

PRELIMINARY STRUCTURAL  
EVALUATION  
FOR  
YANKEE NUCLEAR POWER STATION

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by

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## 1.0 INTRODUCTION

On October 15, 1980 Yankee submitted a report (Reference (1)) summarizing our assessment of the seismic capacity of the Yankee Nuclear Power Station. This report was based on the results of analyses conducted on several structures and systems and a visual survey of the plant by experienced structural analysts with extensive seismic design experience.

As a result of a meeting with the NRC SEP staff in November 1980, and because of comments on the October 15, 1980 submittal (Reference (2)) by the NRC SEP consultants (Drs. Newmark and Hall), Yankee initiated an accelerated structural evaluation.

The accelerated preliminary program, which was performed for Yankee by Earthquake Engineering System, Inc., required that structural and piping models be developed for the computer analysis, response spectra be extracted, piping and structural analyses be performed and stresses tabulated.

## 2.0 PURPOSE

The purpose of this study was to analyze critical systems and structures to demonstrate that a LOCA, MSLB or FWLB would not be initiated by a seismic event. In addition, structures that house critical makeup systems were analyzed to ensure that the charging pumps and auxiliary feedpump would not be damaged.

Since postulated seismic events were not explicitly included within the original design or licensing bases for the Yankee Nuclear Power Station (YNPS), this analysis will be used to demonstrate, on a preliminary basis, sufficient conservatism exists within the existing plant design to provide a reasonable assurance that YNPS is capable of withstanding postulated seismic loads and can be maintained in a safe shutdown condition during and after the postulated seismic event.

All structures were evaluated for the Safe Shutdown Earthquake (SSE) based on the Yankee Interim Design Basis Spectrum, anchored at a Peak Ground Acceleration (PGA) equal to 0.1 g. The spectrum was modified to reflect constant velocity in the frequency range below 3 Hz. Seven percent damping was used.

### 3.0 DESCRIPTION OF ANALYSIS

The key objective of this analysis is to demonstrate that the YNPS is capable of being maintained in a safe and stable shutdown condition following a postulated seismic event. To achieve this objective, the YNPS was analyzed in two key areas: Structural Design Adequacy and Piping System Design Adequacy.

#### A) Structural Design Adequacy

The objective of this analysis was to demonstrate that the existing structures containing piping systems which are available to maintain a safe shutdown condition, include sufficient conservatism in their design to assure that seismically induced failures will not occur. By demonstrating the adequacy of the structural design, it can be concluded that no piping systems included within these structures will fail as a direct result of seismically induced structural failures. The following structures include piping systems which are available to maintain the plant in a safe shutdown condition, and therefore, were included within the scope of this analysis:

- 1) Concrete Containment
- 2) Vapor Container
- 3) Primary Auxiliary Building and Attached Pipe Chase
- 4) Turbine Building
- 5) Turbine Pedestal

The results of these analyses are included in Section 4.

B) Piping System Design Adequacy

Based on reviews performed by YAEC, the scope of the piping system analysis includes those piping systems, which, in the event of a single seismically induced failure, could lead to a postulated accident which in itself would prevent the plant from being maintained in a stable, safe shutdown condition. The specific piping system failures which could prevent the plant from being maintained in this condition are a nonisolable break within the reactor coolant pressure boundary, or a break in the secondary plant steam or feedwater systems nonisolable from the steam generators. Therefore, the nonisolable portions of the following systems were analyzed for seismically induced loadings:

- 1) The reactor coolant loop and all nonisolable piping branch connections up to the vapor container, such as:
  - a) Bypass piping
  - b) Safety injection system
  - c) Pressurizer piping
  - d) Shut cooling piping
- 2) Pressurizer Control and Relief Piping
- 3) The main steam and feedwater systems nonisolable from the steam generators.

The results of these analyses are presented in Section 4.

#### 4.0 RESULTS AND CONCLUSIONS

The preliminary results of the short term effort for the evaluation of critical structures and piping systems indicate that there is no evidence that the intended shutdown function of the structures or systems analyzed is impaired for the Interim Design Basis Spectrum.

All of the analyzed systems and structures were determined to be capable of accepting the postulated seismic event without failure. In some cases, stresses are above applicable code allowable stresses. Modifications will be installed to rectify those situations.

The data generated in the study is currently undergoing the required engineering assurance review by our consultant and selected independent review by Yankee. When that review is complete, a complete detailed report will be issued.

We are prepared to discuss the results of this program during the site visit by NRC staff and consultants.



5.0 REFERENCES

1. YAEC Letter to USNRC, dated October 15, 1980 (WYR 80-114).
2. Letter from Nathan M. Newmark and W.J. Hall to William Russel (NRC), dated November 11, 1980, "Review of Yankee Rowe Seismic Program Material".