

Public Service Company of New Hampshire

Seabrook Station

Interim Report

on

Use of Invalid Seismic Amplified Response Spectra

Date: December 6, 1979

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## Seabrook Project

### Interim Report

on

### Use of Invalid Seismic Amplified Response Spectra

#### Introduction

On Tuesday, November 6, 1979, Mr. J. DeVincentis, Seabrook Project Manager for Yankee Atomic Electric Company, reported by telephone to Mr. J. Mattia, NRC Region I Inspection and Enforcement inspector for the Seabrook Project, two significant design deficiencies under 10 CFR50.55(e). YAEC had that same day received written notice of the two deficiencies from the Seabrook architect-engineer-construction manager, United Engineers & Constructors Inc., under UE&C letter numbers SBU-31426 and SBU-31428.

The purpose of this report is to provide interim information on one of those reported deficiencies; namely, that identified in SBU-31426 (see Attachment 1) involving the use of incorrect seismic amplified response spectra (ARS) in the design of components supported by the containment building annular steel frame.

#### Structural Description of Containment Building

For plans and elevation arrangements of the Seabrook containment building internals, refer to Seabrook PSAR Figures 1.2-2 through 1.2-6.

The following is a brief description of the Seabrook containment building and its internal structures:

Structural Description of Containment Building (Cont'd)

The Containment Shell is a reinforced concrete cylinder with an hemispherical dome, both lined with carbon steel plate. The containment concrete internals consist of the primary and secondary shield walls, supporting columns for the gantry crane, the refueling canal and floor slabs at elevations 25 ft. and 0 ft. The Containment Shell and Internals are connected to the foundation mat which is founded on rock. The working floor slab at the bottom of the containment is at El. (-) 26'.

The structural steel frame involved in this design deficiency is the annular steel frame located inside the containment building in the annular space between the containment secondary shield wall and the containment outer shell.

The annular steel frame consists of steel columns and platform framings at elevations 25 ft. and 0 ft. It also has framings at various lower elevations which are essentially utilized for pipe supports. Several radial beams of the annular steel framing are rigidly connected to the containment secondary shield wall.

Design Deficiency

In late September 1979, a UE&C employee assigned to perform the seismic response analysis of Safety Class 2 and 3 piping in the containment building (including piping running in the annulus, supported by the structural steel framing) was reviewing the file of Seabrook Amplified Response Spectra (ARS) for the proper input to his particular analysis. He came upon the document

Design Deficiency. (Cont'd)

entitled "Seismic Analysis of the Annular Steel", with the unique identification number SBSAG-14CS, dated October 7, 1977. In reviewing the contents of this document, the analyst determined that certain of the ARS for portions of the annular structural steel in that document had considerably higher "g" values than those used as input to previous analyses of Safety Class 2 and 3 piping supported by the same annular structural steel.

Further investigation revealed that the seismic analyses of Safety Class 2 and 3 lines in the same area performed to that time used as input ARS extracted from a document entitled "Seismic Analysis of Containment Structure", with the unique identification number SBSAG-4CS4, dated 3/19/76. This document presented the ARS for the reinforced concrete containment outer shell and the interior concrete structures including the secondary shield walls. The ARS values contained in this document are, in general, lower than the previously mentioned document since, by their nature, concrete structures in general are stiffer than structural steel structures.

The immediate design deficiency was, therefore, that Safety Class 2 and 3 piping systems were seismically analyzed using incorrect, low values of ARS. The possibility exists, therefore, that had this deficiency not been revealed, one or more of the piping systems in question would be overstressed under maximum seismic and operating loadings.

Corrective Action

1. UE&C is conducting a short-term audit of selected seismic Category I systems and components to assure use of correct Amplified Response Spectra in their seismic design.

Corrective Action (Cont'd)

2. Containment building annular steel frame is being redesigned to increase its rigidity. The intent is to reduce the values of the ARS imposed on the piping systems and other components supported by the annular steel frame.
3. A "HOLD" has been placed on the design and analysis of piping systems located in the containment annulus.
4. UE&C will conduct a longer term audit of all seismic Category I systems and components to assure use of correct ARS in their seismic design.
5. When the redesign of the annular steel framing is complete, a seismic analysis of it will be performed, generating new ARS at significant individual points.
6. Existing analyses of Safety Class 2 and 3 piping running in the containment annulus will be reviewed against ARS generated in #5 above. Where necessary, piping will be reanalyzed to assure conformance with applicable Code and regulatory requirements.
7. UE&C is currently reviewing the seismic design requirements of all other components supported by the containment annular steel frame. They are the following:
  - a. Containment Recirculating Air Units:

These would be used for post-LOCA hydrogen mixing and are Safety Class 3.

Corrective Action (Cont'd)

b. Containment Cooling Units:

These are non-safety-related, non-seismic Category I. However, they will be seismically designed since they are located in a seismic Category I building.

c. Hydrogen Recombiners:

There are two thermal-type recombiners mounted on the annular steel frame. They are safety Class 3, seismic Category I.

d. Cable Trays and their Support Systems:

Tray supports are seismic Category I.

e. Heating, Ventilating and Air Conditioning Ductwork Systems:

These are a mixture of Category I and non-Category I systems.

f. Air Compressors:

Two small non-Category I units for instrumentation and control supply.

8. Existing UE&C procedures involving seismic design, especially those treating Amplified Response Spectra, are under review to determine the need for revisions or additions which will upgrade them in areas of selection, use and review of ARS.

9. Quality Assurance training sessions, in addition to those on the regular schedule, are planned on the subject of ARS treatment for all UE&C personnel who interface with ARS.

### Construction Status

The Seabrook containment building, Unit 1, structural mat and 1111 mat have been poured. The cylindrical shell liner plate has been erected to El. 119'-0". Internal concrete, including primary and secondary shield walls, are in various degrees of forming, reinforcing bar installation and concrete pouring to approximately Elevation 0'.

The containment annular steel has not been released for fabrication. It is anticipated that the aforementioned annular steel redesign work and its seismic analysis will be complete in a timely manner so that the prefabricated steel can be delivered and erected in accordance with the present construction schedule - July 1980.

The piping systems analyzed using incorrect ARS have been released for fabrication. Engineering experience and judgement predict that on reanalysis, the geometry and wall thicknesses of these systems will not change; perhaps only the number and location of seismic supports. In any case, geometry of prefabricated piping could be modified in the field. Pipe and other component erection in the containment annulus is scheduled to commence approximately July 1, 1980, and to continue for a period of about two years.

### Final Report

The final report on this subject, including a discussion of any safety implications, and the results of the corrective actions enumerated above, will be complete and issued by June 1, 1980.





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BOSTON  
ECHELON  
KNOXVILLE  
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VIA TELECOPIER

November 6, 1979  
SBU-31426  
File: 3.1.6  
Catg: NRCD  
No Response Required

Mr. John DeVincentis, Project Manager  
Yankee Atomic Electric Company  
Seabrook Station  
20 Turnpike Road  
Westborough, Massachusetts 01581

Dear Mr. DeVincentis:

Public Service Company of New Hampshire  
Seabrook Station  
Discrepancy in the Seismic Design  
in the Containment Annular Area

The purpose of this letter is to advise you of a design discrepancy in the amplified response spectra used in the seismic design of safety related components supported by the containment annular steel frame.

It was recently discovered that the analyses being done for components supported by the containment annular steel frame were based on incorrect seismic amplified response spectra. The amplified response spectra used for this design was that for the containment interior concrete and not the annular steel frame which should have been used.

An evaluation has shown that the amplified response spectra for the annular steel frame has "g" values greater than that used in the component design. Some of the peak values are such that it is unlikely a satisfactory component design could be achieved.

Action is currently underway to redesign the containment annular steel frame by providing additional bracing in order to reduce the "g" values. The design of all components located in this area will then be checked against the redesigned containment annular steel frame and its resulting amplified response spectra.

The containment steel annular frame has not yet been released for fabrication and will be held until the additional bracing is designed. The manufacture of a number of components in this area has been released, but it is not intended to place a hold on these items since it is believed that a satisfactory design can be achieved without significant changes to the components.



Mr. John DeVincentis  
Project Manager

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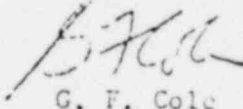
November 6, 1979  
SBU-31426

In order to ensure that other discrepancies do not exist in the seismic design, an audit will be performed to ensure that the proper amplified response spectra was used in the design of all items on the Seabrook project.

We will keep you advised of our progress in resolving this problem and completing the audit of the other items.

It is our belief that this design discrepancy is a reportable item in accordance with 10 CFR 50.55(e) and it is, therefore, recommended that it be reported to the Nuclear Regulatory Commission.

Very truly yours,

  
G. F. Cole  
Project Manager

GFC:hr

cc: Messrs. John DeVincentis - YAEC - 4L  
B. B. Beckley - PSNH - 3L  
J. D. Haseltine - PSNH - 1L  
T. M. Sherry - YAEC - 1L  
J. H. Herrin - PSNH - YAEC Field Office - 1L