

TENNESSEE VALLEY AUTHORITY

5N 157B Lookout Place

MAY 27 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 NUCLFAR PLANT (BFN) - SEISMIC QUALIFICATION OF CONDUIT - (NRC TAG  
00022, 00023, AND 00024)

This letter describes the BFN program for the seismic qualification of  
conduit. This material was requested by R. J. Clark's letter dated  
July 31, 1986 to S. A. White. This letter supplements the information  
provided by my letter dated April 8, 1987 and section III.3.4 of revision 1 to  
the BFN Performance Plan which was transmitted by S. A. White's letter dated  
July 1, 1987 and incorporates resolutions to the NRC staff's concerns as  
discussed in our May 18, 1988 meeting.

Enclosure 1 to this letter describes the BFN program for resolving this  
issue. Enclosure 2 is a copy of the interim operability criteria. TVA  
requests your review of this program and the issuance of a written statement  
documenting the programs acceptability.

Please refer any questions regarding this submittal to M. J. May, Manager, BFN  
Site Licensing, (205) 729-3570.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

*M. J. Ray for*  
R. Gridley, Director  
Nuclear Licensing and  
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Enclosures  
cc: See page 2

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U.S. Nuclear Regulatory Commission

MAY 27 1988

cc (Enclosures):

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## ENCLOSURE 1

### Seismic Design Issues - Conduit Qualification Program

The following is provided in response to the July 31, 1986 letter from R. J. Clark to S. A. White and Request for Additional Information Item No. 2 of enclosure 2 to that letter:

2. Conduit Qualification Program - please provide information similar to Item 1 above (background information, long-term corrective actions, and implementation schedule) for the conduit qualification program.

#### Part I - Background

Historical background on the issue of seismic design of conduits is provided in Section I.C, "Executive Summary and Historical Background," of the DNE Program Document, "Inspection and Seismic Qualification of Existing Electrical Conduit and Conduit Supports," which was provided as an enclosure to the April 8, 1987 submittal from R. Gridley.

#### Part II - Corrective Action Program

The following documents, provided as enclosures to the April 8, 1987 submittal from R. Gridley, presented the details of the BFN conduit seismic qualification program:

DNE Program Document, "Inspection and Seismic Qualification of Existing Electrical Conduit Supports," issued October 16, 1986 - Program overview.

Project Instruction BFEP-PI 85-02, Revision 3, "Seismic Qualification of Existing Electrical Conduit and Conduit Supports," issued October 15, 1986 - Details DNE's method for inspection and seismic qualification of existing electrical conduits and conduit supports in Class I structures at BFN.

The following documents, provided as enclosures to the April 8, 1987 submittal from R. Gridley, presented additional supporting information for the conduit qualification program:

Design Criteria BFN-50-723, "Seismically Qualifying Conduit Supports," issued March 28, 1986, as modified by Exception Number EX-BFN-50-723-1, dated May 29, 1986 - Gives seismic qualification requirements. Exception Number EX-BFN-50-723-1 was never implemented. Its proposed use is being withdrawn by this submittal.

TVA test report WR28-4-900-176, "An Experimental Investigation of Vibration Damping in Aluminum Electrical Conduit," dated March 1986 - Describes TVA tests used in determining natural frequencies and damping values for aluminum electrical conduit.

TVA test report WR28-4-900-140, "A Preliminary Study of Vibration Damping in Electrical Conduit," revised March 1986 - Describes tests used to determine damping values for steel electrical conduit.

Wyle Laboratories Seismic Qualification Test Report No. 17743-1, "Test Report on Seismic Qualification/Verification of Various Aluminum Electrical Conduit Configurations," dated May 9, 1986 - Demonstrated "that the specimens tested possessed sufficient structural integrity to withstand the prescribed qualification level seismic environment."

The majority of the design and modification work associated with the conduit qualification program has been completed. Modifications required for unit 2 interim qualification are scheduled for completion by restart.

### Part III - Conclusion and Request for Review

Certain aspects of the conduit qualification program involve the utilization of new techniques for interim operability to demonstrate original design basis was satisfactory. In this regard, NRC is requested to take the following actions:

- a. Review and approve for interim qualification, bounding calculations demonstrating the adequacy of the type of features accepted by a seismic experience data base review.
- b. Review and approve for interim qualification, use of the Interim Operability Criteria (Lead Civil Engineer Instruction BFEP-TI-C1).
- c. Concur that long-term qualification be implemented in accordance with the guidelines developed by the Seismic Qualification Utility Group (SQUG) to resolve Unresolved Safety Issues (USI) A-46 and to a schedule consistent with the resolution of USI A-46 for Browns Ferry Nuclear Plant.



**TENNESSEE VALLEY AUTHORITY**  
 Division of Nuclear Engineering

LEAD CIVIL ENGINEER INSTRUCTION

BFEP-TI-CI

**TITLE:** OPERABILITY CRITERIA FOR CONDUIT AND CONDUIT

SUPPORTS - BROWNS FERRY

	REVISION NO	R1	R2	R3	R4	R5
ISSUE DATE	5/23/88					
PREPARED	<i>[Signature]</i>					
CHECKED	<i>[Signature]</i>					
REVIEWED	<i>[Signature]</i>					
APPROVED	<i>[Signature]</i>					



OPERABILITY CRITERIA FOR CONDUIT AND  
CONDUIT SUPPORTS - BROWNS FERRY

REVISION LOG

Title:

Revision No.	DESCRIPTION OF REVISION	Date Approved
0	Original Issue	

## 1.0 PURPOSE

The purpose of this instruction is to provide engineering guidelines for implementing Browns Ferry operability criteria as applicable to conduit and conduit supports.

## 2.0 SCOPE

These guidelines shall apply to conduit and supports in TVA Class I structures, for which conduit or conduit support modifications are required; i.e., any physical modification of conduit or conduit support required as a result of the inability to qualify according to Design Criteria BFN-50-C-7104 Section 5 (Reference 6.1). Modifications will be prioritized into two groups; those that require implementation for operability and those that require implementation for design criteria. Operability modifications are those conduit and conduit support modifications that do not comply with the criteria in this document. Design criteria modifications are those conduit and conduit support modifications that comply with the requirements of this document but are necessary for design criteria compliance.

## 3.0 CONDUIT STRESS EVALUATION CRITERIA

For conduit systems that do not meet the design criteria BFN-50-C-7104 a conduit system operability review may be performed as follows.

Conduit stresses and conduit support reactions shall be generated using a seven percent damped spectra. The conduit shall be evaluated for dead weight plus Design Basis Earthquake (DBE), to ensure that the stress in the conduit is limited to a maximum of  $2.0 F_y$ , reduced by a stress intensification factor of 0.75 times 2.3 for threaded connections as applicable. Cast iron components may be evaluated as equivalent conduit stresses established by test.

In cases where conduit exceeds the stress allowables, qualification may be demonstrated by further analysis, test, or safety significance evaluation. This approach shall be used only on a case-specific basis.

## 4.0 CONDUIT SUPPORT EVALUATION CRITERIA

### 4.1 Load Combinations

For the purpose of this evaluation, the only load combination considered is dead load plus the DBE.

### 4.2 Allowable Limits

The following limits shall be used in the evaluations.

#### 4.2.1 Supports

Conduit supports shall be evaluated based on stress allowables or test data as follows. Acceptable flexural/and tensile stresses shall be the lesser of  $0.7F_u$  and  $1.2F_y$  and 90 percent of the critical buckling stress as defined in AISC specification (Reference 6.2) for compressive loads. Acceptable shear stresses shall be the lesser of  $0.42F_u$  and  $0.72F_y$ . Acceptable loads based on test data shall consider mean less one standard deviation capacity.

#### 4.2.3 Bolting

The allowable stress for bolting shall be the minimum specified yield stress of the bolt material. When the yield stress of the bolt material is not specified, the allowable stress shall be 70 percent of the minimum specified ultimate strength.

#### 4.2.4 Concrete Expansion Anchors

The minimum factors of safety for concrete expansion anchors (wedge & shell types) shall be 2.0 (Reference 6.3).

#### 4.2.5 Load Sharing Between Supports

For supports that do not meet the interim allowable stress criteria presented herein, a case-by-case evaluation may be performed that considers redistribution of load to adjacent supports. The effect of load redistribution on conduit stress shall be considered in accordance with section 3.0.

The adjacent conduit supports shall meet the allowables contained in this criteria document.

### 5.0 DOCUMENTATION

Engineering evaluations performed to determine the acceptability of modifications shall be documented in calculations performed in accordance with the applicable QA requirements.

### 6.0 REFERENCES

- 6.1 Design Criteria for Design of Supports BFN-50-C-7104.
- 6.2 Specification for the Design, Fabrication, and Erection of Structural Steel Buildings, AISC 7TH and 8TH Editions.
- 6.3 General Anchorage to Concrete, Civil Design Standard DS-C1.7.1.