GE Nuclear Energy

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May 21, 1993

Docket No. STN 52-001

Chet Poslusny, Senior Project Manager
Standardization Project Directorate
Associate Directorate for Advanced Reactors
and License Renewal
Office of the Nuclear Reactor Regulation

Subject: Submittal Supporting Accelerated ABWR Review Schedule - **Chapter 3 Clarifications**

Dear Chet:

Enclosed are SSAR markups providing the clarifications requested in our May 19, 1993 conference call pertaining to feedwater piping classification and the use of special engineered pipe supports. The clarifications pertaining to duct work will be provided by May 26, 1993.

Please provide copies of this submittal to Jim Brammer and Dave Terao.

Sincerely,

Jack Fox

Jack Fox
Advanced Reactor Programs

cc: Gary Ehlert GE)
Norman Fletcher (DOE)

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TABLE 3.2-1

CLASSIFICATION SUMMARY (Continued)

	Principal Component[a]	Safety Class[b]	Location[c]	Quality Group Classification[d]	Quality Assurance Requirement[e]	Seismic Category[f]	Notes
B2	Nuclear Boiler System (Continued)						
	4. Piping including supports main steamline (MSL) and feedwater (FW) line up to and including the outermost isolation valve	1	C,SC	A	B	I	
	5. Piping including supports-MSL from outermost isolation valve up to and including seismic interface restraint and FW from outermost isolation valve to and including the shutoff valve	2	SC	B	B	I	
	6. Piping including supports-MSL from the seismic interface restraint up to the turbine stop valve and turbine bypass valve	N	SC,T	B	B	---	(r)
	7. Piping from FW shutoff valve to seismic interface restraint	~~3~~ N	SC	~~C~~ D	~~B~~ E	~~I~~ ---	
	8. Deleted						
	9. Deleted						
	10. Pipe whip restraint - MSL/FW if needed	3	SC,C	---	B	---	(dd)
	11. Piping including supports-other within outermost isolation valves						
	a. RPV head vent	1	C	A	B	I	(g)
	b. Main steam drains	1	C,SC	A	B	I	(g)
	12. Piping including supports-other beyond outermost isolation or shutoff valves						
	a. RPV head vent beyond shutoff valves	N	C	C	E	---	
	b. Main steam drains	N	SC,T	B/D	B	I/---	(r)

(2) The feedwater lines are designed to conduct water to the reactor vessel over the full range of reactor power operation.

5.4.9.3 Description

The main steam piping is described in Section 10.3. The main steam and feedwater piping from the reactor through the containment isolation interfaces is diagrammed in Figure 5.1-3.

As discussed in Table 3.2-1 and shown in Figure 5.1-3, the main steamlines are Quality Group A from the reactor vessel out to and including the outboard MSIV and Quality Group B from the outboard MSIVs to the turbine stop valve. They are also Seismic Category I only from the reactor pressure vessel out to the seismic interface restraint.

The feedwater piping consists of two 22-inch diameter lines from the feedwater supply header to the reactor. On each of the feedwater lines from the common feedwater supply header, there shall be a seismic interface restraint. The seismic interface restraint serves as the boundary between the Seismic Category I piping and the non-seismic piping. Downstream of the seismic interface restraint, there is a remote manual, motor-operated valve powered by a non-safety-grade bus. These motor-operated valves serve as the shutoff valves for the feedwater lines. Isolation of each line is accomplished by two containment isolation valves consisting of one check valve inside the drywell and one positive closing check valve outside the containment (Figure 5.1-3). The closing check valve outside the containment is a spring-closing check valve that is held open by air. These check valves will be qualified to withstand the dynamic effects of a feedwater line break outside containment. Inside the containment, downstream of the inboard FW line check valve, there is a manual maintenance valve (B21-F005)

The design temperature and pressure of the feedwater line is the same as that of the reactor inlet nozzle (i.e., 1250 psig and 575°F)for turbine driven feedwater pumps.

As discussed in Table 3.2-1 and shown in Figure 5.1-3 the feedwater piping is Quality Group A from the reactor pressure vessel out to and including the outboard isolation valve, Quality Group B from the outboard isolation valve to and including the seismic interface restraint, and Quality Group D beyond the shutoff valve. The feedwater piping and all connected piping of 2-1/2 inch larger nominal size is Seismic Category I only from the reactor pressure vessel out to, and including, the seismic interface restraint.

The materials used in the piping are in accordance with the applicable design code and supplementary requirements described in Section 3.2. The valve between the outboard isolation valve and the shutoff valve upstream of the RHR entry to the feedwater line is to effect a closed loop outside containment (CLOC) for containment bypass leakage control (Subsections 6.2.6 and 6.5.3).

The general requirements of the feedwater system are described in Subsections 7.1.1.7, 7.7.1.4, 7.7.2.4, and 10.4.7.

5.4.9.4 Safety Evaluation

Differential pressure on reactor internals under the assumed accident condition of a ruptured steamline is limited by the use of flow restrictors and by the use of four main steamlines. All main steam and feedwater piping will be designed in accordance with the requirements defined in Section 3.2. Design of the piping in accordance with these requirements ensures meeting the safety design bases.

5.4.9.5 Inspection and Testing

Testing is carried out in accordance with Subsection 3.9.6 and Chapter 14. Inservice inspection is considered in the design of the main steam and feedwater piping. This consideration assures adequate working space and access for the inspection of selected components.

5.4.10 Pressurizer

Not Applicable to BWR

5.4.11 Pressurizer Relief Discharge System

Not Applicable to BWR

FW Clarification 3 of 3

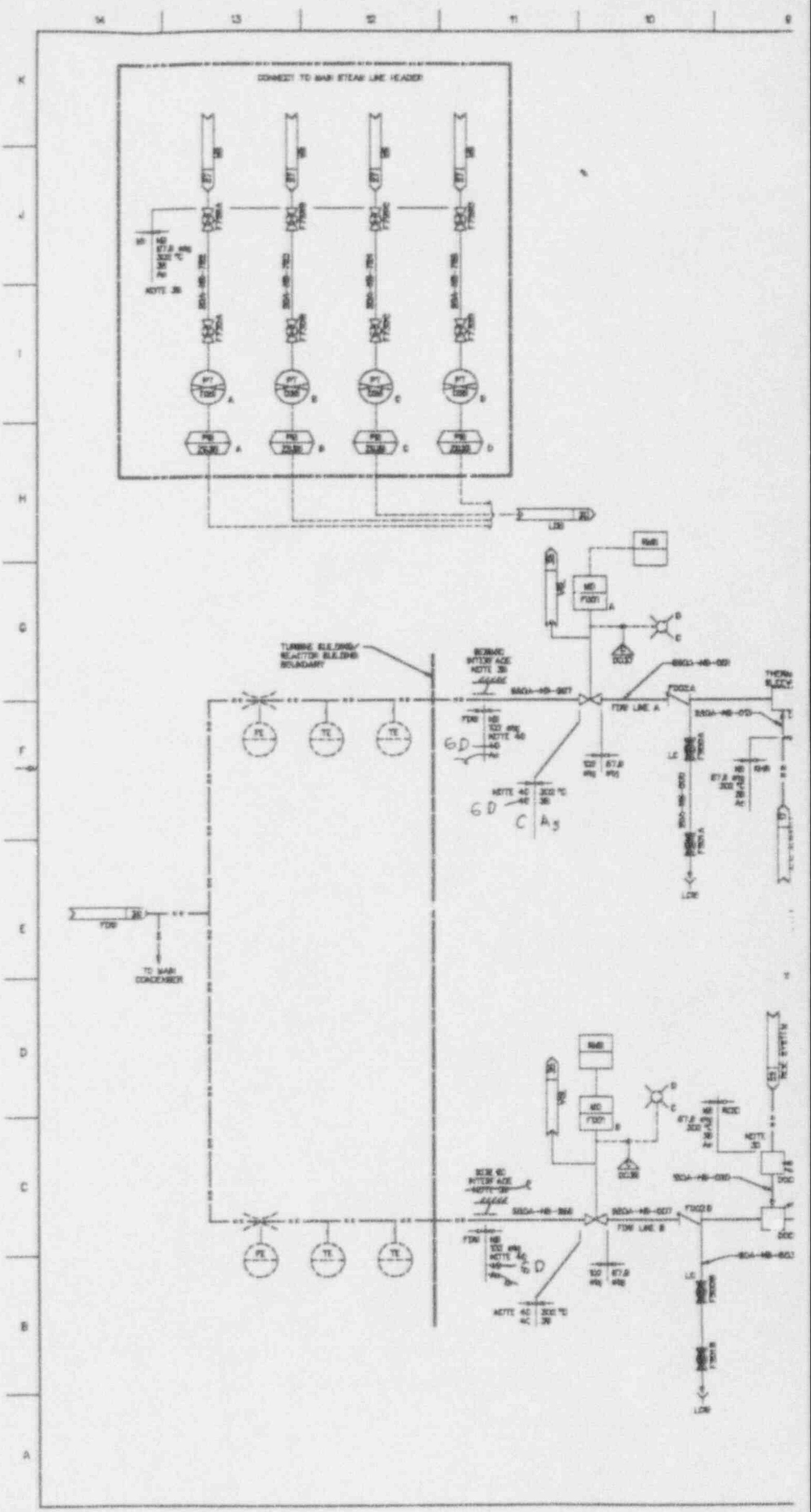

Figure 5.1-3 (Sheet 4 of 11)

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branch line connection to the pipe run and the elevation of the branch line anchors and restraints.

(2) The response spectra will not be less than the envelope of the response spectra used in the dynamic analysis of the run pipe.

(3) Amplification by the run pipe must be accounted for. However, if the location of branch connection to the run pipe is more than three run pipe diameters from the nearest run pipe seismic restraint, amplification by the run pipe will be accounted for.

When the equivalent static analysis method is used, the horizontal and vertical load coefficients C_h and C_v applied to the response spectra accelerations will conform with Subsection 3.7.3.8.1.5.

The relative anchor motions to be used in either static or dynamic analysis of the decoupled branch pipe shall be as follows:

(1) The internal displacements only, as determined from analysis of the run pipe, may be applied to the branch pipe if the relative differential building movements of the large pipe supports and the branch pipe supports are less than 1/16 inch.

(2) If the relative differential building movements of the large pipe supports and the branch pipe supports are more than 1/16 inch, motion of the restraints and anchors of the branch pipe must be considered in addition to the inertial displacement of the run pipe.

3.7.3.3.1.5 Selection of Input Time-Histories

In selecting the acceleration time-history to be used for dynamic analysis of a piping system, the time-history chosen is one which most closely describes the accelerations existing at the piping support attachment points. For a piping system supported at more than two points located at different elevations in the building, the time-history analysis is performed using the independent support motion method where acceleration time histories are input at all of the piping structural attachment points.

3.7.3.3.1.6 Modeling of Piping Supports

Snubbers are modeled with an equivalent stiffness which is based on dynamic tests performed on prototype snubber assemblies or on data provided by the vendor. Struts are modeled with a stiffness calculated based on their length and cross-sectional properties. The stiffness of the supporting structure for snubbers and struts in included in the piping analysis model, unless the supporting structure can be considered rigid relative to the piping. The supporting structure can be considered as rigid relative to the piping as long as the criteria specified in Subsection 3.7.3.3.4 are met.

Anchors at equipment such as tanks, pumps and heat exchangers are modeled with calculated stiffness properties. Frame type pipe supports are modeled as described in Subsection 3.7.3.3.4.

3.7.3.3.1.7 Modeling of Special Engineered Pipe Supports

Modifications to the normal linear-elastic piping analysis methodology used with conventional pipe supports are required to calculate the loads acting on the supports and on the piping components when the special engineered supports, described in Subsection 3.7.3.4.1(6), are used. These modifications are needed to account for greater damping of the energy absorbers and the non-linear behavior of the limit stops. If these special devices are used, the modeling and analytical methodology will be in accordance with methodology accepted by the regulatory agency at the time of certification or at the time of application, per the discretion of the COL applicant.

3.7.3.3.2 Modeling of Equipment

For dynamic analysis, Seismic Category I equipment is represented by lumped-mass systems which consist of discrete masses connected by weightless springs. The criteria used to lump masses are:

(1) The number of modes of a dynamic system is controlled by the number of masses used; therefore, the number of masses is chosen so that all significant modes are included.

(5) **Frame Type (Linear) Pipe Supports**: Frame type supports are linear supports as defined as ASME Section III, Subsection NF, Component Standard Supports. They consist of frames constructed of structural steel elements that are not attached to the pipes. They act as guides to allow axial and rotational movement of the pipe but act as rigid restraints to lateral movement in either one or two directions. Frame type pipe supports are designed in accordance with ASME Code Section III, Subsection NF-3000.

Frame type pipe supports are passive supports, requiring little maintenance and in-service inspection, and will normally be used instead of struts when they are more economical or where environmental conditions are not suitable for the ball bushings at the pinned connections of struts. Similar to struts, frame type supports will not be used at locations where restraint of pipe movement to thermal expansion will significantly increase the secondary piping stress ranges or equipment nozzle loads. Increases of thermal expansion loads in the pipe and nozzles will normally be restricted to less than 20%.

The design loads on frame type pipe supports include those loads caused by thermal expansion, dead weight, and the inertia and anchor motion effects of all dynamic loads. As in the case of other supports, the forces on frame type supports are obtained from an analysis, which are assured not to exceed the design loads for various operating conditions.

(6) **Special Engineered Pipe Supports**: In an effort to minimize the use and application of snubbers there may be instances where special engineered pipe supports can be used where either struts or frame-type supports cannot be applied. Examples of special engineered supports are Energy Absorbers, and Limit Stops.

Energy Absorbers: are linear energy absorbing support parts designed to dissipate energy associated with dynamic pipe movements by yielding. When energy absorbers are used they will be designed to meet the requirements of ASME Section III, Code Class N-420, Linear Energy Supports for Subsection NF, Classes 1, 2, and 3 Construction, Section III, Division 1. The restrictions on location and application of struts and frame-type supports, discussed in (4) and (5) above, are also applicable to energy absorbers since energy absorbers allow thermal movement of the pipe only in its design directions.

Limit Stops: are passive seismic pipe support devices consisting of limit stops with gaps sized to allow for thermal expansion while preventing large seismic displacements. Limit stops are linear supports as defined as ASME Section III, Subsection NF, and are designed in accordance with ASME Code Section III, Subsection NF-3000. They consist of box frames constructed of structural steel elements that are not attached to the pipe. The box frames allow free movement in the axial direction but limit large displacement in the lateral direction. If these special devices are used, the modeling and analytical methodology will be in accordance with methodology accepted by the regulatory agency at the time of certification or at the time of application, per the discretion of the COL applicant.

3.9.3.4.2 Reactor Pressure Vessel Support Skirt

The ABWR RPV support skirt is designed as an ASME Code Class 1 component per the requirements of ASME Code Section III, Subsection NF*. The loading conditions and stress criteria are given in Tables 3.9-1 and 3.9-2, and the calculated stresses meet the Code allowable stresses in the critical support areas for various plant operating conditions. The stress level margins assure the adequacy of the RPV support skirt. An analysis for buckling shows that the support skirt complies with Subparagraph F-1332.5 of ASME III, Appendix F, and the loads do not exceed two thirds of the critical buckling strength of the skirt. The permissible skirt

*Augmented by the following: (1) application of Code Case N-476, Supplement 89.1 which governs the design of single angle members of ASME Class 1,2,3 and MC linear component supports; and (2) when eccentric loads or other torsional loads are not accommodated by designing the load to act through the shear center or meet "Standard for Steel Support Design", analyses will be performed in accordance with torsional analysis methods such as: "Torsional Analysis of Steel Members, USS Steel Manual", Publication T114-2/83.