010, the BWRVIP issued revised interim guidance to the BWR fleet requiring plants to develop and submit a technical justification in the form of a Deviation Disposition to the BWRVIP since the inspection guidance of BWRVIP-25 could not be met. No techniques are currently available to perform an Ultrasonic Test (UT) volumetric examination of the bolting above the core plate. It was also determined that the enhanced VT-1 visual examination below the core plate would not provide meaningful results since the bolt threads would not be visible for inspection. Performing examinations from below the core plate would require disassembly of reactor vessel internals. Section 3.2.5 of BWRVIP-47-A, "BWR Vessel and Internals Project BWR Lower Plenum Inspection and Flaw Evaluation Guidelines," states that removing or dismantling of internal components for the purpose of performing inspections is not warranted to assure safe operation. However, in accordance with BWRVIP-47-A, NPPD performs inspections to the extent practical below the core plate if access is made available due to maintenance activities not part of normal refueling activities. Results of those inspections are provided to the BWRVIP and are then forwarded by the BWRVIP to the NRC.

NPPD provided a Deviation Disposition to the BWRVIP in March 2011 using a generic template developed by the BWRVIP that provided the technical justification and included interim inspection guidance. The technical justification demonstrates that the core plate bolts have a relatively low susceptibility to cracking based on field experience and fabrication practices. In addition, should some cracking occur in some bolts, the consequences are mitigated by redundancy in the bolting and associated alignment hardware. The interim guidance required plants such as CNS to perform VT-3 examinations on 25% of the bolts from the top side by 2015. The BWRVIP stated examinations completed back to 2005 could also be credited towards meeting the 25% minimum. VT-3 examinations from the top side are considered reasonable to detect loosened and rotated bolts due to a combination of vibration and failure of the welds on the locking device, which should be obvious by visual VT-3 examination.

Based on the interim guidance, CNS credited five (5) VT-3 examinations performed in RE25 (Fall 2009) from the top side of five (5) bolts and three (3) bolt examinations performed in RE27 (Fall 2012). No recordable indications were reported, providing reasonable assurance that the bolting is intact after nearly thirty-eight (38) years of operation.

NPPD has scheduled ten (10) additional VT-3 bolting examinations from the top side of the bolting in the next refueling outage in RE28 (Fall 2014) in accordance to the interim guidance provided by the BWRVIP. The BWRVIP interim guidance effectively requires 25% of the bolting to be examined over a ten (10) year interval. In a letter dated April 20, 2011, NPPD notified the NRC that CNS was not able to fully inspect 50% of the core plate bolts in accordance to BWRVIP-25. The BWRVIP is currently working on revised guidance for the core plate bolts and expects to complete that work, including gaining NRC approval of the revised guidance, by 2015. Until such time as new guidance is provided, NPPD will be performing VT-3 inspections on 25% of core plate bolts on the top side on a periodic basis consistent with the interim guidance (i.e., 25% each 10 year interval after 2015 or until such time the BWRVIP provides alternative guidance as approved by the NRC). Given the low likelihood that the function of the core plate will be compromised by bolting failures, the VT-3 examinations constitute an acceptable interim inspection strategy until the BWRVIP develops revised guidance.

NRC Request – *Question P-4*

[[ ]]

NPPD Response

See response to Question P-3.

Enclosure

Proprietary Affidavit for Request for Additional Information Responses

GE-Hitachi Nuclear Energy Americas LLC

AFFIDAVIT

I, Linda C. Dolan, state as follows:

(1) I am the Manager of Regulatory Compliance, of GE-Hitachi Nuclear Energy Americas LLC ("GEH"), and have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.

(2) The information sought to be withheld is contained in Enclosure 1 of GEH letter, 7491-317703-HP1-1, "GEH Responses to CNS Core Plate Hold Down Bolt Stress RAIs," dated June 18, 2013. The GEH proprietary information in Enclosure 1, which is entitled "GEH Responses to CNS Core Plate Hold Down Bolt Stress RAIs," is identified by a dotted underline inside double square brackets. [[This sentence is an example.{3}]] Figures are identified with double square brackets before and after the object. In each case, the superscript notation {3} refers to Paragraph (3) of this affidavit, which provides the basis for the proprietary determination.

(3) In making this application for withholding of proprietary information of which it is the owner or licensee, GEH relies upon the exemption from disclosure set forth in the *Freedom of Information Act* ("FOIA"), 5 U.S.C. Sec. 552(b)(4), and the *Trade Secrets Act*, 18 U.S.C. Sec. 1905, and NRC regulations 10 CFR 9.17(a)(4), and 2.390(a)(4) for trade secrets (Exemption 4). The material for which exemption from disclosure is here sought also qualifies under the narrower definition of trade secret, within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975 F.2d 871 (D.C. Cir. 1992), and Public Citizen Health Research Group v. FDA, 704 F.2d 1280 (D.C. Cir. 1983).

(4) The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs (4)a. and (4)b. Some examples of categories of information that fit into the definition of proprietary information are:

a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by GEH's competitors without license from GEH constitutes a competitive economic advantage over other companies;

b. Information that, if used by a competitor, would reduce their expenditure of resources or improve their competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product;

c. Information that reveals aspects of past, present, or future GEH customer-funded development plans and programs, resulting in potential products to GEH;

d. Information that discloses trade secret or potentially patentable subject matter for which it may be desirable to obtain patent protection.

(5) To address 10 CFR 2.390(b)(4), the information sought to be withheld is being submitted to NRC in confidence. The information is of a sort customarily held in confidence by GEH, and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by GEH, not been disclosed publicly, and not been made available in public sources. All disclosures to third parties, including any required transmittals to the NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary or confidentiality agreements that provide for maintaining the information in confidence. The initial designation of this information as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in the following paragraphs (6) and (7).

(6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, who is the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge, or who is the person most likely to be subject to the terms under which it was licensed to GEH. Access to such documents within GEH is limited to a "need to know" basis.

(7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist, or other equivalent authority for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GEH are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary or confidentiality agreements.

(8) The information identified in paragraph (2), above, is classified as proprietary because it contains the detailed GEH methodology for core plate hold down bolt stress analysis for the GEH Boiling Water Reactor (BWR). These methods, techniques, and data along with their application to the design, and analyses associated with the core plate hold down bolt stress were achieved at a significant cost to GEH.

The development of the evaluation processes along with the interpretation and application of the analytical results is derived from the extensive experience databases that constitute a major GEH asset.

(9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GEH's competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of GEH's comprehensive BWR safety and technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology and includes development of the expertise to determine and apply the appropriate evaluation process. In addition, the technology base includes the value derived from providing analyses done with NRC-approved methods.

The research, development, engineering, analytical and NRC review costs comprise a substantial investment of time and money by GEH. The precise value of the expertise to

devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial. GEH's competitive advantage will be lost if its competitors are able to use the results of the GEH experience to normalize or verify their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

The value of this information to GEH would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive GEH of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing and obtaining these very valuable analytical tools.

I declare under penalty of perjury that the foregoing affidavit and the matters stated therein are true and correct to the best of my knowledge, information, and belief.

Executed on this 18th day of June 2013.

Linda C. Dolan
Manager, Regulatory Compliance
GE-Hitachi Nuclear Energy Americas LLC
3901 Castle Hayne Rd.
Wilmington, NC 28401
Linda.Dolan@ge.com