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TEDESCO,R.L. Assistant Director for Licensing

SUBJECT: Advises that util reviewed preservice insp & pre-operational testing requirements transmitted w/810306 ltr. Pre-operational testing requirements will be detailed in Chapter 1A of FSAR.

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**Washington Public Power Supply System**
P.O. Box 968 3000 George Washington Way Richland, Washington 99352 (509) 372-5000

September 24, 1981
G02-81-313



Docket No: 50-397

Director, Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: Mr. R. L. Tedesco
Assistant Director for Licensing
Division of Licensing

Subject: PRESERVICE INSPECTION AND TESTING
OF SNUBBERS

Reference: Letter, R. L. Tedesco to R. L. Ferguson, "Preservice Inspection and Testing of Snubbers for WNP Units 1 through 5," dated March 6, 1981.

Dear Mr. Tedesco:

The Supply System has reviewed the Preservice Inspection and Pre-Operational Testing requirements transmitted with the reference letter. It is the intent of WNP-2 to fully comply with the requirements as stated. The Preservice Examination is presently detailed in the WNP-2 Preservice Inspection Program Plan Section 9.3.1; all of the reference letter requirements are complied with. The Pre-Operational Testing requirements will be detailed in Chapter 14 of the FASR at a later date.

Very truly yours,

J. W. Shannon
Director, Safety and Security

JWS:JEP:cd

cc: R. Auluck, NRC
O. K. Earle, B&R
R. W. Hernan, NRC
N. S. Reynolds, D&L
D. D. Tillson

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# Washington Public Power Supply System

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D. D. Tillson

Dupe of 8110010343

AMENDMENT NO. 9
April 1980

Q. 110.022
(3.9.2)

Supplement the preoperational piping vibration test program described in Section 3.9.2.1 of the FSAR with detailed information in the manner discussed in Section 3.9.2 of the Standard Review Plan (SRP), NUREG-75/087. In your response, emphasize the measures you will take to conduct visual inspections and measurements of vibration. In addition to the piping discussed in Section 3.9.2.1 (i.e., the recirculation piping and the RHR suction piping), include the following piping systems in your response: (1) all safety-related ASME Class 1, 2 and 3 piping systems; (2) other high energy piping systems inside Seismic Category I structures; (3) those portions of high energy systems whose failures could adversely affect the functioning of any safety-related structure, system or component; and (4) the Seismic Category I portions of moderate energy piping systems located outside containment.

Response:

See revised 3.9.2.1.1, 3.9.2.1.2, 3.9.2.1.3, and 3.9.2.1.7. These modified sections describe and clarify the Preoperational and Startup Piping Vibration Program. The preoperational program includes all the piping systems described in items (1) through (4) in the question. Note that during the preoperational program, all systems contained in the preoperational program described in Chapter 14 are operated at rated flow condition and the piping systems are visually inspected. The exceptions to these are the feedwater, main steam, recirculation, RWCU and RCIC piping systems which cannot be operated at rated conditions until the startup program. Therefore, these systems are specifically included in the Piping Vibration Startup Test which will use remote monitoring equipment located in the drywell to measure piping vibration and expansion in these systems. The portion of the piping systems located outside the drywell will be visually inspected during initial operation and conditions listed in 3.9.2.1.3.

whose failure would degrade an essential component is defined in 9.1 and is classified as Seismic Class I. These components were subjected to an elastic dynamic finite element analysis to generate loadings. This analysis utilizes appropriate seismic floor response spectra and combines loads at frequencies up to 33 HZ in three directions. Imposed stresses were generated and combined for normal, upset, and faulted conditions. Stresses were compared, depending on the specific safety class of the equipment, to industrial codes, ASME, ANSI or industrial standards, AISC allowables.

3.9.1.4.13 Balance of Plant Equipment

With the exception of pipe whip restraint design, the faulted condition was evaluated in accordance with ASME Section III by elastic systems and components analysis. Inelastic stress analysis methods were not utilized for design of any of these components. Pipe whip restraint design is described in 3.6.2.

## 3.9.2 DYNAMIC TESTING AND ANALYSIS

### 3.9.2.1 Preoperational Vibration and Dynamic Effects Testing on Piping

The test program is divided into three phases: preoperational vibration, startup vibration, and operation transients.

#### 3.9.2.1.1 Preoperational Vibration Testing

During the preoperational (safety-related) test phase it is verified that ~~operating~~ (operating) vibrations in all piping systems included in the preoperational test program are within acceptable limits. This phase of the test uses visual observation. If, during the initial system operation, visual observation indicates that piping vibration is significant, measurements are made with a hand-held vibrograph. The results of those measurements will be reviewed by the appropriate engineering group to determine the acceptability of the measured vibration values. If the measured vibration values are not acceptable, appropriate design modifications will be made and the system retested. Visual observations are made during initial operation of all piping systems. During the preoperational test program described in 14.2, all (safety related) systems with the exception of the recirculation, main steam, (SRV discharge) RCIC, feedwater and ~~RWCU~~ piping are operated at rated system flow condition. These remaining piping systems are monitored and/or visually inspected during the startup program. Refer to 3.9.2.1.3 and 14.2.12.3.33.

3.9.2.1.2 Small Attached Piping

During visual observation special attention is given to small attached piping and instrument connections to ensure that they are not in resonance with the ~~recirculation pump motors or flow induced vibrations~~ associated main process piping. If the operating vibration acceptance criteria are not met, appropriate corrective action will be taken and retesting performed.

3.9.2.1.3 Startup Vibration

The purpose of this phase of the ~~delete~~ SRV discharge program is to verify that the main steam, recirculation, (RWCU) and RCIC steam piping vibration are within acceptable limits. Because of limited access due to high radiation levels, remote monitoring is required during this phase of the test. However, during the initial nuclear heat-up to rated temperature and pressure visual inspection of major drywell piping systems will be performed in conjunction with the thermal expansion program to confirm acceptable vibration levels. Remote measurements are made during the following steady state conditions:

a. Main steam flow at 25% of rated;

b. Main steam flow at 50% of rated;

c. Main steam flow at 75% of rated;

d. Main steam flow at 100% of rated;

e. Recirculation flow at minimum, 50%, 75%, and 100% of rated flow along the 100% load line;.

delete ~~f. RCIC turbine steam line at 100% of rated;~~

delete ~~g. RHR suction piping at 100% of rated flow in the shutdown cooling mode.~~

The piping vibration startup test is described in 14.2.12.3.33.

3.9.2.1.4 Operating Transient Loads

The purpose of the operating transient test phase is to verify that pipe stresses are within Code Limits. The

RCIC steam line and SRV discharge line

amplitude of displacements and number of cycles per transient of the main steam ~~and~~ recirculation piping are measured and the displacements compared with acceptance criteria. The deflections are correlated with stresses to verify the pipe stresses remain within Code limits. Remote vibration and deflection measurements are taken during the following transients:

a. Recirculation pump starts;

b. Recirculation pump trip at 100% of rated flow;

c. Turbine stop valve closure at 100% power;

d. Manual discharge of each S/R valve at 1,000 psig and at planned transient tests that result in S/R valve discharge, eg, MSIV full isolation

e) RCIC operation at maximum steam flow.

3.9.2.1.5 Test Evaluation and Acceptance Criteria

The piping response to test conditions are considered acceptable if the organization responsible for the stress report reviews the test results and determines that the tests verify that the piping responded in a manner consistent with the predictions of the stress report and/or that the tests verify that piping stresses are within Code limits. To ensure test data integrity and test safety, criteria have been established to facilitate assessment of the test while it is in progress. These criteria, designated Level 1 and 2, are described in the following paragraphs.

Replace with attachment 1

3.9.2.1.5.1 Level 1 Criteria

If in the course of the tests, measurements indicate that the piping is responding in a manner that would make test termination prudent, the test is terminated. Level 1 criteria establishes bounds on movement that, if exceeded, make a test hold or termination mandatory. The limits on movement are based on maximum allowable Code stress limits.

3.9.2.1.5.2 Level 2 Criteria

Conformance with Level 2 criteria demonstrates that the piping is responding in a manner consistent with the stress report

predictions. Failure to meet Level 2 criteria does not mean that the piping response is unsatisfactory; it means that the system is not responding in accordance with theoretical predictions and further analyses based on test results is necessary. Level 2 criteria is intended to screen out test results that are consistent with predictions and need no analytical review from those that must be evaluated.

3.9.2.1.6 Corrective Actions

During the course of the tests, the remote measurements are regularly checked to determine compliance with Level 1 criteria. If trends indicate that Level 1 criteria may be violated, the measurements are monitored at more frequent intervals. The test is held or terminated as soon as Level 1 criteria is violated. As soon as possible after the test hold or termination, the following corrective actions will be taken:

a. Installation Inspection. A walkdown of the piping and suspension is made to identify any obstruction or improperly operating suspension components. If vibration exceeds criteria, the source of the excitation must be identified to determine if it is related to equipment failure. Action is taken to correct any discrepancies before repeating the test.

b. Instrumentation Inspection. The instrumentation installation and calibration are checked and any discrepancies corrected. Additional instrumentation is added, if necessary.

c. Repeat Test. If actions (a) and (b) identify discrepancies that could account for failure to meet Level 1 criteria, the test is repeated.

d. Resolution of Findings. If the Level 1 criteria is violated on the repeat test or no relevant discrepancies are identified in (a) and (b), the organization responsible for the stress report shall review the test results and criteria to determine if the test can be safely continued.

Attachment 1

(20)

3.9.2.1.5.1 Level 1 Criterion

Level 1 establishes the maximum limits for the level of pipe motion which, if exceeded, makes a test hold or termination mandatory.

If the Level 1 limit is exceeded, the plant will be placed in a satisfactory hold condition, and the responsible piping design engineer will be advised. Following resolution, applicable tests must be repeated to verify that the requirements of the Level 1 limits are satisfied.

3.9.2.1.5.2 Level 2 Criterion

Level 2 specifies the level of pipe motion which, if exceeded, requires that the responsible piping design engineer be advised. If the Level 2 limit is not satisfied, plant operating and startup testing plans would not necessarily be altered. Investigations of the measurements, criteria, and calculations used to generate the pipe motion limits would be initiated. An acceptable resolution must be reached by all appropriate and involved parties, including the responsible piping design engineer. Depending upon the nature of such resolution, the applicable tests may or may not have to be repeated.

If the test measurements indicate failure to meet Level 2 criteria, the following corrective actions are taken after completion of the test:

a. Installation Inspection. A walkdown of the piping and suspension is made to identify any obstruction or improperly operating suspension components. If vibration exceeds limits, the source of the vibration must be identified. Action, such as suspension adjustment is taken to correct any discrepancies.

b. Instrumentation Inspection. The instrumentation installation and calibration are checked and any discrepancies corrected.

c. Repeat Test. If (a) and (b) above identify a malfunction or discrepancy that could account for failure to comply with Level 2 criteria and appropriate corrective action has been taken, the test is repeated.

d. Documentation of Discrepancies. If the test is not repeated, the discrepancies found under actions (a) and (b) above are documented in the test evaluation report and correlated with the test condition. The test is not considered complete until the test results are reconciled with the acceptance criteria.

3.9.2.1.7 Measurement Locations

Remote expansion and vibration measurements are made in the three orthogonal directions at appropriate locations on the main steam, recirculation, feedwater, RCIC, RHR and SRV discharge, and RWCU piping. The exact locations are not finalized but will be documented in the Startup Vibration Test Procedure described in 14.2.12.3.33. During preoperational testing prior to fuel load, visual inspection of all safety-related piping is made, and any visible vibration measured with a handheld instrument.

For each of the selected remote measurement locations, Level 1 and 2 deflection and vibration limits are prescribed in the startup test procedure. Level 2 limits are based on the results of the stress report adjusted for operating mode and instrument accuracy; Level 1 limits are based on maximum allowable Code stress limits.

3.9.2.1.8 RCIC Pump Assembly

The RCIC pump construction is a barrel type on a large cross-section pedestal. Qualification by analysis was performed. The seismic design analysis is based on 3g horizontal and 1g vertical accelerations. Results are obtained by using acceleration forces acting simultaneously in two directions, one vertical and one horizontal. The pump mass, support system and accessory piping have been shown by analysis to have a natural frequency greater than 33 Hz.

The RCIC pump assembly has been analytically qualified by static analysis for seismic loading as well as the design operating loads of pressure, temperature, and external piping loads. The results of this analysis confirm that the stresses are substantially less than 90% of the allowable.

3.9.2.2 Seismic Qualification of Safety-Related Mechanical Equipment

This subsection describes the criteria for seismic qualification of mechanical safety-related equipment and also describes the qualification testing and/or analysis applicable to this plant for all the major components on a component by component basis. In some cases, a module or assembly consisting of mechanical and electrical equipment was qualified as a unit, for example, motor powered pumps. These modules are generally discussed in this paragraph rather than providing discussion of the separate electrical parts in 3.10 and 3.11. Seismic qualification testing is also discussed in 3.9.3.2 and 3.9.3.2.5. Electrical supporting equipment such as control consoles, cabinets, and panels which are part of the NSSS are discussed in 3.10.

Consideration of spatial components of seismic accelerations are taken into account in the analyses of Seismic Category I mechanical equipment in accordance with 3.7.2.1.8.3.

14.2.12.3.32 Not Applicable

14.2.12.3.33 Test Number 33 - Piping Vibration

14.2.12.3.33.1 Purpose

The purpose of this test is to verify that the reactor main steam, recirculation, feedwater, ~~RWCU~~ and RCIC~~RHR~~ piping vibration are responding as predicted. SRV discharge

14.2.12.3.33.2 Prerequisites

The Preoperational Tests have been completed, the POC has reviewed and the Plant Manager has approved the test procedures and initiation of testing. Instrumentation has been checked or calibrated as appropriate.

14.2.12.3.33.3 Description

During reactor operation, it is desirable to show that destructive level piping vibrations do not occur by measuring vibration at steady state and during various planned transients.

14.2.12.3.33.4 Criteria

Level 1

The measured amplitude (peak-to-peak) of main steam and recirculation line vibration shall not exceed the maximum allowable displacements.

Level 2

The measured amplitude (peak-to-peak) of vibration shall not exceed the expected values.

14.2.12.3.17 Test Number 17 - System Expansion

14.2.12.3.17.1 Purpose

The purpose of this test is to verify that piping systems are free and unrestrained in regard to thermal expansion and that suspension components are functioning in the specified manner. The test also provides data for calculation of stress levels in nozzles and weldments and confirmation that hot pipe containment penetrations are adequately designed.

14.2.12.3.17.2 Prerequisites

The Preoperational Tests have been completed, the POC has reviewed and the Plant Manager has approved the test procedures and initiation of testing. Instrumentation has been installed and calibrated.

14.2.12.3.17.3 Description

Record hanger positions of major equipment and piping in the nuclear steam supply system and auxiliary systems after each major thermal cycle until shakedown has taken place (normally about three cycles). During initial heatup visual inspections are made at an intermediate reactor water temperature and again at rated temperature to assure components are free to move as designed. Adjustments are made as necessary. Devices for measuring continuous pipe deflections are mounted on main steam, recirculation, feedwater, RCIC and selected safety/relief valve discharge lines. Motion measured during heatup is compared with calculated values. Selected hot pipe containment penetrations will be monitored for acceptable temperature profiles across the penetration configuration.

14.2.12.3.17.4 Criteria

Level 1

There shall be no evidence of blocking of the displacement of any system component caused by thermal expansion of the system.

Hangers shall not be bottomed out or have the spring fully stretched.

The displacements at the established transducer locations used to measure pipe deflections shall not exceed the allowable values. The allowable values of displacement shall be based on not exceeding ASME Section III Code stress allowables.

QUESTION NO. 22
(3.9.2.5)

The applicant has presented inadequate data to verify the mathematical models for the dynamic analysis. Specifically, the explanation of the dynamic model is requested and justification of the statement that, "only motion in the vertical direction will be considered here; hence, each structural member can only have an axial load."

RESPONSE

Because of the shroud design in a BWR, the core flow during normal operation or a LOCA transient is always upward axially. Therefore, a vertical axial-flow model with 12 nodes is adequate to dynamically analyze the RPV internals. The text description of this model is clarified as the attached.

Summation - This item is closed.

PCY:rf/45E10
9/21/81

### 3.9.2.5 Dynamic System Analysis of the Reactor Internals Under Faulted Conditions

In order to assure that no significant dynamic amplification of load occurs as a result of the oscillatory nature of the blowdown forces (see Figures 3.9-8a and 3.9-8b), a comparison is made of the periods of the applied forces and the natural periods of the core support structures being acted upon by the applied forces. These periods will be determined from a ~~comprehensive~~ dynamic model of the RPV and internals ~~with 27 degrees of freedom~~. Only motion in the vertical direction will be considered here; hence, each structural member (between two mass points) can only have an axial load. Besides the real masses of the RPV and core support structures, account will be made for the water inside the RPV.

Typical curves of the variation of pressures during a steam line break are shown in Figures 3.9-8a and 3.9-8b. The accident analysis method is described in 3.9.5.2.

The time varying pressures are applied to the dynamic model of the reactor internals described above. Except for the nature and locations of the forcing functions and the dynamic model, the dynamic analysis method is identical to that described for seismic analysis and is detailed in 3.7.2.1.

The loads and load combinations acting upon the jet pumps and LPCI coupling are listed in 3.9.3.1.

12-node vertical

### 3.9.3 ASME Code Class 1, 2 and 3 Components, Component Supports and Core Support Structures

#### 3.9.3.1 Loading Combinations Design Transients and Stress Limits

Question 23

The loading combinations and stress limits used in the design of (1) all ASME Class 1, 2 and 3 systems, components, equipment and their supports, (2) all reactor internals and (3) control rod drive components need to be clarified in the FSAR. Section 3.9.3.1 and the majority of Tables 3.9.2(a) through 3.9.2(ac) in the FSAR do not clearly define the loading combinations and stress limits. We will require a concise summary (preferably in table form) of this information. This summary should include a listing of all the loads which were considered for each service condition or load case plus the acceptance criteria. Appendix 110-1 to NRC Question 110.27 contains loading combinations and acceptance criteria applicable to all of the above system, components, equipment and supports. Table 3.6-5 of the WNP-2 "Plant Design Assessment for SRV and LOCA Loads" presents information which is not completely acceptable. We will require a commitment to the Appendix 110-1 mentioned above. In addition, we will require a clarification of the applicability of Table 3.6-5, i.e., are all of the loading combinations and acceptance criteria in Table 3.6-5 applicable to all of the systems, components, equipment, etc., discussed in the first paragraph above.

Response:

The Table number 3.6-5 in the question appears to be in error. Table 3.5-5 appears to be the table to which the question refers.

See revised Table 3.5-5 of the WNP-2 "Plant Design Assessment for SRV and LOCA Loads" for load combinations and acceptance criteria for balance of plant (attached).

See Table Q23-1 for the load combinations and acceptance criteria for NSSS piping and equipment.

Summation - The effects of hydrodynamic loads listed in the load combination table will be documented in the New Loads update. This item is closed.

TABLE 3.5-5 (DAR Rev. 2)

LOAD COMBINATIONS AND ACCEPTANCE CRITERIA

FOR ASME CODE CLASS 1,2, and 3 BOP PIPING AND EQUIPMENT **

| Load Cases | Load Combinations (1)(2) | Design Assessment Acceptance Criteria | |
|---|---|---|---|
| 1 | P+D.W. | Normal | (A) |
| 2 | N+ OBE $+SRV_{ONE}$ | Upset | (B) |
| 3 | N+ OBE $+SRV_{TWO}$ | Upset | (B) |
| 4 | N+ OBE $+SRV_{ALL}$ | Upset | (B) |
| 5 | N+ OBE $+SRV_{ADS}$ +SBA | Emergency * | (C) |
| 6 | N+ OBE $+SRV_{TWO}$ +SBA | Emergency * | (C) |
| 7 | N+ SSE $+SRV_{ADS}$ +SBA/IBA | Faulted * | (D) |
| 8 | N+ SSE $+SRV_{TWO}$ +SBA/IBA | Faulted * | (D) |
| 9 | N+ SSE $+SRV_{ONE}$ | Faulted * | (D) |
| 10 | N+ SSE $+SRV_{TWO}$ | Faulted * | (D) |
| 11 | N+ SSE $+SRV_{ALL}$ | Faulted * | (D) |
| 12 | N+ SSE +DBA | Faulted * | (D) |

(1) As required by the appropriate subsection, i.e., NB, NC or ND of ASME Section III, Division 1, other loads, such as thermal transient, thermal gradients, and anchor point displacement portion of the OBE or SRV, may require consideration in addition to those primary stress-producing loads listed.

(2) SBA, IBA, and DBA include all event induced loads, as applicable, such as chugging, pool swell, drag loads, annulus pressurization, etc.

*All ASME Code Class 1, 2 and 3 piping systems which are required to function for safe shutdown under the postulated events shall meet the requirements of NRC's memorandum, "Evaluation of Topical Report - Piping Functional Capability Criteria", dated July 17, 1980.

**Equipment includes pumps, valves, supports, vessels. For bolting used in connection with the support of ASME Code Class 1,2, and 3 components, vendor load capacity data sheets are used or where design is by the architect engineer, stress levels are maintained less than specified minimum yield at temperature.

## LOAD DEFINITION LEGEND (Table 3.5-5)

| | | |
|---|---|---|
| Normal (N) | - | Normal loads include internal pressure and dead weight |
| OBE | - | Operational Basis Earthquake loads |
| SSE | - | Safe Shutdown Earthquake loads |
| $SRV_{TWO}$ | - | Safety/relief valve diacharge induced loads from two adjacent valves |
| $SRV_{ALL}$ | - | The loads induced by actuation of all safety/relief valves |
| $SRV_{ADS}$ | - | The loads induced by the actuation of safety/relief valves associated with the automatic depressurization system |
| $SRV_{ONE}$ | - | The loads induced by the actuation of one safety/relief valve |
| SBA | - | Small Break Accident |
| IBA | - | Intermediate Break Accident |
| DBA | - | Design Basis Accident |

TABLE Q23-1

# LOAD COMBINATION AND ACCEPTANCE CRITERIA FOR ASME CODE CLASS 1, 2, AND 3 NSSS PIPING AND EQUIPMENT



| Load Combination | Design Basis | Evaluation Basis | (Service Level) |
|---|---|---|---|
| N + $SRV_{(ALL)}$ | Upset | Upset | (B) |
| N + OBE | Upset | Upset | (B) |
| N + OBE + $SRV_{(ALL)}$ | Emergency | Upset | (B) |
| N + SSE + $SRV_{(ALL)}$ | Faulted | Faulted* | (D) |
| N + SBA + SRV | Emergency | Emergency* | (C) |
| N + IBA + SRV | Faulted | Faulted* | (D) |
| N + SBA + $SRV_{(ADS)}$ | Emergency | Emergency* | (C) |
| N + SBA + OBE + $SRV_{(ADS)}$ | Faulted | Faulted* | (D) |
| N + IBA + OBE + $SRV_{(ADS)}$ | Faulted | Faulted* | (D) |
| N + SBA/IBA + SSE + $SRV_{(ADS)}$ | Faulted | Faulted* | (D) |
| ** N + LOCA + SSE | Faulted | Faulted* | (D) |

## LOAD DEFINITION LEGEND

Normal(N) – Normal and/or abnormal loads depending on acceptance criteria.

OBE – Operational basis earthquake loads.

SSE – Safe Shutdown earthquake loads.

SRV – Safety/relief valve discharge induced loads from two adjacent valves (one valve actuated when adjacent valve is cycling).

$SRV_{ALL}$ – The loads induced by actuation of all safety/relief valves which activate within milliseconds of each other (e.g., turbine trip operational transient).

$SRV_{ADS}$ – The loads induced by the actuation of safety/relief valves associated with Automatic Depressurization System which actuate within milliseconds of each other during the postulated small or intermediate size pipe rupture.

Note: This table will be inserted into the FSAR.

## LOAD COMBINATION TABLE (CONT'D)

LOCA — The loss of coolant accident associated with the postulated pipe rupture of large pipes (e.g., main steam, feedwater, recirculation piping).

$LOCA_1$ — Pool swell drag/fallout loads on piping and components located between the main vent discharge outlet and the suppression pool water upper surface.

$LOCA_2$ — Pool swell impact loads on piping and components located above the suppression pool water upper surface.

$LOCA_3$ — Oscillating pressure induced loads on submerged piping and components during condensation oscillations.

$LOCA_4$ — Building motion induced loads from chugging.

$LOCA_5$ — Building motion induced loads from main vent air clearing.

$LOCA_6$ — Vertical and horizontal loads on main vent piping.

$LOCA_7$ — Annulus pressurization loads.

SBA — The abnormal transients associated with a Small Break Accident.

IBA — The abnormal transients associated with an Intermediate Break Accident.

* All ASME Code Class 1, 2, and 3 piping systems which are required to function for safe shutdown under the postulated events shall meet the requirements of NRC's "~~Interim Technical Position Function~~ Capability of ~~passive components~~" - by MEB.

** The most limiting case combination among $LOCA_1$ through $LOCA_7$.

QUESTION NO 24
(3.9.3.1)

Several references are made in Table 3.9.2(a) through 3.9.2(ac) to allowable stresses for bolting. Specifically, what loading combinations and allowable stress limits are used for bolting for (a) equipment anchorage, (b) component supports, and (c) flange connections. Where are these limits defined?

RESPONSE

1. Floor Mounted Equipment

(A) Equipment Anchorage Bolting

The floor anchored mechanical equipment (pumps, heat exchangers, and RCIC turbine) in GE's scope of supply are mounted on a concrete floor or a steel structure. The design of concrete anchor bolts for the equipment mounted on concrete floor, and the responsibility to prescribe and meet the necessary codes and stress limits are in the AE's scope of supply. The design of attachment bolts for the equipment mounted on steel structure, and the responsibility to prescribe and meet the necessary codes and stress limits are also in the AE's scope of supply. GE works with the interface limit of 10,000 psi in tension or shear for the only purpose of sizing bolt holes in the equipment base, based on the required nominal size and number of bolts for maximum loads.

(B) Component Support Bolting

(a) RWCU Pump

The support bolting of this non-safety essential pump is designed for the effects of pipe load and SSE load to the requirements of the ASME code, Section III, Appendix XVII. The stress limits of 0.41Sy for tension and 0.15Sy for shear are used.

(b) RCIC Turbine

The pump-to-base plate bolting is designed as follows:

(1) Normal Plus Upset

a) Primary membrane: 1.0S

b) Primary membrane plus bending: 1.5S, where S is the allowable stress limit per the ASME Code Section III, Appendix I, Table I-7.3.

(2) Emergency or Faulted

Stresses shall be less than 1.2 times the allowable limits for "Normal plus Upset" given above.

(C) Flanged Connection Bolting

There are no flange type connections in component supports.

2. Piping Supports and Pipe Mounted Equipment (Valves and Pump) Supports

The supports are hanger and snubber type (including clamps) linear standard components as defined by the ASME Code Section III, Subsection NF. The bolts used in these supports meet criteria of NF-3280 for Service Levels A and B and NF-3230 for Service Levels C and D. NF-3280 is applicable to bolting for Service Levels A and B.

For Service Levels C and D, XVII-2460 with factors indicated under XVII-2110 is applicable to the design requirements of bolting. The calculated stresses under these categories do not exceed the specified minimum yield stresses at temperature.

Summation - This item is closed.

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9/23/81

3.9.3.1 Loading Combinations Design Transients and Stress Limits

Question 25

The applicant has not yet responded to Question 110.27, Appendix 110-2, "Interim Technical Position - Functional Capability of Passive Piping Components."

Response:

BOP

Piping system functional capability is being evaluated using the criteria given in NRC memorandum, "Evaluation of Topical Report - Piping Functional Capability Criteria," dated July 17, 1980.

NSSS

Referring to the response to Q. 110.27, the WNP-2 project does comply with Appendices A and B to Section 110. Accordingly, the statement of compliance is shown as a footnote in the attached load combination table.

Summation - This item is closed.

TABLE Q 25-1

LOAD COMBINATION AND ACCEPTANCE CRITERIA
FOR ASME CODE CLASS 1, 2, AND 3
NSSS PIPING AND EQUIPMENT

25

| Load Combination | Design Basis | Evaluation Basis | (Service Level) |
|---|---|---|---|
| $N + SRV_{(ALL)}$ | Upset | Upset | (B) |
| N + OBE | Upset | Upset | (B) |
| $N + OBE + SRV_{(ALL)}$ | Emergency | Upset | (B) |
| $N + SSE + SRV_{(ALL)}$ | Faulted | Faulted* | (D) |
| N + SBA + SRV | Emergency | Emergency* | (C) |
| N + IBA + SRV | Faulted | Faulted* | (D) |
| $N + SBA + SRV_{(ADS)}$ | Emergency | Emergency* | (C) |
| $N + SBA + OBE + SRV_{(ADS)}$ | Faulted | Faulted* | (D) |
| $N + IBA + OBE + SRV_{(ADS)}$ | Faulted | Faulted* | (D) |
| $N + SBA/IBA + SSE + SRV_{(ADS)}$ | Faulted | Faulted* | (D) |
| ** N + LOCA + SSE | Faulted | Faulted* | (D) |

LOAD DEFINITION LEGEND

Normal(N) - Normal and/or abnormal loads depending on acceptance criteria.

OBE - Operational basis earthquake loads.

SSE - Safe Shutdown earthquake loads.

SRV - Safety/relief valve discharge induced loads from two adjacent valves (one valve actuated when adjacent valve is cycling).

$SRV_{ALL}$ - The loads induced by actuation of all safety/relief valves which activate within milliseconds of each other (e.g., turbine trip operational transient).

$SRV_{ADS}$ - The loads induced by the actuation of safety/relief valves associated with Automatic Depressurization System which actuate within milliseconds of each other during the postulated small or intermediate size pipe rupture.

Note: This table will be inserted into the FSAR.

## LOAD COMBINATION TABLE (CONT'D)

| | | |
|---|---|---|
| LOCA | – | The loss of coolant accident associated with the postulated pipe rupture of large pipes (e.g., main steam, feedwater, recirculation piping). |
| $LOCA_1$ | – | Pool swell drag/fallout loads on piping and components located between the main vent discharge outlet and the suppression pool water upper surface. |
| $LOCA_2$ | – | Pool swell impact loads on piping and components located above the suppression pool water upper surface. |
| $LOCA_3$ | – | Oscillating pressure induced loads on submerged piping and components during condensation oscillations. |
| $LOCA_4$ | – | Building motion induced loads from chugging. |
| $LOCA_5$ | – | Building motion induced loads from main vent air clearing. |
| $LOCA_6$ | – | Vertical and horizontal loads on main vent piping. |
| $LOCA_7$ | – | Annulus pressurization loads. |
| SBA | – | The abnormal transients associated with a Small Break Accident. |
| IBA | – | The abnormal transients associated with an Intermediate Break Accident. |

* All ASME Code Class 1, 2, and 3 piping systems which are required to function for safe shutdown under the postulated events shall meet the requirements of NRC's "~~Interim Technical Position-Function~~ Capability of ~~passive components~~" - by MEB.

** The most limiting case combination among $LOCA_1$ through $LOCA_7$.

QUESTION No. 26
(3.9.3.1)

The methods of combining responses to all of the loads requested in (a) above is required. Our position in this issue for Mark II plants is outlined in NUREG-0484, Revision 1, "Methodology for Combining Dynamic Responses". However, since the primary containment for the WNP-2 plant is a free-standing steel pressure vessel and the plant is in a higher seismic zone, the staff will require that the criteria in Section 4 of NUREG-0484, Rev. 1, "Criteria for Combination of Dynamic Responses other than those of SSE and LOCA" be satisfied if the square root of the sum of the squares method of combining these responses is used. (Reference Regulatory Position E (2) in the enclosure to a letter from J. R. Miller, NRC to Dr. G. G. Sherwood, GE, "Review of General Electric Topical Report NEDE-24010-P", dated June 19, 1980). The conclusions of NUREG-0484, Rev. 1 are based on the studies performed by GE in NEDE-24010-P and BNL in NUREG/CR-1330. The applicant must demonstrate that an SRSS combination of dynamic responses achieves the 84% nonexceedance probability level because of the difference in containment and seismic level which were not included in the earlier studies.

RESPONSE

When a seismic response from a high seismic input, like that from Hanford, is combined with another dynamic response (e.g. SRV discharge loads), depending on the relative magnitudes of the two responses being combined, the shape of the cumulative Distribution Function (CDF) of the combined response will change. If the maximum magnitude of one of the responses is very large compared to the other response being combined, the CDF curve will almost be vertical and it is immaterial if these two responses are combined using the SRSS or the Absolute Sum (ABS) rule. However, if the maximum magnitudes of the two responses are about equal, use of SRSS vs. ABS rule to combine the responses with cause significant difference in the combined response. In addition, in this case, the CDF curve will be more like S-shaped with the non-exceedance probability (NEP) of SRSS being close to 84%. In the generic Mark II study, examples from both such cases were considered with more examples from the case with responses of comparable magnitudes. This study showed that all these Mark II cases meet the requirements of the NUREG-0484. Hence, the GE topical report NEDE-24010-P, "Technical Bases for the Use of SRSS Method for Combining Dynamic Loads for Mark II Plants" is also applicable to WNP-2 with high seismic input.

The impact of the free-standing steel primary containment is discussed in the areas as follows:

(1) Vessel and Internals are not attached to and not affected by the steel containment.

(2) Piping Systems and Floor Mounted Equipment

The dynamic input to these components at their containment support locations may be affected by the steel containment response to the dynamic loads under consideration and hence, may be different from that obtained from concrete containment. However, the frequencies contributing to the responses of major structures and components in both types of plants will not be significantly different but will fall into the same general range.

The structural frequencies will only determine the magnitude of amplification or attenuation of the response. For multi-frequency random-type dynamic loads, the components of input loads whose frequencies coincide with the structural natural frequencies will be amplified and these components will dominate the response. Although the predominant response of a particular structural component may vary somewhat in frequency between the concrete and steel containment configuration, the variances are expected to be small for the range of frequencies of interest for major structures because of the similarities in systems, types of structural configurations, construction materials and massiveness of buildings. Therefore, key characteristics of the responses (duration of strong response motion and number of peaks) are primarily determined by the input component loads to the structure, and because of the similarity of the dynamic nature of the input loads due to earthquake, SRV and LOCA for both types of containment, their structural responses will have similar dynamic characteristics. Hence, the response of the mechanical components and piping systems supported from the two types of containments will also be similar. Hence, the use of SRSS combinations for combining the dynamic responses for the WNP-2 application will be demonstrated to meet the 84% non-exceedance probability level.

Summation: - This item is closed.

QUESTION NO. 27
(3.9.3.1)

The note in Table 3.9-2(a) of the FSAR states that NSSS components designed to the upset plant condition (normal operating loads + upset transients & .5 SSE) will meet the upset design condition limits without a fatigue analysis. It is the staff's position that for all ASME Class 1 components a fatigue analysis shall be performed for all loading conditions. The basis for deviating from this position should be provided for WNP-2. If the WNP-2 position on this issue is implicit in the letter from W. Gang to R. Bosnak, "GE Position on Fatigue Analysis," dated January 15, 1981, provide the information requested in the letter from R. Bosnak to W. Gang, dated February 19, 1981.

RESPONSE

The information requested was documented in the letter from R. B. Johnson to R. Bosnak, "GE Position on Fatigue Analysis," on June 29, 1981. A copy is attached.

Summation - This item is closed.

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8/18/81