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USI A-46 as requested by 960830 ltr

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December 20, 1996

U.S. Nuclear Regulatory Commission
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Ladies/Gentlemen:

Docket 50-305
Operating License DPR-43
Kewaunee Nuclear Power Plant
Response to Request for Additional Information Regarding the Summary Report For Resolution of USI A-46

References: 1) Supplement No. 1 to Generic Letter (GL) 87-02, that Transmits Supplemental Safety Evaluation Report No. 2 (SSER NO. 2) on SQUG Generic Implementation Procedure, Revision 2, As Corrected on February 14, 1992 (GIP-2), dated May 22, 1992, U.S. Nuclear Regulatory Commission.

2) Letter from C.R. Steinhardt (WPSC) to U.S. Nuclear Regulatory Commission (NRC), "Generic Letter 87-02, Summary Report for Resolution of USI A-46," dated November 10, 1995.

310048

3) Letter from Richard J. Laufer (NRC) to M.L. Marchi (WPSC), "Request for Additional Information Related to the Summary Report for Resolution of Unresolved Safety Issue (USI) A-46 - Kewaunee Nuclear Power Plant," dated August 30, 1996.

In Supplement 1 to Generic Letter (GL) 87-02 (reference 1), the NRC Staff required affected licensees to submit a report summarizing the results of the USI A-46 program. Wisconsin Public Service Corporation (WPSC) submitted the Summary Report for Resolution of US1 A-46 for the Kewaunee Nuclear Power Plant by letter dated November 10, 1995 (reference 2). In reference 3, the NRC requested additional information regarding the Kewaunee USI A-46 Summary Report. The attachments to this letter provide the additional information as requested in reference 3, with the exception of NRC question no. 9. As discussed in the response to NRC question no. 9 provided in Attachment I, WPSC wishes to defer the response following the receipt of the revised RAI from the NRC.

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Please contact a member of my staff, if you have any questions or require any additional information.

Sincerely,

Warren Steinhardt

C. R. Steinhardt
Senior Vice President - Nuclear Power

GCR

Attach.

cc - US NRC Region III
US NRC Senior Resident Inspector

Subscribed and Sworn to
Before Me This 20th Day
of December 1996

Jeanne M. Ferris
Notary Public, State of Wisconsin

My Commission Expires:
June 13, 1999

ATTACHMENT I

Letter from C. R. Steinhardt (WPSC)

to

Document Control Desk (NRC)

Dated

December 20, 1996

RESPONSE TO USNRC QUESTIONS ON KEWAUNEE USI A-46 SUMMARY REPORT

NRC Question 1

In Section 1.3 of Attachment 1 of the referenced letter, it states that Section 6 discusses the results of the Tanks and Heat Exchangers assessment and that the results are also summarized under Class 21 in the Screening Verification Data Sheet (SVDS) given in Appendix D. However, there are no Class 21 items found in the SVDS in Appendix D. Provide such information regarding the assessment results of Tanks and Heat Exchangers in Appendix D.

WPSC Response to Question 1

WPSC misstated in Section 1.3 of the Kewaunee Summary Report that Class 21 equipment is summarized in the Screening Verification Data Sheets (SVDS) provided in Appendix D. Generally, the format of the SVDS is not applicable for Tanks & Heat Exchangers (Class 21) or Electrical Raceways (Class 22), and the results are presented separately (not in SVDS forms) as suggested in Section 9.1 of the GIP-2. Section 6 and Table 6-1 of the Kewaunee Summary Report describe the results of the tanks and heat exchangers reviews. Table 6-1 is reproduced below for information. In addition, Screening and Evaluation Work Sheets (SEWS) were completed for each Class 21 equipment item.

Table 6-1
Tank & Heat Exchanger Evaluation Results

ID	Description	Type	Results
101-011	Accumulator 1A	Large Vertical Accumulator	OK - Checked anchorage and supports Non-A46 equipment. Evaluation required for seismic IPEEE program only.
101-012	Accumulator 1B	Large Vertical Accumulator	OK - Checked anchorage and supports Non-A46 equipment. Evaluation required for seismic IPEEE program only.
135-021	Seal Water Heat Exchanger	Vertical Heat Exchanger	OK - Checked anchorage and supports
135-031	Regenerative Heat Exchanger	Horizontal Heat Exchanger	OK - Checked anchorage and supports
135-051	Residual Heat Exchanger 1A	Vertical Heat Exchanger	OK - Checked anchorage and supports Non-A46 equipment. Evaluation required for seismic IPEEE program only.
135-052	Residual Heat Exchanger 1B	Vertical Heat Exchanger	OK - Checked anchorage and supports Non-A46 equipment. Evaluation required for seismic IPEEE program only.
135-081	Component Cooling Heat Exchanger 1A	Horizontal Heat Exchanger	OK - Checked anchorage and supports
135-082	Component Cooling Heat Exchanger 1B	Horizontal Heat Exchanger	OK - Checked anchorage and supports

ID	Description	Type	Results
153-011	Pressurizer Relief Tank	Horizontal Storage Tank	OK - Checked anchorage and supports
153-021	Tank-Refueling Water Storage Tank	Vertical Storage Tank	Outlier - Evaluated using Appendix H Rules of EPRI Rept. NP-6041, Rev. 1
153-061	Tank - Volume Control Tank	Vertical Storage Tank (on legs)	OK - Checked anchorage and supports (legs)
153-081	Boric Acid Tank 1A	Vertical Storage Tank (on legs)	OK - Checked anchorage and supports (legs)
153-082	Boric Acid Tank 1B	Vertical Storage Tank (on legs)	OK - Checked anchorage and supports (legs)
153-351	DG Fuel Oil Day Tank 1A1	Vertical Storage Tank (on legs)	OK - Checked anchorage and supports (legs)
153-352	DG Fuel Oil Day Tank 1A2	Vertical Storage Tank (on legs)	OK - Checked anchorage and supports (legs)
153-353	DG Fuel Oil Day Tank 1B1	Vertical Storage Tank (on legs)	OK - Checked anchorage and supports (legs)
153-354	DG Fuel Oil Day Tank 1B2	Vertical Storage Tank (on legs)	OK - Checked anchorage and supports (legs)
153-361	DG Fuel Oil Storage Tank 1A	Horizontal Storage Tank (buried)	OK - Checked tank for body waves, seismic soil pressure and axial stresses due to soil friction
153-362	DG Fuel Oil Storage Tank 1B	Horizontal Storage Tank (buried)	OK - Checked tank for body waves, seismic soil pressure and axial stresses due to soil friction
148-011	Turbine Oil Storage Tank	Horizontal Storage Tank	OK - Checked anchorage and supports Non-A46 equipment. Evaluation required for seismic IPEEE program only.
153-944	Tank - Control Room AC Expansion Tank B	Small Accumulator	Outlier - Hung from U-bolts -not positively restrained
153-945	Tank - Control Room AC Expansion Tank A	Small Accumulator	Outlier - Hung from U-bolts -not positively restrained
158-011	Service Water Strainer 1A1	Vertical, rotating drum strainer on discharge of SW pump	OK - Checked anchorage and supports
158-012	Service Water Strainer 1A2	Vertical, rotating drum strainer on discharge of SW pump	OK - Checked anchorage and supports
158-013	Service Water Strainer 1B1	Vertical, rotating drum strainer on discharge of SW pump	OK - Checked anchorage and supports
158-014	Service Water Strainer 1B2	Vertical, rotating drum strainer on discharge of SW pump	OK - Checked anchorage and supports

NRC Question 2

In Section 3 of Attachment 1, it states that the licensee's 120-Day Response to Supplement No. 1 to Generic Letter 87-02, approved by the NRC staff in December 1992, provided in-structure response spectra (IRS) at 0.5% and 1% damping values. For the A-46 assessment, the 5% floor response spectra was generated based on the existing 0.5% IRS. This was done by WPSC using the Stevenson and Associates (S&A) SPECTRA program. Clarify whether the S&A SPECTRA computer code had been bench-marked against codes that are approved by the NRC. If not, provide the validation documentation of the S&A SPECTRA code to demonstrate the acceptability of the generated IRS in comparison to the IRS calculated by using the method described in Section 4.4.3 of the Generic Implementation Procedure, Revision 2 (GIP-2) or other NRC approved methods.

WPSC Response to Question 2

The Stevenson & Associates SPECTRA program is the embedded code used for direct-generation of a power spectral density (PSD) from a response spectrum in the GENRS code. The GENRS program is fully described and validated in Reference 33 of the GIP-2 (EPRI Report NP-7146-SCCML, "Guidelines for Development of In-Cabinet Amplified Response Spectra for Electrical Benchboards and Panels"). In SSER No. 2 (Supplement 1 to Generic Letter 87-02), the NRC reviewed this application in GENRS and concluded that the direct-generation method in general and its application in the GENRS computer code was viable.

Nevertheless, the SPECTRA program is a QA validated and verified, safety-related software package. The QA Program Documentation Manual for SPECTRA is included as Attachment II. SPECTRA, a Windows™ operating system product, has been QA verified against the EDASP direct-generation code written for the DOS™ operating system. The EDASP code is an earlier S&A software product and was QA verified against the STARDYNE computer code. The STARDYNE code is a well established and QA verified code that has been used extensively throughout (and outside) the nuclear industry. The direct-generation algorithm is identical in EDASP and SPECTRA codes.

NRC Question 3

In Table C.5-1 of the GIP-2, the pullout allowables for the grouted-in-place anchors are one tenth of the cast-in-place anchorage allowables in Table C.3-1. However, in Table 5-1 of Attachment 1, it states that the tensile allowables of the cast-in-place anchorage were used for the grouted-in-place anchors which are installed in the following equipment:

Auxiliary Feedwater Pump (AFW) Pumps 145-411 & 412,
Turbine Driven AFW Pumps 145-413,
Service Water Pumps [145]-441, -442, -443, [-444],
DG Fuel [Oil] Day Tanks 153-352 & -353, and
Relay Racks RR101-109, RR112-125, RR130-134.

Based on the information provided by the licensee, it is unclear how these equipment anchorages met the intent of the caveats as stated by the licensee. Provide additional information to clarify whether the installation procedures used for the grouted-in-place anchorages at Kewaunee were similar to those in Reference 28 of the GIP-2, and list the similarities and differences between the two procedures.

WPSC Response to Question 3

The nominal allowable capacities for grouted-in-place bolts provided in Table C.5-1 of GIP-2 are recommended for use if effective installation procedures were not used during anchor bolt installation. However, if installation procedures similar to those in Reference 28 of the GIP-2 were used, then cast-in-place allowable capacities may be used.

Reference 28 is a procedure developed by Tennessee Valley Authority (TVA) for its power plant facilities. In general, the procedure discusses proper clean-out procedures and roughening of the cored anchor hole. During Kewaunee plant construction, procedure QCIP-511, " Procedure for Surveillance of the Installation of Pumps and Similar Rotating Equipment" was used to help ensure proper installation of grouted-in-place-anchors. The QCIP-511 procedure contains provisions for ensuring proper foundation preparation and grout placement. In addition, the construction drawings for the affected equipment specify that sandblasting of the cored hole is required for grouted-in-place anchors. Completed QCIP-511 checklists were found for the auxiliary feedwater (AFW) pumps, the turbine-driven AFW pump, and the service water pumps, which indicate the anchors were properly installed.

With regard to the grout, it was established that Colma-Dur grout was used extensively during plant construction. Colma-Dur is an older version of the Sika-Dur Hi-Mod 32 grout manufactured by the SIKA Corporation. Direct discussions with a representative of the SIKA Corporation established that both grouts could be applied to wet or dry surfaces, and are non-shrink type grouts. During the A-46 walkdowns, the grouted anchorages were closely inspected and found to be in excellent condition with no shrinkage or cracking evident. Therefore, the non-shrink grout is clearly performing as intended. It is concluded that cast-in-place allowables are justified for the grouted-in-place pump anchors.

Although procedures or documentation were not located for the DG Fuel Oil Day Tanks or the Relay Racks in question, interviews with construction personnel employed on-site during plant construction indicate that the construction crews responsible for installation of the grouted-in-place anchors would follow the same practice for all anchors, regardless of the application. However, to ensure that adequate anchor capacity is available for the undocumented anchorages, anchorage evaluations were subsequently conducted using the reduced tension allowables for grouted-in-place anchorages. The evaluations demonstrate that the DG Fuel Oil Day Tanks and Relay Racks have adequate anchorage capacity. The factors of safety for the DG Fuel Oil Day Tanks and the Relay Racks are 2.1 and 3.3, respectively, when using the reduced allowables.

NRC Question 4

In accordance with Appendix C of the GIP-2, the minimum embedment of 16D (Diameter) should be used for the J-bolts. In Section 5 of Attachment 1, it is indicated that Switchgear Buses 5, 6, 51,61 and 62, and Reactor Trip Breaker RD106, are anchored to embedded channels. These channels are anchored in the floor concrete by ½" J-bolts of 12D embedment. It is stated that these anchorages meet the intent of the GIP-2 caveat rules because there is no tensile load in the J-bolts as the restoring moments exceed the seismic moments. Based on above information, we believe that these J-bolts should be considered as outliers in accordance with the GIP-2. Provide detailed calculations of the seismic overturning moments and the restoring moments for the above equipment items.

WPSC Response to Question 4

A worst-case composite configuration of the switchgear buses and reactor trip breaker cabinet can be used to demonstrate that the cabinets are not subject to overturn, and therefore no tensile loads are imparted to the embedded J-bolts.

Each of the switchgear buses and the reactor trip breaker cabinet are part of multi-bay assemblies, with adjacent cabinet compartments bolted together in long line-ups. Therefore, the cabinet front-to-back response causes bending about the narrowest cabinet dimension, which is 55 inches. The breakers are conservatively assumed to have a fundamental frequency equal to 5 Hz, so by selecting the cabinet location with the largest amplified floor response at 5 Hz and 5% damping, the resulting horizontal acceleration is 0.27g. The tallest cabinet is 90 inches in height, so the vertical center of gravity can be conservatively approximated to be 45 inches (geometric center).

Therefore, the overturning moment (M_{otm}) can be established as:

$$M_{otm} = 0.27g \cdot 45" \cdot m = 12.2m$$

(where m = cabinet mass)

The restoring moment (M_{rm}) can be calculated as one-half of the cabinet depth (55 inches) times the cabinet mass (m), times the force of gravity (g) minus the vertical acceleration at 33 Hz (assumed upwards);

$$M_{rm} = (1g - 0.104g) \cdot 55/2" \cdot m = 24.6m$$

Given that the restoring moment (M_{rm}) is approximately twice the value of the overturning moment (M_{otm}), it can be concluded that the cabinets will not lift off the floor, and therefore no tensile loads are imparted to the embedded J-bolts.

NRC Question 5

In Section 6 of Attachment 1, it is stated that the refueling water storage tank (RWST) is a vertical tank that did not meet the caveat for a flat bottom vertical tank in Section 7 of the GIP-2. It was considered an outlier and was evaluated using Conservative Deterministic Failure Margin (CDFM) analysis following the procedures of Appendix H to EPRI Report NP-4061. The following additional clarifications and information are requested from the licensee.

a. Clarify whether the RWST did not meet the applicable range of parameters listed on Table 7-1 of the GIP or that the RWST did not meet the criteria specified in Chapter 7 of the GIP. Also, identify the aspects of the RWST nonconformance.

b. Provide the computed values of the seismic demand overturning bending moment at the base of the RWST (Section 7.3.2 of the GIP), and the overturning moment capacities sustained by the bolts embedded in concrete (Section 7.3.3.1 of the GIP), the anchorage connection capacity (Section 7.3.3.2 of the GIP), and the RWST shell buckling capacity (Section 7.3.3.3 of the GIP).

c. Provide the computed values of the seismic shear demand (Section 7.3.2, Step 5, of the GIP) and the seismic shear capacity of the RWST (Section 7.3.4, Step 19, of the GIP).

d. Describe and justify the use of the CDFM approach in detail, and provide the corresponding values, calculated by the CDFM approach, of the items identified in questions 5.b and 5.c.

WPSC Response to Question 5

The RWST is a 276,500 gal vertical tank measuring 26 ft in diameter and 70 ft in height. The tank is enclosed inside a reinforced concrete shield wall which measures 31 ft inside diameter. The tank is anchored at the bottom with eight, 1" diameter anchors. Sixteen (16) lateral supports are installed between the tank wall and the concrete shield wall. Four lateral supports are installed at the top of the tank (at 90 degree intervals), and four lateral supports are installed at each of three intermediate positions for a total of sixteen supports. The response to NRC question 5 is as follows:

a. The RWST does not meet the criteria of Section 7 of the GIP because it is a braced tank with 16 lateral braces over the height. The GIP method which calculates frequencies and responses based on a free standing tank obviously would not apply. In addition, the fluid height-to-tank radius ratio (H=69.5', R=13') exceeds the upper end value of 5.0 given in Table 7-1 of the GIP.

b. The RWST tank analysis showed that the seismic capacity of the tank is governed by the capacity of the tank lateral supports. In order to model this tank, a finite element model was developed of the tank and the lateral supports. There is a small gap (approximately 1/8") between the lateral support brace arms and the support pad face mounted on the concrete shield wall, so before the gap is closed the tank may be modeled as free standing. The bottom of the tank buckles before the gaps are closed, but once the gap closes the tank still maintains its overall stability. Since the supports and ring girders are shown to be able to sustain the tank's lateral response forces, the buckling that occurs at the base is adjudged acceptable because it is displacement limited and leak integrity is maintained since the strain at the base of the tank is small.

For the purposes of this question, the overturning moment demand is 3200 kip-ft and the overturning moment capacity is 2691 kip-ft. However, the capacity of the tank is governed by the capacity of the top ring girder and lateral support lugs for which the CDFM capacity is 0.15g peak ground acceleration (PGA). Bolt capacity per GIP Section 7.3.3.1 is 25.5 kips. Top plate stress is 17.2 ksi compared to an allowable stress of 36 ksi and tank wall stress is 22.8 ksi compared to an allowable stress of 30 ksi (GIP Section 7.3.3.2). Buckling stress is 7.92 ksi (0.72 x 11.0 ksi) per GIP Section 7.3.3.3. The additional stress due to post-buckling shortening is 13.5 ksi; thus the total stress at the base of the tank is approximately 21.5 ksi. This stress is still well below the yield stress of the tank material (F_y=30 ksi), and therefore tank leakage is not postulated to occur.

c. The base shear demand is 259 kips and the shear capacity is 1183 kips.

d. The RWST did not meet the GIP, Section 7 dimensional provisions and it is a laterally supported tank, so it was declared an outlier. Once a tank is declared an outlier, the method of resolution is not prescribed by the GIP. The EPRI sponsored Add-On Seismic IPE Training Course taught by Dr. R.P. Kennedy (who was also a member of the Kewaunee seismic review team), instructs that the GIP methodology and the CDFM methodology given in Appendix H of EPRI Report NP-6041 are similar. It is suggested that the CDFM method yields approximately a 25-33% higher capacity than the GIP method. There are three significant differences between the GIP and CDFM methodology:

1. The CDFM method is more rigorous in that it considers water hold-down forces which the GIP method ignores for the sake of simplicity. The Kewaunee RWST was analyzed using the CDFM methodology, but water hold-down forces were ignored since the tank has sufficient capacity based on the lateral supports.

2. For the buckling capacity determination, the GIP uses the more restrictive reduction factor of 0.72 while the CDFM allows a 0.90 reduction factor. The analysis of the Kewaunee RWST used the 0.72 factor. However, this

effect is unimportant for the Kewaunee RWST since the bottom of the tank buckles and the lateral supports engage to support the tank. The CDFM capacity for design basis is based on the lateral support capacity and is calculated to be 0.15g, PGA, thus buckling capacity is not a factor.

3. The damping used in the GIP analysis is 4%, while the CDFM analysis allows 5% damping. The Kewaunee RWST analysis used 5% damping.

The RWST CDFM capacity of 0.15g, PGA represents a 25% margin over the design basis (SSE) PGA. Since the fluid hold-down force and the increased buckling capacity available when using the CDFM methodology were not used and were non-contributing factors, it is reasonable that the 25% margin over design basis is adequate.

The only value that changes from the values given in b. and c. above for the CDFM method is the base shear demand which increases to approximately 290 kips due to the reduced damping. All other aforementioned values are essentially unchanged numerically.

NRC Question 6

In Appendix C of Enclosure 1, the enclosed résumés do not show that the individuals who participated in the seismic review have completed the SQUG training course. There is no résumé provided for Dr. Paul Smith, the peer reviewer. In accordance with the commitment to the GIP, the individuals who undertake the seismic review and assessment are degreed engineers, or equivalent, who have completed a SQUG-developed training course on seismic adequacy verification of nuclear power plant equipment. Provide evidence of the SQUG training/certificates for personnel who participated in the seismic review/peer-review efforts and the résumé of Dr. Paul Smith.

WPSC Response to Question 6

The résumé for Dr. Paul Smith and copies of the SQUG training certificates for all members of the seismic review teams are provided in Attachment III.

NRC Question 7

On pages 13, 14 and 15 of the SVDS in Appendix D of Attachment 1, Cabinets CR101 to CR111 are identified as outliers because of the potential for interaction, and Relay Racks RR162 to RR164 are identified as outliers for not meeting certain caveats. However, these outliers were not addressed for resolution in Sections 8 and 9 of Attachment 1. Provide a detailed description and a completion schedule for resolution of these outliers.

WPSC Response to Question 7

Control Room Cabinets CR101 through CR111

Two generic interaction concerns were identified by the seismic review team for cabinets CR101 through CR111.

1. The control room ceiling aluminum diffuser panels were identified as a potential falling hazard to control room operators as discussed in item A5 of Sections 8 and 9 of the Kewaunee Summary Report. Although the concern was noted on the individual SEWS for cabinets CR101 through CR111, WPSC chose to describe the outlier in Sections 8 and 9 of the Summary Report under the heading of "Control Room Ceiling", rather than list the outlier individually for each control room cabinet. As noted in the response to NRC question 13, the necessary modifications to the control room ceiling have been completed and the outlier issue is resolved.

2. The seismic review team also provided a recommendation to have plant personnel verify that all hinged rear doors on the control room consoles and vertical panels be latched shut during plant operation. This recommendation was based on the review team's observation at the time of the walkdown that some of the cabinet rear doors were open for maintenance purposes to support refueling outage activities.

   WPSC chose not to include this recommendation for cabinets CR101 through CR111 in Sections 8 and 9 of the Summary Report since these doors typically remain closed during plant operations, except during routine maintenance. However, to help ensure that the seismic review team recommendations were followed, signs were posted on the rear doors of all applicable cabinets as a reminder to personnel to keep the doors latched shut. The signs were posted in conjunction with the outlier resolution for adjacent cabinets CR112 to CR118, as noted in item A4 of Section 8 and 9 of the Kewaunee Summary Report

Relay Racks RR162 through RR164

The outlier issue relating to Relay Racks RR162 through RR163 is discussed on page 8-3 of the Kewaunee Summary Report, item A3. These three racks were initially identified as outliers by the seismic review team since the row of adjacent cabinets are not bolted together, as required by Caveat 5 for equipment class 20. However, it was later determined during the relay analysis that these racks do not contain essential relays, and therefore the caveat did not apply. As a result, there is no outlier issue associated with relay racks RR162 through RR164.

NRC Question 8

In Appendix E of Attachment 1, the peer review assessment dated April 2, 1993, was done prior to the completion of Kewaunee USI A-46 effort. There are some equipment items that were not evaluated at that time. The reviewer stated that he did not review any structural evaluations since they had not been completed at the time of his review. Provide the follow-up peer review for the portion of the Kewaunee A-46 evaluation, that was not completed at the time of the April 1993 review.

WPSC Response to Question 8

As stated in the GIP-2, the third party audit was intended to be a one or two day overview to assess the adequacy of the walkdown and analyses by audit and sampling. The project management team felt that this requirement would best be served by having the peer reviewer (Dr. Paul Smith) on site while the walkdowns were in progress. During his site visit, Dr. Smith conducted walkdowns with the seismic review teams (SRT) and on his own. His review included the comparison of completed screening evaluation worksheets (SEWS) with equipment previously inspected by the SRTs. A second, follow-up review was not considered necessary since Dr. Smith concluded that the walkdown teams had conducted a "professional, thorough, and conservative" walkdown.

As noted in Dr. Smith's April 2, 1993 letter, the peer review included both the USI A-46 and seismic IPEEE walkdowns. The statement that no structural evaluations were reviewed was in reference to the building structural evaluations performed for the seismic IPEEE program. This type of review is not within the scope of USI A-46.

However, to alleviate any of the NRC's concerns as stated above, Dr. Smith was contracted to do a follow-up peer review, and the results of his review are provided as Attachment IV. WPSC's response to the peer reviewer comments are provided in Attachment V, and reflect the joint opinion of Stevenson & Associates and WPSC.

NRC Question 9

For your plant structures containing equipment in the USI A-46 scope:

a. Identify structures which have licensing-basis floor 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. Provide the response spectra designated according to height above the effective grade identified in Item 1 above and a comparison to 1.5 times the Bounding Spectrum.

c. With respect to the comparison of equipment seismic capacity to seismic demand, indicate which method (Method A or Method B in Table 4-1 of GIP-2) was used to address the seismic adequacy of equipment installed on those floors as identified in Item 1 above.

WPSC Response to Question 9

As stated in a letter from John F. Stolz, NRC to Neil P. Smith, SQUG, dated December 5, 1996, the NRC has agreed to clarify this question and forward a revised RAI to affected USI A-46 licensees for their response. WPSC has just recently received a copy of this letter from the SQUG steering committee, and accordingly wish to defer the response to this question following the receipt of the revised RAI from the NRC.

NRC Question 10

Section 2.4.1, "Key Assumptions," of the Seismic Evaluation Report states in part, "The final assumption of interest is that no other concurrent events or accidents other than a small loss of coolant accident (LOCA) need be considered." Based on this assumption, describe what analyses were performed to determine if any operator actions required to safely shutdown the reactor could be affected by potentially harsh environmental conditions resulting from the LOCA? Are there any other environmental conditions (such as loss of lighting) associated with the design basis earthquake and loss of off-site power which could negatively impact operators ability to respond to the transient? If so, describe the analyses which were conducted to ensure operators had adequate time and resources to respond to such events?

WPSC Response to Question 10

As described in Section 2.2.3 of the Kewaunee Summary Report, the potential for small LOCAs which could defeat the reactor coolant pressure and inventory control functions were examined during the creation of the safe shutdown equipment list (SSEL). As a result, all active valves interfacing with the reactor coolant system, which could change position during a safe shutdown earthquake (SSE) and thus potentially defeat the pressure and inventory control functions, were identified in the SSEL as components requiring a seismic capacity assessment, relay evaluation assessment, or both if appropriate. It was for this purpose only that the potential for a small LOCA was considered. The GIP-2 requires such valves to be identified in the SSEL, and refers to these types of valves as "isolation valves in the main and branch lines which form the boundary of the system". WPSC's use of the term "LOCA" to describe the identification of these valves on the SSEL may not have been appropriate.

With regards to the consideration of harsh environmental conditions in general, the GIP-2, Section 3.2 sets forth the criteria and assumptions used for identifying safe shutdown equipment. Specifically, Section 3.2.5 states that the only potential events postulated to occur, other than a design basis safe shutdown earthquake, is a loss of offsite power. Other events which could cause harsh environmental conditions such as loss of coolant accidents (LOCAs), high energy line breaks (HELBs), and fires do not have to be considered for the USI A-46 program. Therefore the only "harsh environmental conditions" which must be considered for resolution of USI A-46 are those which are associated with the SSE and loss of offsite power.

As defined in the GIP, safe shutdown of the plant requires bringing the plant to, and maintaining it in, a hot shutdown condition during the first 72 hours following a SSE. With the exception of the two operator action tasks which may require manual reset of the service water strainer motors and the reset of the control room A/C system (see NRC Question 11), hot shutdown can be accomplished solely from the control room. Therefore, the only adverse environmental conditions that operators may have to contend with is; (1) the loss of lighting in the control room, (2) the temporary loss of ventilation/cooling in the control room, (3) the loss of lighting in the access routes and areas within the control room A/C equipment room and screenhouse areas, and (4) the potential for structural damage to the plant which could make access to the control room A/C equipment room and screenhouse areas difficult. For the reasons described below, none of these potential conditions should negatively affect the operators ability to bring the plant to a safe shutdown condition.

1. Loss of Lighting in the Control Room

   Licensed operators are trained to perform control room operations following a loss of offsite power and subsequent loss of normal control room lighting. Several independent sources of light are available within the control room to ensure operators have sufficient light to perform their duties. Battery powered emergency lighting of at least an 8 hour duration is available and automatically turns on if normal lighting is lost. However, the control room lighting system is powered from a safety-related power source, and will be available once on-site power is established.

2. Temporary Loss of Cooling/Ventilation in the Control Room

   As stated in Section 2.2.3 of the summary report, primary and backup equipment paths for providing control room HVAC were included as support systems on the SSEL for added conservatism. Operation of the control room HVAC system is not considered absolutely essential, since operators could take action to open doors and place portable fans in the control room as necessary for the required 72 hour period. However, credit is taken for operator reset of the control room A/C system, and operators would have several hours to perform the system evaluations and take the necessary resetting or restoring actions. For these reasons, it is not necessary to conduct detailed analyses to ensure operators have adequate time and resources to accomplish the resetting actions.

3. Loss of Lighting in the Access Routes and Equipment Areas

Battery powered emergency lighting is provided in specific areas of the plant for compliance with Appendix R requirements. The emergency lights are strategically placed in the areas needed for operation of Appendix R safe shutdown equipment, including access and egress routes. In addition, several fully charged flashlights are stored directly outside of the control room, and are available for operator use.

Manual reset of the service water strainer motors will take place in the Screenhouse. A dedicated access path from the control room to the screenhouse is equipped with emergency lights, and licensed operators have been trained in the use of the pathways for Appendix R purposes. The Screenhouse itself is not lit by emergency lighting, and flashlights or other portable light sources may be required by operators to perform the manual reset of the service water strainer motors. As described in the WPSC response to NRC Question 11, operator response to manually reset the strainer drive motors is not expected to be required for at least several days following the SSE.

The access path to the control room A/C equipment room is not equipped with battery powered emergency lights. However, as noted earlier, flashlights are readily available to the operators, and manual reset of the control room A/C system will not be required for at least several hours (if at all) following the SSE.

Finally, as noted in Section 2.2.3 of the Summary Report, emergency lighting systems were not included in the SSEL. However, the seismic review team noted that the majority of the battery powered emergency lights located throughout the plant were seismically mounted. Those emergency lights which were not seismically mounted were modified following the USI A-46 equipment walkdowns to resolve equipment interaction concerns as described in Section 9 of the Summary Report.

4. Structural Damage

Operators may have to contend with structural damage to the plant which may make access to the screenhouse and the control room A/C equipment room difficult. However, this possibility is reduced by the fact that there are no non-seismic block walls located along the access pathways to either location. A seismic review team also inspected HVAC ductwork throughout the facility in support of the seismic IPEEE program, which was performed concurrently with the USI A-46 effort. No significant concerns were noted. Given the ample time allowed for manual reset of the control room A/C system and the reset of the service water strainer drive motors, the potential effect of structural damage should have minimal impact on operator response.

NRC Question 11

Section 3.9, "Operator Action," of the Relay Evaluation Report states that a total of ten devices would require operator actions to reset the associated relays. Six of those were associated with the control room A/C system and four others were associated with the rotating strainers of the discharge side of the service water pumps. In both cases it appears that ample indications of system abnormality would be available to the operators as well as procedural guidance necessary to reset the effected equipment. Based on the licensee's analysis approximate how much time would the operators have to reset the service water strainers assuming relay failure? What training has been provided to operators to ensure they are capable of taking the required actions to reset this equipment in the required time frame?

WPSC Response to Question 11

I. Time Available for Operator Reset of the Service Water Strainers

As described in the Summary Report, credit for operator action is taken to ensure the operation of the rotating strainers on the discharge side of the service water pumps following a safe shutdown earthquake. For resolution of USI A-46, it was assumed that contact chatter of the motor starter contacts could cause a thermal overload trip of the strainer drive motors. Manual reset of the system would then be required to reestablish strainer drum rotation.

The strainers normally rotate continuously whenever the associated service water pump is operating. Rotation of the strainer drum is necessary to facilitate the automatic backwash feature of the strainer. A differential pressure of 8 psig across the strainer causes an associated backwash valve to open and flush the discharge through the backwash outlet. Rotation of the strainer during the backwash operation ensures effective cleaning of the strainer drum. Based on the design features of the strainer, the rotation of the strainer drum has little or no effect on the rate of accumulation of particulate matter in the straining media. Silt and sand particles are known to pass through the straining media and eventually collect in traps and filters downstream. As a result, failure of the strainer drum to rotate will have little effect on the flow of water to the service water header.

The backwashing operation does not occur frequently based on test data collected during a twelve day period in late February and early March of 1990. During the twelve day period, service water strainer differential pressure was monitored and recorded at four hour intervals. Differential pressure did not exceed 1.1 psig, indicating that backwashing did not occur. Periodic monitoring during the following summer months showed no significant increase in differential pressure. Given that strainer differential pressure was monitored at the time of the year when Lake Michigan is normally turbulent, and therefore likely to contain heavy concentrations of suspended particulate, the data is considered to be a reliable indication of backwash frequency.

Therefore, based on the design characteristics of the strainer assembly, which requires rotation of the strainer to primarily ensure effective backwashing, and the infrequency at which backwashing is required, operator reset will not likely be required for several days following a safe shutdown level earthquake.

II. Operator Training

Initial qualification training is provided to operators on the location, function, indications, controls, interlocks, and power supplies for the major equipment associated with the service water system, including the operation of the service water strainers. Operators are also required to understand and perform the actions required for manual reset of the service water strainers as stated in the applicable operating procedures.

No specific training is provided to operators to ensure they are capable of taking the required actions to manually reset service water strainer operation within a given time frame. Operator response to control room alarms are prioritized by level of importance. As noted in the response to part I of this question, manual reset of the service water strainers will not likely be necessary for at least several days following a safe shutdown level earthquake.

NRC Question 12

For the operator actions specified in (11), above, what, if any, modifications to existing operating procedures or development of new procedures (normal, abnormal, and emergency) were required and what methods were used to verify and validate that these procedures are appropriate to the circumstances?

WPSC Response to Question 12

No modifications to existing procedures were required, and it was not necessary to develop any new procedures for the operator actions described in question 11. Existing procedure A-SW-02 "Abnormal Service Water System Operation" and procedure A-ACC-25 "Abnormal Control Room A/C" provide the necessary guidance for the required operator actions.

NRC Question 13

Table 9.2, "A-46 Equipment Outliers," of the Seismic Evaluation Report contains item A5, Control Room Ceiling, which indicates that a potential hazard to operators exists if the ceiling diffuser panels were to dislodge from the T-Bar supports. The resolution was to tie-wrap the diffusers prior to December 31, 1995. Has this been accomplished?

WPSC Response to Question 13

Yes, all tie-wraps were installed prior to December 31, 1995.

ATTACHMENT II

Letter from C. R. Steinhardt (WPSC)

to

Document Control Desk (NRC)

Dated

December 20, 1996