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SUBJECT: Forwards revised FSAR Section 3.10, "Seismic & Dynamic Qualification of Safety-Related Instrumentation & Electrical Equipment." Changes will be incorporated into Amend 24.

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Docket No. 50-397

Mr. A. Schwencer, Chief
Licensing Branch No. 2
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Schwencer:

Subject: NUCLEAR PROJECT NO. 2
SUBMITTAL OF SECTION 3.10 REWRITE

Enclosed are sixty (60) copies of the rewrite of Section 3.10, "Seismic and Dynamic Qualification of Safety Related Instrumentation and Electrical Equipment". This rewrite will be incorporated into Amendment No. 24 of the FSAR.

Very truly yours,

L A Hadley FOR

G. D. Bouchey
Deputy Director, Safety and Security

KSN/jca
Enclosures

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3.10 SEISMIC AND DYNAMIC QUALIFICATION OF SAFETY RELATED INSTRUMENTATION AND ELECTRICAL EQUIPMENT

3.10.1 SEISMIC AND DYNAMIC QUALIFICATION CRITERIA

3.10.1.1 Safety Related Equipment Identification

Table 3.2-1 is a list of the seismic category I equipment arranged by system.

A list of all engineered safety feature systems and associated class IE equipment has been prepared. All parameters required to perform the qualification evaluation have been determined, including normal and accident operational requirements, operating data and manufacturers' data. The location of the equipment has been verified by plant walk down to insure the appropriatness of response spectra. The IE equipment list is being periodically updated and and kept current in the Supply System computer.

Class IE is defined per IEEE 323-1974 as follows:

The safety classification of the electric equipment and systems that are essential to emergency reactor shutdown, containment isolation, reactor core cooling, and containment and reactor heat removal, or otherwise are essential in preventing significant release of radioactive material to the environment.

Instrumentation for the operator to follow the course of an accident was also defined as class IE. This includes instrumentation identified as a result of TMI-2 Lessons Learned and Regulatory Guide 1.97. The list also includes equipment supporting structures.

Table 3.10-1 is a sub-set of that list, showing the level 1 and 2 equipment which has use codes 1,2 and 4. (see notes to table 3.10-1 for explanation.) The equipment is listed by equipment piece number (EPN). The complete list is available at any time.

The equipment furnished by the General Electric Company, our NSSS Contractor, was purchased under contract 2 and 59. Any equipment which shows a 59 or any number beginning in 02 in the contract column in table 3.10-1 was purchased from General Electric. The remainder were supplied by B.O.P. Contractors and monitored by Burns and Roe, Corp., our architect/engineer.

3.10.1.2 Criteria For Acceptability

The original equipment seismic qualification requirement for

Washington Public Power Supply System Nuclear Project Number 2 (WNP-2) were described in the PSAR. These requirements specified that NSSS & BOP equipment be designed and tested to good industry practices. IEEE-344.1971 represented the established industry practiced at that time and equipment purchases were made to these requirements.

In March 1979 first questions to our FSAR were received which notified the Supply System that the NRC would review our equipment seismic qualification to upgraded criteria. This criteria was defined as IEEE-364.1975 as supplemented by Regulatory Guides 1.100 and 1.92 and Standard Review Plan section 3.9.2 and 3.10. A meeting of Lead BWR Plants was held at NRC offices in Bethesda to further define the NRC's expectations of the Licensees. At this meeting it became clear that the staff required a complete review (reevaluation) of the seismic/hydrodynamic load basis along with reevaluation of past equipment qualification documentation be performed by the licensees. The NRC staff would then assemble a Seismic Qualification Review Team (SQAT) to conduct a site visit to audit the Qualification Program and equipment installation.

The Supply System has undertaken an aggressive equipment qualification program to assure all class 1E equipment will perform their safety function during seismic/hydrodynamic loading conditions postulated to occur at WNP-2. This program includes:

a. Identification of Class 1E equipment.

b. Definition of seismic and hydrodynamic loads.

c. Collecting of seismic qualification documentation.

d. Reevaluation of the seismic qualification documentation to current criteria.

e. Identification of document deficiencies.

f. Corrective action or identified deficiencies.

All seismic category I instrumentation and electrical equipment was designed to withstand the effects of the safe shutdown earthquake (SSE) whose motion is described in 3.7.1.

The safety related (class 1E) instrumentation and electrical equipment have been reevaluated in order to assure performance of their safety function during and after OBE's, SSE and/or the hydrodynamic loads which result from a loss of coolant accident or other design basis event.

Hydrodynamic loads as described in Revision 3 to the "Plant Design Assessment Report for SRV and LOCA Loads" (DAR)were limited to equipment located within containment or pipe mounted equipment located between containment and the first anchor point outside containment. For that equipment the hydrodynamic response spectra was added by absolute sum to the response due to the SSE computed using the finite element Soil Structure Interaction Analysis as described in the responses to NRC questions 130.053, 130.055 and 130.056. These questions were raised at the NRC Structural Engineering Branch Meeting held at Burns and Roe, Woodbury in September 1981.

The equipment effected by hydrodynamic loads is designated in table 3.10-1 with a "Y" (yes) in the column headed by H.L. (hydrodynamic loads).

The Equipment located in other buildings was reevaluated for the motion caused by the SSE. That motion is defined by the lumped mass-stick model analysis described in section 3.7.1.

The reevaluation has been based on IEEE 344-1975 "IEEE Guide for Seismic Qualification of Class I Electric Equipment for Nuclear Power Generating Stations" as supplemented by regulatory guide 1.100 and section 3.10 of NUREG-0800, "Standard Review Plan" there are four exceptions to the use of these criteria. These are as follows:

a. Interim criteria have been established to re-evaluate equipment mounted on piping systems whose analyses have not been completed. The interim criteria are to use the peak of the applicable .5% damping floor response spectrum above 8 hertz as input acceleration for analysis or for Sine Dwell Testing. The piping systems are being designed, in turn, not to respond to frequencies less than 8 hertz. When the piping analyses are completed the computed acceleration of the equipment will be compared to the interim acceleration criteria to verify the interim criteria as conservative.

b. Equipment which was qualified by testing using single frequency motion was reevaluated using the following criteria to establish its adequacy.

   1. If the equipment is rigid (no resonant frequency below the Z.P.A. of the applicable response spectra) the test input acceleration must be greater than the acceleration corresponding to the ZPA of the response spectrum of the mounting point of the equipment.

2. If the equipment has only one natural frequency, the response acceleration to the test motion must be calculated at the appropriate damping ratio. To account for cross coupling, the required response acceleration is calculated by multiplying the acceleration corresponding to the equipment's natural frequency found on the applicable response spectrum by square root of 2 (1.41). If test response acceleration exceeds the required response acceleration, the test motion is considered adequate for requalification of the equipment.

3. If the equipment has multiple resonant frequancies, it must be tested at each of them. The response to each test must be calculated at each resonant frequency. That is, the response to a test at one frequency is calculated at that frequency and at all other resonant frequencies. The responses are then combined using the square root of the sum of the squares (SRSS) method. The test motion is considered adequate if the SRSS of the response accelerations to every test is greater than 1.4 times the SRSS of the accelerations found at the resonant frequencies on the applicable response spectrum.

4. If the equipment has closely spaced modes, the criteria of 3., above, is used except the responses to the closely spaced modes combined by the absolute sum rather than SRSS.

c. For equipment which is panel or rack mounted, the maximum transmissibility of the panel or rack is found by a combination of testing and analysis. The ZPA of the applicable response spectrum is then multiplied by this transmissibility to find the required acceleration for the equipment. Test accelerations of the equipment are then compared with the calculated required acceleration to establish qualification of the equipment.

d. IEEE-344-1975 references IEEE-323-1974. Section 6.3.5 of IEEE-323-1974 recommends thermal and radiation aging before vibration testing. It has not been shown that normal service condition environmental aging reduces equipment's ability to withstand a seismic event. The Electric Power Research Institute (EPRI) is running tests to find if a relationship exists. The Supply System is

monitoring those tests. If those tests show that th relationship exists for particular equipment we will reconsider normal service aging effects for that equipment.

For IE equipment located in harsh environments which has not been previously environmentally qualified (see 3.11) aging will be considered prior to seismic/ hydrodynamic testing. For all other equipment consideration of aging will not be required prior to IEEE-344-1975 testing.

All of the equipment which is shown in table 3.10-1 as qualified has been qualified by testing, by analysis or by a combination of testing and analysis. The list shows the method of qualification.

Each tested piece of equipment has been shown to be operable during and after the test. The test specimens were checked for spurious operation during testing. If there were spurious operations, it was determined that they had no detrimental effects on the safety function of the equipment.

Operability by analysis was demonstrated only if moving parts coming into contact with other objects was the only mode of failure. In those cases operability was shown with deflection calculations showing that a gap still remained at maximum load. Also, it was shown that accepted stress limits were not exceeded.

The damping valves used in analyses are those specified in regulatory guide 1.61 unless another was justified and documented.

In the analyses performed, horizontal and vertical loads are assumed to occur simultaneously in the most unfavorable combinations. Normal operating loads are also combined with the accident loads to produce the most severe stress combination. The "no loss of function" stresses are limited to 90% of the materials minimum yield strength with an SSE added to hydrodynamic loads and the normal operating loads.