December 5, 1996

Mr. Neil P. Smith, Chairman
Seismic Qualification Utility Group
c/o MPR Associates, Inc.
320 King Street
Alexandria, Virginia 22314

SUBJECT: EVALUATION OF SEISMIC QUALIFICATION UTILITY GROUP'S RESPONSE TO GENERIC ISSUES INCLUDED IN NRC'S REQUEST FOR ADDITIONAL INFORMATION (TAC NO. M40580)

Dear Mr. Smith:

During the past year, the NRC staff has been reviewing the seismic walkdown summary reports submitted by members of the Seismic Qualification Utility Group (SQUG) for the USI A-46 program, and has transmitted requests for additional information (RAI) to the individual SQUG members. By letter dated August 19, 1996, SQUG provided a response to six potential generic issues included in the RAIs that were forwarded to SQUG member utilities implementing the Generic Implementation Procedure, Revision 2 (GIP-2). A meeting was held between SQUG representatives and the staff on August 28, 1996, to discuss and clarify the NRC's questions and SQUG's responses.

Enclosed is the staff's evaluation of SQUG's August 19, 1996, response to the six potential generic issues. Please forward the enclosure to your member utilities for their information.

If you have any questions regarding this matter, please contact Mr. Dan Dorman at (301) 415-1429.

Sincerely,

(Original Signed By)

John F. Stolz, Lead Project Director
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Enclosure: Staff Evaluation

cc w/encl: Mr. R. Kassawara, EPRI
Program Manager
3412 Hillview Avenue
P.O. Box 10412
Palo Alto, CA 94304

Distribution

Central Files	PYChen
PUBLIC	SVarga
PDI-3 RF	JZwolinski
GLainas	JStolz
GBagchi	DDorman
CThomas	EPeyton
JWermiel	ACRS
RWessman	OGC
KManoly	

DOCUMENT NAME: G:\DORMAN\SQUGLTR
To receive a copy of this document, indicate in the box: "C" = Copy without attachment/enclosure "E" = Copy with attachment/enclosure "N" = No copy

OFFICE	PM:DRPE		LA:DRPW		D:PDI-2			
NAME	DDorman		EPeyton		JStolz			
DATE	~~11~~/2/96		~~11~~/5/96		~~11~~/10/96			

OFFICIAL RECORD COPY

12

96-167

170059

NRC FILE CENTER COPY

RD-8 Generic Items/ Generic Issues

X 2D-16-4

9612170344 961205
PDR ORG NRRA
PDR

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

December 5, 1996

Mr. Neil P. Smith, Chairman
Seismic Qualification Utility Group
c/o MPR Associates, Inc.
320 King Street
Alexandria, Virginia 22314

SUBJECT: EVALUATION OF SEISMIC QUALIFICATION UTILITY GROUP'S RESPONSE TO GENERIC ISSUES INCLUDED IN NRC'S REQUEST FOR ADDITIONAL INFORMATION (TAC NO. M40580)

Dear Mr. Smith:

During the past year, the NRC staff has been reviewing the seismic walkdown summary reports submitted by members of the Seismic Qualification Utility Group (SQUG) for the USI A-46 program, and has transmitted requests for additional information (RAI) to the individual SQUG members. By letter dated August 19, 1996, SQUG provided a response to six potential generic issues included in the RAIs that were forwarded to SQUG member utilities implementing the Generic Implementation Procedure, Revision 2 (GIP-2). A meeting was held between SQUG representatives and the staff on August 28, 1996, to discuss and clarify the NRC's questions and SQUG's responses.

Enclosed is the staff's evaluation of SQUG's August 19, 1996, response to the six potential generic issues. Please forward the enclosure to your member utilities for their information.

If you have any questions regarding this matter, please contact Mr. Dan Dorman at (301) 415-1429.

Sincerely,

John F. Stolz

John F. Stolz, Lead Project Director
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Enclosure: Staff Evaluation

cc w/encl: Mr. R. Kassawara, EPRI
Program Manager
3412 Hillview Avenue
P.O. Box 10412
Palo Alto, CA 94304

EVALUATION OF SEISMIC QUALIFICATION UTILITY GROUP'S AUGUST 19, 1996, RESPONSE TO GENERIC ISSUES INCLUDED IN NRC REQUESTS FOR ADDITIONAL INFORMATION

1. Use of Ground Response Spectra for Estimating Seismic Demand

NRC Questions

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

a. Identify structures which have licensing-basis floor response spectra (5% 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 a 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 a above.

SQUG's Generic Response

"The NRC Staff asked a question related to the use of 1.5 times the plant SSE ground response spectra as a realistic estimate of seismic demand under certain limited conditions as specified in the GIP. Currently, the NRC Staff and representatives of the Seismic Qualification Utility Group (SQUG) jointly are seeking resolution of this issue. Accordingly, SQUG recommends that each member licensee's response to these questions be deferred pending this resolution.

"It is SQUG's position that the GIP methodology, as a whole, has been reviewed and approved by the NRC Staff in Supplementary Safety Evaluation Report No. 2 dated May 22, 1992, as an acceptable method of demonstrating the seismic adequacy of equipment within its scope. This new approved methodology differs from that contained in each SQUG member licensee's licensing basis in substantial and fundamental respects. Accordingly, it is impossible to meaningfully compare isolated aspects of the two whole methodologies including their relative conservatisms; any such comparison must be made at the program level to evaluate compliance with appropriate NRC regulations concerning seismic adequacy."

Staff's Evaluation of SQUG's Generic Response

SQUG's response did not provide the requested information. During the August 28, 1996, SQUG/NRC meeting, the staff elaborated its concern and the primary focus of the request for additional information (RAI) question. As a result of considerable discussions on the subject, the staff agreed to clarify the question. The following revised RAI will be forwarded to affected USI A-46 licensees for their response:

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 were 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.

The staff does not consider a generic response to this question acceptable, and affected licensees should address this question on a plant-specific basis.

2. Operator Actions in Difficult Environmental Conditions

NRC Question

State whether any of the operator actions specified in the normal and emergency procedures...require in-plant actions by the operations crew. If so, outline how potential harsh environmental conditions were factored into the analysis....

...for certain trips of the DGs an operator must go to the local DG control panel or the 4kV switchgear to reset the controls. Given the postulated design basis earthquake, describe what harsh environmental conditions might exist that would inhibit the operators' ability to access these local areas. Indicate how these conditions were factored into the analysis.

SQUG's Generic Response

"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."

Staff's Evaluation of SQUG's Generic Response

The staff is in agreement that the only events which must be considered are the SSE and loss of offsite power. However, each licensee should consider these factors on a case by case basis and determine what, if any, other complications they do need to address. During the August 28, 1996, SQUG/NRC meeting, the staff provided SQUG with some additional clarification on the types of concerns which should be considered including (1) the potential for diminished lighting due to loss of offsite power, (2) other barriers such as damaged equipment or structures which could inhibit operators ability to access plant equipment, and (3) the potential for requiring operators to enter hazardous or unfamiliar areas to manually reset or realign equipment.

Therefore, the staff does not consider a generic response to this question acceptable, and, on a plant-specific basis, each affected licensee should address this question as requested in the original individual RAI.

3. Operator Training on SSEL

NRC Question

Detail the specific operator training that was provided to ensure all operating crews were knowledgeable of the SSEL and the procedural guidance expected to be used during a postulated earthquake.

SQUG's Generic Response

"Section II.3.2.8 of GIP-2 states that existing normal and emergency operating procedures (EOPs) are expected to be sufficient to lead operators to use of appropriate, operational equipment and systems following a SSE, and operators are expected to be trained in their use. As stated in the SQUG (Neil Smith) letter to the NRC (James Partlow) dated August 21, 1992, SQUG's understanding of the NRC staff's position on operator training (as described in SSER #2, Section II.3, Evaluation and Conclusion, item 2) is that appropriate training on plant procedures is required only when it becomes necessary to change these plant procedures to achieve compatibility with the SSEL. Training need be provided only to the extent necessary to familiarize operators with changes to these procedures as a result of the A-46 program. No additional training on existing normal shutdown procedures or symptom-based EOPs is considered necessary, nor is it necessary for operators to have specific knowledge of which items of equipment are on the SSEL. The purpose of the Operations Department review of the SSEL is to verify compatibility with plant procedures and training so that operators will be able to use the SSEL equipment if other choices are not available following a SSE."

Staff's Evaluation of SQUG's Generic Response

The staff is in agreement that existing normal and EOPs are expected to be sufficient to lead operators to use of appropriate, operational equipment and systems following a SSE, and operators are expected to be trained in their use. The staff also agrees that current licensee operator requalification training programs should be sufficient to adequately train operators to respond to such events. However, each licensee should consider their current approach to operator training (both licensed and non-licensed) on a case-by-case basis and determine what, if any, other issues need to be addressed. During the August 28, 1996, SQUG/NRC meeting, the staff provided SQUG some additional clarification on the types of concerns which should be considered including (1) the need to verify that changes to procedures, including the addition of checklists or system alignment information, which require new or different operator actions are reviewed to ensure adequate guidance is provided, (2) verification that a sufficient amount of time and resources are available to perform these actions, and (3) the development of operator aids or guidance for licensed and nonlicensed operators tasked with manipulating plant equipment, such as relays, which are not routinely operated in such a manner.

With regard to the statement by the SQUG that, "...nor is it necessary for operators to have specific knowledge of which items of equipment are on the SSEL," the staff considers it appropriate for operators to be trained to follow their procedures and to use the plant equipment available to mitigate transients and accidents. Operators should not base their actions on preconceived ideas of which systems are on the SSEL, however, knowledge of what systems have been selected for the SSEL and the reasons for such selection should be considered during SSE training.

Therefore, the staff does not consider a generic response to this question acceptable, and, on a plant-specific basis, each affected licensee should address this question as requested in the original individual RAI.

4. Listing and Justifying Insignificant Deviations from the GIP

NRC Question

In its initial submittal, the licensee stated that [Utility xxxx] committed to implement GIP-2. It also stated that no significant or programmatic deviations from the GIP guidance were made. Please list the deviations that were taken and provide the bases for categorizing them as insignificant.

SQUG's Generic Response

"Minor deviations from GIP guidance are noted in documents associated with each member licensee's A-46 implementation, such as walkdown data sheets. Typically each licensee does not attempt to list all such minor deviations in one centralized, location. As described in Section I.1.3 of the GIP, these documents are available on site for NRC staff audit.

"Determinations of whether each deviation was 'minor' were made by qualified, experienced engineers who had each completed the appropriate SQUG training courses on the use and application of judgment for resolution of USI."

Staff's Evaluation of SQUG's Generic Response

The statement provided in the Summary Report is too simplistic and may be subjected to misinterpretation. Since a precise description of what "no significant deviation" really means is needed, the staff is, therefore, requesting each affected plant to itemize those GIP recommended evaluations/methodologies which the licensee did not follow or deviated from. Affected licensees should discuss what the deviations are and why they are justified to enable the staff's assessment of such determinations. Also, a definition including the use of examples as to what is considered significant should be provided.

Therefore, the staff does not consider a generic response to this question acceptable, and, on a plant-specific basis, each affected licensee should address this question as applicable.

5. Lateral Load Ductility Evaluation of Cable Trays

NRC Question

The report states that cable trays and their supporting systems were evaluated for lateral load ductility to ensure that there were no brittle failure modes. Provide the procedure for the ductility evaluation and discuss the bases for the approach, including any references used. In particular, discuss how the ductility is accounted for in the dynamic response analysis.

SQUG's Generic Response

"As we understand, each member licensee used the ductility evaluation procedure contained in Section II.8.3.3 of the GIP for the Limited Analytical Review of cable trays supports. The approach used in this procedure is based on back-analyses of many cable tray and conduit supports which experienced significant earthquake loadings. These back-analyses predicted yielding of members and connections. However, these support systems performed well, with no visible signs of distress. The justification for use of this method is described in GIP Reference 9, EPRI Report NP-7151, "Cable Tray and Conduit System Seismic Evaluation Guidelines," March 1991. The GIP procedure for ductility evaluations does not require a dynamic response analysis to be performed on cable tray systems. Supplemental Safety Evaluation Report No. 2 (SSER #2) on GIP-2 accepts this GIP procedure for evaluating the ductility of cable tray supports under lateral loading."

Staff's Evaluation of SQUG's Generic Response

In response to the staff RAI for the Point Beach USI A-46 report, SQUG provided a generic answer (Reference 1). The response stated that the basis for the ductility evaluation procedure is in EPRI NP 7151 (Reference 2). Our review found that the report did not contain the basis we are looking for, namely, a quantitative evaluation that demonstrates the ductile behavior of cable tray systems and the exclusion of lateral load evaluation specified in GIP-2 for ductile cable tray systems vs. those constructed with less ductility.

The staff reviewed additional reports related to this issue. These reports were suggested by Mr. Starck of MPR Associates who authored the SQUG response to NRC. Review summaries of the three reports are as follows:

EPRI NP-7150 (Reference 3) contains a summary of test data (Blume, Bechtel and ANCO) and site experience data. However, there is no specific data relating to ductility except a general statement that

ductile cable trays are better than non-ductile ones. Experience data does not provide a quantitative demonstration of the validity of the GIP's guideline regarding ductile cable trays.

The March 1, 1991, report of the Senior Seismic Review and Advisory Panel (SSRAP) (Reference 4) contains only an outline of the procedure for the cable tray evaluation, but the basis for the ductility evaluation is not provided except to refer to the test and experience data mentioned above.

The last report referenced by MPR is EPRI NP-7152 (Reference 5), on rod hanger supported cable trays. It discusses fatigue data for rod hangers, but there was no mention of ductility in the report.

The staff finds that the documents referenced by SQUG and its consultants do not provide an adequate basis for the ductility assumption and specified evaluation approach for these cable tray systems.

6. Seismic Adequacy of Relays Mounted on Diesel Generators and Air Compressors

NRC Question

In reference to [the section of the summary report which discusses relays mounted on vibrating equipment], demonstrate by calculation and/or testing that normal operational vibration of equipment supporting relays is more severe than the vibration induced by a design seismic event.

SQUG's Generic Response

"SQUG does not consider it necessary to perform detailed calculations and/or testing of relays mounted on reciprocating engines and air compressors since such relays mounted on engine generators and air compressors routinely experience high vibration during start-up and normal operation.

The Senior Seismic Review and Advisory Panel (SSRAP) takes the position in their report (GIP reference 5), that it is unnecessary to perform explicit seismic capacity versus demand evaluations of relays on reciprocating engines (page 81) and air compressors (page 82) that routinely see high vibration due to operation.

We also note that this method of screening relays mounted on diesel generators is included as an explicit example in Appendix B of EPRI report NP-7148. The report is the basis for the relay evaluation procedure in the GIP and is intended to be used for implementing this procedure. Note that this EPRI report states (on page B-69) that relay-type control devices are considered seismically adequate since they are mounted on the diesel engine and subject to significant vibration on a normal basis.

Based on these elements of the GIP procedure, each member licensee's Seismic Capability Engineers were trained to evaluate the normal vibration of the engine generators and air compressors which support the subject relays and typically found that they are significant. This evaluation is based on the engineering judgment of qualified and experienced Seismic Capability Engineers as defined in the GIP. Therefore a detailed seismic capacity versus demand evaluation is considered beyond the scope of the GIP."

Staff's Evaluation of SQUG's Generic Response

The SQUG's generic response to the NRC question is not acceptable. First, the specific issue in question is not regarding relays mounted on diesel generators and air compressors. The issue is the inappropriateness of using the "rule-of-the-box" concept and the judgment based on the normal operation of the diesel generators or air compressors to justify the seismic adequacy of devices, such as relays, mounted in the instrumentation and control cabinets anchored on the common skid of the diesel generator or air compressor.

The concept of the "rule-of-the-box" applies to components in a system that has already been successfully subjected to a vibratory environment comparable with or greater than the required motion (e.g., SSE). Therefore, the "rule-of-the-box" concept can also be applicable for acceptance of the relays mounted on vibratory equipment (or in a cabinet supported on the common skid) provided it is demonstrated that the vibratory motion of the equipment (or the skid) is at least equal to the required seismic motion at that location, and that the relays performed all their intended functions during the periods of vibration.

With regard to relays mounted on diesel generators and air compressors, the following specific questions should be addressed:

a. Does the mechanical vibration envelop the required input motion (e.g., SSE) from all aspects (e.g., amplitude, frequency, direction, etc.)?

b. Do these vibratory equipment-mounted relays perform all their operational safety functions (e.g., change of state) during the mechanical vibrations (i.e., during startup and normal operation) so that the relays can be considered qualified to that level?

c. For any of these vibratory equipment items, could an SSE occur when the equipment is vibrating? If so, then the earthquake load will be an increment to the normal operational vibratory load, and the relay may need to be reviewed for the increased motion.

The vibratory motion of the skid is expected to be less severe than the vibratory equipment item itself provided the skid is rigidly mounted on a heavy foundation. Therefore, all of the above questions will also apply

for relays contained in skid-mounted cabinets with a particular emphasis on the vibration level verification, with the understanding that it is the vibration of the skid and not of the vibrating equipment, that will be compared with the required input motion (i.e., Item a. above). In addition, the cabinet that houses the relays may also change the vibration level and characteristics at the relay locations.

Regarding "bad actor" relays, they are so described mainly because of their low seismic capacities, or inexplicable performance characteristics. Therefore, "bad actor" relays mounted on vibratory equipment may be expected to have demonstrated their performance under certain conditions. But, in general, these relays also should be verified following the approach for other vibratory equipment-mounted relays discussed above.

In conclusion, the staff's original RAI has been clarified and divided into three questions as described above. Any USI A-46 plant licensees who have inappropriately used the "rule-of-box" concept or exercised the judgment, based on normal operation of the vibratory equipment, to justify the seismic adequacy of component/device mounted on a vibratory equipment or mounted in a cabinet which is anchored to the common skid of the vibratory equipment, should demonstrate the seismic adequacy of the component/device by calculation and/or test data.

REFERENCES:

1. Letter from Neil P. Smith of SQUG to Daniel H. Dorman of NRC, August 19, 1996.

2. EPRI Report NP-7151 "Cable Tray and Conduit System Seismic Evaluation Guidelines," March 1991.

3. EPRI Report NP-7150 "The Performance of Raceway Systems in Strong Motion Earthquakes," EPRI, Palo Alto, CA, prepared by EQE Engineering Consultants, March 1991.

4. SSRAP Report "Review Procedure to Assess Seismic Ruggedness of Cantilever Bracket Cable Tray Supports," Senior Seismic Review and Advisory Panel, Rev. 3.0, March 1, 1991.

5. EPRI Report NP-7152 "Seismic Evaluation of Rod Hanger Supports for Electrical Raceway Systems," EQE Engineering, March 1991.