**Nebraska Public Power District**
*Nebraska's Energy Leader*

NLS2002136
November 25, 2002

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

Subject: Response to Draft Request For Additional Information On the Supplemental Information Submitted By Nebraska Public Power District For Cooper Nuclear Station License Condition 2.C.(6)-Docket No.: 50-298
Cooper Nuclear Station, NRC Docket No. 50-298, DPR-46

References:

1. E-Mail to P. Fleming (Nebraska Public Power District) from M. Thadani (U.S. Nuclear Regulatory Commission) dated October 21, 2002, "Draft Request For Additional Information."

2. Letter to U.S. Nuclear Regulatory Commission from D. Wilson (Nebraska Public Power District) dated September 27, 2002, "Response to Request for Additional Information Related to Nebraska Public Power District's Seismic Reevaluation Proposed to Address Cooper Nuclear Station License Condition 2.C.(6)" (NLS2002120).

3. Letter to U.S. Nuclear Regulatory Commission from D. Wilson (Nebraska Public Power District) dated February 26, 2002, "License Condition 2.C.(6) Seismic Evaluation" (NLS2002014).

The purpose of this letter is to respond to a Nuclear Regulatory Commission (NRC) draft Request for Additional Information (RAI) provided in Reference 1. This draft RAI refers to information previously provided in Reference 2, which in turn relates to the seismic evaluation provided in Reference 3. A teleconference was held with the NRC staff on November 6, 2002 to discuss the issues raised in the NRC's information request. The draft RAI questions and the Nebraska Public Power District (NPPD) responses are provided in Attachment 1, along with additional information reflecting subject matter discussed in the teleconference.

NPPD is concerned that there appears to be a change in NRC approach to approving licensee use of NEDC-31858P, "BWROG Report for Increasing MSIV Leakage Rate Limits and Elimination of Leakage Control Systems" to seismically qualify the Main Steam Isolation Valve (MSIV) leakage pathway to the main turbine condenser. In the case of Cooper Nuclear Station (CNS), the RAIs received to date and the technical discussions with the NRC staff have largely focused on the acceptability of the means used to perform confirmatory dynamic analyses and to analytically resolve outliers. The bases for NRC acceptance of these analyses have included the degree of conformance to Standard Review Plan (SRP) guidance. NPPD acknowledges that the

**Cooper Nuclear Station**
*P O Box 98 / Brownville, NE 68321-0098*
***Telephone:** (402) 825-3811 / **Fax:** (402) 825-5211*
http //www nppd com

A001

NRC Safety Evaluation to NEDC-31858P, dated March 3, 1999, states that the methodology and criteria used for the analytical evaluations should be "acceptable to the staff" (if the plant design basis methodology and criteria are not being used). However, neither NEDC-31858P nor the associated Safety Evaluation refers to the SRP as an acceptance standard. Fundamentally, CNS was not licensed as an SRP plant, and it should not be necessary to judge the acceptability of the new licensing basis analyses against those standards. NPPD has reviewed the regulatory precedent of other plants that have performed similar seismic evaluations. The CNS effort was largely based on the methodology approved for Monticello Generating Station in an NRC Safety Evaluation dated September 16, 1998. More recently, the NRC issued a Safety Evaluation dated May 30, 2002, which approved the seismic methodology used for Brunswick Steam Electric Plant, Units 1 and 2. Neither of these Safety Evaluations refers to SRP guidelines as being the NRC's review basis. While NPPD is willing to respond to the NRC's information requests, we wish to ensure that the SRP is not inadvertently introduced as a new licensing basis standard for assessing this issue at CNS. We believe that use of new acceptance criteria at this stage would be inconsistent with the CNS licensing basis and represent a change in position by the NRC regarding the level of seismic qualification for the MSIV leakage pathway.

Should you have any questions concerning this matter, please contact Mr. Paul Fleming at (402) 825-2774.

Sincerely,

David L. Wilson
Vice President- Nuclear

/wrv
Attachment

cc: Regional Administrator w/attachment
USNRC - Region IV

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

Senior Resident Inspector w/attachment
USNRC

NPG Distribution w/o attachment

Records w/attachment

STATE OF NEBRASKA )
)
NEMAHA COUNTY )

David L. Wilson, being first duly sworn, deposes and says that he is an authorized representative of the Nebraska Public Power District, a public corporation and political subdivision of the State of Nebraska; that he is duly authorized to submit this correspondence on behalf of Nebraska Public Power District; and that the statements contained herein are true to the best of his knowledge and belief.

David L. Wilson

Subscribed in my presence and sworn to before me this 25 day of November, 2002.

Wilma M Werner

NOTARY PUBLIC

GENERAL NOTARY - State of Nebraska
WILMA M. WERNER
My Comm. Exp. Oct. 26, 2006

ATTACHMENT 1

Question

*In your submittal (Letter, Nebraska Public Power District to U.S. NRC, "Response to Request for Additional Information Related to Nebraska Public Power District's Seismic Reevaluation Proposed to address Cooper Nuclear Station License Condition 2.C.(6), Cooper Nuclear Station, NRC Docket No. 50-298, DPR-46," dated September 27, 2002), you indicated that the "Collapsed Load Method", used for the stress analysis of the main steam line piping, is the same as the Equivalent Static Load Method identified in Section 3.9.2 of the NRC Standard Review Plan (SRP). It is our understanding that the Collapsed Load Method utilizes a factor of 1.0 to account for modal participation in the calculation of piping stresses for the main steam leakage piping under seismic loading condition. However, SRP Section 3.9.2 recommends that a factor of 1.5 is applied to the peak acceleration of the applicable floor response spectrum. We request your responses to the following:*

*a) In your submittal, you referenced Appendix N, Article N-1225 of the ASME Boiler and Pressure Vessel Code, Section III, Division I. The NRC does not endorse Appendix N of the ASME Code. Provide your justification that the main steam leakage piping from the main steam isolation valves (MSIV) to the main turbine condenser and the turbine building can be realistically represented by a simple model and that your use of the Appendix N method for the analysis produces conservative results in terms of the piping responses (i.e., stress, deformation, etc.).*

*b) Provide a discussion to show that the design and associated simplified analysis account for the relative motion between all points of support.*

Response

During the teleconference of November 6, 2002, NPPD explained that the use of Equivalent Static Load Methodology was only for "outlier" resolution, and that these outliers only concerned boundary piping that was attached to the credited MSIV Leakage Pathway to the Main Turbine Condenser.

NPPD notes that the RAI questions closely follow the criteria of SRP 3.9.2 Section II.2.a.(2) for use of an Equivalent Static Load Method. To facilitate NRC review, this SRP criteria has been transcribed, followed by NPPD's approach relative to each criterion.

*An equivalent static load method is acceptable if:*

*(a) Justification is provided that the system can be realistically represented by a simple model and the method produces conservative results in terms of responses. Typical examples or published results for similar systems may be submitted in support of the use of the simplified method.* [This addresses the first part of Draft RAI Question a).]

NPPD Approach

NPPD used two variants of an Equivalent Static Load Method when required for outlier resolution, as described below. NPPD believes that both variants meet the intent of the SRP for accuracy of the modeling and the appropriateness of the response results.

For piping systems with more complex geometric configurations or systems where the span criteria of Appendix D of NEDC-31858P was greatly exceeded throughout most of the piping system, a more rigorous variant of the classical Equivalent Static Load Method was applied. An analytical model was developed using the ADLPIPE program, and the resulting uniform static acceleration was applied in each of two orthogonal horizontal directions and the vertical direction. On a case by case basis, the acceleration applied in the orthogonal horizontal directions could be either the same or different magnitude. In general, a different value of acceleration was applied in the vertical direction than was applied in either orthogonal horizontal direction. The three directional responses (response being defined to include force, moment, support load, displacement, etc.) were then combined on a square root sum of the squares (SRSS) basis to generate an equivalent static seismic inertial response. If seismic anchor motions existed at the branch connection point or inter-building seismic anchor motions were being evaluated, the seismic anchor motions were then applied in each of two orthogonal horizontal directions and the vertical direction. These three directional responses were then combined on a SRSS basis to generate an equivalent static seismic displacement response. The displacement response was combined with the inertial response in accordance with the load combinations provided in Reference 3 (Section 4.5.4 of EE 01-147) and evaluated using the criteria contained in that section.

For piping systems with relatively simple geometric configurations, or where the span criteria were only slightly exceeded in a very local area of the piping system, an Equivalent Static Load Method was applied that used classical beam design and analysis theory. Simplified models were created based on the principles of mechanics as well as the experience and judgement of the analyst, and were reviewed by individuals with extensive experience in the seismic design and analysis of piping systems. The piping system was represented in each of two orthogonal horizontal directions and the vertical direction by a beam having end conditions and properties defined such that they conservatively represented the portion of the piping system under review. These beam models in many cases were slightly different in each of these three directions to more accurately represent the piping system. An equivalent uniform static acceleration was then applied to the entire length of each of the two orthogonal horizontal beam models and the vertical beam model. On a case by case basis, the acceleration applied in the orthogonal horizontal directions could be either the same or different magnitude. In general, a different value of uniform acceleration was applied in the vertical direction than was applied in either orthogonal horizontal direction. These maximum responses (response being defined to include force, moment, support loads, etc.), regardless of location, from each of these three beam models were then combined on a SRSS basis to generate an equivalent static seismic inertial response. If seismic anchor motions existed at the branch connection point, or inter-building seismic anchor motions were being evaluated, the seismic anchor motions were then applied in each of two orthogonal horizontal directions and the vertical direction. These three responses were then combined on a SRSS basis to generate an equivalent static seismic displacement response. The displacement response was combined with the inertial response in accordance with the load combinations provided in Reference 3 (EE 01-147 Section 4.5.4).

*(b)* *The design and associated simplified analysis account for the relative motion between all points of support.* [This addresses Draft RAI Question b).]

NPPD Approach

The following paragraphs provide a discussion of the approach used to evaluate relative seismic motions between points of support in a given piping system. The same approach was applied to the Equivalent Static Load Methods and the dynamic seismic analyses.

The points of support for the MSIV leakage pathway are located in the Turbine Building, the Reactor Building, and the Turbine Pedestal. The inter-floor displacements within these structures were evaluated and determined to be negligible. It was therefore unnecessary to evaluate the piping for relative motions between supports attached to various elevations or locations within each of these structures. However, the seismic displacements between these structures were evaluated and determined to be of significance. In conducting the analysis of a given piping configuration that was routed between the Reactor Building and the Turbine Building, or the Turbine Building and the Turbine Pedestal, these relative displacements were applied at appropriate attachment points individually in each of orthogonal directions (X, Y, Z). The SRSS of these individual directional load cases resulted in the total seismic displacement load case, which was then combined as with the seismic inertia and other load cases as discussed in Reference 3 (Section 4.5.4 of EE 01-147).

For small branch lines attached to larger systems (such as branch lines attached to the Main Steam piping), where the larger system had seismic motions of significance, an approach very similar to the one discussed in the previous paragraph was used. The principal difference was that the seismic displacements were applied at the branch line to the larger pipe connection point.

*(c)* *To obtain an equivalent static load of equipment or component which can be represented by a simple model, a factor of 1.5 is applied to the peak acceleration of the applicable floor response spectrum. A factor of less than 1.5 may be used if adequate justification is provided* [This addresses the second part of Draft RAI Question a).]

NPPD Approach

For either of the Equivalent Static Load Methods discussed previously to resolve specific outliers, the uniform acceleration applied in the analysis was 1.0 times the peak acceleration of the amplified floor response spectra (AFRS) in the applicable orthogonal horizontal or vertical direction. The use of a factor of 1.0 is based on the work conducted in References 7.17 and 7.22 of EE 01-147. These published studies demonstrated that for equivalent static seismic analyses (when using a conservative AFRS as was developed for the CNS MSIV leakage pathway evaluation), a factor of 1.0 applied to the peak of the two orthogonal horizontal AFRS and the vertical AFRS enveloped the results as predicted by the Response Spectra Modal Analysis Method for piping stresses and pipe support loads. In addition, these studies demonstrated that factors lower than 1.0 could be justified for low frequency piping systems, similar to those systems found in the main steam drain lines at CNS. However, it was conservatively decided to limit the factor to a lower bound value of 1 for the CNS MSIV leakage pathway analyses. For CNS, use of a factor of 1.0 in the equivalent static analysis method is further supported by other conservatism used in the overall evaluation approach:

- The building AFRS were generated using SRP methodology and Regulatory Guidelines 1.60 & 1.61. The input ground response spectra is conservative relative to the CNS licensing basis ground response spectra.
- The application of stress criteria that limits the piping stress and pipe support member stresses to essentially $S_y$ for the SSE load case. This is significantly below the 1.2 $S_y$ to 2.0 $S_y$ stress limits, which the NRC has accepted in the past for interim operability evaluations and functional capability determinations.

To validate the application of this factor of 1.0 for use at CNS, an additional plant-specific comparison was done in which a bounding piping system was evaluated using both a static seismic analysis with a factor of 1.0 and the Response Spectrum Modal Analysis method. The bases for selection of the model studies were:

- The piping system reviewed contained a larger amount of piping in comparison to most of the equivalent of static analyses conducted.
- The model included multiple pipe sizes (4", 1½") which represented the possible interaction effects (elastic follow-up) between large and small piping systems.
- For the piping systems evaluated using equivalent static analysis method, this system had the lowest margin (1.2) against the pipe stress acceptance criteria of 2.4 $S_h$.
- The system contained multiple directions of piping runs and multiple branch lines.
- The system contained reduced outlet branches that resulted in points of high lateral and vertical stress and load concentration.
- The system contained a large valve approximately mid-span between two supports. The valve had an upper bound pressure rating (i.e., weight) in comparison to the valves in other systems evaluated using equivalent static load methodology. This valve created a large concentrated lateral and axial load in the piping system.
- The piping had vertical support locations in some areas approximately twice the B31.1 recommended deadweight spans and lateral support locations 2 to 3 times the suggested B31.1 deadweight spans. This is typical of other piping system evaluated using equivalent static load methodology.
- The piping was configured higher in the Turbine Building and used an AFRS with the highest amplification in the Turbine Building.

The results of this analysis are summarized as follows:

- The fundamental lateral response frequency was ≈ $3h_z$ and the fundamental vertical response frequency was ≈ $11.5h_z$.
- The pipe stresses predicted by the dynamic analyses were less than those predicted by the static analysis with a factor of 1.0.
- The pipe support loads predicted by the dynamic analyses were no more than 90% of those predicted by the static analysis with a factor of 1.0. This provides at least 10% margin to account for possible variations that may result due to uncertainties in other outlier piping systems.

This comparative study of a bounding piping system provides a sound technical basis for the application of a 1.0 factor to peak AFRS when applying the Equivalent Static Analyses Method to specific outliers in the MSIV leakage pathway at CNS.

Regarding the reference to Appendix N of the ASME Code provided in Reference 2, NPPD recognizes that the NRC has not endorsed this appendix. However, the purpose of that discussion was to show that the use of a factor of 1.0 has received extensive technical review via the ASME Boiler and Pressure Code process and was found acceptable.

The use of the Equivalent Static Load Method with a factor less than 1.5 has regulatory precedent. In the seismic verification of the MSIV leakage path submitted by Monticello Generating Station on June 15, 1996, the licensee applied an Equivalent Static Load Method that used a demand static load coefficient derived by multiplying the maximum spectral acceleration of the ground response spectrum by 1.5 in the horizontal direction, and 1.5 times two-thirds of the maximum spectral acceleration of the ground response spectrum in the vertical direction. No additional factors were applied to the resulting peak accelerations. This approach was accepted by the NRC in Paragraph 3 of Section 4.6.1 of the associated NRC Safety Evaluation, dated September 16, 1998. NRC acceptance of a 1.0 factor to the conservatively developed CNS Turbine Building AFRS should accordingly be appropriate.

Correspondence No: NLS2002136

The following table identifies those actions committed to by the 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 to the NRC for the NRC's information and are not regulatory commitments. Please notify the NL&S Manager at Cooper Nuclear Station of any questions regarding this document or any associated regulatory commitments.

| COMMITMENT | COMMITTED DATE OR OUTAGE |
|---|---|
| None | N/A |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |