Docket File

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

May 15, 1992

Docket No. 52-001

Mr. Patrick W. Marriott, Manager
Licensing & Consulting Services
GE Nuclear Energy
175 Curtner Avenue
San Jose, California 95125

Dear Mr. Marriott:

SUBJECT: SUMMARY OF THE ADVANCED BOILING WATER REACTOR (ABWR) STRUCTURAL DESIGN AUDIT AT GENERAL ELECTRIC COMPANY (GE)

On March 30 - April 3, 1992, the Structural and Geosciences Branch staff and NRC consultants (the NRC team) conducted an audit of the detailed design of ABWR seismic and non-seismic Category I structures at the GE office in San Jose, California. The purpose of the audit was to determine if: the structures of the ABWR are adequately designed; the floor response spectra (FRS) are properly generated; and commitments documented in the standard safety analysis report (SSAR) are properly implemented. The NRC team audited three major areas: (1) the reactor building outside primary containment, the control building, and radwaste building substructure, (2) the seismic design of turbine building and the seismic input to the analysis of the main steam line at the condenser side of the system, and (3) the procedures for evaluating site specific parameters.

As a result of this audit, the NRC team identified two major issues: (1) the detailed design calculations for the reactor building (including containment shell, internal structures, and the balance of Category I structures on the nuclear island) were not available for review, and the quality assurance status of these calculations is not clear, and (2) the detailed design calculations for both control building and radwaste building were not completed. The NRC team also identified an open issue in that GE did not consider the effect of the flexibility of the drywell equipment and piping support structure (DEPSS) in generating the FRS which are to be used as seismic input to the design of subsystems supported by the DEPSS.

Enclosed is the ABWR audit report prepared by Mr. Thomas Cheng of the Structural and Geosciences Branch, which documents the NRC team's findings and GE's commitments to address the NRC team's concerns and requests. A list of attendees in both the entrance and exit meetings are provided in the enclosure of the audit report.

Should you have any questions concerning this audit, please contact Son Ninh at (301-504-1141) or Mr. Thomas Cheng (301-504-2770), of this office.

Sincerely,

Original signed by Robert C. Pierson

Robert C. Pierson, Director
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Enclosure:
As stated

cc w/enclosure:
See next page

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ABWR Audit Report

April 27, 1992

1. INTRODUCTION

From March 30 to April 2, 1992, the staff of the U.S. Nuclear Regulatory Commission (NRC) performed the second design audit of the advanced boiling water reactor (ABWR) standard plant to determine if the structures of the ABWR are adequately designed and if commitments documented in the standard safety analysis report (SSAR) are properly implemented. The audit plan was to review detailed design calculations, which are important to safety but usually not included in the SSAR, to make a safety evaluation before the ABWR is certified.

In November 1989, the staff conducted the first design audit of the ABWR, covering the containment structure and the structures inside the containment. In this second design audit, which was conducted at the General Electric Company (GE) office in San Jose, California, the staff covered other ABWR Category I structures, that is, the control building and the reactor building structures that are outside the containment. The staff also reviewed the radwaste building substructure and the turbine building which are not seismic Category I but are important to safety.

The NRC audit team (the "team") consisted of the NRC staff and its consultants. The Enclosure is a list of the attendees in both the entrance and exit meetings. The team audited three major areas:

(1) The design of the reactor building outside the primary containment, the control building, and radwaste building substructure
(2) The seismic design of turbine building and the seismic input

to the anlysis of main steam line at the condenser side of the system

(3) The procedures for evaluating of site specific parameters

2. AUDIT FINDINGS

2.1 Design Adequacy of ABWR Structures

(A) Quality Assurance Status of Analyses and Design Calculations

During the audit, no detailed design calculations for structures were available for review. The information available for review included (a) seismic analyses, including floor response spectra (FRS), (b) static analyses for determining distribution of structural forces and moments, and (c) a design and analysis summary report for the reactor building. GE provided the team with the quality assurance (QA) status for all analyses and detailed design calculations at the time of the audit:

Design and Analysis Information	Reactor Building	Control Building	Radwaste Building
Seismic analysis and FRS generation	Yes	Yes	No*
Static analysis	Yes	No	No
Detailed design calculations	Yes	No	No

* Note: GE indicated that the FRS need not be generated for the radwaste building because it does not house any safety related systems or components.

The team found that, during the 1989 design audit, the staff reviewed only a preliminary version of the reactor building summary report. The team could not determine the QA status of this preliminary summary report.

GE committed to complete the implementation of the QA program for all the analyses and calculations before the staff performs its next audit, which was tentatively scheduled for May 1992.

(B) **Reactor Building**

The design summary report of the reactor building reviewed by the staff in November 1989 was a preliminary report because the final design summary report was not published until September 1990 (Ref. 1). The team also found that the detailed design calculations were not available during this audit. GE indicated that the detailed design calculations will not be available for the staff to review until the middle of April 1992.

GE is revising those envelope FRS in Amendment 16 to the standard safety analysis report (SSAR) for the ABWR standard plant that are to be used in the seismic design of equipment, piping, and components. GE indicated that the revision included (a) removing the contributions to FRS from the few soil-structure interaction (SSI) parametric studies that were performed using the CLASSI/ASD code, and (b) applying uncertainty factors equal to 1.33 and 1.0, respectively, to the revised horizontal and vertical envelope FRS. GE indicated that it is making the revision because the Standard Review Plan (SRP), Revision 2, no longer requires the use of two different methods in SSI analyses. The team requested GE to provide a justification for the uncertainty factors and to include in the next amendment of SSAR a description of the complete procedure for generating the revised envelope FRS for the reactor building. The team questioned the adequacy of applying an uncertainty factor of 1.0 to the vertical FRS because the team found that the calculations for the vertical FRS did not include the effect of the rocking mode response of the structure in the horizontal SSI analysis. The team also requested GE to include in the SSAR the seismic displacements of structures because this information is required in the design of piping systems. GE agreed to respond to the team's requests and concerns.

During a piping audit conducted in the week of March 23 to 27, 1992, the staff found high spectral peak accelerations in the revised standard plant FRS at certain locations in the reactor building. Some of these accelerations are in the order of 14g to 16g, on both the horizontal and vertical SSE FRS. The team concluded that these high spectral peak accelerations could result from (a) using a value two times the OBE floor response spectra as the SSE spectra, (b) applying the overall uncertainty factor of 1.33 to all horizontal FRS regardless of the site condition, (c) increasing the width of the spectral peak at the main steam line (MSL) nozzle on the reactor pressure vessel (RPV) to envelop the frequency shifts in spectral peak for two conditions: both with and without the seismic stabilizer between the reactor shield wall (RSW) and reinforced concrete containment vessel (RCCV), and (d) amplifying the vertical FRS at particular floors to account for their flexibility (Ref. 2). After the audit, the team performed a preliminary assessment and concluded that causes (a) and (b) are the most probable reasons for the increased amplifications of the spectral peak on the envelope FRS. Cause (a) is very obvious and increased the amplification for all SSE spectra. Cause (b) would likely increase the amplification of the spectral peaks on those horizontal FRS generated for the hard rock and extra hard rock sites because they dominated the envelope FRS and because of the smaller uncertainty in amplitude of the FRS peaks which the team anticipated for hard rock sites.

The team informed GE about its plan to perform a confirmatory SSI analysis of the reactor building using the SASSI computer code. One purpose of the confirmatory SSI analysis is to assist the staff in determining the causes for the high FRS peak accelerations discussed previously. To perform the confirmtory analysis, the team requested GE to provide the SASSI two-dimensional (2D) SSI models for 5 of the 14 generic ABWR site conditions. These 5 generic site cconditions and the associated earthquake directions for which GE performed the 2D SSI analyses are as follows:

Site Designation	Earthquake Directions
UB1D150	X, Y, Z
UB1D300	X
VP4D85	X
VP4D150	X
EHD85	X, Y, Z

The team also requested GE to provide the digital time history data of the three components of the free field earthquake input motion and the SASSI code output for the 5 selected sites. GE agreed to provide the requested information in the middle of April 1992. This information has now been received.

During the piping audit,the staff also expressed a concern that GE did not consider the effect of the flexibility of the drywell equipment and piping support structure (DEPSS) in generating the FRS which are to be used as seismic input to the design of subsystems supported by the DEPSS. During this audit, GE confirmed that it did not include the DEPSS either in the structural model of the reactor building when generating the FRS at the particular location or in the subsystem model as part of the supporting system. GE contended that the combined operating license (COL) applicant should be responsible to account for the dynamic flexibility of the DEPSS. The team considers this concern as an open item.

The stack over the reactor building is a thin-walled steel structure. GE stated that because the stack is of light weight a failure of the stack will not cause damage to the reactor building. This information resolved the staff's concern that a failure of the stack could affect the structural integrity of the reactor building.

(C) Control Building

The team reviewed GE calculation DRF U73-000 (Ref. 3). Volume I of this calculation contains the results of the seismic SSI analysis and FRS generation, and Volume II contains the results of the static analysis to determine the structural element forces and moments for the various loading conditions.

GE performed seismic analyses of the control building using a 2D SSI model and the SASSI computer code. GE used a lumped mass stick model to respresent the structure because it is symmetric about the two horizontal axes. The team found the structural model and the use of SASSI code for the seismic analysis to be acceptable. Only three generic site conditions were considered (soil site VP3D150, soil site VP5D150, and hard rock site HRD85). GE obtained the standard plant FRS by applying an uncertainty factor of 1.5 to the envelope of the horizontal FRS generated for the three generic site conditions, and applying an uncertainty factor of 1.0 to the vertical FRS. GE did not consider the effect of building-building interaction through soil and did not use a three dimensional (3D) SSI model to generate the FRS. The team also found that GE followed a practice similar to the one it had followed for the reactor building: in generating the vertical FRS for the control building it did not include the effect of the rocking mode response of the building to the horizontal component of earthquake motion. The team expressed the following concerns during the audit:

(a) The effect of interaction among the reactor building, the control building, and the turbine building through the soil may affect the seismic response significantly. GE indicated in the SSAR indicates that, at certain soil sites, this effect increased some horizontal FRS peak accelerations of the reactor building significantly. The SSAR did not include as much information on this effect on the vertical FRS of the reactor building. The fact that the reactor building is much heavier than the control building (approximately 200,000 tons vs. 43,000 tons) led the team to believe that the interaction between these buildings could cause an even more significant effect on the FRS of the control building.

(b) The difference between the 3D and 2D SSI may be significant on the seismic response. This concern is based on the results of GE's parametric studies for the reactor building, as shown in the SSAR, which indicate that a 2D SSI analysis typically underestimated both the horizontal and vertical spectral peak accelerations at higher elevations of the building for medium stiff soil sites and hardrock sites.

(c) The team could not determine the basis for the uncertainty factors of 1.5 and 1.0 to be applied to the horizontal and vertical FRS, respectively. The team questioned the adequacy of applying an uncertainty factor of 1.0 to the vertical FRS because the vertical FRS did not include the response from the rocking mode of the building to the horizontal earthquake component.

(d) The seismic response envelopes developed based on only three generic site conditions may not be sufficient for a standard design.

(e) The team found inconsistencies in the presentation of the individual and envelope FRS at a given structural location, both in the analysis report and between the analysis report and SSAR. One example is the X-direction horizontal FRS at elevation 79000 mm.

GE committed to address these five concerns. GE also agreed to amend the SSAR to (a) state the three generic sites conditions considered in the SSI analyses and (b) describe the complete procedure for developing the standard plant envelope FRS.

To determine the element forces and moments in the control building for the various loading conditions, GE performed static analyses using the NASTRAN computer code. The symmetry of the building about both horizontal axes enabled GE to use a 1/4 finite element structural model in the analysis. Loads considered included dead load, live load, accident pressure load (21 psi) on interior of the main steam line (MSL) tunnel caused by an MSL break, seismic loads, and both static and seismic soil pressures on embedded portions of the building walls. GE considered the load combinations according to ACI-349, and the team found them to be acceptable. However, GE did not include wind, tornados and tornado missile loads in the analysis. Except for this, the team found the method of analysis and results for the element force and moment calculation acceptable. GE agreed to address the staff concern relating to the inclusion of wind, tornado and tornado missile loads. Detailed design calculations based on the calculated element forces and moments were not available for review during this audit. GE indicated that these calculations will not be available until the middle of April 1992. GE also agreed to correct the code reference in the SSAR, Section 3.8.4.5.2, from ACI-318 to ACI-349.

The team discussed the pilot inspections, tests, and acceptance criteria (ITAAC) for the control building with GE during the audit. GE informed the team that it had revised the pilot ITAAC for the control building in March 1992 to include the floor heights and the thicknesses of the floors and walls. GE had not completed the detailed design calculations using the calculated structural element forces and moments. Therefore, such tier 1 information as the building dimensions may be changed. GE agreed to further revise the ITAAC to document these changes when it makes them.

(D) **Radwaste Building**

GE indicated that the radwaste building does not house any safety-related equipment and components and hence does not require FRS. To ensure that the building maintains structural integrity during and after an SSE and to prevent unacceptable leakage of the radwaste material outside the building, GE elected to design the structure for the SSE seismic load computed in a dynamic analysis. The team reviewed a preliminary seismic analysis report (Ref. 4) and a preliminary design calculation file. During the audit, the team could not make a final conclusion about the design adequacy of the building because GE had not completed the QA program for these two documents.

GE conducted the seismic analysis using a free-standing fixed-base stick model for the structure, with four masses located at the roof and the three floor elevations. GE did not consider the structural embedment. The resulting fundamental horizontal frequencies of the analysis model, calculated with the NASTRAN computer code, are 3.2 Hz and 3.9 Hz in each of the two horizontal directions. GE used the response spectrum method of analysis to compute the seismic response and considered the three earthquake components in three separate analyses. The team found the method and results of the seismic analysis adequate. The team concludes that it is sufficient to use a fixed base structure model in the analysis and to ignore the effects of both embedment and site soil conditions since only the seismic forces and moments induced in the structure are needed for the design. The basis for this conclusion is that the fundamental horizontal frequency of the analysis model is within the frequency range of the maximum amplification of the response spectrum of input ground motion.

GE used the NASTRAN computer code and the static analysis of a finite element model to calculate the element forces and moments caused by dead, live, seismic, and soil pressure loads for the design of this building. GE considered the load combinations according to the ACI-349 code requirements. The team found the method and results of the static analysis for the element forces and moments acceptable, with two exceptions: (a) the wind load was not included in the analysis, and (b) the soil pressure load appeared to be incorrectly calculated. GE agreed to address these two concerns. The detailed design calculations were not available for review during the audit. GE stated that they will be completed around the middle of April 1992.

(E) **Modular Construction**

GE indicated that it would not apply the modular construction techniques to the ABWR Category I structures but may apply them to equipment and components.

2.2 **Seismic Analysis of Turbine Building**

In Table 3.2-1, footnote "r" of the SSAR, GE committed to perform a dynamic analysis for a portion of the main steam line (MSL) inside the turbine building. The team discussed the need to perform a dynamic analysis of the condenser to generate a set of FRS as the seismic input to the MSL analysis based on the guidelines documented in SRP Section 3.7.2 and 3.7.3. GE committed to use the FRS obtained at the reactor containment shell (one of the two anchor points of this portion of MSL) and agreed to provide the procedure for generating the FRS at the condenser (the other MSL anchor point). GE stated that the final FRS and the generation procedures will be available for the staff to review by the next design calculation audit.

GE added a new Section 3.7.3.16 to the SSAR for seismic design of the building in which GE proposed to use the Uniform Building Code (UBC) approach for seismic zone 2A. The team expressed its concern that the use of the UBC approach for seismic design does not ensure that the building can withstand an SSE. GE committed to address this concern.

2.3 Verification of Plant Specific Seismic Design Adequacy

Section 2.3.1 of the SSAR requires that, to confirm the site-specific seismic design adequacy of the standard plant, the COL applicant demonstrate that it has satisfied the eight site-dependent conditions as specified in Section 3A.1 of the SSAR. On August 19, 1991, GE provided the staff with the procedure for evaluating the standard design against these eight site-dependent conditions (Ref. 5). In a draft safety evaluation, the staff concluded that the confirmation procedure as proposed in Reference 5 is adequate if the COL applicant complies with five of the staff's positions (Ref. 6). The five staff's positions are as follows:

Position (1) - When a site-specific seismic SSI analysis is required, the site-specific seismic responses (structural seismic loads and FRS) should be compared with the standard design responses at all locations.

Position (2) - When a site-specific seismic SSI analysis is performed, the adequacy of the standard seismic design for subsystems (piping and equipment) should be confirmed by comparing the peak-broadened, site-unique FRS with the standard design envelope FRS.

Position (3) - GE proposed that, if the site-specific responses exceed the standard design responses, it would confirm the design adequacy of equipment and piping by examining whether or not the standard design responses are exceeded at major resonant frequencies of the item. GE should clarify the manner in which the COL applicant should evaluate the multiple frequencies of piping since the response of a system such as piping that has multiple supports may be governed by modes other than the fundamental mode.

Position (4) - GE should specify the location of the free field input motion for a shallow soil site in accordance with the SRP 3.7.1 because it may not be sufficient to specify the input motion at finished grade.

Position (5) - GE should provide procedures for confirming site-specific conditions 3, "liquefaction potential," 4, "fault movement," and 8, "bearing capacity."

To comply with the staff's positions, GE submitted a revised SSAR Section 2.3.1.2, Amendment 18, with hand marked changes, to the staff for review (Ref. 7). GE responded to staff position (1) by including Insert (B) in Reference 7 a requirement that, when a site-specific SSI analysis is performed, the design adequacy of Category I structures be established by comparing the site-specific structural responses to the corresponding standard design responses at all the locations shown in Tables 3G.4-1 through 3G.4-3 for the reactor building, Table 3G.5-3 for the control building, and Table 3G.6-2 for the radwaste building. To confirm the design adequacy of seismic Category I equipment and piping when a site-specific SSI analysis is made, Insert (C) in the revised SSAR requires that the site-specific FRS be compared to the standard design FRS at all the locations shown in Figures 3G.4-1 through 3G.4-20 for the reactor building, and Figures 3G.5-5 through 3G.5-22 for the control building. GE agreed to submit SSAR Appendix 3G.6, which contains the standard design seismic responses for the radwaste building.

Responding to staff position (2), GE revised the SSAR to require that, when a site-specific SSI analysis is performed, the site-specific FRS be peak-broadened and then compared to the standard plant envelope FRS in order to confirm the adequacy of the standard design for equipment and piping.

Responding to staff position (3), GE included Insert (D) in the revised SSAR in which it requires that the peak-broadened site-specific FRS be compared with the standard plant envelope FRS for a flexible system (a) at the fundamental frequency of the system when the response may be adequately represented by that of a single-degree-of-freedom system or of the fundamental mode, or (b) at all dominant mode frequencies within the frequency range of interest for a system having multiple dominant modes.

Responding to staff position (4), GE revised the SSAR to require that the location for free-field input ground motion at a shallow soil site be specified according to the guidelines in SRP 3.7.1, Revision 2.

Responding to staff position (5), GE included in the revised SSAR a requirement that for a site susceptible to liquefaction for ground motion up to the SSE level, techniques acceptable to NRC be used to improve the site by eliminating the liquefaction potential. In the revised SSAR, GE requires the COL applicant to provide justification acceptable to NRC to demonstrate that the effect of fault movement is inconsequential on plant facilities at a site that deviates from site-specific condition (4) that is susceptible to fault displacement but that is chosen for other reasons. In the revised SSAR, GE also requires that the COL applicant perform a site-specific SSI analysis to address the soil bearing capacity issue if the site deviates from site-spedific condition (8). However, GE does not require the applicant to compare the structural response if it performs the SSI analysis only to address this deviation.

The team reviewed Reference 7 and discussed this issue with GE. The team concluded that the revised requirementss meet the staff's five positons herein. However, the team identified the following additional concerns with the confirmation procedure after reviewing other parts of the SSAR and DSER:

(a) In the confirmation procedure, GE requires that the COL applicant perform a site-specific SSI analysis upon finding a deviation in average shear wave velocity (site-specific condition (6)) or an abrupt variation in shear wave velocity with depth (site-specific condition (7)). GE does not consider the deviation in soil depth as another site-specific condition. In Section 2.5.4.1 of the draft safety evaluation report (DSER) for the SSAR (Ref. 8), the staff requires the COL applicant to demonstrate that the standard plant envelope response with fixed soil depth will cover completely the cases in which the depths and properties of the soil deposits differ from those assumed in the SSAR. GE developed the ABWR standard plant envelope responses based on 14 generic site conditions. Each site condition is characterized as the combination of at least the two properties: soil deposit depth and the associated shear wave velocity profile. Therefore, this DSER interface requirement applies to all site conditions that differ from the 14 generic conditions. During the audit, the team stated its position that GE should not only include soil depth as a site parameter in the confirmation procedure but also should require the COL applicant to consider soil depth and the shear wave velocity profile simultaneouly, instead of considering each parameter separately. However, the COL applicant need not perform a site-specific SSI analysis for a site condition that differs from the 14 generic conditions if the COL applicant can demonstrate by some other means that the structural response anticipated for such site condition would be bounded by the standard plant envelope response.

(b) The team questioned the criterion in Insert (C) of the revised SSAR, that the "spectrum comparison can be made for one damping only" when confirming the seismic design adequacy of piping and equipment. The team questioned this criterion because in Regulatory Guide 1.61, "Damping Values for Seismic Design of Nuclear Power Plants," the staff stated that different damping ratios should be assigned to different subsystems in the analysis.

(c) In item (b) of Insert (D) of the SSAR, GE stated that "For flexible components....design adequacy is established when the site-specific spectra bound the design spectra." The word "bound" appears to be a typographic error for "are bounded by" or the equivalent.

GE agreed to address these concerns of the staff.

3. CONCLUSIONS

Upon reviewing the audit findings herein, the staff draws the following conclusions:

3.1 Verification of Completion of Design

The staff cannot verify the design until it reviews detailed design calculations for the reactor building, control building, and radwaste building. GE stated that these calculations will not be available for the staff to review until the middle of April 1992. When the team performed the audit, GE had not yet completed the QA program for the analyses and detailed design calculations of the control building and radwaste building. GE committed to complete the required QA program before the staff performs the next audit, which is tentatively scheduled for May 1992.

(A) Reactor Building

GE is revising the standard plant envelope floor response spectra (FRS) for the reactor building by deleting contributions from the parametric studies that were previously performed using the CLASSI/ASD code. The staff cannot reach a conclusion regarding the adequacy of the revised standard plant envelope FRS until GE completes its commitments to resolve the concerns tthat the staff found during the audit. GE's commitments include the following:

(a) Provide in the SSAR a detailed description of the procedure for generating the revised standard plant envelope FRS.
(b) Provide a justification for the uncertainty factors of 1.33 and 1.0 to be applied to, respectively, the horizontal and vertical revised FRS.
(c) Include in the SSAR the information of seismic structural displacements.
(d) Provide the necessary input and output data of the SASSI 2D SSI analysis models for five generic site conditions by the of April 1992, to enable the staff to perform a confirmatory SSI analysis.

The staff considers as an open issue the effect of the drywell equipment and piping support structure (DEPSS) on the FRS to be used as input to the analysis of the piping and equipment supported by the DEPSS. The staff maintains this position although GE stated during the audit that this is outside GE's scope and the COL applicants are responsible for addressing such effect.

The staff cannot draw a conclusion on the adequacy of the design calculations until it reviews the final design summary report and the detailed design calculations.

(B) Control Building

The method and results for the seismic analysis of the control building are adequate if GE completes its commitments to address the staff's concerns. GE's commitments include the following:

(a) List the three generic site conditions in the SSAR that were considered in developing the seismic responses for the standard plant, and provide a description of the procedure for generating the standard plant envelope FRS.
(b) Address the effects of interaction between buildings on the seismic responses of the standard plant, and address the differences between 2D and 3D SSI analyses.
(c) Provide the basis for considering only three generic sites, and the basis for applying the uncertainty factor of 1.5 and 1.0 to the horizontal and vertical FRS, respectively.
(d) Clarify the discrepancy in FRS that the team found in the seismic analysis report and between the analysis report and SSAR.

The static analysis for computing the structural element forces and moments appeared adequate. GE agreed to include the effects of wind, tornados, and tornado missles in the analysis for the applicable load combinations. GE also agreed to replace the code reference in the SSAR, Section 3.8.4.5.2, from ACI 318 to ACI 349. The staff cannot draw a conclusion on the design calculations until GE completes the QA program for both the static analysis and detailed design calculations and until the staff audits the detailed design calculations. GE agreed to further revise the ITAAC when the detailed design calculations require changes in the floor heights or thicknesses of the floors and walls.

(C) Radwaste Building

Both the seismic and static load analyses appeared sufficient. GE agreed to two of the staff's requests:

(a) Include wind load in the static analysis

(b) Correct the soil pressure loads used in the static analysis

The staff cannot draw a conclusion on the design of the radwaste building until GE completes the QA program for all analyses and detailed design calculations and until the staff performs an audit of the detailed design calculations.

3.2 Turbine Building

GE agreed to generate the FRS at the condenser for use as seismic input to the analysis of a portion of the MSL outside the primary containment, and agreed to provide a description of the procedure for the FRS generation to the staff for review. GE also agreed to address the staff's concern with the ability of the turbine building to withstand an SSE when the building is designed according to the proposed UBC approach.

3.3 Verification of Plant Specific Seismic Design Adequacy

The team found that the confirmation procedure provided in Reference 7 complies with the staff's five positions stated in a previous DSER. GE agreed to address the staff's two additional staff concerns:

(a) GE should comply with the interface requirement in the DSER, Section 2.5.4.1, which requires the applicant to demonstrate that the standard plant envelope response will cover the cases in which the depth and properties of the soil deposit differ from those assumed in the SSAR. Soil depth and shear wave velocity profile should be simultaneously considered as one site condition, and not separately as individual parameters, when demonstrating the adequacy of the standard plant seismic design or assessing the need for a site-specific SSI analysis.

(b) GE should clarify the criterion that the "spectrum comparison can be made for one damping only" when confirming the design adequacy of piping and equipment.

4. REFERENCES

(1) "ABWR Reactor Building and Containment Structural Design Evaluation Report," Bechtel, September 1990.

(2) GE Calculation RF A00-02900, Section 11, "Floor Response Spectra," Volume 2 of 4, Binder 2 of 30.

(3) GE Calculation DRF U73-0001, "DOE C/B SSI Analysis," Volume I and II.

(4) "Radwaste Building Seismic Analysis," prepared by G. W. Ehlert, GE, February 19, 1992 (submitted by GE during the audit).

(5) "Confirmation of ABWR Seismic Design Adequacy," Letter from A. E. Rogers of GE to C. L. Miller of NR August 19, 1991.

(6) Note from R. Nease, NRC, to docket file, General Electric Advanced Boiling Water Reactor (ABWR)," April 16, 1992.

(7) Note from R. Nease, NRC, to docket file, "General Electric Advanced Boiling Water Reactor (ABWR)," February 26, 1992.

(8) "Draft SER on Standard Safety Analysis Report (SSAR) for the Advanced Boiling Water Reactor (ABWR) Standard Plant" enclosure to letter from D. M. Crutchfield of NRC to P. W. Marriott of GE, June 10, 1991.

Enclosure

(1) Attendees at Entrance Meeting:

Name	Organization
Thomas M. Cheng	NRC
Ting- Yu Lo	LLNL
Tom Tsai	NCT Engineering
Jack Fox	GE
Gary Ehlert	GE
Ai-Shen Liu	GE

(2) Attendees at Exit Meeting

Name	Organization
Eugene Imbro	NRC
Thomas M. Cheng	NRC
Ting-Yu Lo	LLNL
Tom Tsai	NCT Engineering
Jack Fox	GE
Gary Ehlert	GE
Ai-Shen Liu	GE