

TENNESSEE VALLEY AUTHORITY

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SEP 28 1988

U.S. Nuclear Regulatory Commission  
ATTN: Document Control Desk  
Washington, D.C. 20555

Gentlemen:

In the Matter of	)	Docket Nos. 50-259
Tennessee Valley Authority	)	50-260
	)	50-296

BROWNS FERRY NUCLEAR PLANT (BFN) - SEISMIC AMPLIFIED RESPONSE SPECTRA AND OFFICE OF INSPECTION AND ENFORCEMENT BULLETIN (IEB) 79-14 AND 79-02 PIPE AND PIPE SUPPORTS SEISMIC CALCULATION METHODS

The purpose of this letter is to respond to questions expressed by the staff relative to seismic amplified response spectra (ARS) generation and IEB 79-14 and 79-02 pipe and pipe support calculation methods.

The enclosure contains TVA's response to these questions and reflects TVA's understanding of the conclusions reached during the meeting between TVA and NRC on September 8 and 9, 1988.

ARS questions were initially raised during an August 15 to 19, 1988 NRC audit of BFN seismic spectra. 79-14/02 questions were noted in a June 30, 1988 meeting between TVA and NRC.

Discussion of programmatic 79-14/02 milestones, commitments, and schedules will be addressed in a separate submittal.

If you have any questions, please telephone Patrick Carrier, BFN, at (205) 729-2689.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

*R. Gridley*  
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Enclosure  
cc: See page 2

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## BROWNS FERRY NUCLEAR PLANT

### SEISMIC AMPLIFIED RESPONSE SPECTRA AND

### 79-14/02 PIPE AND PIPE SUPPORT SEISMIC CALCULATION METHODS

During an August 15 to 19, 1988 audit of BFN seismic spectra generation, the NRC staff questioned the original structural dynamic model and some of the assumptions used to generate the horizontal and vertical seismic amplified response (ARS) for the reactor building. In a June 30, 1988 meeting between TVA and NRC, the NRC staff also questioned the pipe and pipe support seismic calculation methods being used for Browns Ferry Inspection and Enforcement Bulletin (IEB) 79-14/02 program. The following is TVA's response to the staff's questions related to seismic ARS items and nine items of piping seismic design methodology (from the above referenced meeting).

#### A. Seismic Amplified Response Spectra

1. TVA has developed a new artificial ground time history whose spectra closely enveloped the original licensed ground design spectra for all damping values required for the building and subsystem analyses. This artificial ground motion time history is in compliance with the NRC safety evaluation dated January 29, 1988, "Alternate Input for Seismic System Analysis - Artificial Time history," and is consistent with Standard Review Plan (SRP) 3.7.1, Enveloping Requirements.
2. New horizontal ARS will be generated based on the new time history and existing building structural models except where model refinement is required to address the staff's questions. For example, a multistick model will be used to generate new spectra inside the drywell in lieu of the one stick model used previously.
3. New vertical ARS will be generated for each Class I building using two-thirds of the new artificial ground time history and a model similar to the existing horizontal seismic model unless the building can be shown to be rigid (greater than 20 Hertz) in the vertical direction.
4. The new ARS will be broadened  $\pm 10$  percent for rock-founded structures and  $\pm 15$  percent for soil-founded structures.
5. The design basis ARS will be compared to the new ARS. Differences between the design basis ARS and new ARS will be evaluated and action taken if required.
6. The design basis ARS as justified by the evaluation process described in item A.5 or the new ARS may be used for new work.

B. 79-14/02 Pipe and pipe Support Seismic Calculation Methods

1. Vertical Seismic Input - vertical ARS will be used (See A.3 above).
2. Seismic Damping Value - 1/2 percent critical damping will be used for the OBE case and the OBE (SSE) case.
3. Peak Broadening of the Seismic spectra - the new broadened ARS will be used (see item A.4 above). The peak shifting method may be used in lieu of the broadened spectra.
4. Seismic Anchor Motions - seismic anchor motions will be considered.
5. Elevation of ARS Input - either enveloped spectra or independent support motion will be used.
6. Zero Period Acceleration (ZPA) Effects - ZPA effects will be considered.
7. Combination of Modes - the square root of the sum of squares method will be used for the combination of modes except that closely spaced modes will be combined by the absolute summation method (10 percent grouping method).
8. Combination of Directions - the spatial combination of the effects of one horizontal (X or Z direction) and the vertical (Y direction) will be combined by the absolute summation method. The maximum results of the two by absolute summation; either (X, Y) or (Y, Z) will be used.
9. Rigid Range - 20 Hertz is considered to be the lower bound of the rigid range.

As an alternative, the time history method may be used in lieu of the response spectrum method. When the time history method is used, it will be applied in a manner consistent with the commitments above.

The methodologies presented for seismic amplified response spectra generation and 79-14/02 pipe and pipe support seismic analyses are consistent with the Browns Ferry Final Safety Analysis Report (FSAR). This enclosure more specifically defines the FSAR analysis methods.