



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

February 3, 1992

Docket Nos. 50-259, 50-260
and 50-296

LICENSEE: Tennessee Valley Authority

FACILITY: Browns Ferry Nuclear Plant, Units 1, 2, and 3

SUBJECT: SUMMARY OF MEETING WITH THE TENNESSEE VALLEY AUTHORITY
REGARDING SEISMIC DESIGN CRITERIA FOR SUPPORTS AND DUCTWORK
OF CLASS I HEATING, VENTILATION AND AIR CONDITIONING SYSTEMS
(TAC NOS. M82125, M82126, AND M82127)

On January 23, 1992, the NRC staff held a meeting with representatives of the Tennessee Valley Authority (TVA) at NRC Headquarters in Rockville, Maryland. Meeting attendees are listed in Enclosure 1. The handouts used by TVA in their presentation are provided in Enclosure 2.

The purpose of this meeting was to discuss TVA's submittal of November 15, 1991 regarding long-term seismic design criteria for supports and ductwork of Class I heating, ventilation, and air conditioning (HVAC) systems at the Browns Ferry Nuclear Plant (BFNP). TVA submitted its letter of November 15, 1991, to resolve the following BFNP, Unit 2 post-restart items documented in NUREG-1232, Volume 3, Supplement 2:

1. Evaluate and identify the need for long-term modification of about 11,830 feet of ductwork that met the interim criteria,
2. Perform long-term modifications of the 509 existing supports that were qualified to the interim criteria, and
3. Develop long-term criteria for HVAC evaluations, and perform long-term buckling evaluations for all ductwork qualified to the interim criteria.

TVA's presentation at the January 23, 1992 meeting was comprehensive and informative. However, the staff did have a number of questions and/or requests for additional information that TVA was unable to accommodate at the meeting. Consequently, TVA was requested to submit a formal response that addresses all of the staff's queries, as listed in Enclosure 3, by February 3, 1992.

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No significant conclusions or decisions were made by the NRC staff at this meeting with TVA. As a working-level meeting it was only intended as an information-gathering tool to aid the staff in expediting its safety evaluation of TVA's proposed long-term seismic design criteria for HVAC supports and ductwork at BFNP.



Thierry M. Ross, Senior Project Manager
Project Directorate II-4
Division of Reactor Projects I/II

Enclosures:

1. List of Attendees
2. TVA Handouts
3. Staff questions

cc w/enclosures:
See next page

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Original signed by

Thierry M. Ross, Senior Project Manager
Project Directorate II-4
Division of Reactor Projects I/II

Enclosures:

1. List of Attendees
2. TVA Handouts
3. Staff questions

cc w/enclosures:
See next page

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ENCLOSURE 1

LIST OF ATTENDEES

January 23, 1992

Name

Organization

Thierry Ross	NRC/NRR/PDII-4
Joe Williams	NRC/NRR/PDII-4
Fred Hebdon	NRC/NRR/PDII-4
David Jeng	NRC/NRR/ESGB
Joe Carrasco	NRC/NRR/ESGB
James Davenport	TVA/BFN/Licensing
Greg Pierce	TVA/BFN/Licensing
Roger Houston	TVA Rockville Licensing
Dave Osborne	TVA/BFN/Civil
Rick Cutsinger	TVA/BFN/Civil
John Dizon	EQE
James Johnson	EQE

BROWNS FERRY NUCLEAR PLANT

HVAC SEISMIC QUALIFICATION PROGRAM

TVA/NRC MEETING

JANUARY 23, 1992

AG NDA
TVA/NRC MEETING - JANAUARY 23, 1992
BFN HVAC DESIGN CRITERIA

<u>TOPIC</u>	<u>SPOKESMAN</u>
INTRODUCTION	J. DAVENPORT
BACKGROUND	R. CUTSINGER
INTERIM vs LONG-TERM CRITERIA	R. CUTSINGER
PROGRAM STATUS	R. CUTSINGER
ANALYSIS PROCEDURES	D. OSBORNE
EXAMPLES	D. OSBORNE
SUMMARY	G. PIERCE
DISCUSSION	OPEN

TVA/NRC MEETING - JANAUARY 23, 1992

BFN HVAC DESIGN CRITERIA

<u>ITEM</u>	<u>SPOKESMAN</u>
INTRODUCTION	J. DAVENPORT

TVA/NRC MEETING - JANAUARY 23, 1992
BFN HVAC DESIGN CRITERIA

ITEM	SPOKESMAN
BACKGROUND	R. CUTSINGER
<ul style="list-style-type: none">• ORIGINAL DESIGN<ul style="list-style-type: none">- SUPPORTED TO SMACNA STANDARDS- 1970 DECISION TO QUALIFY SEMISMICALLY<ul style="list-style-type: none">• DEVELOPMENT OF CRITERIA• IDENTIFICATION OF GENERIC MODS	

TVA/NRC MEETING - JANAUARY 23, 1992
BFN HVAC DESIGN CRITERIA

<u>ITEM</u>	<u>SPOKESMAN</u>
BACKGROUND	R. CUTSINGER
<ul style="list-style-type: none">• REASON FOR RE-REVIEW<ul style="list-style-type: none">- SCR BFN CEB 8603 INITIATED AGAINST ORIGINAL CRITERIA▪ INCORRECT FREQUENCY CALCULATION METHOD▪ ADDITIONAL WEIGHTS NOT ACCOUNTED FOR▪ OTHER MINOR INCONSISTENCIES	

TVA/NRC MEETING - JANAUARY 23, 1992
BFN HVAC DESIGN CRITERIA

<u>ITEM</u>	<u>SPOKESMAN</u>
BACKGROUND	R. CUTSINGER
<ul style="list-style-type: none">• DEVELOPMENT OF INTERIM CRITERIA<ul style="list-style-type: none">- LIMITED INELASTIC BEHAVIOR- EXPANSION ANCHOR REDUCED FACTOR OF SAFETY- NEGOTIATED WITH NRC	

TVA/NRC MEETING - JANAUARY 23, 1992
BFN HVAC DESIGN CRITERIA

<u>ITEM</u>	<u>SPOKESMAN</u>
BACKGROUND	R. CUTSINGER
• DEVELOPMENT OF LONG-TERM CRITERIA	
- NRC POST RESTART COMMITMENT	
- DEVELOP BUCKLING ALLOWABLE	
- PROVIDE ADEQUATE MARGIN OF SAFETY	
- UTILIZED TVA TEST INFORMATION	

TVA/NRC MEETING - JANAUARY 23, 1992
BFN HVAC DESIGN CRITERIA

INTERIM vs LONG-TERM CRITERIA

<u>FEATURE</u>	<u>INTERIM CRITERIA</u>	<u>LONG-TERM CRITERIA</u>
DUCT STRESS (BENDING)	1.5 SMACNA	1.5 SMACNA
DUCT STRESS* (SHEAR)	TVA TEST	TVA TEST
DUCT BUCKLING*	N/A	0.9 Pcr

*NO SMACNA REQUIREMENT

TVA/NRC MEETING - JANUARY 23, 1992

BFN HVAC DESIGN CRITERIA

INTERIM vs LONG-TERM CRITERIA

<u>FEATURE</u>	<u>INTERIM CRITERIA</u>	<u>LONG-TERM CRITERIA</u>
Support member stress tension and bending	smaller of $1.2F_y$ and $0.7F_u$	1.5 x AISC*
Shear	smaller of $0.72F_y$ and $0.42F_u$	1.5 x AISC*
Compression	90% critical buckling	1.5 x AISC* \leq 90% critical buckling
Bolt stress tension	$1.0F_y$ or $0.7F_u$	1.5 x AISC*
Shear	smaller of $0.6F_y$ and $0.42F_u$	1.5 x AISC*
Weld stress	increase factor smaller of 1.8 or $1.05 F_u/F_y$ (F_u & F_y for base metal)	1.5 x AISC*
Concrete expansion shell anchors	F.S. = 2 for evaluation of existing anchors	GIP for evaluation of existing anchors

*AISC eighth edition

TVA/NRC MEETING - JANUARY 23, 1992
BFN HVAC DESIGN CRITERIA

<u>ITEM</u>	<u>SPOKESMAN</u>
PROGRAM STATUS	R. CUTSINGER
• WALKDOWNS	COMPLETE
• CRITERIA DEVELOPMENT	COMPLETE
• PRELIMINARY SCOPE OF MODS - 130 SUPPORT MODIFICATIONS OR ADDITIONS	COMPLETE
• DESIGN EVALUATIONS	MAY 15, 1992
• DESIGN OF REQUIRED MODS	JULY 3, 1992

TVA/NRC MEETING - JANUARY 23, 1992
BFN HVAC DESIGN CRITERIA

<u>ITEM</u>	<u>SPOKESMAN</u>
ANALYSIS PROCEDURES	D. OSBORNE
• SIMILARITIES BETWEEN HVAC DUCT ANALYSIS AND PIPING ANALYSIS	
- ANALYSIS METHOD	
- RESPONSE SPECTRA	
- FREQUENCY CUT OFF	
- COMBINATION METHOD	
- SEISMIC ANCHOR MOVEMENT EVALUATION	
- ZERO POINT ACCELERATION EVALUATION	

TVA/NRC MEETING - JANAUARY 23, 1992
BFN HVAC DESIGN CRITERIA

<u>ITEM</u>	<u>SPOKESMAN</u>
ANALYSIS PROCEDURES	D. OSBORNE
• ADDITIONAL CONSIDERATIONS FOR HVAC DUCT ANALYSIS	
- SHEAR CAPACITY EVALUATED	
- BUCKLING EVALUATED	
- SUPPORT STIFFNESS INCLUDED	
- FREQUENCY CORRECTION FACTOR	

TVA/NRC MEETING - JANAUARY 23, 1992
BFN HVAC DESIGN CRITERIA

<u>ITEM</u>	<u>SPOKESMAN</u>
ANALYSIS PROCEDURES	D. OSBORNE
• DISSIMILARITIES BETWEEN HVAC DUCT ANALYSIS AND PIPING ANALYSIS	
- DAMPING RATIO	
- BENDING STRESS ALLOWABLES	
- MOMENT OF INERTIA CALCULATED	

TVA/NRC MEETING - JANAUARY 23, 1992
BFN HVAC DESIGN CRITERIA

	<u>ITEM</u>	<u>SPOKESMAN</u>
EXAMPLES		D. OSBORNE

TVA/NRC MEETING - JANAUARY 23, 1992
BFN HVAC DESIGN CRITERIA

<u>ITEM</u>	<u>SPOKESMAN</u>
CONCLUSION	G. PIERCE
<ul style="list-style-type: none">• TVA SUBMITTED LONG-TERM HVAC CRITERIA• TVA PREPARED TO SUPPORT NRC REVIEW• REQUEST ISSUANCE OF SER	

TVA/NRC MEETING - JANAUARY 23, 1992
BFN HVAC DESIGN CRITERIA

<u>ITEM</u>	<u>SPOKESMAN</u>
DISCUSSION	OPEN

Enclosure 3

NRC Staff Request for Additional Information

1. Does the proposed long-term design criteria adequately accommodate normal operation and accident load combinations (excluding earthquake loads)?
2. Has the actual type of anchor for each and every support been identified and documented for use in the determining load allowables?
3. Provide rationale for using an analytical method based on "Absolute Sums" (ABS) of two components when Appendix C of the Updated Final Safety Analysis Report (UFSAR) refers to the use of "Square Root of the Sum of the Squares (SRSS).
4. Confirm that the proposed long-term seismic design criteria does not deviate from the current design basis as described in the UFSAR. Discuss the basis for any deviations.
5. Describe the methodology and basis used for evaluating seismic anchor movement effect.
6. Clarify the use of "restoring force methodology" mentioned in the proposed criteria. Describe how the effective spring constant was derived and applied.
7. Provide an example on the use of the missing mass correction factor in the evaluation of seismic response.
8. Provide an example of a buckling evaluation for HVAC ductwork. Also provide the AISC criteria to be used for buckling evaluations associated with HVAC ducts and supports.
9. Could the conservative assumptions (i.e., effective moment of inertia, test based damping, and frequency correction factor) made by TVA, when integrally applied in the evaluations, adversely affect a realistic assessment of the seismic demands on HVAC at BFN?P?
10. Only the safe shutdown earthquake was considered by TVA. Why wasn't the operating basis earthquake also considered as called for in the UFSAR?

Distribution

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Local PDR

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P. Kellogg	RII
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