VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

July 16, 1981

R. H. LEASBURG
VICE PRESIDENT
NUCLEAR OPERATIONS

RECEIVED JUL 22 1981 U.S. NUCLEAR REGULATORY COMMISSION

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
Attn: Mr. Robert A. Clark, Chief
Operating Reactors Branch No. 3
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Serial No. 442
NO/LEN:ms
Docket Nos. 50-338
50-339
License Nos. NPF-4
NPF-7

Gentlemen:

SEISMIC QUALIFICATION OF AUXILIARY FEEDWATER SYSTEMS
NORTH ANNA POWER STATION
UNITS 1 AND 2

Attached is Vepco's response for North Anna to NRC Generic Letter No. 81-14 on Seismic Qualification of Auxiliary Feedwater Systems. Included in the attachment is Table 1, which was provided in the generic letter. By leaving this table blank, we are indicating seismic qualification of those listed items. Also included in the attachment is a description of the methodologies and acceptance criteria used to support our conclusion of seismic qualification.

If you have questions or require additional information, please contact us.

Very truly yours,

R. H. Leasburg
Vice President - Nuclear Operations

Attachment

cc: Mr. Victor Stello
Office of Inspection and Enforcement
Region II

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ATTACHMENT 1
NORTH ANNA POWER STATION
RESPONSE TO ENCLOSURE 1

The design basis and methodology for seismic qualification of the Auxiliary Feedwater System is given in various sections of the FSAR.

The North Anna FSAR (Table 3.2.1-1) identifies the Condensate and Feedwater System as meeting the Class I seismic criteria including:

Condensate and Feedwater System

110,000 gallon Condensate Storage Tank

Auxiliary Steam Generator Feed Pumps

Piping, Valves and Supports

From 110,000 gallon Condensate Storage Tank to Auxiliary Steam Generator Feed Pumps

From Auxiliary Steam Generator Feed Pumps to Steam Generator Feed Lines

Steam Generator Feed Lines Inside Containment to and including first Isolation Check Valve Outside Containment.

This table further indicates that these criteria are met for all instrumentation and controls to operate and monitor operation of critical system components and for all cable to critical components, instruments, and controls.

The Auxiliary Feedwater (AFW) system components are housed in the Reactor Containment, the Main Steam Valve House Cubicles, and the Auxiliary Steam Generator Feed Pump Cubicle; Table 3.2.1-1 identifies these structures as meeting the Class I seismic criteria. The Condensate Storage Tank is a separately founded seismic Class I tank.

Seismic Class I components and systems are designed to resist the Operating Basis Earthquake within allowable stresses, and failure to function will not occur during the DBE (FSAR Section 3.2.1).

A. The North Anna Unit 1 and 2 auxiliary feedwater system, being a safety-related system, falls under the requirements of FSAR Section 3.1. In this section it states:

"Structures, systems and components important to safety are designed to meet the intent of the General Design Criteria."

Vepco's Nuclear Power Station Quality Assurance manual applies to all Category I systems and was developed in accordance with Appendix B to 10 CFR 50. Therefore, the North Anna auxiliary feedwater system meets the requirements of Regulatory Guide 1.29 by complying with GDC 2 and Appendix B to 10 CFR 50.

The piping of the auxiliary feedwater system as identified in Table 3.2.1-1 of the FSAR is Seismic Class I and was included within the scope of seismic related Bulletins 79-02, 79-04, 79-07, 79-14, and 80-11, and I.E. Information Notice 80-21.

B. General methodologies for seismic Class I qualification of equipment are described in FSAR Section 3.7.3.2. In this section it states:

Seismic Analyses Methods

"Three principal categories of documentation are considered. These are:

Static Analysis

Dynamic Analysis

Testing"

Further descriptions are provided for the Static and Dynamic Analysis and Testing in this section.

Cable tray systems are designed for static acceleration loads equal to 1.3 times the applicable peak amplified resonant response at the support points using 5% damping. The adequacy of the 1.3 dynamic amplification factor is justified in the FSAR Response to Comment S 3.33. This response provides results of an analysis of a typical cable tray system which indicates the conservatism of the factor.

The seismic design of Category I instrumentation and electrical equipment is discussed in FSAR Section 3.10. In this section it states:

"Typical protection system equipment is subjected to type tests under simulated seismic motion consisting of sine beats to demonstrate its ability to perform its functions.

Type testing has been done on this equipment by using conservatively large accelerations and applicable frequencies. This testing conforms to the IEEE Standard 344-1971."

Further information is provided on seismic testing of electrical equipment in the FSAR Responses to Comments S 3.30 and 3.31.

Section 3.7.3.1 states:

"Analyses of Seismic Class I piping systems are based on criteria and procedures specified in the ASME Boiler and Pressure Vessel Code, Section III, (including the 1971 Winter Addenda), which satisifies all the requirements of ANSI-B31.7 Nuclear Power Piping Code (1969 edition).

Seismic analyses of Class I piping, which include all ASME Code Classes 1, 2, and 3 piping systems, are performed by the modal analysis response spectra method."

Static analysis for seismic loads was performed for most seismic Class I piping 6 inches in diameter or less. The general seismic analysis procedure is then described in Section 3.7.3.1 of the FSAR.

Seismic Input

FSAR Section 3.7.3.2 states:

> "All Seismic Class I equipment is documented for seismic adequacy. Depending upon equipment location, the basic source of seismic design data is either the ground response spectra or the amplified response spectra derived through a dynamic analysis of the relevant structure (see Section 3.2.1).
>
> These spectra are developed and used for equipment consistent with the damping factors tabulated in Table 3.7.2.1 or as justified by test. The uncertainties in the calculated values of fundamental structural frequencies due to reasonable variations is subgrade and structural properties are taken into account. The peak resonant period value(s) in the amplified response spectra developed as described in Section 3.7.1 are subject to variations of plus 15 percent and minus 15 percent for this plant and site. Accordingly, equipment designed using these amplified response spectra having modal periods within plus 15 percent and minus 15 percent of the peak resonant period(s) are assigned the peak resonant response value(s). Beyond this range, the amplified response spectra are utilized exactly as shown.
>
> These requirements pertain to all seismic Class I equipment regardless of industry code or code classification. The requirements for seismic qualification are intended to either supplement existing industry analytical requirements where applicable, or to provide documentation of component adequacy to combined normal plus earthquake loads where no documentation requirements currently exist. All acceleration ("g") factors and analyses are based on elastic analysis exclusively."

Section 3.7.3.1 of the FSAR states:

> "Structural response spectra, consisting of peak responses of a family of seismic loadings for the piping systems, are the amplified response spectra, obtained for discrete locations in the structure where the piping system is supported. (See Section 3.7.1 for the development of the amplified response spectra.) Damping factors used for critical piping and components are 0.5 percent for the Operating Basis Earthquake (OBE) and 1 percent for the Design Basis Earthquake (DBE)."
>
> ". . . Piping systems designed using those amplified response spectra having modal periods within ±15 percent of the peak resonant period(s) are assigned the peak response value(s). Outside this range, the amplified response spectra are used exactly as stated."

Load Combinations

The response to Comment D.3.7.3 provides the criteria for combining modal responses in those cases where modal response spectrum analysis is used.

The load combinations which include SSE are discussed in FSAR Section 3 7.3.2. In this section it states:

> "The equipment is designed to withstand the combined effects of all normal operating loads acting simultaneously with Design Basis Earthquake (see Section 2.5.2) loads without loss of function or structural integrity. Horizontal and vertical seismic loads are added considering a horizontal direction earthquake acting concurrently with the vertical direction earthquake, again on the most severe basis."

The load combinations including OBE and DBE and acceptance criteria are discussed in FSAR Section 3.7.3.1.1.

> "The seismic design and analysis criteria for ASME Code Classes 1, 2, and 3 are defined in Table 3.7.3-1. The design loading combinations and stress limits for seismic Class I piping systems are defined in Table 3.7.3-2."

Acceptance Criteria

Maximum working stress limits permitted for Design Basis Earthquake are stated in FSAR Section 3.7.3.2 as follows:

> "It is permissible to allow strain limits in excess of yield strain in safety related components during the Design Basis Earthquake and under postulated concurrent conditions, provided the necessary safety functions are maintained. These limits were defined and utilized only with reference to specific design codes, such as ASME Section III, which allow such limits for this loading."

The limits for Operating Basis Earthquake are also given in Section 3.7. These limits are as follows:

> "The stress levels due to these combined loading conditions are kept within maximum working stress limits permitted under applicable design standards, AISC Manual of Steel Construction, ASMF Boiler and Pressure Vessel Code, AWWA Standards, or other codes or specifications. If no codes are used, the stress level under the combined loading is limited to 90 percent of the minimum yield strength of the material per the ASTM Specification."

The design margins with respect to seismic events for safety related components are listed in the Response to Comment 3 3.74, whether determined by analysis or test.

The minimum acceptance criteria for components qualified by testing is given in Section 3.7.3.2.

TABLE 1

NORTH ANNA POWER STATION

AUXILIARY FEEDWATER SEISMIC QUALIFICATION

(1) Pumps/Motors

(2) Piping

(3) Valves/Actuators

(4) Power Supplies

(5) Primary Water and Supply Path

(6) Secondary Water and Supply Path*

(7) Initiation and Control System

(8) Structures Supporting or Housing these AFW System Items

*Applicable only to those plants where the primary water supply or path is not provided, however, a seismically qualified alternate path exists.