NORTHEAST UTILITIES

THE CONNECTICUT LIGHT AND POWER COMPANY
WESTERN MASSACHUSETTS ELECTRIC COMPANY
HOLYOKE WATER POWER COMPANY
NORTHEAST UTILITIES SERVICE COMPANY
NORTHEAST NUCLEAR ENERGY COMPANY

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March 1, 1984

Docket No. 50-423
B11058

Director of Nuclear Reactor Regulation
Mr. B. J. Youngblood, Chief
Licensing Branch No. 1
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Reference: (1) B. J. Youngblood to W. G. Counsil, Request for Additional Information for Millstone Nuclear Power Station, Unit 3 dated December 5, 1983.

(2) B. J. Youngblood to W. G. Counsil, Draft SER for Millstone Nuclear Power Station, Unit 3.

Dear Mr. Youngblood:

Millstone Nuclear Power Station, Unit No. 3
NRC Mechanical Engineering Branch (MEB)
Review Meeting

A meeting was held between the NRC-MEB, Northeast Nuclear Energy Company (NNECO), Stone & Webster, and Westinghouse in Boston on January 17-19, 1984 to discuss 36 questions contained in Reference (1). During the meeting each of the 36 questions was discussed. A status of each question was noted as defined by one of the following three categories:

Closed - No further NNECO input or action is needed to resolve the NRC concern.

Confirmatory - NNECO must provide the requested information on the Millstone 3 docket, either by a letter or FSAR amendment.

Open - No resolution possible at this time, NNECO to address.

Attachment I provides the status of those NRC questions. It was agreed that NNECO will transmit a letter to the NRC providing a written response on each question by March 1, 1984. NNECO also agreed to provide all additional information as committed to in confirmatory items (questions) as the information becomes available.

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The attached responses to the questions (Attachment II) simply formalize the above commitment given orally at the meeting. The responses contained herein are being provided as they will appear in Amendment 7 which is scheduled to be submitted approximately by the middle of March 1984. Also Attachment II provides additional information on the open and confirmatory items (question). A meeting is tentatively being set for March 22, 1984 in Washington, D.C. with the NRC-MEB to discuss and resolve open questions.

Attachment III provides responses to open items listed in the Draft Safety Evaluation Report (Reference 2).

If you have any concerns related to the information contained herein or any questions related to our responses, please contact our Licensing representative directly.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY
et al
By Northeast Nuclear Energy Company, their Agent

W. G. Counsil
Senior Vice President

By: C. F. Sears
Vice President Nuclear and
Environmental Engineering

STATE OF CONNECTICUT)
) ss. Berlin
COUNTY OF HARTFORD)

Then personally appeared before me C. F. Sears, who being duly sworn, did state that he is Vice President of Northeast Nuclear Energy Company, Applicant herein, that he is authorized to execute and file the foregoing information in the name and on behalf of the Applicants herein and that the statements contained in said information are true and correct to the best of his knowledge and belief.

Notary Public

My Commission Expires March 31, 1988

ATTACHMENT I

Status of the NRC-MEB Questions Discussed at Meetings with the NRC-MEB January 17-19, 1984.

NRC Question No.	Status	NRC Question No.	Status
210.8	Closed	210.26	Closed
210.9	Open	210.27	Closed
210.10	Closed	210.28	Closed
210.11	Closed	210.29	Closed
210.12	Closed	210.30	Closed
210.13	Open	210.31	Open
210.14	Closed	210.32	Closed
210.15	Closed	210.33	Confirmatory
210.16	Confirmatory	210.34	Open
210.17	Confirmatory	210.35	Open
210.18	Closed	210.36	Open
210.19	Closed	210.37	Open
210.20	Confirmatory	210.38	Closed
210.21	Closed	210.39	Closed
210.22	Closed	210.40	Closed
210.23	Closed	210.41	Open
210.24	Closed	210.42	Open
210.25	Closed	210.43	Open

Summary - Closed - 22
Confirmatory - 4
Open - 10

ATTACHMENT II

Responses to the NRC-MEB Questions 210.8 through 210.43

NRC Letter: December 5, 1983

Question No. Q210.8 (Section 3.6.2)

SRP 3.6.2 requires the postulation of through-wall leakage cracks in moderate energy lines both inside and outside of containment. In FSAR Section 3.6.1.1.2, it is stated that through-wall leakage cracks are postulated to occur in moderate energy systems located outside containment only. Justify not postulating through-wall leakage cracks in moderate energy systems located inside containment.

Response:

Containment environmental zones are defined by high energy line breaks which envelope moderate energy line crack environmental effects for temperature, pressure, and humidity. Class 1E equipment in the containment is qualified per IEEE-323 for LOCA spray wetting and flooding, as applicable.

NRC Letter: December 5, 1983

Question No. Q210.9 (Section 3.6.2)

Discuss how high energy leakage cracks were considered.

Response:

High energy pipe breaks are postulated in accordance with SRP 3.6.2. In addition, high energy leakage cracks are considered at locations where inadequate separation exists to adjacent essential systems, structures, and components. For these cases not enveloped by a high-energy line break, either protection against the environmental effect of such cracks is provided or an analytical review is made to show that cracks are unlikely at these positions, using the criteria for crack postulation specified in BTP MEB 3-1, Item B.1.d.

NRC Letter: December 5, 1983

Question No. Q210.10 (Section 3.6.2)

The break location criteria as stated on Page 3.6-14 of the FSAR for the CHS charging lines applies to Class 2 lines. Item 1, Section 3.6.1.3, which is supposed to discuss the break postulations in the Class 1 portion of this line, could not be found. Please provide this discussion.

Response:

A portion of the CHS charging line upstream of the second isolation valve is Class 1 and is part of the RCS. The remainder of the CHS charging line is Class 2. Refer to revised FSAR Section 3.6.1.3.

NRC Letter: December 5, 1983

Question No. Q210.11 (Section 3.6.2)

BTP MEB 3-1, Section B.1.c.(1) specifies critieria for selecting postulated break locations. Both location of high stress and cumulative usage factor (items B.1.c.(1).(b) and (c)) should be considered. Provide assurance that all locations where either item (b) or (c) or both are exceeded that a break is posulated.

Response:

Breaks are postulated at all locations where the criteria of either BPT MEB 3-1, Item B.1.c.(1)(b) or (c), or both are exceeded. Refer to revised FSAR Section 3.6.2.1.1.

NRC Letter: December 5, 1983

Question No. Q210.12 (Section 3.6.2)

BTP MEB 3-1 requires for piping in the break exclusion zone, that loadings resulting from a postulated piping failure beyond the break exclusion zone should meet certain limits. Provide assurance that the criteria of BTP MEB 3-1 items B.1.b.(1).(c) and (e) have been met for lines both inside and outside containment.

Response:

BTP MEB 3-1, Item B.1.b.(1)(c) is not applicable, since no Class 1 lines penetrate the containment.

The criteria of MEB 3-1, Item B.1.b(1)(e) are met for lines both inside and outside containment.

Refer to revised FSAR Section 3.6.2.1.1.

NRC Letter: December 5, 1983

Question No. Q210.13 (Section 3.6.2)

BTP MEB 3-1 specifies that breaks in non-nuclear class piping should be postulated at (a) terminal ends and (b) each intermediate pipe fitting, welded attachment, and valve. Breaks in non-nuclear high energy piping, which are not seismically analyzed (or qualified), should be postulated at those locations which produce the greatest effect on the essential component or structure. FSAR Section 3.6.2.1.2 states that for non-nuclear safety class high energy piping, breaks are postulated according to a "fitting" criteria or based on thermal expansion stresses. Provide justification for postulating breaks in these lines based on thermal expansion stresses only.

Response:

Millstone 3 did not perform an evaluation using thermal stresses only. When nonnuclear class piping is stress analyzed as part of an ASME Class 2 or 3 analysis for stress ranges associated with a Normal, Upset, and 1/2 SSE event and calculated by Equations (9) and (10) of the ASME III Code, breaks are postulated in accordance with BTP MEB, Item B.1.c.(2).

In all other nonnuclear class piping, pipe break locations are postulated in accordance with BTP MEB 3-1, Items B.1.c.(3) and (4).

Refer to revised FSAR Section 3.6.2.1.2.

NRC Letter: December 5, 1983

Question No. Q210.14 (Section 3.6.2)

SRP 3.6.2, Section III.2.a, states that the rated energy dissipating capacity shall be taken as not greater than the area under the essentially flat portion of the load deflection curve for crushable materials. Provide assurance that this guideance has been used.

Response:

The rated energy dissipating capacity for crushable materials assures that essentially flat portions of the force deflection curve are used.

Refer to revised FSAR Section 3.6.2.2.1.

NRC Letter: December 5, 1983

Question No. Q210.15 (Section 3.6.2)

SRP 3.6.2 states that rise times for jet thrust not exceeding one millisecond should be used unless justified. Provide assurance that this justification will be included in the FSAR.

Response:

Rise times exceeding 1 millisecond have not been used. If longer rise times are used, proper justification will be provided.

NRC Letter: December 5, 1983

Question No. Q210.16 (Section 3.6.2)

Provide a schedule for completion of the tables concerning jet impingement effects.

Response:

FSAR Tables 3.6-8, 3.6-11, 3.6-14, 3.6-17, 3.6-20, 3.6-23, 3.6-36, 3.6-29, and 3.6-32 are scheduled to be finalized by June 1985.

Tables will be submitted as they are completed.

NRC Letter: December 5, 1983

Question No. Q210.17 (Section 3.6.2)

Provide a schedule for completion of Tables 3.6-21, 3.6-24, and 3.6-27.

Response:

FSAR Tables 3.6-21, 3.6-24, and 3.6-27 are scheduled to be finalized by December 1984. Tables will be submitted as they are completed.

NRC Letter: December 5, 1983

Question No. Q210.18 (Section 3.6.2)

Justify the use of limited area circumferential or longitudinal breaks. Provide a list showing where limited break areas have been postulated.

Response:

No limited area longitudinal breaks have been considered. Limited area circumferential breaks have been considered only for the reactor coolant system primary coolant piping. Limited area breaks at these locations are assured by use of rigid bumpers and the stiffness of the primary coolant system supports as described in FSAR Section 5.4.14.1.6. Use of limited area breaks minimizes cubicle pressurization effects and nozzle loads subsequent to very low probability primary coolant system pipe breaks. FSAR Section 3.6, Table 3.6-12, provides break locations on primary coolant piping. All primary loop breaks, except numbers 7, 9, 10 and 11 (longitudinal breaks) are limited area breaks. Restraints on other piping systems may effectively limit break areas, but no credit has been taken for reduced effects.

See revised FSAR Notes to Figure 3.6-12 for a list of break areas for primary coolant system breaks.

NRC Letter: December 5, 1983

Question No. Q210.19 (Section 3.6.2)

It is the staff's position that jet expansion is not acceptable when used to evaluate jet impingement forces due to saturated water or subcooled water blowdown. Justify your jet expansion model for saturated water blowdown or change your FSAR to conform to the staff's position.

Response:

Refer to revised FSAR Section 3.6.2.3 for the response to this question.

NRC Letter: December 5, 1983

Question No. Q210.20 (Section 3.6.2)

Provide assurance that 100 percent volumetric inservice examination of all pipe welds in the break exclusion zone will be conducted during each inspection interval as defined in IWA-2400, ASME Code, Section XI.

Response:

All pipe welds within the break exclusion zone, as described in FSAR Section 3.6 and FSAR Figures 3.6-8 through 3.6-17, will receive augmented examinations for the Preservice Examinations and Inservice Inspection Intervals as defined in ASME Section XI.

Augmented exams (surface and volumetric) will be performed on all welds in the break exclusion are on piping greater than 4 inches nominal pipe size.

Augmented exams (surface only) will be performed on all welds in the break exclusion area on piping of less than or equal to 4 inches nominal pipe size.

NRC Letter: December 5, 1983

Question No. Q210.21 (Section 3.6.2)

SRP 3.6.2 requires that an amplification factor of 1.1 should be used to establish the magnitude of the forcing function in order to determine the maximum reaction force of a restraint. If amplification factors less than 1.1 have been used, provide justification for their validity.

Response:

Amplification factors less than 1.1 are not used for final restraint design by energy balance analysis.

NRC Letter: December 5, 1983

Question No. Q210.22 (Section 3.6.2)

Provide the loads, load combinations, and stress limits that were used in the design of pipe rupture restraints. Include a discussion of the design methods applicable to the auxiliary steel used to support the pipe rupture restraint. Provide assurance that the pipe rupture restraint and supporting structure cannot fail during a seismic event.

Response:

Elastic components of pipe rupture restraints and auxiliary steel are designed to the loads, load combinations, and stress limits of SRP 3.8.3, as applicable. Energy absorbing components are designed to strain limits rather than limits on stress. These allowables are defined in FSAR Section 3.6.2.1.1.

The auxiliary steel is designed for seismic loads and typically is seismically rigid. Rupture loads for auxiliary steel are factored by an appropriate dynamic load factor, or this steel is included in the dynamic analysis of the restrained system.

Application of the above procedures assure that the rupture restraint and supporting structure cannot fail during a seismic event.

NRC Letter: December 5, 1983

Question No. Q210.23 (Section 3.6.2)

Provide the design criteria used for pipe rupture restraints that also support piping.

Response:

The dual purpose restraints are nonenergy absorbers and are designed to AISC (7th Edition) as amended by SRP 3.8.3, or to ASME III, Subsection NF (1974 Edition through Summer 1976 Addenda), as applicable.

NRC Letter: December 5, 1983

Question No. Q210.24 (Section 3.6.2)

Is there any unrestrained whipping pipe inside containment? If so, discuss how pipe whip and jet impingement effects were determined for those postulated breaks in the high energy piping that are not restrained (unrestrained whipping pipe). Provide the acceptance criteria for the impacted safety-related structures, systems, and components.

Response:

Unrestrained pipe whip is postulated inside containment. Structures, systems, and components targeted by the whipping pipe are assessed as essential or nonessential for the postulated initiating event.

The containment internal structures are heavily designed and may generally be subject to pipe whip and jet impingement loads. If not, rupture restraints are provided. The design procedure for pipes whipping into concrete is described in FSAR Section 3.6.2.2.7 and the acceptance criteria is described in FSAR Section 3.5.3.1.

The plant has emphasized separation between high energy piping and essential systems and components. Pipes are allowed to whip, without further justification, in zones where separation or enclosure is demonstrated.

Unrestrained pipe whip into safety-related structures, systems, or components is permitted in certain circumstances. For example, whipping pipes and the associated jet impingement from these pipes are allowed to impact other pipes of equal or greater diameter and wall thickness when function is dependent on pressure boundary. In other cases, the pipe whip impact and jet impingement loads will be evaluated in conjunction with other applicable design loads.

The acceptance criteria for impacted systems or components is in compliance with SRP 3.8.3 load case 6, or with the ASME III Code (applicable dates) for the faulted condition design limits in Appendix F.

In all cases of unrestrained pipe whip, the selection of targets recognizes that the whip path may be ill-defined.

NRC Letter: December 5, 1983

Question No. Q210.25 (Section 3.9.1)

a. Provide a schedule for completion of Table 3.9B-2 which lists the documents describing components requiring inelastic analysis.

b. Identify components for which inelastic analysis has been used.

c. If any, provide details of methods used.

Response:

a. Piping stress analysis information necessary to complete FSAR Table 3.9B-2 in its entirety will be available by June 1984.

b. Inelastic analysis has been used for two 3-inch charging line nozzles, four 3-inch high pressure safety injection nozzles, and 12 sets of circumferential as-welded butt welds.

c. The method of analysis is in accordance with NB-3228 and Code Case N-196-1. Geometries are checked for fatigue life and incremental collapse due to ratcheting for the specified number of severe stress cycles. A limit of 5 percent on the maximum accumulated strain is used to preclude the possibility of incremental collapse.

NRC Letter: December 5, 1983

Question No. Q210.26 (Section 3.9.2)

Regulatory Guide 1.122 requires that when floor response spectra curves are broadened that the lines bounding the peaks should be parallel to the lines forming the original spectrum peak. Provide justification for not using this method of broadening response spectra.

Response:

A description of the methodology for seismic analysis and its justification is provided in FSAR Section 1.8, Table 1.8-1 under the position for Regulatory Guide 1.122.

NRC Letter: December 5, 1983

Question No. 210.27 (Section 3.9.2)

On Page 3.7-21 of the FSAR, it is stated that all significant dynamic modes of responses under seismic excitation with frequencies less than 50 cps or modes less than 30, whichever is reached first, are included in the dynamic analysis. Provide assurance that all modes less than or equal to 33 hz have been included.

Response:

FSAR text reads "frequencies less than 50 cps or modes less than 50..."

Application of this criteria ensures that all significant system responses less than or equal to 33 Hz has been included.

NRC Letter: December 5, 1983

Question No. Q210.28 (Section 3.9.2)

Regulatory Guide 1.92 considers modes to be closely spaced if their frequencies differ from each other by 10 percent or less of the lower frequency. Provide assurance that this is the definition of closely spaced modes that has been used.

Response:

The definition of closely spaced modes for Millstone 3 is consistent with Regulatory Guide 1.92 (see FSAR Table 1.8-1).

NRC Letter: December 5, 1983

Question No. Q210.29 (Section 3.9.2)

Provide the basis used for the design of piping anchors which separate seismically designed piping and nonseismic Category I piping. Include in your discussion, the loads and load combinations used and how the local pipe wall stresses are considered.

Response:

Design Basis

To maintain the integrity of seismic portion of seismic/nonseismic interface, Millstone 3 design basis is to comply with Regulatory Guide 1.29. This is accomplished as follows:

1. For piping sizes 8 inch nominal pipe size and smaller, the next anchor beyond the outermost containment isolation valve, or beyond the valve providing the seismic to nonseismic transition (which may be inside containment), is designed to accommodate the maximum loads (plastic hinge) for which the piping on the nonseismic side of the restraint can transmit. An anchor may be a series of restraints which effectively act as an anchor.

2. Normally, larger than 8 inch nominal pipe size is seismically supported and analyzed to the anchor beyond the valve providing the seismic to nonseismic transition.

   Design of the anchor is based upon seismic loadings from the seismically analyzed side of the anchor multiplied by a factor of 3. These loads are integrated with other operational loadings (i.e., thermal expansion, deadweight, flow transients from both sides of the anchor, etc) to form total design loads for the anchor. Both OBE and SSE are considered.

In utilizing the above criteria, the nonseismic side of the interface anchor is reviewed to assure that it is adequately supported for the operational loads (i.e., thermal, deadweight, and fluid transient loads where applicable), and the supports are sufficient to limit the seismic load to the values compatible with the assumptions used above for arriving at the anchor design load.

The seismic/nonseismic anchor is evaluated to assure adequate structural design. The integrity of the pressure boundary is not of concern, including local pipe wall stresses, since piping beyond that interface anchor may have the pressure boundary compromised since it provides no safety function.

NRC Letter: December 5, 1983

Question No. Q210.30 (Section 3.9.2)

SRP 3.9.2 requires a list of systems to be included in the preoperational testing program. Our review cannot proceed without this information. Provide a schedule for the completion of Tables 3.9B-3 and 3.9B-4.

Response:

Refer to revised FSAR Table 3.9B-3. Table 3.9B-4 has been deleted from the FSAR. The information concerning Table 3.9B-4 will be included in detailed test procedures (FSAR Section 14.2.3.2) and will be available for all systems no later than 2 months prior to functional testing.

NRC Letter: December 5, 1983

Question No. Q210.31 (Section 3.9.2)

Provide the acceptance criteria that will be used to determine if the vibration levels observed or measured during the preoperational testing are acceptable. Specifically address how the vibration amplitudes will be related to a stress level and what stress levels will be used for both steady-state and transient vibration.

Response:

Vibration levels are observed or measured during preoperational testing for both steady state and transient vibration conditions. The programs used to monitor these conditions are described below.

Steady State Vibrations

Visual observations are used for judging acceptability of steady state vibration. Visual observations may be aided by hand-held instruments (e.g., vibrometers) when considered appropriate by engineers experienced in piping design.

A screening velocity or displacement will be established. If the measurement indicates that the velocity or displacement limit is exceeded, the measured values are reconciled with the respective analyses by considering the specific piping configuration, velocity or displacement amplitude measured, stress indices, and the endurance strength of the material properly accounting for the impact of high cycle effects. If system modifications are required, the applicable ASME design calculations are reconciled to assure acceptable system characteristics for all applicable design conditions.

Transient Vibrations

Transient vibration conditions are subjected to visual and instrumented observations as described in the response to NRC Question 210.30. When instrumented observations are taken, the acceptance criteria are based on the applicable fluid system transient analysis (stress, deflection, etc) results. Instrumented observations are considered acceptable if they are within the transient analysis results acceptance criteria. If instrumented results exceed the acceptance criteria, the results are reconciled with the design analysis. When system modifications are required to achieve acceptable levels of transient vibration, the ASME design calculations are reviewed and modified as necessary to assure acceptable system characteristics.

NRC Letter: December 5, 1983

Question No. Q210.32 (Section 3.9.2)

It is the staff's position that all essential safety-related instrumentation lines should be included in the vibration monitoring program during pre-operational or start-up testing. We require that either a visual or instrumented inspection (as appropriate) be conducted to identify any excessive vibration that will result in fatigue failure.

Provide a list of all safety-related small bore piping and instrumentation lines that will be included in the initial test vibration monitoring program.

Response:

Small bore piping and instrument lines potentially affected by steady state vibrations of large bore piping and components are monitored visually. Generally, this includes the portion up to and including the first support away from the connection to large bore piping or component. If observations suggest that other spans are being excited, further inspection would be conducted on a case by case basis.

The safety-related small bore piping and instrument lines that are included in the vibration test program will be identified in the detailed test procedures (FSAR Section 14.2.3.2). The list will be available for all systems no later than 2 months prior to hot functional testing.

NRC Letter: December 5, 1983

Question No. Q210.33 (Section 3.9.3)

The staff finds that there is insufficient information describing the design of safety-related HVAC ductwork and supports. Provide the design basis used for qualifying the HVAC ductwork and support structural integrity.

Response:

Design of safety-related duct is in accordance with SMACNA (Reference 1). Allowable combination of gage, stiffners, and joints and seams are governed by conformance to this document. Limited applications beyond these pressure ratings (-2 to +10 inches of water) are designed in accordance with similar engineering practice.

Safety-related HVAC ductwork is further restricted by the general requirements of seismic design and of Paragraph C.3.n of Regulatory Guide 1.52, Rev. 2. Regulatory Guide 1.52, as applicable, requires design of ductwork in accordance with ANSI/ASME N509-1976 Paragraph 5.10. Beyond the specific exception noted in Section 1.8 of the FSAR, additional exceptions are herewith noted regarding design factors.

1. Seismic duct is no thinner than 20 gage (an 18 gage minimum is required in Paragraph 5.10.4).

2. Allowable stress of .7 S_y (Paragraph 5.10.3.3) has been revised in the N509-1980 issue to be, "0.6 of the yield stress for loads encountered during normal operation and shutdown and shall be 0.9 of the yield stress for combined loads which include the safe shutdown earthquake and design basis tornado." Further, it is recognized that, for beamwise confirmation of ductwork, certain types of buckling occur which have the effect variously of either reducing allowable stress (round duct) or changing the effective moment of inertia (rectangular duct).

Seismic design of duct is facilitated by standards limiting spans to less than 16 feet. Each support typically provides at least transverse restraint (2 orthogonal directions). Axial restraint is provided at every third (or less) support.

Beamwise integrity of the ductwork is confirmed by computing the effective cross section under seismic plus deadweight loads. Duct fundamental frequencies are calculated and appropriate response loads determined assuming 7 percent equipment damping. Available test data available supports this assumption (Reference 2).

The design of seismically qualified duct supports is based upon the conservative presumption that peak resonant response transverse loads are generated by the ductwork system. Dynamic analysis of certain

ductwork systems has confirmed the use of a multiplier of 1.0 times the peak resonant response values for equivalent static design and analysis. System damping values ranging from 2.0 to 7.0 percent can be used as appropriate (References 2, 3, and 4). The duct system is regarded as rigid in its axial response direction: a conservative value of 2 g's is applied to the (up to) three spans of duct (this accounts for rigid range response and dead load associated with vertical duct). Duct support frames and anchor loads were found to be primarily affected by vibration mode characterized by side-to-side (transverse) motion of the duct system. From analytical results obtained for this mode in particular, design equations for frame section modulus were derived as a function of duct geometry, support spacing, and seismic response loading. Support from design was based upon satisfaction of AISC (7th edition) limits.

References:

1. High Pressure Duct Construction Standards (SMACNA). Sheet Metal and Air Conditioning Contractors National Association Inc. Third Edition, 1975.

2. TVA Report MA2-79-1. Summary Report for HVAC Ducts Seismic Qualification and Verification/Improvement Program. June 16, 1979.

3. FSAR Table 3.7B-1 - Damping Factors.

4. ERDA 76-21. Burchstead, C.A.; Kahn, J.E.; and Fuller, A.B. Nuclear Air Cleaning Handbook, Appendix D, Seismic Design and Qualification of ESF Air Cleaning Systems, p 277.

NRC Letter: December 5, 1983

Question No. Q210.34 (Section 3.9.3)

Provide the basis for assuming that ASME Code Class 1, 2 and 3 piping systems are capable of performing their safety function under all plant condition. Describe the methodology used to assure the functional capability of essential piping systems when service limits C or D are specified.

Response:

ASME III Classes 1, 2 and 3 piping systems are designed for all plant conditions in accordance with the ASME III code requirements as shown in FSAR Tables 3.9B-10, 3.9B-11, and 3.9B-12.

Numerous operating fluid transient events have occurred in operating nuclear power plants (NUREG-0582 and NUREG/CR-2059). Many of these events caused code allowable stresses to be exceeded, and some were severe enough to significantly damage piping and pipe supports. None of these events resulted in a loss of functional capability where the integrity of the pressure boundary was maintained. Other experiences, such as the effects of the 1979 Imperial Valley earthquake on the El Centro Steam Plant (NUREG/CR-1665), which did not cause any loss of functional capability although design to withstand earthquake was minimal and the earthquake was of high intensity, indicate that functional capability is, again, not a practical concern.

The difference between operating experience and academic concern is in part explained by a study of seismic design margins for piping (NUREG/CR-2137) where lower bound margins of 1.4 or greater indicated significant reserve strength when designed to ASME III rules. In addition, stresses are dominated by stress intensification factors which address fatigue strength of local areas, but are not indicative of the general state of stress in the piping system. Although ASME Level D stress limits theoretically permit gross yielding of piping while only protecting the pressure boundary, practical experience indicates otherwise. Failures of the pressure boundary have occurred due to unanticipated loads (e.g., waterhammer, vibration, etc) or corrosion/erosion, but gross yielding of an intact pressure boundary has not led to a loss of functional capability.

Functional adequacy of piping systems subjected to dynamic and earthquake loadings is adequately confirmed by an increasing body of published reports. However, the record is silent regarding postulated pipe ruptures. It is contended that conformance with plant arrangement requirements of SRP 3.6.1.and 3.6.2 (i.e., separation, enclosure, or restraint) effectively mitigates concerns regarding functional capability of essential systems, structures, or components.

The practice of reducing code allowable stresses to preclude theoretical gross yielding for very low probability loads may in fact reduce the overall safety and reliability of the piping system. Lower allowable stresses are achieved by additional pipe supports, and usually snubbers (which reduce dynamic stresses without increasing thermal or deadweight stresses), resulting in a stiffer system with higher stresses during normal plant operation, but theoretically lower stresses for the low probability design events applicable to Level D stress limits which are dynamic in nature. Additional pipe supports, particularly snubbers, and increased piping stiffness are often cited (e.g., NUREG/CR-2136 and S. H. Bush letter to N. J. Palladino of August 20, 1981) as sources of potential failures due to limiting access for maintenance and inservice inspection, difficulty in installation and proper adjustment, and higher stresses during normal plant operation.

The use of service limits C or D does not compromise the functional capability of ASME Code Classes 1, 2, and 3 piping systems because:

a. an increasing body of evidence confirms the general integrity (both pressure boundary and functional capability) of piping systems subjected to dynamic loading, and

b. proper conformance to NRC guidelines for protection against postulated piping failure mitigates this load case as a concern for essential piping systems.

NRC Letter: December 5, 1983

Question No. Q210.35 (Section 3.9.3)

Provide a discussion of the design considerations used for safety and relief valve loads and piping reactions. Include in your discussion (1) the basis for assuring that the valve end loads are acceptable, (2) the support arrangement for the affecting piping, and (3) the methodology used to calculate the hydraulic transient forces in the piping due to valve blowdown.

Response:

BOP Scope

FSAR Section 3.9B.3.3 describes the design considerations used for safety and relief valve loads and provides response to the three items noted above.

For large bore computer analyzed piping calculated piping reactions on the safety valve outlet nozzle will be reconciled for acceptability with the valve vendors.

NSSS Scope

Valve end loads acceptabliity:

For the 3-inch pressurizer power operated relief valves fabricated by Garrett and the 6-inch pressurizer safety valves fabricated by Crosby, the maximum nozzle loads are defined in the equipment specifications. These nozzle loads take into account all loads on the valve including fluid discharge loads. These nozzle loads are provided to the piping designer (SWEC) as interface criteria. If the specified valve nozzle loads are exceeded by the piping designer, the loads are then sent to Westinghouse for evaluation to determine their acceptability.

NRC Letter: December 5, 1983

Question No. Q210.36 (Section 3.9.3)

The staff review of FSAR Section 3.9B.3.4 and 3.9N.3.4 finds that there is insufficient information regarding the design of component supports. Per SRP Section 3.9.3, our review includes an assessment of design and structural integrity of the supports. The review addresses three types of supports: (1) plate and shell, (2) linear, and (3) component standard types. For each of the above three types of supports, provide the following information (as applicable) for our review:

(a) Describe for typical support details which part of the support is designed and constructed as component supports and which part is designed and constructed as building steel (NF vs AISC jurisdictional boundaries).

(b) Provide the complete basis used for the design and construction of both the component support and the building steel up to the building structure. Include the applicable codes and standards used in the design, procurement, installation, examination, and inspection.

(c) Provide the loads, load combinations, and stress limits used for the component support up to the building structure.

(d) Provide the deformation limits used for the component supports.

(e) Describe the buckling criteria used for the design of component supports.

Response:

BOP Scope

a. The reactor vessel support system (RVSS) is classified "plate and shell". It has been designed, fabricated, and installed in accordance with ASME III, Subsection NF. The RVSS bears on a concrete floor. Connection to building structure is by embedded thread rod, designed in accordance with NF.

All other nonintegral supports for ASME III equipment are linear types but can have component standard elements within the load path. These are designed, fabricated, and installed in accordance with ASME III/NF. For linear type supports, the jurisdictional boundaries are defined as follows:

- Attachment to embedded plates via welding to or bolting into embedded plates; the plate is per AISC and bolts or welds fall within NF jurisdiction.

- Grouted in surface mounted plates anchored by threaded embedded rods, rods (bolting), and nuts are in accordance with AISC. Surface plates are designed and fabricated in accordance with ASME III/NF but are defined as being outside the NF jurisdictional boundary.

b. Equipment supports are designed, fabricated, inspected, and installed in accordance with ASME III/NF. This includes the component standard support elements included in the load path except leveling devices on the RVSS and hydraulic snubbers on the steam generator and RCP supports. These exceptions were in accordance with ASME III to the greatest extent feasible. There are no occurrences of intervening building steel within the load path. Design criteria for building steel is in FSAR Section 3.8.

c. Loading combinations are in accordance with FSAR Section 3.9B.3.1.1 for Class 1 supports and Section 3.9B.3.1.2 for Classes 2 and 3 supports. Allowable stress is in accordance with ASME III NF-3100 for plate and shell, normal and upset conditions. For linear type supports, including component standard types within the load path, stress allowables are in accordance with ASME III, Appendix XVII for normal and upset conditions. Faulted condition allowables are in accordance with Appendix F.

d. All equipment supports are elastic. Deformation limits are not used.

e. For the RVSS, buckling for a cylindrical shell was considered.

   For linear type supports the buckling criteria is in accordance with ASME III, Appendix XVII-2220.

Millstone 3 pipe supports consist of linear and component standard types. Plate and shell type supports are not used for pipe support applications. The response to items (a) through (e) of the question as applicable to pipe supports are:

a. All linear type supports (except for dual function restraints described in response to NRC Question 210.23) and component standard supports within the load path are designed according to AISC code with the exceptions noted in Tables Q210.36-1 and Q210.36-2

b. All pipe supports (except for dual function restraints described in the response to NRC Question 210.23) are designed, fabricated, installed, and inspected in accordance

with AISC Code and with Tables Q210.36-1 and Q210.36-2. When pipe supports include integral welded attachments to pressure retaining boundaries, the integral welded attachments are designed, fabricated, installed, and inspected in accordance with the Code rules applicable to the pressure retaining members.

c. Loads and load combinations used for linear type pipe supports are described in Tables Q210.36-1, Q210.36-2, and Q210.36-3. The allowables are based on AISC Code and Tables Q210.36-1 and Q210.36-2. The loads, load combinations, and the corresponding allowables for designing integral welded attachments to pressure retaining boundaries are described in FSAR Section 3.9B.3, Tables 3.9B-10, 3.9B-11, and 3.9B-12.

d. All pipe supports are designed elastic. Deformation limits are not defined.

e. Buckling criteria used for pipe supports is in accordance with AISC Code, 7th Edition. (See Table Q210.36-4 for applicable AISC Code equations used for buckling check.)

NSSS Scope

a. Westinghouse has supplied supports only for those Class 2 and 3 components also supplied by Westinghouse to which the supports are attached. This equipment is divided into two groups.

The first group consists of auxiliary tanks and heat exchangers. The supports for these components are, for the most part, plate and shell type supports. These supports meet the requirements of Subsection NF of the ASME Code with the exception of the volume control tank supports, which, because of the procurement date, are designed to the requirements of the AISC Code. The FSAR will be amended to clarify this point by May 1984.

The second group consists of Class 2 and 3 auxiliary pumps. The supports for these pumps are linear type supports. The supports for the charging and safety injection pumps meet the requirements of Subsection NF of the ASME Code. Other auxiliary pump supports are designed by the pump manufacturer to pressure boundary stress limits, but in no case is yield stress exceeded. The FSAR will be amended to clarify the point by May 1984.

c. The loads and load combinations of the supports for the auxiliary equipment supplied by Westinghouse are the same as those of the supported component. These loads and load combinations are given in FSAR Table 3.9N-4

d. There are no permanent deformation limits for the supports for tanks, heat exchangers, or pumps since these supports are required to remain elastic. Additionally, the supports for active pumps must not deform such that specified critical clearances are maintained so that the pump remains operable. The clearances are specified in the pump specifications.

e. Buckling, for all auxiliary equipment supports, is prevented by maintaining the two thirds of critical buckling criteria.

TABLE Q210.36-1

LOAD CONDITIONS FOR LINEAR TYPE PIPING SUPPORTS (Except for Containment Spray Systems)(1)(2)

Plant Operating Condition	Load Conditions(3)	Allowable(4) Tensile Stress
Normal/Upset	D + T + R	0.6 S
	D + E + H + T + R + A + W	0.8 S
Faulted(5)	D + E' + H + A' + W	1.2 S or 0.7 S (6)

NOTES:

1. See Table Q210.36-2 for allowable tensile stress values for containment spray system pipe supports.

2. Containment spray system is comprised of the following:

   - recirculation (containment) spray piping
   - quench spray piping
   - portions of SIL/SIH piping

3. See Table Q210.36-3 for identification of loadings.

4. Buckling check is performed using the provisons of AISC Code, 7th Edition. (See Table Q210.36-4 for list of AISC Code equations used.)

5. For ANSI B31.1 piping, faulted conditions noted above do not apply; and under normal/upset condition, unless otherwise specified in applicable support summaries, loads due to seismic conditions are not considered. When seismic load becomes applicable, the allowable of 0.8 S is used as stated above.

6. The faulted allowables are based upon the guidance provided in Appendix XVII of ASME III, 1974 Edition.

TABLE Q210.36-2

LOAD CONDITIONS FOR LINEAR TYPE PIPING SUPPORTS FOR CONTAINMENT SPRAY SYSTEMS[1][2]

Plant Operating Condition	Load Conditions[3]	Allowable[4] Tensile Stress
Normal/Upset	D + T + R	0.6 S
	D + T + R + E + A + H + W	0.8 S
Faulted[5]	D + E' + H + W	0.8 S
	T + R' + A'	0.8 S

NOTES:

Refer to notes on Table Q210.36-1.

TABLE Q210.36-3

LOADING APPLICABLE TO PIPE SUPPORT DESIGNS
(See Tables Q210.36-1 and Q210.36-2)

D	-	Sustained mechanical loads including deadweight of piping, components, contents, and insulation
T	-	Loads due to thermal expansion of the system in response to average fluid temperature
R	-	Loads induced in the piping due to the thermal growth of equipment and/or structures to which the piping is connected as a result of plant normal or upset plant conditions.
R'	-	Loads induced in the piping due to the thermal and pressure growth of equipment and/or structures to which the piping is connected as a result of plant faulted conditions.
E	-	Inertia effects of the OBE.
E'	-	Inertia effects of the SSE.
A	-	Loads induced in the piping due to response of the connected equipment and/or civil structures to the OBE (commonly referred to as OBE anchor movements).
A'	-	Loads induced in the piping due to response of the connected equipment and/or civil structures to the SSE (commonly referred to as SSE movements).
H	-	Loads resulting from occasional loads other than seismic. Examples of these loads would be: water hammer, steam hammer, opening and closing of safety relief valves, etc.
Y	-	Effects of components striking pipe (pipe whip) or effects of blowdown of an adjacent system (jet impingement loads), as defined for the emergency plant condition.
W	-	Loads imposed by wind. (Wind load is not considered to occur concurrently with earthquake loads.)

TABLE Q210.36-4

AISC CODE EQUATIONS USED FOR BUCKLING CHECK
(Based on AISC Code, 7th Edition)

AISC Code Equation No.	Description
1.5.1.3.1	Axial compression when: $\frac{Kl}{r} < C$
1.5.1.3.2	Axial compression when: $\frac{Kl}{r} \geq C$
1.5.1.4.4	Bending minor axis and major axis.
1.6.1(a)	Axial compression plus bending.
1.6.2	Axial tension plus bending.

NRC Letter: December 5, 1983

Question No. Q210.37 (Section 3.9.3)

The staff's review of your component support design finds that additional information is required regarding the design basis used for bolts.

(a) Describe the allowable stress limits used in equipment anchorage, component supports, and flanged connections.

(b) Provide a discussion of the design methods used for expansion anchor bolts used in component supports.

Response:

BOP Scope

a. All bolting within the ASME III, NF jurisdictional boundaries, whether for equipment anchorage, support, or flange connection, is in accordance with ASME III, Appendix XVII and Code Case 1644. Bolt stresses are maintained below yield strength for all load combinations.

   Bolts for flange connections are designed in accordance with ASME III.

   All other bolts are per AISC (7th Edition) specifications.

b. Basic allowable values of shear and tension, including rules for consideration of interaction, are used based on manufacturers' test data and SWEC analysis.

   Performance specifications and testing assure a minimum safety factor of 4 against anchor failure.

The criteria for determining design load on anchor bolts consider base plate flexibility effects where applicable.

NSSS Scope

Westinghouse has no responsibility for bolting used for equipment anchorage. The only bolting for tanks and heat exchanger supports is on the regenerative heat exchanger. These bolts, as are any support bolts for the NF designed pump supports (charging and safety injection pumps; see response to Question 210.36), meet the requirements of ASME Code Case 1644. Any bolting on other pump supports are to pressure boundary limits, as are valve body-to-bonnet bolts. Flanged connections for Westinghouse supplied equipment are to the requirements of Appendix XI of the ASME Code.

NRC Letter: December 5, 1983

Question No. Q210.38 (Section 3.9.3)

Valves discs are considered part of the pressure boundary and as such should have allowable stress limits. Provide these limits for our review.

Response:

BOP Scope

Class 1 valve discs are designed such that the primary membrane stress intensity will not exceed S_m and the primary bending stress intensity will not exceed 1.5 S_m (NB-3546.2).

Class 2 and 3 valves are designed to ASME III. Structural integrity of the disc is assured by hydrostatic testing.

NSSS SCOPE

Westinghouse also considers valve discs as part of the pressure boundary. The valve discs are designed to the same pressure boundary code limits as those valves in which they are contained.

Specifically, stress limits for Class 1 valves (and discs) are contained in FSAR Table 3.9N-3. Stress limits for Class 2 and 3 valves (and discs) are contained in FSAR Table 3.9N-8.

NRC Letter: December 5, 1983

Question No. Q210.39 (Section 3.9.3)

Due to a long history of problems dealing with inoperable and incorrectly installed snubbers, and due to the potential safety significance of failed snubbers in safety related systems and components, it is requested that maintenance records for snubbers be documented as follows:

Pre-Service Examination

A pre-service examination should be made on all snubbers listed in Tables 3.7-4a and 3.7-4b of Standard Technical Specification 3/4.7.9. This examination should be made after snubber installation but not more than six months prior to initial system pre-operational testing, and should as a minimum verify the following:

(1) There are no visible signs of damage of impaired operability as a result of storage, handling, or installation.

(2) The snubber location, orientation, position setting, and configuration (attachments, extensions, etc.) are according to design drawings and specifications.

(3) Snubbers are not seized, frozen or jammed.

(4) Adequate swing clearance is provided to allow snubber movement.

(5) If applicable, fluid is to the recommended level and is not leaking from the snubber system.

(6) Structural connections such as pins, fasteners and other connecting hardware such as lock nuts, tabs, wire, and cotter pins are installed correctly.

If the period between the initial pre-service examination and initial system pre-operational test exceeds six months due to unexpected situations, re-examination of Items 1, 4, and 5 shall be performed. Snubbers which are installed incorrectly or otherwise fail to meet the above requirements must be repaired or replaced and re-examined in accordance with the above criteria.

Pre-Operational Testing

During pre-operational testing, snubber thermal movements for systems whose operating temperature exceeds 250°F should be verified as follows:

(a) During initial system heatup and cooldown, at specified temperature intervals for any system which attains operating temperature, verify the snubber expected thermal movement.

(b) For those systems which do not attain operating temperature, verify via observation and/or calculation that the snubber will accommodate the projected thermal movement.

(c) Verify the snubber swing clearance at specified heatup and cooldown intervals. Any discrepancies or inconsistencies shall be evaluated for cause and corrected prior to proceeding to the next specified interval.

The above described operability program for snubbers should be included and documented by the pre-service inspection and pre-operational test programs.

The pre-service inspection must be a prerequisite for the pre-operational testing of snubber thermal motion. This test program should be specified in Chapter 14 of the FSAR.

Response:

Refer to revised FSAR Table 14.2-1, Test Number 85, for the response to this question.

NRC Letter: December 5, 1983

Question No. Q210.40 (Section 3.9.3)

Provide the stress categories and limits for core support structures and include the applicable codes used for evaluation of the faulted condition?

Response:

Contractually, the Millstone 3 internals predate implementation of Subsection NG of the ASME Code. The internals were, however, fabricated to the requirements of Subsection NG with the exceptions that code stamps are not provided and a plant specific stress report is not being written (a generic stress report has been written).

FSAR Section 3.9N.5.4 outlines code limits and FSAR Table 3.9N-2 outlines loading combination used on the internals.

NRC Letter: December 5, 1983

Question No. Q210.41 (Section 3.9.3)

Does the design criteria for component supports in Millstone 3 systems categorize the stresses produced by seismic anchor point motion of piping and the thermal expansion of piping as primary or secondary? It is the staff's position that for the design of components supports, the stresses produced by seismic anchor point motion of piping and the thermal expansion of piping should be categorized as primary stresses.

Response:

BOP Scope

The design criteria for component supports in Millstone 3 systems does not categorize the stresses produced by seismic anchor point motion of piping and the thermal expansion of piping as primary or secondary.

Mechanical loads and thermal expansion loads produced by piping are combined and imposed upon the piping supports. Combined load effects on the supports are maintained within the limits provided in the response to NRC Question 210.36.

NSSS Scope

Westinghouse considers thermal loads and seismic anchor motions as primary stresses for Class 2 and 3 component supports.

As noted in FSAR Table 3.9N-4, load combinations for Class 2 and 3 component supports are specified and thermal expansion loads are included as part of the equipment nozzle loads specified by Westinghouse. The effects of equipment nozzle loads are translated to and evaluated as primary loads on the component supports.

Seismic anchor motions are included as part of the SSE loads specified in FSAR Table 3.9N-4. The SSE loads are also evaluated as part of the total component support load.

NRC Letter: December 5, 1983

Question No. Q210.42 (Section 3.9.6)

There are several safety systems connected to the reactor coolant pressure boundary that have design pressure below the rated reactor coolant system (RCS) pressure. There are also some systems which are rated at full reactor pressure on the discharge side of pumps but have pump suction below RCS pressure. In order to protect these systems from RCS pressure, two or more isolation valves are placed in series to form the interface between the high pressure RCS and the low pressure systems. The leak tight integrity of these valves must be ensured by periodic leak testing to prevent exceeding the design pressure of the low pressure systems.

Pressure isolation valves are required to be Category A or AC per IWV-2000 and to meet the appropriate requirements of IWV-3420 of Section XI of the ASME Code except as discussed below.

Limiting Conditions for Operation (LCO) are required to be added to the technical specifications which will require corrective action; i.e., shutdown or system isolation when the final approved leakage limits are not met. Also, surveillance requirements which will state the acceptable leak rate testing frequency shall be provided in the technical specifications.

Periodic leak testing of each pressure isolation valve is required to be performed at least once per each refueling outage, after valve maintenance prior to return to service, and for systems rated at less than 50 percent of RCS design pressure each time the valve has moved from its fully closed position unless justification is given. The testing interval should average to be approximately one year. Leak testing should also be performed after all disturbances to the valves are complete, prior to reaching power operation following a refueling outage, maintenance, etc.

The staff's present position on leak rate limiting conditions for operation must be equal to or less than 1 gallon per minute (GPM) for each valve to ensure the integrity of the valve, demonstrate the adequacy of the redundant pressure isolation function and given an indication of valve degradation over a finite period of time. Significant increases over this limiting value would be an indication of valve degradation from one test to another.

The Class 1 to Class 2 boundary will be considered the isolation point which must be protected by redundant isolation valves.

In cases where pressure isolation is provided by two valves, both will be independently leak tested. When three or more valves provide isolation, only two of the valves need to be leak tested.

Provide a list of all pressure isolation valves included in your testing program along with two sets of piping and instrument diagrams

which describe your reactor coolant system pressure isolation valves. Also discuss in detail how your leak testing program will conform to the above staff position.

Response:

Leak testing to verify leak tight integrity will be performed on the pressure isolation valves listed in Table Q210.42-1 once each refueling outage, but no less frequently than once every 2 years. Pressure isolation valves will be included in the Millstone 3 inservice testing program and categorized for inservice testing as Category A valves.

The Applicant has studied the NRC staff position that pressure isolation valves for systems rated at less than 50 percent of design pressure should be leak tested each time the valve is moved from its fully closed position. For Millstone 3, the affected systems are either equipped with relief valves designed to protect the low pressure portion of the system from any credible back leakage through the isolation valves, or with piping which is pressurized to a pressure greater than or equal to the RCS pressure during normal operation or accident conditions to effectively isolate the low pressure portion of the system from the RCS. Therefore, requiring testing in addition to that stated above would not significantly increase the safety of the systems involved.

The Applicant has reviewed the staff position on allowable pressure isolation valve leakage rates. In lieu of the NRC staff position limit of 1 gpm, NUSCO proposes that leakage rates of up to 5 gpm will be permitted with the following limitation:

> Leakage rates in excess of 1 gpm will be considered unacceptable if the latest measured leakage rate exceeds the rate measured during the previous test by an amount that reduces the margin between the measured leakage rate and the maximum permissible rate of 5 gpm by 50 percent or greater.

All pressure isolation valve pairs selected for examination are located at the boundary between Safety Class 1 and Safety Class 2. Each valve in the pressure isolation valve pairs will be separately leak tested.

Table Q210.42-1 contains a list of the Millstone 3 pressure isolation valves. In addition, four copies of the referenced piping and instrumentation diagrams will be submitted under separate cover showing the pressure isolation valves highlighted in blue.

TABLE Q210.42-1

MILLSTONE 3 PRESSURE ISOLATION VALVES

Valve Number	Description	P&ID/ Coordinates
3-SIL-V15	SI Tank 1A Discharge Isolation Valve	EM-112B/B-7
3-SIL-V17	SI Tank 1B Discharge Isolation Valve	EM-112B/E-7
3-SIL-V19	SI Tank 1C Discharge Isolation Valve	EM-112B/G-7
3-SIL-V21	SI Tank 1D Discharge Isolation Valve	EM-112B/J-7
3-SIL-V26	RHR/SI to RCS Loop 2, Hot Leg	EM-112A/K-8
3-SIL-V27	HPSI to RCS Loop 2, Hot Leg	EM-112A/J-7
3-SIL-V28	RHR/SI to RCS Loop 4, Hot Leg	EM-112A/K-8
3-SIL-V29	HPSI to RCS Loop 4, Hot Leg	EM-112A/J-9
3-SIL-V984	RHR/SI to RCS Loop 4, Cold Leg	EM-112B/L-8
3-SIL-V985	RHR/SI to RCS Loop 3, Cold Leg	EM-112B/J-9
3-SIL-V986	RHR/SI to RCS Loop 2, Cold Leg	EM-112B/G-9
3-SIL-V987	RHR/SI to RCS Loop 1, Cold Leg	EM-112B/D-10
3-SIH-V5	HPSI to RCS Cold Legs	EM-113A/J-4
3-SIH-V110	HPSI to RCS Loop 1, Hot Leg	EM-113B/K-10
3-SIH-V112	HPSI to RCS Loop 3, Hot Leg	EM-113B/K-9
3-RCS-V26	HPSI to RCS Loop 1, Hot Leg	EM-102A/J-8
3-RCS-V29	HPSI to RCS Loop [illegible] Leg	EM-113A/M-4
3-RCS-V30	LPSI to RCS L[illegible] Leg	EM-112B/L-9
3-RCS-V69	RHR/SI to RCS Loop 2, Hot Leg	EM-112A/L-7
3-RCS-V70	HPSI to RCS Loop 2, Cold Leg	EM-113A/M-5
3-RCS-V71	LPSI to RCS Loop 2, Cold Leg	EM-112B/L-9
3-RCS-V102	HPSI to RCS Loop 3, Hot Leg	EM-102B/B-3
3-RCS-V106	HPSI to RCS Loop 3, Cold Leg	EM-113A/M-2

TABLE Q210.42-1 (Cont)

Valve Number	Description	P&ID/ Coordinates
3-RCS-V107	LPSI to RCS Loop 2, Cold Leg	EM-112B/L-8
3-RCS-V142	RHR/SI to RCS Loop 4, Hot Leg	EM-112A/L-9
3-RCS-V145	HPSI to RCS Loop 4, Cold Leg	EM-113A/M-3
3-RCS-V146	LPSI to RCS Loop 4, Cold Leg	EM-112B/L-8

NRC Letter: December 5, 1983

Question No. Q210.43 (Section 3.9.6)

Provide a schedule for completion of your program for inservice testing of pumps and valves including any request relief from ASME Section XI requirements.

Response:

The Applicant is proposing to submit the Millstone 3 Inservice Testing (ISI) Program, including any relief requests, to the NRC no later than January 1, 1985.

Only the charging, letdown, and seal water system is systematically analyzed for pipe rupture, since it qualifies as a high energy system. Although the remaining systems function in conjunction with the charging and letdown lines, they are moderate-energy systems by definition.

Summaries for postulated pipe breaks, pipe whip analysis, and jet impingement effects for the charging, letdown, and seal water subsystems of the CHS are given in Tables 3.6-21 thru 3.6-29.

CHS Charging Lines:

Break Locations

Figures 3.6-15 thru 3.6-17 illustrate the design basis break locations. Pipe breaks are excluded between the containment penetration and the charging isolation valves. The stress distributions along the charging line in the break exclusion zone are below the break exclusion limit of 0.8 $(1.2S_h + S_A)$, thus satisfying the break exclusion criteria.

Separation

The charging lines inside and outside the containment fully meet the separation criteria, except the relatively short section that
210.10 connects to the reactor coolant system. Separation of the charging lines from the essential equipment is achieved as follows:

Each charging pump is isolated in a cubicle so that a piping failure in one cubicle will not affect the other pumps and their associated piping and valves.

A portion of the charging line inside the containment is enclosed within the regenerative heat exchanger cubicle and the continuing piping run in the annulus area is physically routed away from safety related essential equipment. Similarly, the charging lines in the auxiliary building are routed in an area which will preclude potential damage to essential equipment.

Pipe Whip Effects

Since the separation criterion is fully met in the regenerative heat exchanger cubicle, the annulus area, and in the auxiliary building, prevention of pipe whip to mitigate its consequential effects in these areas is unnecessary. Pipe restraints, however, are provided in the vicinity of the reactor coolant cold leg to protect the adjoining piping associated with the boron injection. Details of these restraints are discussed in the subsequent section.

Conclusion

Analysis is in progress; results will be provided as an amendment to the FSAR.

3.6.2 Determination of Break Locations and Dynamic Effects Associated with the Postulated Rupture of Piping

This section describes the design bases used for defining postulated pipe break and crack locations in high- and moderate-energy piping systems inside and outside of the containment, the methods of analysis used to evaluate the jet reaction forces at the break locations, and the jet impingement effects and loading effects on adjacent essential systems, components, and structures.

3.6.2.1 Criteria Used to Define Break and Crack Location and Configuration

Pipe breaks and cracks are postulated in those high- and moderate-energy piping systems located in proximity to essential systems, components, and structures required for the safe shutdown of the plant. All postulated breaks and cracks are systematically analyzed for potential damage to systems, components, and structures due to pipe whip, jet impingement, and environmental effects. If the damage is unacceptable, protective measures are provided either by rerouting of piping, relocation of essential equipment, or providing enclosures. Where this is not feasible, pipe whip restraints and/or jet impingement shields are installed to protect the essential systems, components, and structures.

Design basis break and crack locations, type, and orientation are postulated in accordance with the following sections.

3.6.2.1.1 Criteria for Inside Containment

Break Locations - ASME Section III Code Class 1 Piping

Breaks in ASME Section III Code Class 1 high-energy piping are postulated to occur at the following locations in each piping run or branch run:

1. At terminal ends of the pressurized portions of the runs (terminal ends are extremities of piping runs that connect to structures, components (e.g., vessels, pumps, valves) or pipe anchors. A branch connection to a main piping run is a terminal end of the branch run. However, if the branch run is included in the structural model with the main run, the connection need not be considered a terminal end for a branch run, and

2. At intermediate locations between terminal ends where either of the following criteria are exceeded: 210.11

a. At any intermediate locations between terminal ends where the maximum stress intensity ranges, for normal and upset plant conditions, and for a 1/2 safe shutdown earthquake (OBE) event transient exceed 2.4Sm (the design stress intensity as specified in Section III of the ASME Boiler and Pressure Vessel Code), calculated by either Equation 12 or Equation 13 in Paragraph NB-3653 of the ASME Code, Section III, or

b. At any intermediate locations between terminal ends where the cumulative usage factor U (the cumulative usage factor as specified in Section III of the ASME Boiler and Pressure Vessel Code), derived from the piping fatigue analysis under the loadings associated with OBE and operational plant conditions, exceeds 0.1.

As a minimum, there are at least two separated intermediate locations, selected on the basis of highest cumulative usage factor or stress intensity range, for each piping run or branch run. Each minimum break point is separated from the other break points by a change in direction of the pipe run.

Break Locations - ASME Section III Code Classes 2 and 3 Piping

210.12 Breaks in ASME Section III, Code Classes 2 and 3, high energy piping systems are not postulated at locations delineated in Section 3.6.2.1.2, Item 2. The portions of piping within the break exclusion zone are designed to meet the requirements of ASME Section III, Subarticle NE-1120 and the additional criteria specified in Section 3.6.2.1.2, Items 2a through 2f.

Breaks in ASME Section III Code Classes 2 and 3 high-energy piping are postulated to occur at the following locations in each piping run or branch run:

1. At terminal ends of the pressurized portions of the runs, and

2. At intermediate locations selected by either of the following criteria:

   a. At each pipe fitting (e.g., elbow, tee, cross, flange, and nonstandard fitting), welded attachment, and valve.

   b. At each location where the stress ranges associated with normal and upset plant conditions and a OBE event, calculated by Equations 9 and 10, Paragraph NC-3652 of the ASME Code, Section III, exceed 0.8 $(1.2S_h + S_A)$

   S is the stress calculated by the rules of NC-3600 and ND-3600 for Classes 2 and 3 components, respectively, of ASME Code Section III, 1971 edition up to and including the summer 1973 addenda. S_A is the allowable

stress range for expansion stress calculated by the rules of NC-3600 of ASME Code Section III, 1971 edition up to and including the summer 1973 addenda.

At least two separated locations are chosen on the basis of highest stress. Where the piping consists of a straight run without fittings, welded attachments, or valves, and all stresses are below 0.8 $(1.2S_h + S_A)$, a minimum of one location is chosen on the basis of highest stress.

3.6.2.1.2 Criteria for Outside Containment

High-Energy Piping Systems

1. Piping Systems Separated from Essential Structures, Systems and Components - A primary objective in the piping layout and plant arrangement is to have adequate separation, so that the effects of postulated pipe breaks at any location are isolated or physically remote from essential structures, systems, and components. Pipe breaks are not postulated in these separated high-energy piping systems.

2. Piping Systems Between Containment Penetrations and Isolation Valves (Break Exclusion Zone) - Breaks are not postulated in portions of high-energy piping between the first rupture restraint outboard of the isolation valve and the containment penetration. Portions of this piping outboard of the isolation valve, for which failure could affect the leaktight integrity of the containment structure, are provided with pipe whip restraints capable of resisting bending and torsional moments produced by the postulated piping failure outboard of the first restraint beyond the containment isolation valves. These restraints are located as close as practical to the containment isolation valves.

   The restraints are designed to withstand the loadings imposed by a postulated pipe rupture so that neither isolation valve structural integrity nor the leaktight integrity of the associated containment penetration will be impaired.

   The portions of piping within the break exclusion zone are designed to meet the requirements of ASME Code Section III, Subarticle NE-1120 and the following additional design requirements:

   a. The following design stress and fatigue limits should not be exceeded for Class 2 piping:

      - The maximum stress ranges as calculated by Equations 9 and 10 in Paragraph NC-3652, ASME Code, Section III, considering normal and upset plant conditions (i.e., sustained loads, thermal

expansion and a 1/2 SSE event) do not exceed 0.8 $(1.2S_h + S_A)$.

- The maximum stresses as calculated by Equation 9 in Paragraph NC-3652 under the loadings resulting from a postulated piping failure beyond these portions of piping do not exceed $1.8S_h$.

b. Welded attachments, for pipe supports or other purposes, to these portions of piping are avoided.

c. The number of circumferential and longitudinal piping welds and branch connections are minimized.

d. The length of these portions of piping is reduced to the minimum length practicable.

e. The design of pipe anchors or restraints (e.g., connections to containment penetrations and pipe whip restraints) does not require welding directly to the outer surface of the piping (e.g., flued integrally forged pipe fittings are used) except where such welds are capable of 100-percent volumetric inservice inspection. This criterion is also applicable to the portion of piping between the containment and the inside containment isolation valves.

f. For these portions of high-energy piping, inservice examination will be performed in accordance with the requirements specified in ASME Code, Section XI. In addition, 100-percent volumetric examination of circumferential and longitudinal pipe welds is required on the portions of high-energy piping between the first isolation valve outside containment and the first rigid pipe connection to the containment penetration or first pipe whip restraint inside containment. Details of containment penetration, identification of pipe welds, access for inservice inspection, and points of fixity and discontinuity are provided in Section 6.6.

3. Piping Systems Outboard of Isolation Valves

Breaks in ASME Section III Code Classes 2 and 3 high-energy piping are postulated at the following locations in each piping and branch run outboard of isolation valves and beyond first pipe whip restraint (except those portions of piping systems identified in Section 3.6.2.1.2, Items 1 and 2:

a. At terminal ends of the pressurized portions of the runs, and

b. At intermediate locations selected by either of the following criteria:

- At each pipe fitting (e.g., elbow, tee, cross, and nonstandard fitting) welded attachment and valve or, if the run contains no fittings, at one location at each extreme of the run (a terminal end, if located within a protective structure, may substitute for one intermediate break) or

- At each location where the stresses exceed 0.8 $(1.2S_h + S_A)$. At least two separated locations are chosen on the basis of highest stress. In the case of straight pipe run without any pipe fittings, welded attachments, or valves and stresses below 0.8 $(1.2S_h + S_A)$, a minimum of one location chosen on the basis of highest stress.

Breaks in nonnuclear safety class high-energy piping are postulated at the following locations in each piping run or branch run:

1. At terminal ends of the pressurized portions of the runs, and

2. At intermediate locations selected by either of the following criteria:

   a. At each pipe fitting, welded attachment, and valve, or

   b. At each location where the stress ranges associated with normal and upset plant conditions and a 1/2 SSE event, calculated by Equations 9 and 10, paragraph NC-3652 of ASME Section III exceed 0.8 $(1.2\ S_h + S_A)$. As a minimum, two separated locations are chosen on the basis of highest stress. In the case of a straight pipe run without any pipe fittings, welded attachments, or valves and stresses below 0.8 $(1.2\ S_h + S_A)$, a minimum of one location is chosen on the basis of highest stress. 210.13

Moderate-Energy Piping Systems

For the purpose of satisfying the separation provisions of plant arrangement, a review of the piping layout and plant arrangement drawings is conducted to show that the effects of through-wall leakage cracks at any location are isolated or physically remote from essential systems, components, and structures.

Leakage cracks are not postulated in those portions of ASME Section III Code Class 2 piping between isolation valve and containment penetration provided they meet the requirements of ASME Code Section III, Subarticle NE-1120, and are designed such that the maximum stress range (as calculated by Equations 9 and 10, paragraph NC-3652 of Section III of the ASME Code) does not exceed 0.4 $(1.2S_h + S_A)$.

Through-wall leakage cracks are postulated in moderate-energy piping except where exempted by Moderate-Energy Piping Systems under Section 3.6.2.1.2, or where the maximum stress range in these portions of ASME Section III Code Class 2 or 3 piping is less than 0.4 $(1.2S_h + S_A)$, or where the maximum thermal expansion stress in these portions of non-nuclear piping is less than $0.4S_A$. The cracks are postulated to occur individually at locations that result in the maximum effects from fluid spraying and flooding. Only environmental effects developed from these cracks are considered.

Cracks are not postulated in moderate-energy piping location in an area in which a break in high-energy piping occurs. Where a postulated leakage crack in the moderate-energy piping results in more limiting environmental conditions than the break in proximate high-energy piping, the provisions of the previous paragraph are applied.

Through-wall leakage cracks instead of breaks are postulated in the piping of those fluid systems that qualify as high-energy systems for only short operational periods, but qualify as moderate-energy systems for the major operational period.

An operational period is considered short if the fraction of time that the system operates within the pressure-temperature conditions specified for high-energy systems is less than 2 percent of the time that the system operates as a moderate-energy system (e.g., systems such as the reactor residual heat removal systems qualify as moderate-energy systems); however, systems such as auxiliary feedwater systems operated during reactor startup, hot standby, or shutdown, qualify as high-energy systems.

3.6.2.1.3 Design Basis Break/Crack Types and Orientation

Circumferential Pipe Breaks

The following circumferential breaks are postulated in high-energy piping at the locations specified in Sections 3.6.2.1.1 and 3.6.2.1.2:

1. Circumferential breaks are postulated in high-energy piping runs and branch runs exceeding a nominal pipe size of 1 inch. When the maximum stress range or usage factor exceeds the limits specified for break postulation, and if it is determined by detailed stress analysis, that the maximum stress range in the circumferential direction is at least 1.5 times that in the axial direction, then only longitudinal breaks will be postulated.

2. Where break locations are selected at pipe fittings without the benefit of stress calculations, breaks are postulated at the piping weld to each fitting, valve, or welded attachment. If detailed stress analyses or tests are performed, the maximum stressed location in the fitting may be selected instead of the pipe-to-fitting weld.

3. Circumferential breaks are assumed to result in pipe severance and separation amounting to a one-diameter lateral displacement of the ruptured piping sections unless physically limited by piping restraints, structural members, or piping stiffness as may be demonstrated by inelastic analysis.

4. The dynamic force of the jet discharge at the break location is based on the effective cross-sectional flow area of the pipe and on a calculated fluid pressure as modified by a thrust coefficient. Limited pipe displacement at the break location, line restrictions, flow limiters, positive pump-controlled flow, and the absence of energy reservoirs are taken into account as applicable, in the reduction of jet discharge.

5. Pipe whipping is assumed to occur in the plane defined by the piping geometry and configuration, and is assumed to cause pipe movement in the direction of the jet reaction.

Longitudinal Pipe Breaks

The following longitudinal breaks are postulated in high-energy piping at the locations of each circumferential break specified under Circumferential Pipe Breaks in this section, except as noted:

1. Longitudinal breaks in piping runs and branch runs are postulated in nominal pipe sizes 4 inches and larger. However, when the maximum stress range or usage factor exceeds the limits specified for break postulation and if it is determined by detailed stress analysis that the maximum stress range in the axial direction is at least 1.5 times that in the circumferential direction, then only a circumferential break will be postulated.

2. Longitudinal breaks are not postulated at terminal ends or intermediate locations where the criterion for a minimum number of break locations must be satisfied.

3. Longitudinal breaks are assumed to result in an axial split without pipe severance. Splits are located (but not concurrently) at two diametrically opposed points on the piping circumference such that a jet reaction causing out-of-plane bending of the piping configuration results. Alternately, a single split may be assumed at the section of highest stress as determined by detailed stress analysis.

4. The dynamic force of the fluid jet discharge is based on a circular break area equal to the effective cross-sectional flow area of the pipe at the break location, and on a calculated fluid pressure modified by an analytically or experimentally determined thrust coefficient as determined for a circumferential break at the same location. Line restrictions, flow limiters, positive pump-controlled flow,

and the absence of energy reservoirs are taken into account, as applicable, in the reduction of jet discharge.

5. Pipe movement is assumed to occur in the directions defined by the stiffness of the piping configuration and jet reaction forces, unless limited by structural members or piping restraints.

<u>Through-Wall Leakage Cracks (outside of containment only)</u>

The following through-wall leakage cracks are postulated in moderate-energy piping at the locations specified under Moderate-Energy Piping Systems in Section 3.6.2.1.2, item 3.

1. Cracks are postulated in moderate-energy piping runs and branch runs exceeding a nominal pipe size of 1 inch.

2. Fluid flow from a crack is based on a circular opening of area equal to that of a rectangle one-half pipe diameter in length and one-half pipe wall thickness in width.

3. The flow from the crack is assumed to result in an environment that wets all unprotected components within the compartment, with consequent flooding in the compartment and communicating compartments. Flooding effects are determined on the basis of a conservatively estimated time period required to effect corrective actions.

3.6.2.1.4 Conformance with Regulatory Guide 1.46

Refer to Section 1.8 for this information.

3.6.2.2 Analytical Methods to Define Forcing Functions and Response Models

3.6.2.2.1 Introduction

Pipe whip rupture analyses include calculations to determine the fluid forces generated by blowdown of pressurized lines, complemented by dynamic or energy-balance methods to determine pipe motion and impact effects. Restraints for lines 6 inches and less in diameter are usually qualified on a generic basis using an energy balance method. However, restraints for larger lines are normally engineered individually for each system, using standard design concepts. The response of unrestrained lines is analyzed by either inelastic dynamic analysis or energy balance analysis. Figure 3.6-19 provides a flowchart for the pipe rupture analysis.

Criteria for the pipe rupture response analysis include:

1. An analysis of the pipe run or branch is performed for each postulated longitudinal and circumferential rupture or, alternatively, for a worst case. Worst cases are selected

on the basis of gap, fluid force, and piping system stiffness.

2. The loading condition of a pipe run or branch prior to postulated rupture in terms of internal pressure, temperature, and stress state is that condition associated with reactor operation at 100-percent power.

3. For a circumferential rupture, pipe whip dynamic analyses are only performed for that end (or ends) of the pipe or branch that is (are) connected to a contained fluid energy reservoir having sufficient capacity to develop a jet stream.

4. Dynamic analytical methods, used for calculating the piping or piping/restraint system response to the jet thrust developed after a postulated rupture, account for the effects of the following:

   a. Mass, inertia, and stiffness properties of the system

   b. Impact and rebound (if any) as permitted by gaps between piping and restraint

   c. Elastic and inelastic deformation of piping and/or restraint

   d. Support boundary conditions

5. An allowable design strain limit of 0.5 ultimate uniform strain of the restraints is used for energy-absorbing components. For compressive energy absorbing components, the following deformation limits are used:

   a. The design limit for pipe crush bumpers shown on Figure 3.6-30 and metallic honeycomb is 80 percent of energy absorbing capacity.

   b. The design limit for pipes crushed uniformly along their length is the lesser of: 210.14

      1. one half of the pipe diameter, or

      2. the maximum flattening limits as prescribed by ASTM A530.

   The above deformation limits assure that the area under the essentially flat portion of the materials force-deflection curve is not exceeded.

6. A 10-percent increase of minimum specified yield strength (S_y) may be used to account for strain rate effects in inelastic nonlinear analyses. Alternatively, experimental

data may be used to determine the strain rate parameters for use in nonlinear codes which monitor strain rate.

3.6.2.2.2 Time Dependent Blowdown Force

Blowdown force calculations are based on methods suggested by Moody (1973) and include consideration of the transient pressures, velocities, and other thermodynamic properties of the fluid. To provide the time history of pressure, velocity, etc., the method of characteristics is used to solve the continuity and momentum equations simultaneously. A general description of the method can be found in gas dynamics textbooks (De Haller 1945, Rudinger 1969, Owzarek 1968). For these one-dimensional fluid mechanics analyses, the pipe run is treated as an equivalent section of straight pipe. The calculated momentum and pressure forces are applied at changes in direction or cross section of the piping to provide time-dependent loads for pipe dynamic analysis.

The transient forces result from wave propagation and fluid momentum. It is assumed that pipe bends and elbows neither attenuate the traveling pressure waves nor cause reflections. Immediately following the rupture of a pipe, a decompression wave travels from the break at the speed of sound relative to the fluid. The fluid ahead of and behind the wave is at different thermodynamic states. This initial blowdown condition is maintained until a return signal from the pressure reservoir reaches the break. At this time, repeated wave reflections between the reservoir and break prevail until a steady-state flow condition is established. Boundary conditions that govern the flow at the break are considered.

Fluid momentum changes will result in dynamic forces being exerted on pipe segments. The forcing function is calculated as follows:

$$F = (P - P_a)\,A + \frac{\dot{m}u}{g} = \left[(P - P_a) + \frac{Ru^2}{144g}\right]A \qquad (3.6.2.2\text{-}1)$$

where:

P = Local static pressure (psia)

P_a = Ambient pressure (psia)

R = Fluid density (lb_m/ft^3)

u = Velocity of blowdown fluid (fps)

A = Local flow cross-sectional area (in^2)

g = Gravitational acceleration (32.2 fps^2)

$\dot{m}$ = Mass flow rate (lb_m/sec)

During the blowdown process, the local static pressure, mass flow rate, and other thermodynamic properties change with time; therefore, the forcing function varies with time.

3.6.2.2.2.1 Subcooled Nonflashing Waterline Blowdown

When a pipe rupture occurs, the blowdown flow rate and properties must go from an initial set of conditions to the final or steady state condition. A decompression wave travels upstream toward the pressure source. The initial blowdown velocity can be calculated by applying the momentum equation across the wave:

$$RC \quad \Delta u = g \, \Delta P \qquad (3.6.2.2\text{-}2)$$

$$(u - o) = 144g \, (P_o - P_a)/RC \qquad (3.6.2.2\text{-}3)$$

where:

C = The speed of sound (fps)

P_o = The initial blowdown thrust (psia)

where:

T_{i1} and T_i = Any two consecutive oscillator periods

T_i/T_{i-1} = The period ratio (ratio between the i^{th} period, T_i, and the (i-1) period, T_{i-1}).

3.7B.1.3 Critical Damping Values

The values of the percentage of critical damping used in the analysis
of Seismic Category I structures, systems, and components depends on
220.17 the stress levels resulting from the seismic input motion (SSE or
OBE) used in the analysis.

The values of damping used for the input motion are listed in Table 3.7B-1. Structural damping is assigned to be 2.0 percent for the OBE and 5.0 percent for the SSE.

The higher damping values (Table 3.7B-1) are used only where justified by detailed study (either testing or calculated stress levels). Damping values utilized in the analysis of Seismic Category I structures, systems, and components are conservative with regard to Regulatory Guide 1.61 which does apply as described in Section 1.8.

3.7B.1.4 Supporting Media for Seismic Category I Structures

The founding materials for major plant structures are listed in
Table 2.5.4-14. Most of the major safety related structures are
founded on bedrock, with the exception of the control building,
7 emergency diesel generator building, and the hydrogen recombiner
building. The control building is founded on 1 to 4 feet of
compacted structural backfill overlying basal till of thickness
varying between 1 foot on the east side and 15 feet on the west. The
emergency diesel generator building is founded on basal till varying
in thickness from less than 10 feet to 30 feet overlying bedrock.
7 The hydrogen recombiner is founded on concrete fill overlying
bedrock.

A large portion of the circulating water discharge tunnel and the service water intake lines are founded on bedrock. However, some sections are founded on soil, particularly near the intake and discharge points in the vicinity of Niantic Bay. When soil was encountered as a founding material, all unsuitable overburden was removed to sound ablation or basal till. In the event that the invert elevation was higher than the excavated grade, compacted structural backfill was placed in thin lifts to the subgrade elevation in accordance with procedures described in Section 2.5.4.5.2.

NOTES TO FIGURE 3.6-12
PRIMARY COOLANT PIPING BREAK OPENING AREAS

Break No.	Type	Break Areas, In.^{2} Loop Forces (Full Area)	Computed(1)	Asymmetric Pressure(2)
1	G	2 x 661	50	100
2	G	2 x 594	90	100
3	G	2 x 755	80	196
4	G	2 x 755	425	500
5	G	2 x 755	160	500
6	G	2 x 594	40	120
7	G	661	-	707
8	G	2 x 755	140	500
9	S(3)	87	-	2 x 98
10	S(3)	60	-	2 x 60
11	S(3)	98	-	2 x 98

210.18

NOTES:

1. Maximum break opening area calculated for full area forcing function and considering displacement limitation due to rupture restraints.

2. Area used for mass and energy release rates - arbitrarily larger than computed separation area.

3. Branch line guillotine at nearest weld to RCL.

where:

P = System pressure prior to pipe break

A = Pipe break area

K = Jet coefficient (theoretical maximum)

The following K values are:

a. 1.26 for saturated steam, saturated water, and steam/water mixtures blowdown (presented in 3.6.2.2.2).

b. 2.00 for nonflashing subcooled water blowdown (presented in 3.6.2.2.2).

3. In calculating the jet impingement load on an object or target, the retarding action of the surrounding air along the jet path is neglected. The jet impingement pressure on the target is calculated by taking the jet force as being constant at all distances from, and normal to, the break area and by assuming that the jet stream diverges conically at a solid angle of 20 degrees for steam or water-steam mixtures. For those cases where the 20-degree divergence assumption is shown to be unnecessarily conservative for the blowdown of steam or steam-water mixtures, Moody's
210.19 asymptotic jet expansion model is utilized (Moody 1969). Jet expansion is not applicable to cases involving saturated water or subcooled water blowdown which are below the saturation temperature at the corresponding ambient pressure beyond the break.

4. The proportion of the total jet force acting on a target is determined from the fraction of the jet intercepted and by the shape factor of the target. For a target with flat surface area normal to the center axis of the jet stream, the load is the product of the impingement pressure at the target and the intercepted jet area. In those cases where the target area is such that the intercepted jet stream is deflected rather than totally stopped, a shape factor which is less than unity and is a function of the target geometry is used in calculating the total jet impingement load. For a 20-degree divergence angle and target at a distance x, the pressure intensity at the target is:

$$P = P_1\left(\frac{d_1}{d_1 + 2x \tan 10}\right)^2 \qquad (3.6.2.3\text{-}2)$$

where:

P_1 = Pressure intensity at the source (psi)

d_1 = Diameter of the assumed circular break area (inch)

x = Normal distance between the break and the target (inch)

Since the jet impingement force is a dynamically applied load, the target is analyzed either by static methods using an appropriate dynamic load factor, or dynamically using elastic or inelastic structural response codes (Section 3.8.3.3). The load combinations and design allowables are given in Sections 3.8.3 and 3.9.

3.6.2.3.1 Pipe Rupture Restraints

Two basic restraint types are used, elastic and energy-absorbing. Elastic restraints are generally used where displacements subsequent to a postulated pipe rupture must be minimized to restrict the break opening area, limit loads in the broken piping run, limit the pipe movement to protect some equipment, or to limit pressure buildup to minimize external loading on structures and equipment. Energy-absorbing restraints are used where the primary objective is to dissipate the kinetic energy of a ruptured pipe and prevent unrestricted pipe whip.

Elastic Restraints

Since elastic restraints are used to minimize displacements of the broken pipe, they are close-gapped. For some applications, this requires that they contact the pipe during conditions other than a postulated rupture, in which case they are also designed as a pipe support. If an elastic restraint contacts the pipe following a rupture, it is designed according to the criteria for structural steel (Section 3.8.3) which in effect limits stresses to the elastic range.

Energy-Absorbing Restraints

Several approaches are used for energy absorption in pipe rupture restraints. In tension, stainless steel studs or straps are used, with a design limit of 50 percent of uniform ultimate strain. In compression, honeycomb panels or crushable pipes are used. The design limit for crushable energy absorbing components is defined in Section 3.6.2.2.1, Item 5. 210.14

Elastic intermediate structures of energy-absorbing restraints are designed to the criteria for structural steel (Section 3.8.3).

1. Pipe Crush Bumper - The pipe crush bumper absorbs impact energy in a direction toward the supporting structure. The energy absorber is a length of pipe placed normal to the axis of the process pipe. Subsequent to a rupture, the

bumper pipe is crushed between its support structure and the moving process pipe. Energy is absorbed by deformation of the bumper pipe which forms a retaining recess in the bumper pipe. The bumper pipe is mechanically attached to its support by welding or bolting (Figures 3.6-29 and 3.6-30).

2. Laminated Strap Restraint - The laminated strap restraint is capable of absorbing impact loads in the outward direction from the supporting structure (Figure 3.6-22). The energy-absorbing component is a "U" shaped strap consisting of multiple strips (number and geometry depending on energy to be absorbed) of highly ductile material.

   This laminated design exhibits great flexibility in application. The design minimizes bending strains, permitting the strap to act mainly as a membrane during the postulated rupture event.

3. Omni-Directional Restraint - The omni-directional restraint is capable of absorbing impact loads applied in any direction in the plane of the restraint (Figure 3.6-31). This restraint consists of a base weldment, an arch, ductile stainless steel holddown studs on each side of the base weldment, and a honeycomb panel. The primary function of the studs is to absorb impact energy in tension. The honeycomb panel absorbs energy from impact loads acting in an inward direction. Side load impacts are absorbed by the combined action of the studs and honeycomb.

   Combinations of pipe crush bumpers and laminated straps are used to achieve energy absorption over a range of impact directions up to a full 360 degrees.

3.6.2.4 Guard Pipe Assembly Design Criteria

Guard pipes were not used on Millstone 3.

3.6.2.5 Material to be Submitted for the Operating License Review

Material required to be submitted in the FSAR has been incorporated
7 into the text of 3.6.1 and 3.6.2 to provide a coherent presentation of the requirements.

Since the analysis for high and moderate energy piping is still in progress, conclusions for pipe rupture events will be submitted in a future amendment.

3.6.3 References for Section 3.6

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TABLE 3.9B-2

LIST OF MNPS-3 DOCUMENTS DESCRIBING COMPONENTS REQUIRING INELASTIC ANALYSIS

	Component Description	Assoicated MNPS-3 PPG System & Component Location	Document Providing Details of Analysis
	3 in. Charging Nozzle on RC Loop	RC Loop 1 & 3RCS-003-149-1 EP 74B (H-8)	Teledyne Engineering Services Report TR 2658-21
	3 in. Charging Nozzle on RC Loop	RC Loop 4 & 3RCS-003-145-1 EP 74B (E-8)	Teledyne Engineering Services Report TR 2658-21
	3 in. Safety Injection Nozzle on RC Loop	RC Loop 1 & 3RCS-003-121-1 EP 108A (I-4)	Teledyne Engineering Services Report TR 2658-22
210.25	3 in. Safety Injection Nozzle on RC Loop	RC Loop 2 & 3RCS-003-133-1 EP 108B (G-7)	Teledyne Engineering Services Report TR 2658-22
	3 in. Safety Injection Nozzle on RC Loop	RC Loop 3 & 3RCS-003-139-1 EP 108C (C-7)	Teledyne Engineering Services Report TR 2658-22
	3 in. Safety Injection Nozzle on RC Loop	RC Loop 4 & 3RCS-003-147-1 EP 108D (C-5)	Teledyne Engineering Services Report TR 2658-22
	12 sets of Circumferential Butt Welds (as welded)	Later (6-1-84)	SWEC Calculation 12179-NP(B)-199-x

3.9B.2 Dynamic Testing and Analysis

3.9B.2.1 Preoperational Vibration and Dynamic Effects Testing on Piping

A preoperational vibration, thermal expansion (in discrete temperature step increments), and dynamic effects testing program will be conducted on:

1. ASME Code Class 1, 2, and 3 piping systems
2. High energy piping systems inside Seismic Category I structures
3. High energy portions of systems whose failure could reduce the functioning of any Seismic Category I plant feature to an unacceptable level
4. Seismic Category I portions of moderate-energy piping systems located outside containment. The purpose of the tests is to confirm that these piping systems, restraints, components, and supports have been designed adequately to withstand the flow-induced dynamic loadings under operational transient and steady-state conditions anticipated during service and to confirm that normal thermal motion is not restrained.

A list of the systems and the types of tests being conducted is contained in Table 3.9B-3. The different flow modes of operation and transients to which each system will be subjected during the tests are contained in Chapter 14. The test titles, test prerequisites, test objectives, and summary of testing are also described in Chapter 14. For each system defined in items 1 through 4, all flow modes of operation that the systems are subjected to during the tests will be visually observed where accessible. In addition, systems that were stress analyzed for fluid flow instabilities will have instrumented measurements at selected locations for the specific flow modes analyzed. The measured results will be compared to the analytically predicted values. Instrumented measurements will also be conducted (as needed) for all other systems and conditions. For ASME Code Class 1, 2, and 3 piping systems, design and supervision of the tests, definition of acceptance critieria, evaluations of test results, and the making of any changes in the piping system necessary to ensure that the piping is adequately designed and supported, are performed as required by Section III of the ASME code.

210.30 If vibrations are observed which from visual examination appear to be excessive in the opinion of experienced engineers who will supervise, conduct, and witness the various tests, then either:

TABLE 3.9B-3

PREOPERATIONAL TESTS

System Code	System Title	Reg. Guide 1.68, Rev. 2 Classification[2]	Types of Tests[1]		
			Thermal Expansion	Transient Vibrations	Steady State Vibrations
PGS	Primary Grade Water	A,D	NR[3]	NR	V[4]
IAS	Instrument Air	A,D	NR	NR	V
GSN	Nitrogen System	A,3	NR	V&I	V
CCE	Charging Pump Cooling		NR	V&I[5]	V
SWP	Service Water	A,D	NR	V&I	V
WTC	Water Treating - Chlorination	A	NR	NR	V
CHS	Chemical and Volume Control	A,B,A1	V&I	V&I	V
CCP	Reactor Plant Component Cooling	A,D	NR	V&I	V
EGF	Emergency Diesel Fuel	A,A1	NR	NR	V
CDS	Chilled Water	A,D	NR	V&I	V
EGA	Air Startup Emergency Diesel	A	V	NR	V
EGD	Emergency Generator Exhaust and Combustion Air	A	V	NR	V

210.30

TABLE 3.9B-3 (Cont)

System Code	System Title	Reg. Guide 1.68, Rev. 2 Classification[2]	Types of Tests[1] Thermal Expansion	Transient Vibrations	Steady State Vibrations
EGS	Emergency Diesel Jacket and Intercooler Water	A	NR	NR	V
MSS	Main Steam	A,B	V&I	V&I	V
DTM	Turbine Plant Miscellaneous Drains	A	V	NR	V
QSS	Quench Spray	A,D	NR	V&I	V
CCI	Safety Injection Pump Cooling	A,A1	NR	NR	V
HVC	Air Conditioning - Control Building	A	NR	NR	V
HVK	Chilled Water - Control Building	A	NR	V	V
SIH	Safety Injection - High Pressure	A,B	NR	V&I	V
FWS	Feedwater	A,B	V&I	V&I	V
FWA	Auxiliary Feedwater	A,B,A1	NR	V&I	V
RHS	Residual Heat Removal	A,B,D	V&I	V&I	V
SIL	Safety Injection - Low Pressure	A,B	V&I	V&I	V
RCS	Reactor Coolant	A	V&I	V&I	V
BDG	Steam Generator Blowdown	A,B	V&I	V&I	V

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TABLE 3.9B-3 (Cont)

System Code	System Title	Reg. Guide 1.68, Rev. 2 Classification[2]	Types of Tests[1] Thermal Expansion	Transient Vibrations	Steady State Vibrations
DAS	Reactor Plant Aerated Drains	A,D	V	NR	V
SGF	Steam Generator - Chemical Feed	A	NR	NR	V
RSS	Containment Recirculation Spray	A,B,C	V&I	V&I	V
SSR	Sampling System - Reactor Plant	A	V	NR	V
HVU	Ventilation - Containment Structure	A	NR	NR	V
SFC	Fuel Pool Cooling and Purification	A,D	NR	NR	V
HCS	DBA Hydrogen Recombiner	A,A1	NR	NR	V
SSP	Sampling System - Post Accident	A	V	NR	V
GWS	Radioactive Gaseous Waste[6]	A	V	V&I	V
VRS	Reactor Plant Gaseous Vents	A,D	V	NR	V
LMS	Containment Leakage Monitoring	A	NR	NR	V
DGS	Reactor Plant Hydrogenated Drains	A	V	NR	V

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TABLE 3.9B-3 (Cont)

System Code	System Title	Reg. Guide 1.68, Rev. 2 Classification[2]	Types of Tests[1]: Thermal Expansion	Types of Tests[1]: Transient Vibrations	Types of Tests[1]: Steady State Vibrations
CMS	Containment Atmosphere Monitoring	A	NR	NR	V
CVS	Containment Vacuum	A,B,D	V	NR	V
ICI	Incore Instrument Lines	A,B	V&I	V&I	V
RCS	Pressurizer Safety and Relief System	A,B	V&I	V&I	V
RCS	Pressurizer Spray System	A,B	V&I	V&I	V
FPW	Fire Protection Water	D	V	NR	V
DWS/PBS	Domestic Water/Sanitary System	D	NR	NR	NR
SAS	Service Air Containment Service Air	D	NR	NR	NR
SVV	Main Steam Safety Valve Steam Vents and Drains	B	V	NR	V
WSS	Radioactive Solid Waste	D	NR	NR	NR
VAS	Nuclear Aerated Vents	D	NR	NR	NR
LWS	Radioactive Liquid Waste	B	V	NR	V
BRS	Boron Recovery	B,D	V	NR	V

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TABLE 3.9B-3 (Cont)

System Code	System Title	Reg. Guide 1.68, Rev. 2 Classification[2]	Types of Tests[1] Thermal Expansion	Transient Vibrations	Steady State Vibrations
NSS	Neutron Shield Tank Cooling System	A	V	NR	V
ASS	Aux. Steam	B	V	NR	V

NOTES:

1. Type of tests noted above reflects the graded approach.

2. U.S.N.R.C. Regulatory Guide 1.68, Rev. 2 Classifications:

   A = ASME III, High Energy Piping, Classes 1, 2 and 3.

   A1 = ASME III, Moderate Energy Piping, Classes 1, 2 and 3.

   B = Other ASME III, High Energy Piping Inside Seismic Category I Structure.

   C = Other Non-ASME III, High Energy Outside Seismic Category I Structures whose failure could reduce the functioning of any seismic Category I plant feature to any unacceptable level. Since there are no seismic category plant features outside Seismic Category I Structures, this classification does not exist for Millstone 3. 210.30

   D = Seismic Category I portions of Moderate Energy Piping located outside containment structures.

3. NR = Testing not recommended.

4. V = Visual. When V appears in the table, hand held instruments may be required to perform observations.

5. I = Instrumented measurements. Approximately 50 locations are expected to be observed with instruments. When V&I appears in the table, only a portion of the system requires instrument observations.

6. Radioactive Gaseous Waste (GWS) System is non-ASME III for design and analysis purposes.

TABLE 3.9B.-4

TEST POINTS FOR VIBRATION, THERMAL EXPANSION, AND DYNAMIC EFFECT TESTING

This table has been deleted 210.30

TABLE 14.2-1 (Cont)

77. Condensate and condensate storage
78. Turbine plant sampling
79. Turbine plant component cooling
80. Heat tracing
81. Refueling water storage tank cooling 640.26
82. Reactor vessel head vent
83. Condenser air removal
84. Leak test of SFP gates and transfer tube
85. Mechanical and hydraulic snubbers 210.39

TABLE 14.2-1 (Cont)

85. PREOPERATIONAL TEST - MECHANICAL AND HYDRAULIC SNUBBERS

Prerequisites for Testing

General prerequisites have been met. System is ready for hot functional testing. All snubbers required to be operable as listed in Tables 3.7-4a and 3.7-4b of Technical Specifications have satisfied a preservice examination during the construction phase which contains, as a minimum, verification that:

1. There are no visible signs of damage or impaired operability as a result of storage, handling, or installation.

2. The snubber location, orientation, position setting, and configuration (attachments, extensions, etc) are according to design drawings and specifications.

3. Snubbers are not seized, frozen, or jammed.

4. Adequate swing clearance is provided to allow snubber movement.

5. If applicable, fluid is to the recommended level and is not leaking from the snubber system.

6. Structural connections such as pins, fasteners, and other connecting hardware such as lock nuts, tabs, wire, cotter
210.39 pins are installed correctly.

Those snubbers exceeding a time interval of 6 months between initial preservice examination and preoperational testing have satisified a reexamination of Items 1, 4, and 5.

Test Objective and Summary

The test objective will be to verify snubber thermal movements for systems whose operating temperature exceeds 250°F. Prior to heatup, snubber position will be recorded. At essentially normal operating temperature snubber positions will be recorded and evaluated to verify expected thermal movement and adequate swing clearance. In addition to this, during initial heatup and cooldown, measurements of selected snubbers will be taken at specified intervals to verify expected thermal movement and adequate swing clearance. Any discrepencies or inconsistences will be evaluated and corrected, if necessary, prior to proceeding to the next specified interval.

For those snubbers on systems that do not attain operating temperature during hot functional testing, verification that the snubber will acccomodate protected thermal movement will be done by visual observation and examination of snubber clearance.

TABLE 14.2-1 (Cont)

Acceptance Criteria

Movement of each snubber will be verified to be within design limits. No contact with or potential interference from any adjacent object will be permissible. 210.39

ATTACHMENT III

Responses to the Draft SER Open Items

Open Items

Mechanical Engineering Branch

MEB-1 Information Relating to Postulated Pipe Breaks (Draft SER Section 3.6.1)

The applicant's analysis for jet impingement and environmental effects of postulated pipe breaks for pipe break locations is not complete. The applicant has stated that the missing information referenced in the FSAR will be supplied later.

Status (1/84)

Open

Open Items

Mechanical Engineering Branch

MEB-2 Postulated Through-wall Leakage Cracks (Draft SER Section 3.6.2)

The applicant has not postulated through-wall leakage cracks in moderate-energy lines inside of containment nor in high-energy systems. This is not in compliance with SRP Section 3.6.2.

Response (1/84)

Refer to the responses to NRC Questions 210.8 and 210.9.

Status (1/84)

Closed.

Open Items

Mechanical Engineering Branch

MEB-3 Break postulations for CHS Charging Lines (Draft SER Section 3.6.2)

More information on the break postulations for the CHS charging lines is required.

Response (1/84)

Refer to the response to NRC Question 210.10.

Status (1/84)

Closed.

Open Items

Mechanical Engineering Branch

MEB-4 Loadings from Postulated Pipnig
Failures Outside Break Exclusion Area (Draft SER Section 3.6.2)

Assurance needs to be provided that loadings resulting from postulated piping failure outside the break exclusion area are considered according to the criteria in BTP MEB 3-1.

Response (1/84)

Refer to the response to NRC Question 210.12.

Status (1/84)

Closed.

Open Items

Mechanical Engineering Branch

MEB-5 Postulated Break Locations in ASME Class 1, 2, and 3 Piping (Draft SER Section 3.6.2)

Mor information and clarification are required on the criteria used for selecting postulated break locations in ASME Code, Class 1, 2, and 3 piping.

Response (1/84)

Refer to the response to NRC Question 210.11.

Status (1/84)

Closed.

Open Items

Mechanical Engineering Branch

MEB-6 Postulated Breaks in Non-nuclear Class Piping (Draft SER Section 3.6.2)

Justification is required for the methods used for postulating breaks in non-nuclear class piping.

Response (1/84)

Refer to the response to NRC Question 210.13.

Status (1/84)

Open.

Open Items

Mechanical Engineering Branch

MEB-7 Design of Crushable Material for Whip Restraints (Draft SER Section 3.6.2)

Further information is required on the methods used for the design of crushable material used for whip restraints.

Response (1/84)

Refer to the response to NRC Question 210.14.

Status (1/84)

Closed.

Open Items

Mechanical Engineering Branch

MEB-8 FSAR Tables Concerning Jet Impingement Effects (Draft SER Section 3.6.2)

Tables concerning jet impingement effects are not complete and the staff review cannot be performed until this information is available.

Response (1/84)

Refer to the responses to NRC Questions 210.16 and 210.17.

Status (1/84)

Confirmatory.

Open Items

Mechanical Engineering Branch

MEB-9 Limited Break Areas (Draft SER Section 3.6.2)

Justification is required for the use of limited break areas.

Response (1/84)

Refer to the response to NRC Question 210.18.

Status (1/84)

Closed.

Open Items

Mechanical Engineering Branch

MEB-10 Saturated or Subcooled Water Blowdown (Draft SER Section 3.6.2)

Justification is required on the methods used for saturated or subcooled water blowdown.

Response (1/84)

Refer to the response to NRC Question 210.19.

Status (1/84)

Closed.

Open Items

Mechanical Engineering Branch

MEB-11 Inservice Examination of All Pipe Welds in Break Exclusion Area (Draft SER Section 3.6.2)

Assurance needs to be provided that 100% volumetric inservice examination of all pipe welds in the break exclusion zone will be conducted during each inspection interval as defined in IWA-2400, ASME Code, Section XI.

Response (1/84)

Refer to the response to NRC Question 210.20.

Status (1/84)

Confirmatory.

Open Items

Mechanical Engineering Branch

MEB-12 Design of Pipe Rupture Restraints (Draft SER Section 3.6.2)

More information is required on the design of pipe rupture restraints.

Response (1/84)

Refer to the response to NRC Questions 210.21, 210.22, 210.23, and 210.24.

Status (1/84)

Closed.

Open Items

Mechanical Engineering Branch

MEB-13 Systems to be Monitored During Preoperational Testing (Draft SER Section 3.9.2.1)

A list of systems to be monitored during the preoperational testing program needs to be included in the FSAR. This information is currently incomplete.

Response (1/84)

Refer to the response to NRC Question 210.30.

Status (1/84)

Closed.

Open Items

Mechanical Engineering Branch

MEB-14 Observed or Measured Vibration Levels, SER 3.9.2.1

A description of the criteria to be used for determining acceptability of observed or measured vibration levels must be included in the FSAR.

Response (1/84)

Refer to the response to NRC Question 210.31.

Status (1/84)

Open.

Open Items

Mechanical Engineering Branch

MEB-15 Monitoring of All Essential Safety-related Instrument Lines (Draft SER Section 3.9.2.1)

It is the staff's position that all essential safety-related instrumentation lines should be included in the vibration monitoring program during pre-operational or start-up testing. We require that either a visual or instrumented inspection (as appropriate) be conducted to identify any excessive vibration that will result in fatigue failure.

Provide a list of all safety-related small bore piping and instrumentation lines that will be included in the initial test vibration monitoring program.

Response (1/84)

Refer to the response to NRC Question 210.32.

Status (1/84)

Closed.

Open Items

Mechanical Engineering Branch

MEB-16 Floor Response Spectra Curves (Draft SER Section 3.9.2.2)

Regulatory Guide 1.122 requires that when floor response spectra curves are broadened that the lines bounding the peaks should be parallel to the lines forming the original spectrum peak. Provide justification for not using this method of broadening response spectra.

Response (1/84)

Refer to response to NRC Question 210.26.

Status (1/84)

Closed.

Open Items

Mechanical Engineering Branch

MEB-17 Design of Seismic Interface Anchors (Draft SER SEction 3.9.2.2)

Justification is needed for the method used to broaden floor response spectra curves.

Response (1/84)

Refer to the response to NRC Question 210.29.

Status (1/84)

Closed.

Open Items

Mechanical Engineering Branch

MEB-18 Modes Less Than or Equal to 33 Hz Included in Seismic Analysis (Draft SER Section 3.9.2.2)

Assurance needs to be made that all modes less than or equal to 33 Hz have been included in the seismic analyses.

Response (1/84)

Refer to the response to NRC Question 210.27.

Status (1/84)

Closed.

Open Items

Mechanical Engineering Branch

MEB-19 Loading Combinations, Design Transients, and Stress Limits (Draft SER Section 3.9.3.1)

More information is required on loading combinations, system operating transients and stress limits for each of the following for all classes of construction: vessels, pumps, valves, piping, and supports. Assurance must be provided for the functional capability of ASME Code Class 1, 2, and 3 piping system. This is an open item.

Response (1/84)

Refer to the response to NRC Question 210.34.

Status (1/84)

Open.

Open Items

Mechanical Engineering Branch

MEB-20 HVAC System Ductwork and Supports (Draft SER Section 3.9.3.1)

The staff requires additional information on the design of HVAC system ductwork and supports.

Response (1/84)

Refer to the response to NRC Question 210.33.

Status (1/84)

Confirmatory.

Open Items

Mechanical Engineering Branch

MEB-21 Design of Safety and Relief Valves (Draft SER Section 3.9.3.2)

The staff requires additional information on the design of safety and relief valves.

Response (1/84)

Refer to the response to NRC Question 210.35.

Status (1/84)

Open.

Open Items

Mechanical Engineering Branch

MEB-22 ASME Class 1, 2, and 3 Component Supports (Draft SER Sections 3.9.3.3)

The staff's review of FSAR Sections 3.9B.3.4 and 3.9N.3.4 relates to the methodology used by the applicant in the design of ASME, Code, Class 1, 2, and 3 component supports. The review includes assessment of design and structural integrity of the supports. The review addresses three types of supports: plate and shell linear, and component standard types. More information regarding the design and construction of ASME, Code, Class 1, 2, and 3 component supports is required. The specific concerns have been transmitted to the applicant.

Response (1/84)

Refer to the responses to NRC Questions 210.36 and 210.37.

Status (1/84)

Open.

Open Items

Mechanical Engineering Branch

MEB-23 Inservice Testing of Pumps and Valves (Draft SER Section 3.9.6)

The applicant has not yet submitted his program for the preservice and inservice testing of pumps and valves; therefore, the staff has not yet completed its review. The staff will report the resolution of these issues in a supplement to this report.

Response (1/84)

Refer to the responses to NRC Questions 210.42 and 210.43.

Status (1/84)

Open.

Open Items

Mechanical Engineering Branch

MEB-24 Components Requiring Inelastic Analysis (Draft SER Section 3.9.1)

Information on the components requiring inelastic analysis and a description of the inelastic analysis methods must be provided. This is an open item.

Response (1/84)

Refer to the response to NRC Question 210.25.

Status (1/84)

Closed.