Mr. G. R. Horn
Sr. Vice President of Energy Supply
Nebraska Public Power District
1414 15th Street
Columbus, NE 68601

September 8, 1998

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION RELATED TO UNRESOLVED SAFETY ISSUE A-46, "VERIFICATION OF SEISMIC ADEQUACY OF MECHANICAL AND ELECTRICAL EQUIPMENT IN OPERATING REACTORS," COOPER NUCLEAR STATION (TAC NO. M69439)

Dear Mr. Horn:

By letter dated June 13, 1996, the Nebraska Public Power District (NPPD) submitted a summary report for the Cooper Nuclear Station related to Unresolved Safety Issue A-46, "Verification of Seismic Adequacy of Mechanical and Electrical Equipment in Operating Reactors." Based on the NRC staff's ongoing review of that submittal, the staff has developed the enclosed request for additional information (RAI).

You are requested to provide a response to the enclosed RAI within 90 days of the receipt of this letter. If you have any questions concerning the enclosure, please contact me at (301) 415-1336.

Sincerely,
ORIGINAL SIGNED BY:
James R. Hall, Senior Project Manager
Project Directorate IV-1
Division of Reactor Projects III/IV
Office of Nuclear Reactor Regulation

Docket No. 50-298

Enclosure: Request for Additional Information

cc w/encl: See next page

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WASHINGTON, D.C. 20555-0001

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REQUEST FOR ADDITIONAL INFORMATION

RELATED TO UNRESOLVED SAFETY ISSUE A-46:

VERIFICATION OF SEISMIC ADEQUACY OF MECHANICAL AND ELECTRICAL

EQUIPMENT IN OPERATING REACTORS

COOPER NUCLEAR STATION

By letter dated June 13, 1996, the Nebraska Public Power District (NPPD, the licensee) submitted a summary report for the Cooper Nuclear Station (CNS) related to Unresolved Safety Issue A-46, "Verification of Seismic Adequacy of Mechanical and Electrical Equipment in Operating Reactors." The NRC staff has developed the following questions, based on our review of that submittal and its attachments.

1. Based on the information provided, it is unclear as to how some equipment was determined to meet the intent of the caveats described in Appendix B of the Generic Implementation Procedure (GIP-2). The following items pertain to Table 3.1 in Attachment 2 to your letter of June 13, 1996.

   a. For equipment CRD-ACC-125 and CRD-ACC-128, you stated that the HCU racks differ from the typical instrument racks in the experience data base, but the Seismic Review Team judged that their construction, equipment attachments, and anchorage are at least as strong as those racks included in the data base. Provide the basis of the judgement.

   b. Core Spray and RHR instrument racks LRP-PNL-(25-1), LRP-PNL-(25-59), LRP-PNL-(25-60), and LRP-PNL-(25-62) are anchored to 3.5" thick concrete pads that are not doweled into the underlying floor slab. Provide the technical basis to demonstrate the seismic adequacy of the anchorage.

   c. For valves SW-AOV-857AV and SW-AOV-858AV whose bodies are made of cast iron, provide the technical basis to demonstrate that the seismic stresses in the valve bodies due to piping loads are within the allowable limits.

   d. For valves SW-MOV-2128MV, SW-MOV-2129MV, and CRD-AOV-CV33, provide a calculation to demonstrate that the offsetting operators do not over-stress the valves and the attached piping during a seismic event.

2. On page 5 of Attachment 2 to your June 13, 1996 letter, you stated that since the 120-day submittal, other floor response spectra (FRS) were developed that, per the GIP, would be considered realistic, median-centered. You further stated that these FRS were being considered for outlier evaluations. In your submittal, you mentioned several computer programs such as SHAKE, CLASS, SSIN and SUPELM which were used in the analyses. However, these computer codes were reviewed and approved by the NRC on a case-by-case basis for limited application. Provide validation documents which should include the details of the analysis including input ground motions, the

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manuals for the programs used, appropriate references where one can find methodologies and treatment of strain dependence of parameters and its application in a soil-structure interaction (SSI) analysis. In addition, the July 1994, EQE Report (Attachment 4 to your submittal) indicates that the SSI model was divided into simpler substructure models that were analyzed separately and the results were superposed to obtain the overall response. Provide an explicit procedure that shows how strain dependent parameters of soil were treated in the SSI analysis. Also, provide a detailed summary of results including intermediate results of substructural analyses and parametric studies, etc. sufficient for the staff to perform its technical review.

In your submittal of the technical validation, provide estimates of the errors associated with the numerical methods used, to demonstrate that the results are not sensitive to small changes in initial values and parameters such as damping and shear modulus. Provide references where the method has been compared against actual data.

Also, provide complete documentation for Attachment 4 to your June 13, 1996 letter, (a July 1994, report by EQE international), including the complete index and page numbers. Attachment 4 provided with letter appears to be incomplete.

3. The NRC staff has concerns about the way the USI A-46 cable trays and conduit raceways issue was being disposed of by some USI A-46 licensees. The staff issued requests for additional information (RAI) to several licensees on this issue. SQUG responded instead of the licensees because SQUG considered the RAI to be generic in nature. The staff issued a subsequent RAI to SQUG as a follow up to their response. However, the staff found that the correspondence with SQUG did not achieve the intended results in that it did not address the identified technical concerns of the staff. Therefore, we are requesting your response to the items stated below.

The GIP procedure recommended performing what is called "a limited analytic evaluation" for selected cable and conduit raceway supports. The procedure further recommended that when a certain cable tray system can be judged to be ductile and if the vertical load capacity of the anchorage can be established by a load check using three times the dead weight, no further evaluation is needed to demonstrate lateral resistance to vibration from earthquakes. The staff has concerns with the manner in which these simplified GIP criteria were implemented at your plant.

The GIP procedure eliminates horizontal force evaluations by invoking ductility. However, some so called non-ductile cable tray support systems would eventually become ductile by inelastic deformation, buckling or failure of the non-ductile cable tray supports and members. This procedure is a basic departure from conventional methods of engineering evaluation and the GIP does not provide an adequate bases for dealing with those cable trays that are initially judged to be non-ductile but are eventually called ductile by postulating failure of the lateral supports. If this procedure was followed for eliminating cable trays from further assessment at your plant, then all the cable trays could conceivably be screened out from A-46 evaluation. We request that you provide the following information to enable our assessment and safety evaluation of cable trays at your plant.

a. Define ductility in engineering terms as used at Cooper for the USI A-46 evaluation. Clarify how this definition is applied to actual system configurations at Cooper consistently for the purpose of analytical evaluation.

b. Provide the total number of raceways that were selected for worst-case analytical calculations and were classified as ductile in your A-46 evaluation and for which you did not perform a horizontal load evaluation. Indicate the approximate percentage of such raceways as compared with the population selected for analytical review. Discuss how the ductility concept is used in your walkdown procedures.

c. Describe the typical configurations of your ductile raceways (dimension, member size, supports, etc.)

d. Justify the position that ductile raceways need not to be evaluated for horizontal load. When a reference is provided, state the page number and paragraph. The reference should be self-contained, and not refer to another reference.

e. In the evaluation of the cable trays and raceways, if the ductility of the attachments is assumed in one horizontal direction, does it necessarily follow that the same system is ductile in the perpendicular direction? If yes, provide the basis of this conclusion. If it is not ductile in the perpendicular direction, how was the seismic adequacy of the attachments evaluated?

f. Discuss any raceways and cable trays including supports in your plant that are outside of the experience data. Explain what criteria are used for establishing their safety adequacy and specify your plan for resolution of outliers that did not meet the acceptance criteria. Provide examples of the configurations of such raceways and cable trays including supports. Also, indicate the percentage of cable trays and raceways outside the experience data in relation to the population of raceways and cable trays examined during the walkdowns of the safe shutdown path. How are they going to be evaluated and disposed?

g. Submit the evaluation and analysis results for four of the representative sample raceways (one single non-ductile, one single ductile, one multiple non-ductile, and one multiple ductile raceway), including the configurations (dimension, member size, supports, etc.).

4. The loading diagram shown on page 1 of Calculation 95C2893 in Section 6 of Appendix D to Attachment 2 of your letter, (for limited analytical reviews (LARs) of cable spreading room at Control Building Elevation 918'-6") indicates that the top and the right hand side of the cable tray system are attached to the wall leaving the left and the bottom of the panel free to deform in the directions out of the plane, as well as in the plane of the panel.

For a lateral load evaluation, it appears that the only load investigated is lateral load in the plane of the panel, which is in tension with respect to restraints called T_{HA} and T_{HB}. Discuss the lateral compressive load path and demonstrate that the panel is stable with respect to in-plane buckling (out-of-plane sway). This may be the weak path (or governing path). For example, under a compressive load, the member that supports the weight of W5 (shown in the loading diagram) and similar members that support other loads may swing away from the plane of the panel in the direction perpendicular to the panel and render itself useless as a load-supporting structural member. Provide a sample evaluation of the cable tray system considering all load paths that include a horizontal SSE load perpendicular to the plane of the cable tray.

Provide sample drawings that were used in the evaluation, particularly, the drawings showing the overall layout of the cable tray system where you established the structural boundary for your calculation. Also, provide the drawings beyond the boundary which you did not include as part of the cable tray system you evaluated. The drawings should include a layout of the cable tray systems perpendicular to the panel. Also, discuss the sensitivity of your results with respect to changes of the structural boundaries in your analytical model.

5. If Thermo-Lag panels are attached to a cable tray system, discuss how the changes in weight have been incorporated in the GIP evaluation of these systems and their supports.

6. In the summary report, you stated that you were committed to implement the GIP-2, including the clarifications, interpretation, and exceptions in SSER-2, and to communicate to the NRC staff any significant or programmatic deviations from the GIP guidance. You further stated that there are no significant or programmatic deviations from the GIP guidance.

   Provide the worst-case items (from the safety point of view) which deviate from the GIP-2 guideline but were categorized as not being significant. In addition, provide the definition of "safety significant" that the walkdown crew used and the technical basis to ensure that the definition is adequate for plant safety.

7. You stated that resolution of the USI A-46 outliers is continuing at your plant. With regard to the unresolved outliers in Table 3-2 of Attachment 2, explain the safety implications for not resolving these outliers, in accordance with Item 17 in Section 9.1 of the GIP-2. You are also requested to elaborate on your decision to defer the resolution of certain identified outliers and your evaluation in support of the conclusion that the licensing basis for the plant will not be affected by your decision.

8. In reference to Section 4 of Attachment 2, provide a sample calculation to demonstrate the seismic adequacy of large tanks (e.g., Diesel Generator Fuel Oil Day Tanks DGDO-TK-DOD1, Diesel Generator Fuel Oil Storage Tanks DGDO-TK-DOSA, Diesel Generator Air Receivers DGSA-RCVR-1A).

9. Appendix I to Attachment 3 of your letter contains thirty-two outlier relays; including sixteen relays whose seismic capacity could not be established from the EPRI GERS, fourteen relays of which the seismic demand exceeded relay capacity, and two low ruggedness relays that were identified from Table 6.2 of EPRI Report NP-7147-SL. On the basis of the information provided in the relay data sheet in Appendix I, a total of 159 equipment components may not be able to perform their required functions during a seismic event. If any of these subject components will remain in service following the October 1998, refueling outage, provide an assessment to ensure the acceptability of their continued use.

10. Referring to the in-structure response spectra provided in your 120-day-response to the NRC's request in Supplement No.1 to Generic Letter (GL) 87-02, dated May 22, 1992, the following information is requested:

    a. Identify structure(s) which have in-structure response spectra (5% critical damping) for elevations within 40-feet above the effective grade, which are higher in amplitude than 1.5 times the SQUG Bounding Spectrum.

    b. With respect to the comparison of equipment seismic capacity and seismic demand, indicate which method in Table 4-1 of GIP-2 was used to evaluate the seismic adequacy for equipment installed on the corresponding floors in the structure(s) identified in Item (a) above. If you have elected to use method A in Table 4-1 of the GIP-2, provide a technical justification for not using the in-structure response spectra provided in your 120-day-response. It appears that some A-46 licensees are making an incorrect comparison between their plant's safe shutdown earthquake (SSE) ground motion response spectrum and the SQUG Bounding Spectrum. The SSE ground motion response spectrum for most nuclear power plants is defined at the plant foundation level. The SQUG Bounding Spectrum is defined at the free field ground surface. For plants located at deep soil or rock sites, there may not be a significant difference between the ground motion amplitudes at the foundation level and those at the ground surface. However, for sites where a structure is founded on shallow soil, the amplification of the ground motion from the foundation level to the ground surface may be significant.

    c. For the structure(s) identified in Item (a) above, provide the in-structure response spectra designated according to the height above the effective grade. If the in-structure response spectra identified in the 120-day response to Supplement No.1 to GL 87-02 was not used, provide the response spectra that was actually used to verify the seismic adequacy of equipment within the structures identified in Item (a) above. Also, provide a comparison of these spectra to 1.5 times the Bounding Spectrum.

11. With respect to operator actions in response to a seismic event:

    a. Describe what reviews were performed to determine if any local operator actions required to safely shutdown the reactor (i.e., implement the SSEL) could be affected by potentially adverse environmental conditions (such as loss of lighting, excessive heat or humidity, or in-plant barriers) resulting from the seismic event. Describe how staffing was evaluated and describe the reviews which were conducted to ensure operators had adequate time and resources to respond to such events.

b. As part of the licensee's review, were any control room structures which could impact the operator's ability to respond to the seismic event identified? Such items might include, but are not limited to: MCR ceiling tiles, non-bolted cabinets, and non-restrained pieces of equipment (i.e., computer keyboards, monitors, stands, printers, etc.). Describe how each of these potential sources of interaction has been evaluated and describe the schedule for implementation of the final resolutions.

c. Describe what reviews were performed to determine if any local operator actions were required to reposition "bad actor relays." For any such activities, describe how adverse environmental conditions (such as loss of lighting, excessive heat or humidity, or in-plant barriers) resulting from the seismic event were analyzed and dispositioned. Describe how staffing was evaluated and describe the reviews which were conducted to ensure operators had adequate time and resources to respond to such events.

d. Describe which of the operator actions associated with resetting SSEL equipment affected by postulated relay chatter are considered to be routine and consistent with the skill of the craft. If not considered skill of the craft, what training and operational aids were developed to ensure the operators will perform the actions required to reset affected equipment?

e. Assume the alarms associated with " bad actor relays" are expected to annunciate during the seismic event. Do the operators have to respond to those annunciators and review the annunciator response procedures associated with them for potential action? How would those additional actions impact the operators' ability to implement the Normal, Abnormal, and Emergency Operating Procedures required to place the reactor in a safe shutdown condition?

f. To the extent that Normal, Abnormal, and Emergency Operating Procedures were modified to provide plant staff with additional guidance on mitigating the A-46 Seismic Event, describe what training was required and provided to the licensed operators, non-licensed operators, and other plant staff required to respond to such events.