Omaha Public Power District
444 South 16th Street Mall
Omaha NE 68102-2247

August 23, 1996
LIC-96-0121

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Station P1-137
Washington, D.C. 20555

References:
1. Docket No. 50-285
2. Letter from OPPD (T. L. Patterson) to NRC (Document Control Desk) dated September 28, 1995 (LIC-95-0181)
3. Letter from NRC (L. R. Wharton) to OPPD (T. L. Patterson) dated June 21, 1996

Subject: Response to Request for Additional Information (RAI) on the Resolution of Unresolved Safety Issue (USI) A-46 (TAC No. M69447)

On June 25, 1996, the Omaha Public Power District (OPPD) received the NRC's request for additional information (RAI) related to the Fort Calhoun Station (FCS) resolution of unresolved safety issue (USI) A-46. Attached please find OPPD's responses to this RAI.

If you should have any questions, please contact me.

Sincerely,

T. L. Patterson
Division Manager
Nuclear Operations

TLP/dll

Attachments

c: Winston & Strawn (w/o Attachments)
L. J. Callan, NRC Regional Administrator, Region IV
L. R. Wharton, NRC Project Manager
W. C. Walker, NRC Senior Resident Inspector

A025

OMAHA PUBLIC POWER DISTRICT
FORT CALHOUN STATION UNIT NO. 1

Response to RAI: Unresolved Safety Issue (USI) A-46

NRC Question 1:

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

a. **Identify structures which have licensing-basis floor response spectra (five percent 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 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.**

OPPD Question 1 Response:

a. In-structure response spectra for the Auxiliary Building, Internal Structure, Containment Structure, and Intake Structure at elevations within 40 feet above the effective grade (1004 ft.) are bounded by 1.5 times the SQUG Bounding Spectrum, for frequencies greater than 8 Hz.

b. Typical comparisons of in-structure response spectra, at frequencies greater than 8 Hz, for the four structures noted above and 1.5 times the Bounding Spectrum are provided in Attachment 2. These comparisons are for those elevations in the Auxiliary Building, Internal Structure and Containment Structure which are closest to and within the 1044 ft. elevation (40 ft. above the effective grade), and therefore represent the worst comparison. For the Intake Structure, the comparison is provided for elevation 1007'-6" (the Operating Floor) since all the A-46 components are either at this elevation or below.

c. In general, Method A of Table 4-1 of GIP-2 was used to compare the equipment seismic capacity to seismic demand. Both Methods A and B are acceptable since the licensing-basis floor response spectra does not exceed 1.5 times the SQUG Bounding Spectrum at any elevation. A detailed listing of which method was used for each component can be developed, if necessary.

NRC Question 2:

In Section 2.2, Generation of In-Structure Response Spectra (ISRS) for use in A-46 Project, the procedure of scaling the ISRS generated for the Alternate Seismic Criteria and Methodology (ASCM) to the IPEEE motion is described. Provide the rationale in using (a) the 7 percent of critical damping spectral accelerations instead of the 5 percent of critical damping values, and (b) the procedure to scale down the ISRS used in the IPEEE so that they are considerably less than the ASCM spectra originally approved for the Fort Calhoun A-46 review.

OPPD Question 2 Response:

a. In the process of generating the ASCM spectra, a structural damping of 7% was used for the safe shutdown earthquake (SSE). Therefore, in the determination of the scaling factor, the 7% damped ground level spectra were used.

   Use of the 5% damped spectra for scaling purposes would not make any significant difference. For example, using the 0.64g peak spectral acceleration value for the 5% damped NUREG CR/0098 spectrum (corresponding to 0.3g maximum ground acceleration), and an acceleration of 0.32g obtained from the 5% damped ground time history spectrum over the same frequency range of 2.4 to 2.9 Hz for the upper bound soil properties, a scale factor of 0.64/0.32 = 2.0 is obtained instead of 2.04, which was obtained originally using the 7% damped spectra. (See Attachment 3, Figure 2.3 of Reference 6 in the ASCM Report). Similar results are expected for other buildings and directions as well.

b. As noted in Table 1 and Section 2.2 of the Seismic Evaluation Report, the final scale factors used for scaling the in-structure ASCM response spectra for use in the A-46 Project were all greater than 1.0, sometimes significantly so. Therefore, it is not true, as noted in the NRC RAI question, that the final scaled spectra used for the A-46 review are considerably lower than the ASCM spectra originally approved for the Fort Calhoun Station (FCS) A-46 review. To the contrary, they are considerably higher, by the amount represented by the scale factors over 1.0. The two additional conservatisms applied to the use of these scaled spectra, as noted in Section 2.2, were:

   - The scaled peak broadened spectra were broadened by an additional amount of +10% over the frequency range to account for additional soil property uncertainties.

   - The spectra, in general, were used as "median centered," whereas the NRC had approved use of ASCM spectra, which are lower than the scaled spectra used as explained above, as a "conservative design."

<u>NRC Question 3</u>:

In Section 2.2, upper bound and lower bound soil cases are used in determining the spectral acceleration. In the actual seismic analysis, are they represented by the soil springs? What are the values of the spring constants? Since at Fort Calhoun Station the structures are supported on bearing piles, how is this foundation support condition represented in the seismic analysis?

<u>OPPD Question 3 Response</u>:

The upper bound (UB) and lower bound (LB) soil structure interaction (SSI) soil variation analyses were performed using SASSI/CLASSI soil-structure models. The analysis methodology consists of frequency domain analyses performed using a substructuring technique. In this approach, the site-foundation system is modeled by a series of frequency-dependent impedance functions representing the stiffness and damping characteristics of the FCS site-pile foundation system. In the substructuring approach, the SSI problem is broken down into three steps, as follows:

Step 1: Determination of the Foundation Input Motions

This is also called the scattering problem and consists of the determination of the motions of the foundation alone, without including the effects of the superstructure. For a surface-founded foundation system and for vertically propagating shear and compressional wave field, the foundation input motions are identical to the free-field motions. This is the case for the application to FCS (i.e., the wave field consists of vertically propagating shear and compressional waves and the foundation is assumed to be surface founded, with no deamplification of the motion due to spacial variation considerations). Thus, the foundation input motions correspond to the free-field motions and are applied at the foundation elevation in the free field. This is also in accordance with the recommendations of the Standard Review Plan (SRP), Rev. 1.

Step 2: Determination of Impedance Functions

These are the complex and frequency-dependent force-displacement relationships of the soil-pile foundation system. Consistent with the analysis approach used for the "Best Estimate" analyses, foundation impedance functions were calculated for both the UB and LB analyses cases using the same SASSI three-dimensional model of the soil-pile foundation system. The UB and LB strain-compatible soil properties were obtained from the SHAKE analyses. SASSI is a program developed specifically for SSI applications.

Separate analyses were performed for calculation of impedances for the UB and LB cases. The SASSI impedances are 6 X 6 (horizontal translations, vertical translation, rocking about both horizontal axes and torsion) complex and frequency-dependent matrices describing the stiffness and damping characteristics of the soil-pile foundation system. A 6 x 6 matrix is generated for each impedance frequency. The real part of the complex terms of the matrix represent the stiffness of the soil-pile-group foundation system and the imaginary part represents the damping of the system.

The SASSI model used for impedance computation incorporates the 803 piles driven to bedrock and capped to the concrete basemat. The basemat is assumed rigid for purposes of condensing the pile impedance to 6 x 6 impedance matrices at each frequency. Also, since some separation between the bottom of the basemat and the soil is possible over time, the basemat is assumed not to be in contact with the soil. Therefore, its contribution to the impedance is conservatively neglected (i.e., the basemat impedance is not added to the pile impedance).

Step 3: SSI Response Computation

Solution of the coupled soil-pile foundation-structure system of equations of motion using the results from Steps 1 and 2, and the fixed base dynamic properties of the superstructure produces structural responses. These are in the form of acceleration time histories at specified locations throughout the structural model. The CLASSI program module, SSIN, is used in this step to compute time histories of response using a frequency domain analysis approach. A total of 4096 points is used in the Fourier decomposition. The response acceleration time histories are calculated at a time step of 0.01 seconds. The response acceleration time histories are used to obtain floor response spectra at 2, 3, 5 and 7% damping ratios using the program RESPEC.

The model of the super ructure includes rigid links extending from the centers of mass to e locations farthest away from the centers of mass, locations at which the contributions from rocking and torsion would be the largest. Response spectra generated at these locations are enveloped and these enveloped spectra constitute the response spectra applicable to the entire floor at a particular elevation.

<u>NRC Question 4</u>:

In section 9.2, Tanks and Heat Exchanger Outliers, eight (8) tanks have been identified as neither being welded to the saddles nor pretensioned by straps. The resolution indicated in Table 8, item 21, is to weld the saddles to the tanks or pretension the straps. By constraining the movement of the horizontal tanks, there is a potential of generating compressive stresses in tank shell, which may result in the buckling of the shell. Indicate in your response if such a condition has been considered.

<u>OPPD Question 4 Response</u>:

The subject eight (8) Diesel Generator Starting Air tanks are small tanks storing air. Their dimensions are only 15" radius X 72" length and weigh under 1000 pounds. The bottom half of one of the two saddle supports will be attached by five 1/8" fillet/stitch welds to the tank shell by modification MR-FC-94-017 allowing growth in the other direction. There is sufficient flexibility in the straps/rod to allow the growth. The modification evaluation judged that the marginal horizontal seismic component does not impose any significant stresses on the shell of these air tanks. The modification is scheduled for completion by the end of 1996.

<u>NRC Question 5</u>:

Briefly outline the methodology used to analyze tanks AC-IC, AC-1D, and CH-7 that were found to have allowable anchorage capacity less than that based on spectral peak acceleration specified by the GIP.

<u>OPPD Question 5 Response</u>:

Since the anchorage capacity of tanks AC-1C, AC-1D and CH-7 were found to be outliers in accordance with GIP guidelines, detailed outlier resolution calculations were performed for these tanks. The calculations, FC06313 and FC06314, which present the methodology used to analyze these tanks, are provided in Attachment 4.

Based on the results of the calculations, since there was not sufficient margin above the design basis requirements, and AC-1C and AC-1D were in the seismic IPEEE component list also, the seismic anchorage of these heat exchangers are being modified per MR-FC-94-017. The modification will bring their High Confidence Low Probability of Failure (HCLPF) to greater than 0.3g. The modification is scheduled for completion by the end of 1996.

<u>NRC Question 6</u>:

In reference to Section 9.2, provide an explanation for the difference between the number of tanks identified in the last paragraph as outliers versus that of Table 8, "Summary of Outliers." It is stated that there are fourteen (14) tanks which do not meet the screening guidelines of the GIP, identified as outliers, and require additional detailed analyses for resolution. Are these fourteen tanks listed under items 22 and 23 of Table 8? Provide detailed analysis of a representative tank performed for the resolution of seismic adequacy. Indicate if you have used the method outlined in Appendix H of the EPRI report NP-6041-SL, Revision 1, "A Methodology for Assessment of Nuclear Power Plant Seismic Margin (Revision 1)."

<u>OPPD Question 6 Response</u>:

As noted in the first paragraph of Section 9.2, and described in Items 20 through 23 of Table 8 of the Seismic Evaluation Report, 24 of the 36 tanks and heat exchangers were determined to be outliers. The last paragraph of Section 9.2 has a typographical error in the second sentence. Instead of "the remaining 14 outlier tanks," it should be "the remaining 11 outlier tanks."

Three of the 14 tanks (AC-1C, AC-1D and CH-7) are listed under Item 23 of Table 8, with the remaining 11 tanks listed under Item 22 of Table 8.

Detailed analyses of tanks CH-7, AC-1C and AC-1D are included in response to Question No. 5.

The method outlined in Appendix H of EPRI Report NP-6041-SL, Rev. 1 was not used in the resolution of any A-46 tanks.

<u>NRC Question 7</u>:

In the calculation of resistance of embedded channels contained in Appendix D, it appears that the shear capacity of the concrete curb based on the 45 degree section behind the leg of the channel may control the design. Provide the basis for not considering this shear plane in determining the capacity of embedded channels.

<u>OPPD Question 7 Response</u>:

The shear plane at 45 degrees section behind the leg of the channel was not considered because it is associated with the bond between the inner face of the channel and the concrete. Also, the presence of the strap will hold the channel in place.

Even if the bond and strap resistances are ignored, and the concrete shear failure along the 45 degree plane is considered alone, the resistance will be:

$$R_{45} = 2\sqrt{f_c'} \cdot A_c \cdot \phi$$

$$= 2\sqrt{4000x}\ \{(1.584\_0.184)\}x0.65^*$$ (for the channel dimensions, refer to the figure in Appendix D)

* ϕ factor for plain concrete per ACI-318.1, 1989, is conservatively used

This resistance is considerably higher than the minimum calculated shear resistance of R_v = 1350 lbs, which was used to qualify the equipment anchorage. Therefore, shear resistance does not govern.

NRC Question 8:

In reference to Table 7, "Items Accepted Based on Existing Documentation":

a. Provide your calculation for seismic qualification of Outdoor Diesel Fuel Oil Tank, FO-1 for staff's review.

b. For motor-operated valves HCV-150 and 151, discuss the basis for the approach to determine seismic adequacy from calculation performed for these valves under (GL 89-10) MOV program.

c. For motor control centers MCC-3C2 and 4A2, provide your calculation on seismic qualification of Blockwall No. 9 that resolves a potential interaction concern.

OPPD Question 8 Response:

a. Calculation No. FC06011 for the qualification of Diesel Fuel Oil Tank FO-1 is provided in Attachment 5.

b. Structural "Weak Link" calculations were performed for the valves included in the FCS Motor-Operated Valve (MOV) Program. These calculations determined stresses in the critical structures of the valve and operator assemblies for both seismic and operating loads. The stresses from these loads and their combinations were compared to appropriate stress allowables from the applicable licensing basis design codes. Seismic demand was based on in-structure response spectra. The calculations, therefore, provide "licensing basis" seismic qualification which negates the need for applying GIP methodology. The Seismic Review Team (SRT) walked down these two valves to ensure that there are no interaction or other concerns with them.

c. A summary of the calculation related to those sections of Blockwall No. 9 which are close to motor control centers MCC-3C2 and MCC-4A2 is provided in Attachment 5. The SRT walked down this wall and noted the seismic upgrade done as a result of GL 80-11 reviews. Based on these upgrades and the existing documentation, the interaction concern was resolved.

<u>NRC Question 9</u>:

In the event of a malfunction of the following valves in the preferred safe shutdown path, manual operations were specified as stated below:

a. Manual closure of LCV-218-2 (valve in the branch line from the volume control tank to the suction of the charging pumps).

b. Manual opening of HCV-258 or HCV-265 (valves in the boron rejection flow path from concentrated boric acid storage tank to the suction of the charging pumps).

c. Manual opening of LCV-218-3 (valve in the line connecting the Safety Injection and refueling water tank to the suction of the charging pumps).

d. Manual closure of the main steam isolation valves HCV-1041A and HCV-1042A.

<u>NRC Question 10</u>:

Discuss effects of harsh environmental condition and the accessibility to the components, during a design basis earthquake, on the operator's ability to perform the above functions. Also, discuss the procedure that would be used by plant operators to accomplish these functions.

<u>OPPD Questions 9 and 10 Response</u>:

During the development of the Safe Shutdown Equipment List (SSEL), it was intended to minimize the impact on plant operating procedures and develop safe shutdown success paths based on existing success paths in plant operating procedures. Based on this, the SSEL identifies applicable plant procedures which are associated with each success path.

Emergency Boration

The SSEL identified a number of manual actions which may be required to establish emergency boration of the Reactor Coolant System (RCS). These actions are:

- Close valve LCV-218-2 (Auxiliary Building Room 29)

- Open valves HCV-258 and HCV-265 (Auxiliary Building Room 4)
- Open valve LCV-218-3 (Auxiliary Building Room 7)

The operation of these valves is directed by the following two procedures:

- Emergency Operating Procedure EOP-20, *Functional Recovery Procedure* - success paths RC-1 and RC-2 (SSEL Reference 5.17)
- Abnormal Operating Procedure AOP-03, *Emergency Boration* (SSEL Reference 5.14)

It is expected that steps in AOP-03 for emergency boration would be performed within the first hour of the event if required. The areas where these manual actions are to be performed are all located in the seismically designed Auxiliary Building and all access/egress paths are also within the Auxiliary Building. Therefore, a seismic event would not impact access to the valves. The access/egress paths are provided with emergency lighting in the event normal lighting is lost due to a loss of offsite power. Based on the room heat-up analysis (SSEL reference 5.73), the areas where these manual actions are to be performed would be habitable.

The normal plant staffing will be adequate to support the manual actions identified in AOP-03 for emergency boration. AOP-03 is a procedure that was in place prior to the A-46 Project. The operations staff is trained on AOP-03 as part of operator training.

Decay Heat Removal

Potential operator actions were identified to manually close HCV-1041A and HCV-1042A. These valves fail closed on loss of power or loss of instrument air, therefore, failure of the valves to close is highly unlikely. However, if the valves should fail to close, manual actions can be taken to either pull the control fuses for the valves (main Control Room), or isolate instrument air to the valves which are located in Room 81 adjacent to the Control Room. It is expected that failure of these valves to close would be identified by the operators during the first minutes of the event and immediate actions would be taken. Failure of these valves to close would result in the operators entry into EOP-05, *Uncontrolled Heat Extraction*. This procedure directs the operators to ensure that the valves are closed. Based on the room temperature profiles provided in SSEL Reference 5.73, it is expected that room temperatures would not preclude performance of this manual action. Attachment C to the SSEL addresses the operators' capabilities with respect to ensuring that the valves are closed (i.e., take manual actions, if necessary).

Based on discussions with the plant operating staff, as documented in Attachment C of the SSEL Report, the operators would take the needed actions to ensure the valves are closed. This manual action is consistent with the philosophy of the existing EOPs and AOPs.

NRC Question 11:

Section 3.5, Resolution of Outliers, of the Relay Evaluation Report, states in part that, "Operator action is proposed as the preferred method of resolving the six 87/1AD1 and 87/1AD2 outliers relays, which are in the direct control paths of the DG-1 and DG-2 feeder breakers and the EDG #1 and EDG #2 engines. However, since an operating procedure for this action does not currently exist, one will have to be written if this method of resolution is selected." When do you expect to determine if this is the selected resolution? Given that operator action is chosen, describe the process to be used to determine that the procedures to be developed are adequate and that sufficient manpower and time will be available to properly reset the affected relays? What field and Control Room simulator scenarios were developed to verify and validate that these operator actions could be accomplished in the timeframe required to facilitate safe shutdown? Describe the operator training to be provided to ensure crews are knowledgeable of the relays and activities for which operator action is credited?

OPPD Question 11 Response:

As identified in Appendix G of the Relay Evaluation Report, instead of operator action, the selected resolution is to replace the bad actor relays per FCS modification MR-FC-95-003. This modification is currently scheduled for completion during the 1998 refueling outage.

NRC Question 12:

Do any of the operator actions required to reset the affected relays necessitate in-plant actions by the operating crew? If so, how were potentially harsh environmental conditions factored into the analysis?

OPPD Question 12 Response:

As identified in Appendix G of the Relay Evaluation Report, operator actions are selected as the preferred approach for the resolution of 15 items. All of these actions are accomplished from the Control Room or the Rooms 56 and 57 of the seismically designed Auxiliary Building and are currently in the AOPs/EOPs. The rooms and the access/egress paths are accessible from the Control Room and have emergency lighting in case of a loss of offsite power. Loss of the Heating, Ventilation and Air Conditioning (HVAC) will not render these rooms uninhabitable based on a room heatup calculation performed for the A-46 Project review.

NRC Question 13:

Appendix I, Generic Implementation Procedure (GIP) Outlier Seismic Verification Sheets (OSVSs), contains a list of all relays which are resolved through operator actions to reset the systems affected by the outlier relays. Item 3, subpart B, Method of Outlier Resolution, of several of these OSVSs contains an incomplete description which states, "For the first proposed method of resolution (Operator Action), operating procedures to reset the circuits controlling equipment 1A3-20 and DG-1 does not currently exist. MR-FC-95-003 will." Please provide the complete description of the method of outlier resolution.

OPPD Question 13 Response:

This was a typographical error. The statement should have read "MR-FC-95-003 will replace the bad actor relays with qualified relays." The last part of the sentence was inadvertently omitted from Appendix I, OSVSs for 87/1AD1-1, 1-2, 1-3, 2-1, 2-2 and 2-3 relays. The modification is currently scheduled for completion during the 1998 refueling outage.

NRC Question 14:

Section 3.0, Assumptions/Limitations, of the Safe Shutdown Equipment List (SSEL) Report states in part, "Operator actions which are not addressed with existing procedures will be evaluated for accessibility and time constraints." Please describe what evaluations were performed to ensure adequate manpower was available in a timeframe necessary to perform the operator actions required to place the plant in a safe shutdown condition? What specific operator training was provided to ensure all operating crews were knowledgeable of the SSEL and the procedural guidance expected to be used during a postulated earthquake?

OPPD Question 14 Response:

Potential manual actions as identified in the SSEL are addressed by existing plant procedures and the operators have been fully trained on their use. The actions required by the SSEL are defined in these procedures and therefore do not represent a significant additional burden to the operators. See OPPD's response to questions 9 and 10 for additional information.

NRC Question 15:

For those operator actions specified in Section 4.0, Results, of the SSEL Report which if any require in-plant actions by the operations crew? How were potentially harsh environmental conditions factored into the analysis?

<u>OPPD Question 15 Response</u>:

The manual actions identified in section 4.0 of the SSEL would be performed in the Auxiliary Building. This building is seismically designed, therefore these areas will not be impacted by a seismic event. Emergency lighting is also located in this building should normal lighting be lost due to a loss of offsite power. See response to questions 9 and 10 for additional information.

<u>NRC Question 16</u>:

Section 3.7, Operations Department Review of SSEL, of the GIP requires a review of the SSEL to confirm compatibility with plant normal and emergency operating procedures, and to verify that a trained operator, following such procedures will be eventually directed to use the safe shutdown equipment and indications. Attachment C, Plant Reviews, provides a compilation of plant memos and meeting minutes regarding the operations department review of the issue, however, there does not appear to be a succinct discussion in the report of the Operations Department review and the results of that review. Please provide a copy of the operations department review, including the scope, approach, evaluation methods, and results.

<u>OPPD Question 16 Response</u>:

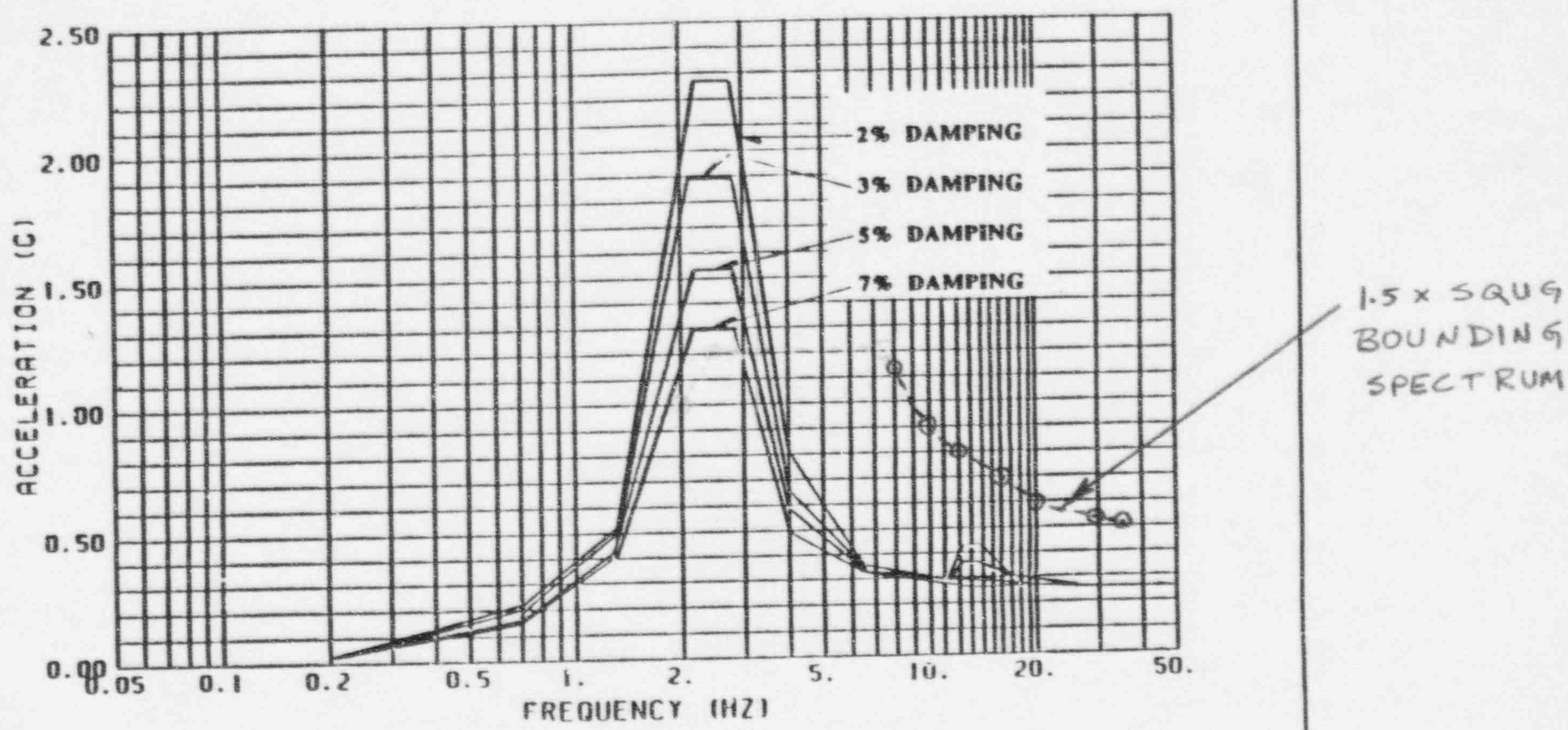
A SQUG technical review team was assembled with representatives from FCS Operations, Operations Training, Systems Engineering, Nuclear Engineering, Electrical/I&C Engineering and Mechanical Engineering. The team was involved in the selection and review of the Safe Shutdown Path and Equipment List. These individuals were intimately familiar with Sections 3.7 and 3.8 of the GIP. A "desk top" review of the procedures was performed as part of these reviews. The team reviewed and commented on the SSEL, and several revisions to the SSEL were made to incorporate the team's comments. A summary of the final documented review of the SSEL by this team, which included representatives from the Operations Department, is provided in Attachment 6.

LIC-96-0121

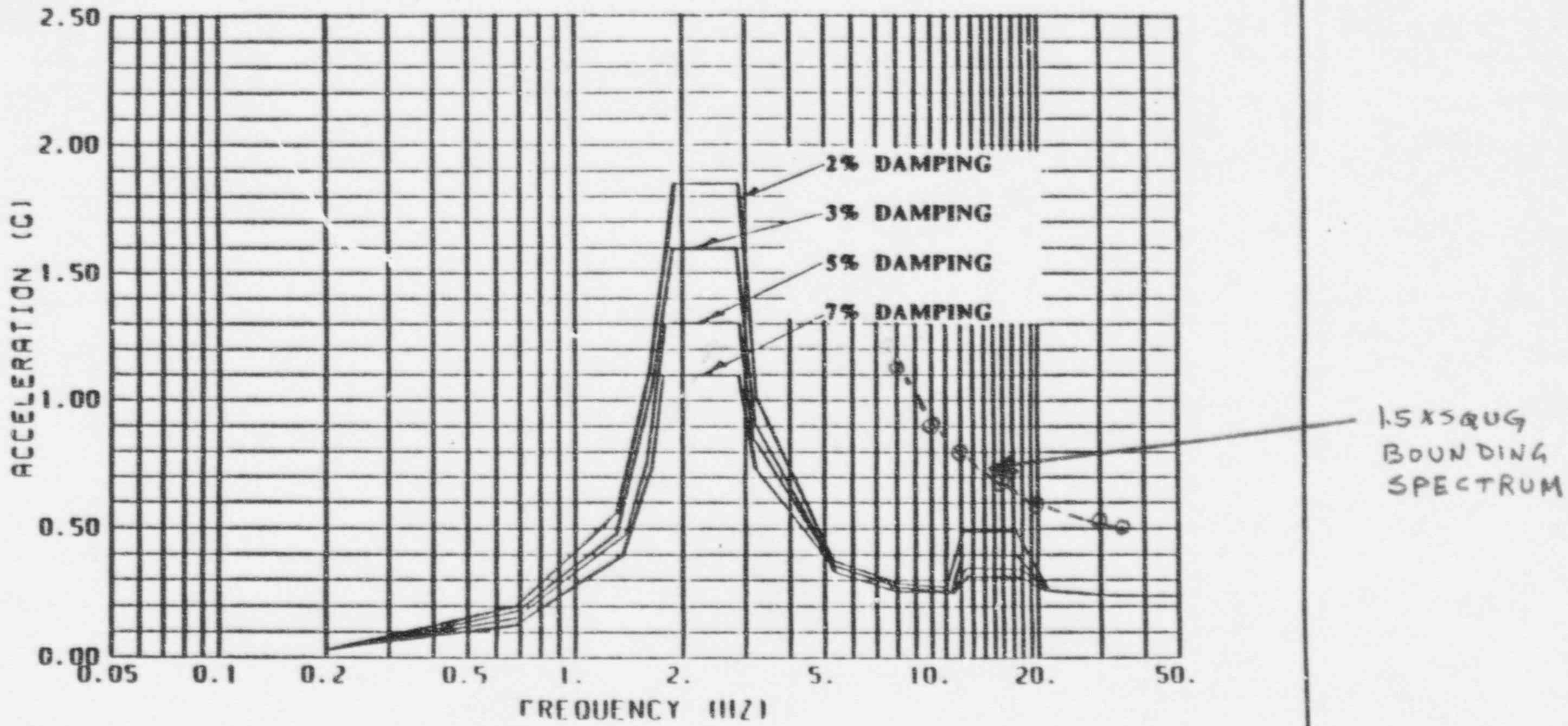
ATTACHMENT 2

Question 1

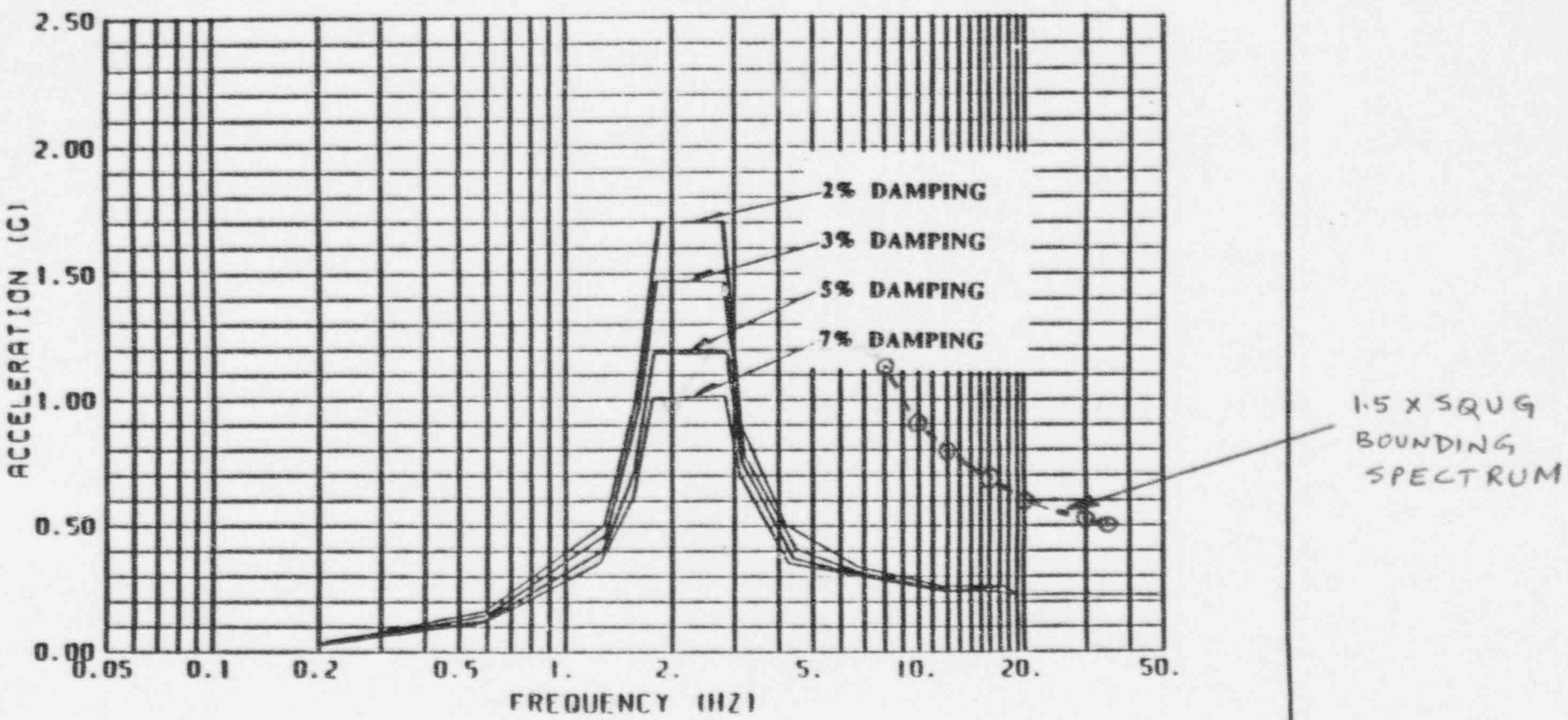
Comparisons of In-Structure Response Spectra
at Frequencies > 8 Hz
1.5 Times Bounding Spectrum



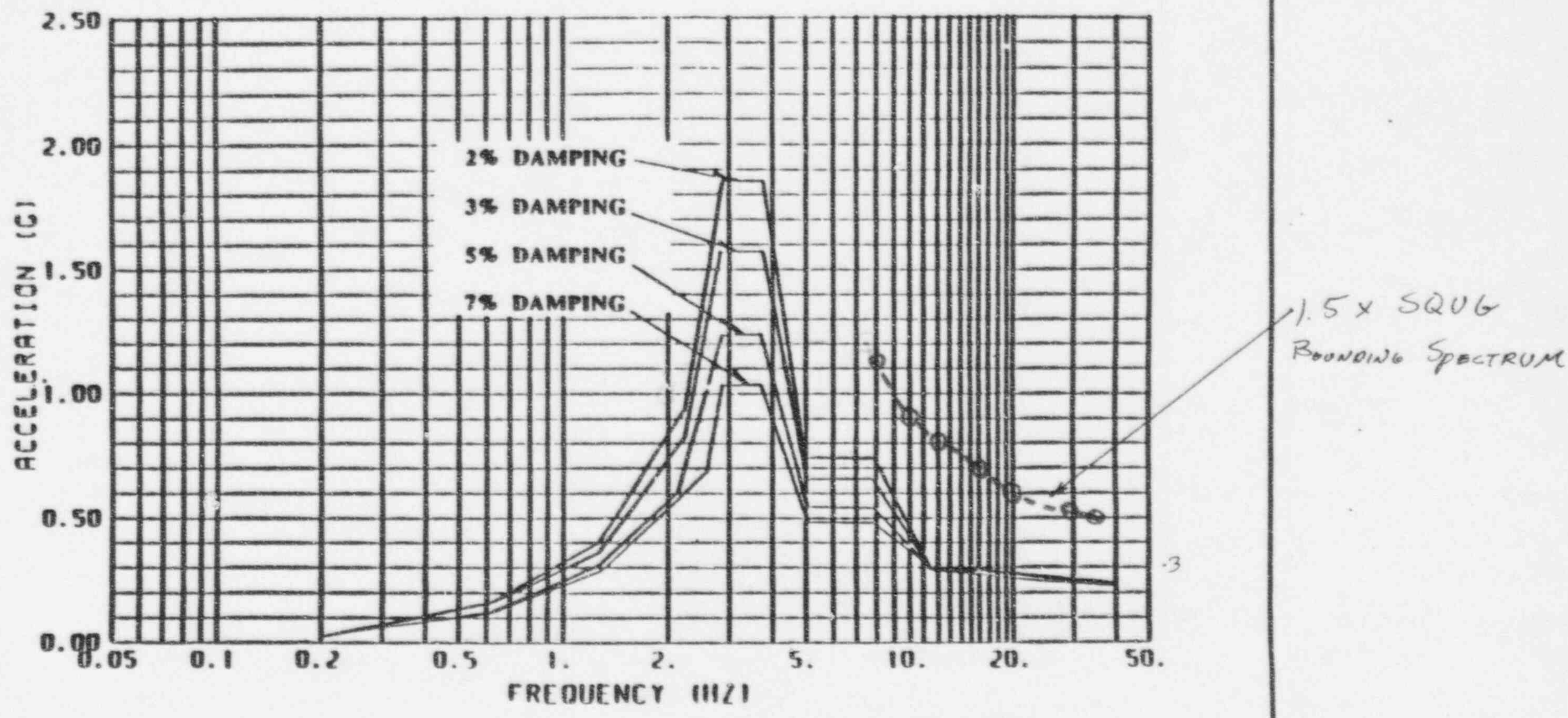
OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (NORTH-SOUTH) DIRECTION AT ELEVATION 1044'-0" AUXILIARY BUILDING
SAFE SHUTDOWN EARTHQUAKE	
BY MC DATE 7-1-92 CHKD AW DATE 07/01/92	SKETCH NO. REV.



OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1		HORIZONTAL (NORTH-SOUTH) DIRECTION AT ELEVATION 1038'-6" INTERNAL STRUCTURE	
SAFE SHUTDOWN EARTHQUAKE			
BY DTC DATE 7-1-92	CHKD AW DATE 07/01/92	SKETCH NO.	REV.



OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (NORTH-SOUTH) DIRECTION AT ELEVATION 991'-0" CONTAINMENT STRUCTURE
SAFE SHUTDOWN EARTHQUAKE	
BY AMR DATE 7-1-92 CHKD AW DATE 07/01/92	SKETCH NO. REV.



OMAHA PUBLIC POWER DISTRICT FORT CALHOUN STATION, UNIT 1	HORIZONTAL (NORTH-SOUTH) DIRECTION AT ELEVATION 1007'-6" INTAKE STRUCTURE
SAFE SHUTDOWN EARTHQUAKE	
BY ARK DATE 7-17-92 CHKD DW DATE 7/17/92	SKETCH NO. REV.

LIC-96-0121

ATTACHMENT 3

Question 2

Figure 2.3

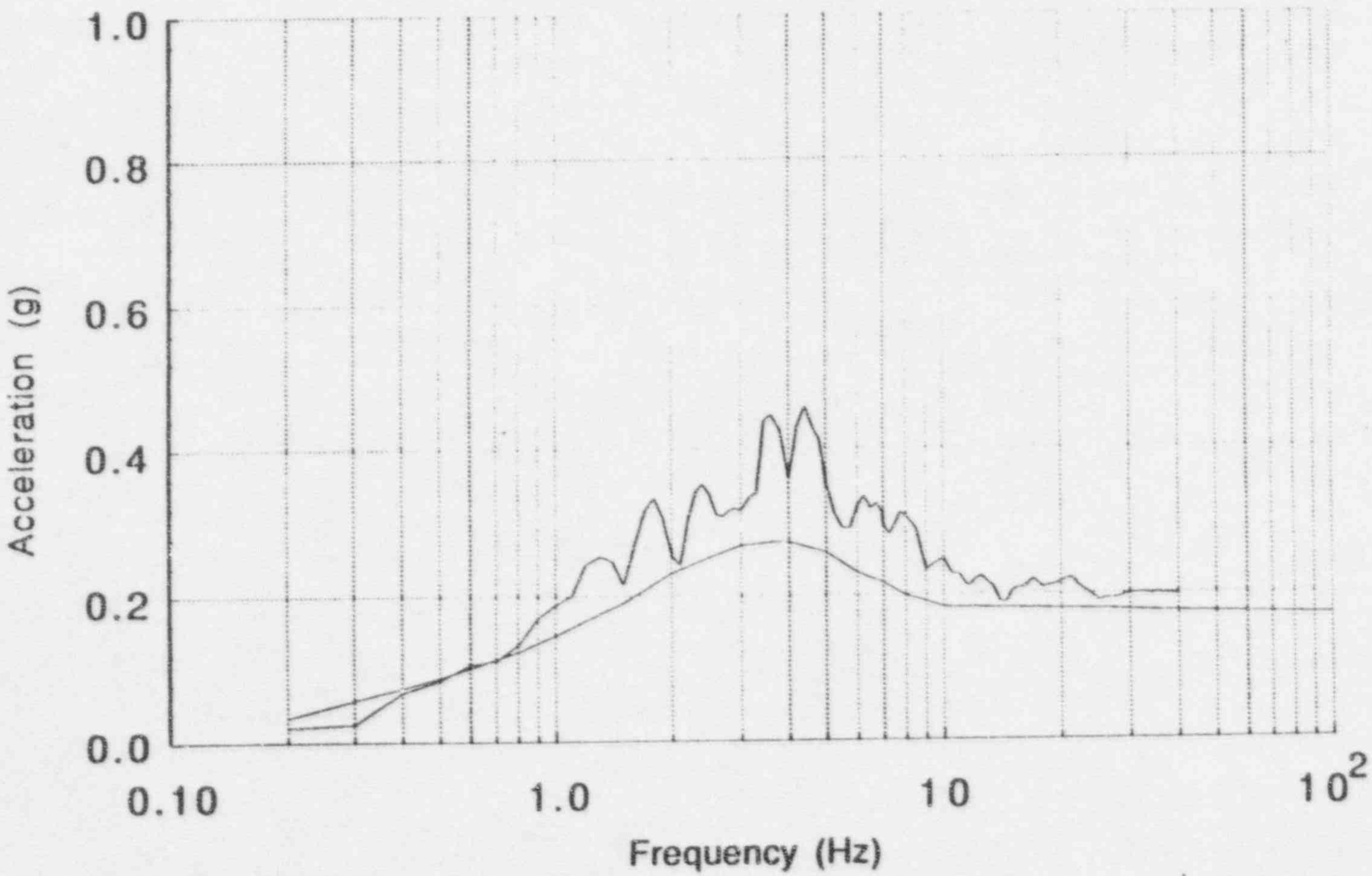


FIGURE 2.3 COMPARISON OF DESIGN BASIS GROUND RESPONSE SPECTRUM AND ENVELOPING TIME HISTORY RESPONSE SPECTRUM, NORTH-SOUTH DIRECTION, 5% DAMPING

Table 1

Scale Factors for Scaling ASCM Spectra to Obtain A-46 Spectra

Building	Direction	Factor
Auxiliary/Containment/Internal Structures	NS EW Vert.	1.36 1.20 1.05
Intake Structure	NS EW Vert.	1.12 1.16 1.81

LIC-96-0121

ATTACHMENT 4

Question 5

Calculations FC06313 and FC06314