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SUBJECT: Provides info on seismic qualification of HVAC Ductwork & Supports & forwards Civil Engineering Branch Instruction.

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U.S. Nuclear Regulatory Commission
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Gentlemen:

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

BROWNS FERRY NUCLEAR PLANT (BFN) - SEISMIC QUALIFICATION OF HVAC DUCTWORK AND SUPPORTS

This letter describes the BFN program for the seismic qualification of HVAC ductwork. 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 R. Gridley's letter dated April 8, 1987, and section III.3.5 of revision 1 to the Browns Ferry Nuclear Performance Plan that was transmitted by S. A. White's letter dated July 1, 1987.

Enclosure 1 to this letter describes the BFN program for resolving this issue. Enclosure 2 is the BFN Class I HVAC duct and duct support seismic qualification interim operability acceptance 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
Regulatory Affairs

Enclosures
cc: See page 2

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U.S. Nuclear Regulatory Commission

MAR 10 1988

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Enclosure 1

TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR PLANT (BFN)
UNIT 2
QUALIFICATION OF SEISMIC CLASS I HVAC
DUCTWORK AND SUPPORTS

This report gives TVA's plan to qualify the as-configured seismic Class I HVAC ductwork installation.

Issue

Design deficiencies were identified in TVA's Significant Condition Report No. SCRBFNCEB8603 that was issued during February 1986. Subsequent walkdowns of the HVAC ductwork were performed by TVA, and discrepancies were noted between as-constructed installations and the original design.

Background

Initially, HVAC ducts and duct supports at BFN were fabricated to industry standards without consideration of seismic loads. In 1970, the need for HVAC ducts to be designed for earthquake loads was identified. As a result, modification of existing HVAC ducts and supports was initiated. An HVAC seismic design criteria was issued in July 1970 and transmitted to the BFN Project Manager for implementation. The duct construction was based on the Sheet Metal and Air-Conditioning National Association (SMACNA) standards, with both the pocket-lock and companion-flange types being used. Several field evaluations (at least one per unit) were made by design engineers to review the as-built installations against the design criteria. Recommendations were made as a result of the field evaluations and changes were made accordingly.

In January 1986, a significant condition report was written against the design criteria (BFN-50-721) used for installation and qualification of supports for the HVAC system. That report questioned whether the design criteria was adequate to ensure the necessary seismic qualification of the HVAC system. In addition, field investigations of the HVAC system led to concerns that significant discrepancies might exist between the as-built system and the requirement of the design criteria.

Resolution

The scope of this activity involves 9500 ft of ductwork, ranging in size from 6 in. to 30 in. diameter round ducts, and 5 in. x 6 in. to 72 in. x 84 in. rectangular ducts. There are 600 deadweights, 300 two-way and 100 three-way supports for the duct systems.

As-built sketches are generated as part of the walkdown effort and will document key attributes of the systems including the locations of supports and attachments, as well as their construction details and anchorage. The key attributes for the ducts which will be documented are routing, size, construction, location, and types of attachments.

The technical design criteria has been revised to include the correct weight of the ducts, and the duct systems' natural frequency calculation methods have been modified to reflect test results. Additionally, the revised criteria now addresses cantilevered ducts and DBE (SSE) loads; and the allowable stresses are based on the AISC and the SMACNA standards.

The FSAR requires that essential HVAC systems remain functional for all plant conditions. The design criteria used in the qualification are based on AISC and SMACNA allowables which ensure that their HVAC systems remain functional. The approach used for qualification of the duct systems is to evaluate 100 percent of the ductwork and supports against the design criteria stress levels for DBE (SSE) loads. Those ducts or supports that do not meet the design criteria will be evaluated against the interim operability criteria. Those which did not meet the design criteria, but are within the interim operability criteria, will be modified to the design criteria after restart. Those which do not meet the interim operability criteria will be modified to the design criteria unless specifically requested and approved by NRC on a case-by-case basis before restart. A comparison of design and operability criteria is summarized in table 1.

Licensing Issue

This program utilizes interim operability acceptance criteria for ducts and duct supports.

Justification

The duct stress interim operability criteria are based on test data (see table 1). The duct support interim operability criteria are the same as the pipe support interim operability criteria, which are similar to the Sequoyah Nuclear Plant's large bore pipe support operability criteria. Approval of the Sequoyah operability criteria is documented in NUREG 1252.

The HVAC qualification is comprehensive and provides assurance that the ducts and supports will remain functional. Those modifications which are required to meet the design criteria will be completed before restart following the next refueling outage.

TABLE 1

BROWNS FERRY UNIT 2
HVAC
CRITERIA COMPARISON CHART

| ADDRESSES | DESIGN CRITERIA | OPERABILITY CRITERIA | REMARKS |
|---|---|---|---|
| ALLOWABLE DUCT STRESS RECTANGULAR DUCTS | 8,000 PSI PER SMACNA | 12,000 PSI | BASED ON TEST DATA REPORTS TVA-CEB-79-7 AND MA 2-79-1 |
| ROUND DUCTS | 10,000 PSI PER SMACNA | 15,000 PSI | BASED ON TEST DATA REPORTS TVA-CEB-79-7 AND MA 2-79-1 |
| ALLOWABLE SUPPORT STRESS - TENSION AND BENDING | PER AISC UP TO $0.9S_Y$ $0.7S_U$ | SMALLER OF $1.2S_Y$ OR $0.7S_U$ | SAME AS PIPE SUPPORT OPERABILITY CRITERIA |
| ALLOWABLE SUPPORT STRESS - COMPRESSION, AXIAL AND BENDING | PER AISC UP TO $0.9S_Y$ | $0.9P_{CR}$ | SAME AS PIPE SUPPORT OPERABILITY CRITERIA |
| SHEAR | PER AISC - UP TO $0.52S_Y$ $0.42S_U$ | SMALLER OF $0.72S_Y$ OR | SAME AS PIPE SUPPORT OPERABILITY CRITERIA |
| ALLOWABLE WELD STRESS SHEAR | PER AISC UP TO $0.5S_Y$ BASE METAL | 0.42S BASE METAL | BASED ON ASME III SUBSECTION NF, APPENDIX F, FOR SUPPORTS |
| ALLOWABLE BOLT STRESS (TENSION) | PER AISC UP TO $0.56S_Y$ OF BOLT | GREATER OF $0.7S_U$ OR $S_Y$ OF BOLT | SAME AS PIPE SUPPORT OPERABILITY CRITERIA |
| ALLOWABLE CONCRETE EXPANSION ANCHORS FACTOR OF SAFETY WEDGE AND SHELL TYPE | WEDGE TYPE-4 SHELL TYPE 5 FOR TENSION 4 FOR SHEAR | ALL TYPES 2 | SAME AS PIPE SUPPORT OPERABILITY CRITERIA |