VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

July 16, 1981

R. H. LEASBURG
VICE PRESIDENT
NUCLEAR OPERATIONS

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
Attn: Mr. Steven A. Varga, Chief
Operating Reactors Branch No. 1
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Serial No. 443
NO/LEN:ms
Docket Nos. 50-280
50-281
License Nos. DPR-32
DPR-37

Gentlemen:

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

Attached is Vepco's response for Surry 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. James P. O'Reilly, Director
Office of Inspection and Enforcement
Region II

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ATTACHMENT I
SURRY 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 FSAR (Table 15.2.1-1) identifies the Condensate and Feedwater System as meeting the Class I seismic criteria including:

100,000 gallon Condensate Storage Tank

Auxiliary Steam Generator Feed Pumps

Piping, Valves and Supports

From 100,000 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 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 Cubicle, and the Auxiliary Steam Generator Feed Pump Cubicle; Table 15.2.1-1 identifies these structures as meeting the Class I seismic criteria. The Condensate Storage Tank is a separately founded seismic Class I tank.

Furthermore, the FSAR (paragraph 8.2) defines design bases and acceptance criteria for electrical system components as follows:

> "The electrical systems are designed to supply electrical power to all essential unit equipment during normal station operation and under incident conditions. The electrical system components vital to unit safety, including the emergency diesel generators, are designed and protected as necessary so that their integrity is not impaired by potential earthquakes, high winds, floods or disturbances on the external electrical system. Cables, motors and other electrical equipment required for operation of the Engineered Safeguards are suitably protected against the effects of either a nuclear system accident or a severe external environmental phenomenon in order to ensure a high degree of reliability."

A. The piping of the auxiliary feedwater system as identified in Table 15.2.1-1 of the FSAR is Seismic Class I and has been included within the scope of seismic related Bulletins 79-02, 79-04, 79-14, and 80-11. The concerns of Bulletin 79-07 have been addressed in our program to respond to the order to Show Cause dated March 13, 1979. All of the Seismic Class I piping at Surry within the scope of Bulletin 79-14 has been reanalyzed as a result of the Show Cause Order and Bulletin 79-14. Documentation of these reanalyses is being completed, and the final reports are scheduled to be prepared by November 1981. The Auxiliary Feedwater System was included in the scope of I.E. Information Notice 80-21.

B. General methodologies for seismic Class I qualification of equipment are described in FSAR Section 15.2.4, the Seismic Design Report (SDR)*, and response to Question 4.14.

Seismic Analyses Methods

Seismic analyses methods outlined in the FSAR and SDR include Static Analysis and Testing. These analyses methods are further described in the FSAR Responses to Questions 4.10 and 4.11. The methodology employed to qualify the Class I piping is described in Section 4.0 of the Seismic Design Review.

Electrical and control system equipment design is based on static acceleration loads equals to peak resonant response since restraints, snubbers, etc. are not used to preclude resonance of electrical and control systems equipment (Response to Question 4.11.).

Typical protection system equipment is subject to testing under simulated seismic accelerations to demonstrate the ability to perform and complete its function. Seismic testing conforms to guidelines referenced in the Response to Question 4.11.

The original design of a number of safety-related lines in Surry Units 1 and 2 had been performed using the SHOCK2 computer code; the stress summation methodology of this code was determined to be unacceptable by the NRC in 1979. The resulting Order to Show Cause of March 13, 1979 required those piping systems designed with these codes to be reanalyzed using an acceptable piping code. As a result of this Show Cause Order and the subsequent Bulletin 79-14, virtually all of the piping and supports within the scope of 79-14, have been reanalyzed using the NUPIPE program. The piping was analyzed including the effects of thermal expansion, internal pressure stresses, and earthquake loads. The reanalysis and modification program have verified that the Seismic Class I piping meets the requirements of Section 15.2.4 of the FSAR, in accordance with the code of record, ANSI B31.1, 1955, with Code Case N-7.

The conservatisms applied to the reanalysis of the piping systems for Surry have been extensively delineated in Section 7 of the VEPCO submittal to the NRC of June 5, 1979 (Serial No. 453).

*"Seismic Design Review, Equipment and Piping, Surry Power Station," issued June 30, 1971 and revised September 15, 1971.

Seismic Input

The Surry FSAR states in Section 15.2.4:

> "Class I structures, systems, and components designed to resist seismic forces are listed in Table 15.2.1-1. The design is based on two separate seismic criteria: The Operational Basis Earthquake (OBE) and the Design Basis Earthquake (DBE), as described in Section 2.5 and Appendix A. Acceleration response spectra for each earthquake are given on Fig. 2.5-1 and 2.5-2."

Because the AFW System is identified in Table 15.2.1-1, it falls under the above design conditions for seismic input as described in FSAR Section 2.5 and in the SDR Section 2.0.

In most cases for piping, Soil Structure Interaction Amplified Response Spectra (SSI ARS) were employed. The acceptability of SSI was obtained in an NRC letter from D. Eisenhut dated May 25, 1979. The completion of documentation for the NRC staff review of SSI was provided by the report, "Soil Structure Interaction in Development of Amplified Response Spectra for Surry Power Station - Units 1 and 2," dated June 8, 1979. In accordance with NRC letters of May 25, 1979 and November 15, 1979, the seismic inertial stresses and loads computed using the SSI-ARS were increased by factors of 1.5 for the DBE and 1.25 for the OBE cases, compounding the conservatisms in the seismic analysis.

Load Combinations

The Response to Question 4.10 provides the criteria for combining modal responses in those cases where modal response spectrum analysis is used.

The load combinations which include seismic loads are discussed in FSAR Section 8.2 and Table 15.2.1-1. Furthermore for piping, Section 15.2.4 stated:

> "Seismic loading includes the horizontal or vertical responses acceleration or combinations of both where the effects, as measured by the separate acceleration components, of horizontal and vertical accelerations are combined to produce maximum stress intensities, taking into account any potential adverse effect due to phase of the separate accelerations."

The stress combinations and acceptance criteria are given in the following equations from section 4.2 of the SDR:

$$S_P + S_{DL} \leqq S_H \quad (1)$$

$$S_P + S_{DL} + S_{OBE} \leqq 1.2\ S_H \quad (2)$$

$$S_P + S_{DL} + S_{DBE} \leqq 1.8\ S_H \quad (3)$$

$$\text{THERMAL STRESS} \leqq 1.25\ S_C + 0.25\ S_H \quad (4)$$

where:

S_P = Longitudinal Pressure Stress

S_{DL} = Dead Load Stress

S_{OBE} = Operational Basis Earthquake Stress

S_{DBE} = Design Basis Earthquake Stress

S_H = Basic material allowable stress at maximum (hot) temperature

S_C = Basic material allowable stress at minimum (cold) temperature

Acceptance Criteria

Maximum working stress limits permitted for Operating Basis Earthquake combined loading and the acceptance criteria for the Design Basis Earthquake combined loading conditions are referenced in the FSAR Table 15.2.1-1 and Section 15.2.4.

Table 15.2.1-1 designates that the AFW System is designed to Class I seismic criteria. The legend to Table 15.2.1-1 further states:

> "All Class I components and structures are designed to resist the operational basis earthquake within allowable working stresses. A check has been made to determine that failure will not occur with a design basis earthquake."

The acceptance criteria for components qualified by testing is no loss of function, as given in the FSAR Section 8.2.

TABLE 1

SURRY 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.