ENCLOSURE 2

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Division of Nuclear Engineering

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CIVIL ENGINEERING BRANCH INSTRUCTION

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TITLE: OPERABILITY CRITERIA FOR PIPE AND PIPE SUPPORTS ON TVA CLASS I SEISMIC PIPING - BROWNS FERRY

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TVA

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REVISION LOG
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Revision No.	DESCRIPTION OF REVISION	Date Approved
1	Revise to require documentation on a case-by-case basis for exception to the criteria in sections 3.0, 4.2.6 and 4.2.9 to reflect US-NRC comments in a meeting on March 17, 1988. Revise allowable stress limits for bolting material to reflect US-NRC comments in a meeting on March 17, 1988 in Rockville, Maryland.	3/31/88

TVA 10534 (EN DES-4-78)

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1.0 PURPOSE

The purpose of this instruction is to provide engineering guidelines for implementing Browns Ferry operability criteria as applicable to non-torus attached pipe and pipe support modifications for TVA Class I seismic piping.

2.0 SCOPE

These guidelines shall apply to all piping and supports on TVA Class I seismic piping, for which pipe or pipe support modifications are required; i.e., any physical modification of pipe or pipe support required as a result of the inability to qualify according to Design Criteria BFN-50-C-7103 and BFN-50-C-7104 (Reference 1 & 2). 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 piping and pipe support modifications that do not comply with the criteria in this document. Design criteria modifications are those piping and pipe supports modifications that comply with the requirements of this document but are necessary for design criteria compliance.

3.0 PIPE STRESS EVALUATION CRITERIA

For piping systems that do not meet the design criteria BFN-50-C-7103 a case by case piping system operability review maybe performed as follows.

For the emergency loading combinations and stress intensification factors as defined in BFN-50-C-7103, evaluate the piping to ensure that the primary stress in the piping is less than 2 S_y and the secondary stress meets ASME Section III Equation 10 and 11 allowables of Reference 5.

In cases where piping secondary exceeds the secondary stress allowables of reference 5 they may be shown to meet an augmented Class 2 and 3 fatigue evaluation (Reference 7). This approach shall be used only on a case-specific basis, and specifically documented and filed for inspection and audit.

The adjacent pipe supports shall meet allowables given in this criteria document.

4.0 PIPE SUPPORT EVALUATION CRITERIA

4.1 Load Combinations and Piping Movements

For prioritization the proposed pipe support modifications shall be evaluated only for the emergency loading condition in accordance with BFN-50-C-7103.

4.2 Allowable Limits

The following limits shall be used to establish priorities for pipe support modifications.

4.2.1 Linear Supports:

The support member stresses shall not exceed the lessor of 1.2 S_y and 0.7 Su for tensile and flexural stresses, and 90 percent of the critical buckling stress as defined in AISC specification (Reference 3) for compressive loads. Shear stresses shall not exceed 60 percent of allowable stress for tensile and flexure stresses.

4.2.2 Standard Support Components:

These shall meet the emergency allowables of BFN-50-C-7103.

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).

4.2.5 Pipe to Pipe Support Gap:

Supports with pipe to pipe support total gap which exceeds 1/2" shall be modified unless acceptable in accordance with the evaluation in 4.2.6. In addition, the first support adjacent to equipment nozzles, anchors, penetrations, and active valves and body or stem supported valves shall be modified if the total gap exceeds the installation requirement of 5/32 inch maximum total gap. (Reference 4)

4.2.6 Load Sharing Between Supports:

For supports that do not meet the interim allowable stress criteria presented herein and are not adjacent to an equipment nozzle, an anchor, a penetration, an active valve, or a body/stem-supported valve, a case-by-case evaluation may be performed that considers redistribution of load to adjacent supports. This case-by-case evaluation must be specifically documented and filed for inspection and audit. The effect of load redistribution on piping stress shall be considered in accordance with section 3.0.

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

4.2.7 Constant and Variable Spring Supports:

Shall be evaluated to accommodate the "maximum pipe movement" without bottoming out.

4.2.8 Subsystem Evaluations

Portions of a stress analysis math model may be decoupled and a local analysis may be performed, to assess the need for the modification, provided appropriate overlap on model boundaries is considered. Hand calculations, new subsystem models, and scaling techniques may be utilized in addition to computer calculations.

The following section provide guidance for the evaluation of modifications required due to thermal loading.

4.2.8.1 Modifications Due to Thermal Loading:

Support flexibility for specific supports may be utilized in the subsystem evaluations in lieu of conservative computer code default values to more realistically predict thermal loading.

The effects of gaps may be considered where large thermal loads result from the constraint of small thermal growths due to opposing supports.

4.2.9 Thermal Monitoring

Modifications identified due to exceeding the swing angle, binding, or other potential thermal interferences on snubber, strut, and spring supports need not be a design constraint and may be deferred, if visual monitoring shows no thermal binding or restraint in the support assembly. Additionally, supports requiring modification due to unrealistic thermal loads will be monitored with instrumentation to determine the actual thermal loads and the impact to other supports in the system should be assessed. This approach shall be used only on a case-specific basis, and specifically documented and filed for inspection and audit.

5.0 DOCUMENTATION

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

6.0 REFERENCES

6.1 Design Criteria for Structural Analysis and Qualification of Mechanical and Electrical Equipment BFN-50-C-7103.

6.2 Design Criteria for Design of Supports BFN-50-C-7104.

6.3 Specification for the Design, Fabrication, and Erection of Structural Steel Buildings, AISC 7TH and 8TH Editions.

6.4 Letter from R. L. Cloud Associates to TVA "Position Paper on Pipe to Support Gap Limit, "Letter No. P154-3 L-020, August 25, 1987.

6.5 ASME Section III, Subsection NC, 1983.

6.6 IE Bulletin No. 79-02, Revision 1, Supplement 1 dated August 20, 1079, Pipe Support Base Plate Designs Using Concrete Anchor Bolts.

6.7 NUREG/CR-2343, DATED June 1983, Comparisons of ASME Code Fatigue Evaluation Methods for Nuclear Class 1 Piping with Class 2 or 3 Piping.