GE Nuclear Energy

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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 - SSAR Section 3.6**

Dear Chet:

Enclosed are the SSAR markups for Subsections 3.6-2, 3.6-3, 3.6-4 and 3.6-5.

Sincerely,

Jack Fox

Jack Fox
Advanced Reactor Programs

cc: Paul Chen (ETEC)
Norman Fletcher (DOE)
Maryann Herzog (GE)
Shou Hou (NRC)

JF93-45

the fixed end and at the location supported by the restraint.

Effects of pipe shear deflection are considered negligible. The pipe-bending moment-deflection (or rotation) relation used for these locations is obtained from a static nonlinear cantilever-beam analysis. Using the moment-rotation relation, nonlinear equations of motion of the pipe are formulated using energy considerations and the equations are numerically integrated in small time steps to yield time-history of the pipe motion.

The piping stresses in the containment penetration areas are calculated by the ANSYS computer program, a program as described in Appendix 3D. The program is used to perform the non-linear analysis of a piping system for time varying displacements and forces due to postulated pipe breaks.

Note: Edition date for ANSI/ANS 58.2 is specified on the attached page 1.8-53.

3.6.2.3 Dynamic Analysis Methods to Verify Integrity and Operability

3.6.2.3.1 Jet Impingement Analyses and Effects on Safety-Related Components

The methods used to evaluate the jet effects resulting from the postulated breaks of high-energy piping are described in Appendices C and D of ANSI/ANS 58.2 and presented in this subsection.

The criteria used for evaluating the effects of fluid jets on essential structures, systems, and components are as follows:

(1) Essential structures, systems, and components are not impaired so as to preclude essential functions. For any given postulated pipe break and consequent jet, those essential structures, systems, and components ~~need~~ needed to safely shut down the plant are identified.

(2) Essential structures, systems, and components which are not necessary to safely shut down the plant for a given break are not protected from the consequences of the fluid jet.

(3) Safe shutdown of the plant due to postulated pipe ruptures within the RCPB is not aggravated by sequential failures of safety-related piping and the required emergency cooling system performance is maintained.

(4) Offsite dose limits specified in 10CFR100 are complied with.

(5) Postulated breaks resulting in jet impingement loads are assumed to occur in high-energy lines at full (102%) power operation of the plant.

(6) Throughwall leakage cracks are postulated in moderate energy lines and are assumed to

TABLE 1.8-21 (Continued)

INDUSTRIAL CODES AND STANDARDS
APPLICABLE TO ABWR

Code or Standard Number	Year	Title
ANS		
2.3	1983	Standard for Estimating Tornado and Other Extreme Wind Characteristics at Nuclear Power Sites
2.8	1981	Determining Design Basis Flooding at Power Reactor Sites
5.1	1979	Decay Heat Power in LWRs
18.1 (N237)	1984	Radioactive Source Term for Normal Operation of LWRs
52.1	1983	Nuclear Safety Design Criteria for the Design of Stationary Boiling Water Reactor Plants
55.4	1979	Gaseous Radioactive Waste Processing Systems for Light Water Reactors
57.1	1980	Design Requirements for LWR Fuel Handling Systems
57.2(N270)	1976	Design Requirements for LWR Spent Fuel Storage Facilities at NPP
58.2	1988	Design Basis for Protection of Light Water NPP Against Effects of Postulated Pipe Rupture
59.51 (N195)	1976	Fuel Oil Systems for Standby Diesel-Generators

result in wetting and spraying of essential structures, systems, and components.

(7) Reflected jets are considered only when there is an obvious reflecting surface (such as a flat plate) which directs the jet onto an essential equipment. Only the first reflection is considered in evaluating potential targets.

(8) Potential targets in the jet path are considered at the calculated final position of the broken end of the ruptured pipe. This selection of potential targets is considered adequate due to the large number of breaks analyzed and the protection provided from the effects of these postulated breaks.

The analytical methods used to determine which targets will be impinged upon by a fluid jet and the corresponding jet impingement load include:

(1) The direction of the fluid jet is based on the arrested position of the pipe during steady-state blowdown.

(2) The impinging jet proceeds along a straight path.

(3) The total impingement force acting on any cross-sectional area of the jet is time and distance invariant with a total magnitude equivalent to the steady-state fluid blowdown force given in Subsection 3.6.2.2.1 and with jet characteristics shown in Figure 3.6-3.

(4) The jet impingement force is uniformly distributed across the cross-sectional area of the jet and only the portion intercepted by the target is considered.

(5) The break opening is assumed to be a circular orifice of cross-sectional flow area equal to the effective flow area of the break.

(6) The jet impingement force is equal to the steady-state value of the fluid blowdown force calculated by the methods described in Subsection 3.6.2.2.1.

(7) The distance of jet travel is divided into two or three regions. Region 1 (Figure 3.6-3) extends from the break to the asymptotic area. Within this region the discharging fluid flashes and undergoes expansion from the break area pressure to the atmospheric pressure. In Region 2 the jet expands further. For partial-separation circumferential breaks, the area increases as the jet expands. In Region 3, the jet expands at a half angle of 10^{o}. (Figures 3.6-3a and c.)

(8) The analytical model for estimating the asymptotic jet area for subcooled water and saturated water assumes a constant jet area. For fluids discharging from a break which are below the saturation temperature at the corresponding room pressure or have a pressure at the break area equal to the room pressure, the free expansion does not occur.

(9) The distance downstream from the break where the asymptotic area is reached (Region 2) is calculated for circumferential and longitudinal breaks. (a)

3, Figure 3.6-3)

friction loss

(10) Both longitudinal and fully separated circumferential breaks are treated similarly. The value of fL/D used in the blowdown calculation is used for jet impingement also.

(11) Circumferential breaks with partial (i.e., h<D/2) separation between the two ends of the broken pipe not significantly offset (i.e., no more than one pipe wall thickness lateral displacement) are more difficult to

quantify. For these cases, the following assumptions are made.

(a) The jet is uniformly distributed around the periphery.

(b) The jet cross section at any cut through the pipe axis has the configuration depicted in Figure 3.6-3b and the jet regions are as therein delineated.

(c) The jet force F_j = total blowdown F.

(d) The pressure at any point intersected by the jet is:

$$P_j = \frac{F_j}{A_{Rj}}$$

where

A_{Rj} = the cylindrical surface ~~total 360°~~ area of the jet at a radius equal to the distance from the pipe centerline to the target, calculated in accordance with ANSI/ANS-58.2, Appendix C.

(e) The pressure of the jet is then multiplied by the area of the target submerged within the jet.

(12) Target loads are determined using the following procedures.

(a) For both the fully separated circumferential break and the longitudinal break, the jet is studied by determining target locations vs. asymptotic distance and ~~applying~~ the target shape factor and load are calculated in accordance with ANSI/ANS-58.2, Appendices C and D.

(b) For circumferential break with limited separation, the jet is analyzed by using the equations of ANSI/ANS 58.2, Appendices C and D and determing respective target and asymptotic locations

c) After determination of the total area of the jet at the target, the jet pressure is calculated by:

$$P_1 = \frac{F_j}{A_x}$$

where

P_1 = incident pressure

A_x = area of the expanded jet at the target intersection.

Target shape factors are included in accordance with ANSI/ANS 58.2.

If the effective target area (A_{te}) is less than expanded jet area ($A_te \leq A_x$), the target is fully submerged in the jet and the impingement load is equal to (P_1) (A_{te}). If the effective target area is greater than expanded jet area ($A_{te} > A_x$), the target intercepts the entire jet and the impingement load is equal to (P_1) (A_x) = F_j. The effective target area (A_{te}) for various geometries follows:

(1) Flat surface - For a case where a target with physical area A_t is oriented at angle ~~d~~ Ø with respect to the jet axis and with no flow reversal, the effective target area A_{te} ~~is:~~ equals At.

~~A_{te} = (A_t) (sin Ø).~~

(2) Pipe Surface - As the jet hits the convex surface of the pipe, its forward momentum is decreased rather than stopped; therefore, the jet impingement load on the impacted area is expected to be reduced. For conservatism, no credit is taken for this reduction and the pipe is assumed to be impacted with the full impingement load. ~~However, where shape factors are justifiable, they may be used~~. The effective target area A_{te} is:

$$A_{te} = (D_A)(D)$$

where

D_A = diameter of the jet at the target interface, and

D = pipe OD of target pipe for a fully submerged pipe.

When the target (pipe) is larger than the area of the jet, the effective target area equals the expanded jet area

$$A_{te} = A_x$$

(3) For all cases, the jet area (A_x) is assumed to be uniform and the load is uniformly distributed on the impinged target area A_{te}.

3.6.2.3.2 Pipe Whip Effects on Essential Components

This subsection provides the criteria and methods used to evaluate the effects of pipe displacements on essential structures, systems, and components following a postulated pipe rupture.

Pipe whip (displacement) effects on essential structures, systems, and components can be placed in two categories: (1) pipe displacement effects on components (nozzles, valves, tees, etc.) which are in the same piping run that the break occurs in; and (2) pipe whip or controlled displacements onto external components such as building structure, other piping systems, cable trays, and conduits, etc.

3.6.2.3.2.1 Pipe Displacement Effects on Components in the Same Piping Run

The criteria for determining the effects of pipe displacements on inline components are as follows:

(1) Components such as vessel safe ends and valves which are attached to the broken piping system and do not serve a safety function or failure of which would not further escalate the consequences of the accident need not be designed to meet ASME

Code Section III-imposed limits for essential components under faulted loading.

(2) If these components are required for safe shutdown or serve to protect the structural integrity of an essential component, limits to meet the ASME Code requirements for faulted conditions and limits to ensure required operability are met.

The methods used to calculate the pipe whip loads on piping components in the same run as the postulated break are described in Section 3.6.2.2.2.

3.6.2.3.2.2 Pipe Displacement Effects on Essential Structures, Other Systems, and Components

The criteria and methods used to calculate the effects of pipe whip on external components consists of the following:

(1) The effects on essential structures and barriers are evaluated in accordance with the barrier design procedures given in Subsection 3.5.3

(2) If the whipping pipe impacts a pipe of equal or greater nominal pipe diameter and equal or greater wall thickness, the whipping pipe does not rupture the impacted pipe. Otherwise, the impacted pipe is assumed to be ruptured.

(3) If the whipping pipe impacts other components (valve actuators, cable trays, conduits, etc.), it is assumed that the impacted component is unavailable to mitigate the consequences of the pipe break event.

(4) Damage of unrestrained whipping pipe on essential structures, components, and systems other than the ruptured one is prevented by either separating high energy systems from the essential systems or providing pipe whip restraints.

3.6.2.3.3 Loading Combinations and Design Criteria for Pipe Whip Restraint

Pipe whip restraints, as differentiated from piping supports, are designed to function and carry load for an extremely low-probability gross failure in a piping system carrying high-energy fluid. In the ABWR plant, the piping integrity does not depend on the pipe whip restraints for any piping design loading combination including earthquake but shall remain functional following an earthquake up to and including the SSE (See Subsection 3.2.1). When the piping integrity is lost because of a postulated break, the pipe whip restraint acts to limit the movement of the broken pipe to an acceptable distance. The pipe whip restraints (i.e., those devices which serve only to control the movement of a ruptured pipe following gross failure) will be subjected to once-in-a-lifetime loading. For the purpose of the pipe whip restraint design, the pipe break is considered to be a faulted condition (See Subsection 3.9.3.1.1.4) and the structure to which the restraint is attached is also analyzed and designed accordingly. The pipe whip restraints are non-ASME Code components; however, the ASME Code requirements are used as optional in the design selectively to assure its safety-related function. Other methods, i.e. testing, with a reliable data base for design and sizing of pipe whip restraints can also be used.

The pipe whip restraints utilize energy absorbing U-rods to attenuate the kinetic energy of a ruptured pipe. A typical pipe whip restraint is shown in Figure 3.6-6. The principal feature of these restraints is that they are installed with several inches of annular clearance between them and the process pipe. This allows for installation of normal piping insulation and for unrestricted pipe thermal movements during plant operation. Select critical locations inside primary containment are also monitored during hot functional testing to provide verification of adequate clearances prior to plant operation. The specific design objectives for the restraints are:

(1) The restraints shall in no way increase the reactor coolant pressure boundary stresses by their presence during any normal mode of reactor operation or condition;

(2) The restraint system shall function to stop the movement of a pipe failure (gross loss of piping integrity) without allowing damage to critical components or missile development; and

(3) The restraints should provide minimum hindrance to inservice inspection of the process piping.

For the purpose of design, the pipe whip restraints are designed for the following dynamic loads:

(1) Blowdown thrust of the pipe section that impacts the restraint;

(2) Dynamic inertia loads of the moving pipe section which is accelerated by the blowdown thrust and subsequent impact on the restraint;

(3) Design characteristics of the pipe whip restraints are included and verified by the pipe whip dynamic analysis described in Subsection 3.6.2.2.2; and

(4) Since the pipe whip restraints are not contacted during normal plant operation, the postulated pipe rupture event is the only design loading condition.

replace w/ new section 3.6.2.3.3

New Section 3.6.2.3.3

3.6.2.3.3 Design Criteria and Load Combinations for Pipe Whip Restraints.

The loading combinations and design criteria for pipe whip restraints is dependent on the type of restraint and the function it performs. Some restraints in the ABWR are designed to perform a dual function of supporting the pipe during operating conditions and also controlling the motion of the pipe following a postulated rupture. However, most pipe whip restraints in the ABWR are single purpose restraints designed to control the motion of a broken pipe.

Figure 3.6.5 illustrates some acceptable pipe whip restraint designs. These designs include:

(1) The U-bar restraint - This is a single purpose, energy absorbing restraint designed for once-in-a-lifetime loading. The gap between the pipe and the restraint is relatively large to permit free thermal expansion of the pipe and does not provide support to maintain structural integrity of the pipe during any of the plant operating conditions. Most of the restraints used in the ABWR plant on large ASME Class 1 piping are U-bar restraints with stainless steel U-bars, this restraint is further defined in this Subsection and serves as the basis for the Appendix 3Ø L procedure for evaluation of postulated ruptures in high energy pipes. Although piping integrity does not depend on this single purpose pipe whip restraint, the restraint shall be designed to remain functional following an earthquake up to and including the SSE (See Subsection 3.2.1) This pipe whip restraint is further illustrated in Figure 3.6-6.

(2) Restraints with Crushable Material - Pipe whip restraints with crushable material have the same design basis as the U-bar restraint. It is a single purpose, energy absorbing restraint with sufficient gap between the pipe and the restraint to allow free thermal expansion of the pipe. Restraints with crushable pads may not have lateral load capability so they must be provided in every direction in which the jet thrust from the ruptured pipe may occur. Figure 3.6-5 illustrates several acceptable pipe whip restraint designs using crushable material: the crushable ring, the honeycomb restraint, and the frame with series of crushable rings.

(3) Rigid Restraints - Rigid pipe whip restraints are dual purpose, essentially elastic restraints that take the form of seismic guides, struts, and structural frames. Since rigid restraints are attached to the pipe or are separated from the pipe by very small gaps, they carry loads caused by thermal expansion, dead weight, seismic and other dynamic events during plant operation. Rigid restraints therefore serve a pressure integrity function and are considered as pipe supports that must meet the requirements of ASME III, Subsection NF. They are modeled as ~~rigid~~ spring elements in the static and dynamic analysis of the piping. Following a postulated pipe rupture these restraints carry the load from the jet thrust and control motion of a broken pipe. These restraints are designed to stop the pipe without exceeding ASME III, Subsection NF Level D limits. The seismic guide provided on the main steam and feedwater pipe serves a rigid pipe whip restraint performing a dual function.

The specific design objectives of pipe whip restraints are:

(1) Single purpose restraints shall in no way increase the reactor coolant pressure boundary stresses by their presence during any normal mode of reactor operation.

(New) Sect. 3.6.2.3.3

(2) The restraint system shall function to stop the movement of a ruptured pipe without allowing damage to critical components or missile development; and

(3) The restraints should ~~provide minimum~~ permit ~~hindrance to~~ inservice inspection of the process piping.

For the purpose of design, the pipe whip restraints are designed for the following dynamic loads:

(1) Blowdown thrust of the pipe section that impacts the restraint;

(2) Dynamic inertia loads of the moving pipe section which is accelerated by the blowdown thrust and subsequent impact of the restraint;

(3) Non-linear Design characteristics of the pipe whip restraints are included and verified by the pipe whip dynamic analysis described in Subsection 3.6.2.2.2 and Appendix 3~~G~~ L;

(4) Since single purpose pipe whip restraints are not contacted during normal plant operation, the postulated pipe rupture event is the only design loading condition; and

(5) For unruptured pipe, dual purpose pipe whip restraints act as ASME III, Subsection NF pipe supports and must meet the Code requirements for service loads and load combinations for unruptured pipe specified in the design specification and summarized in Table 3.9-2. Following postulated pipe rupture, the restraint stress must not exceed ASME III, Subsection NF Level D limits for pipe rupture loads acting ~~alone~~ in combination with loadings for which Service Level A limits are Specified.

CONTINUE AS ON PAGE 3.6-22

Strain rate effects and other material property variations have been considered in the design of the pipe whip restraints. The material properties utilized in the design have included one or more of the following methods:

(1) Code minimum or specification yield and ultimate strength values for the affected components and structures are used for both the dynamic and steady-state events;

(2) Not more than a 10% increase in minimum code or specification strength values is used when designing components or structures for the dynamic event, and code minimum or specification yield and ultimate strength values are used for the steady-state loads:

(3) Representative or actual test data values are used in the design of components and structures including justifiably elevated strain rate-affected stress limits in excess of 10%; or

(4) Representative or actual test data are used for any affected component(s) and the minimum code or specification values are used for the structures for the dynamic and the steady-state events.

3.6.2.4 Guard Pipe Assembly Design

The ABWR primary containment does not require guard pipes.

3.6.2.5 Material to be Supplied for the Operating License Review

See Subsection 3.6.4.1 for COL license information requirements

3.6.3 Leak-Before-Break Evaluation Procedures

Per Regulatory Guide 1.70, the safety analysis Section 3.6 has traditionally addressed the protection measures against dynamic effects associated with the non-mechanistic or postulated ruptures of piping. The dynamic effects are defined in introduction to Section 3.6. Three forms of piping failure (full flow area circumferential and longitudinal breaks, and throughwall leakage crack) are postulated in accordance with Subsection 3.6.2 and Branch Technical Position MEB 3-1 of NUREG - 0800 (Standard Review Plan) for their dynamic as well as environmental effects.

However, in accordance with the modified General Design Criterion 4 (GDC-4), effective November 27, 1987, (Reference 1), the mechanistic leak-before-break (LBB) approach, justified by appropriate fracture mechanics techniques, is recognized as an acceptable procedure under certain conditions to exclude design against the dynamic effects from postulation of breaks in high energy piping. The LBB approach is not used to exclude postulation of cracks and associated effects as required by Subsections 3.6.2.1.5 and 3.6.2.1.6.2. It is anticipated, as mentioned in Subsection 3.6.4.2, that a COL applicant will apply to the NRC for approval of LBB qualification of selected piping. These approved piping, referred to in this SSAR as the LBB-qualified piping, will be excluded from pipe breaks, which

are required to be postulated by Subsections 3.6.1 and 3.6.2, for design against their potential dynamic effects.

The following subsections describe (1) certain design bases where the LBB approach is not recognized by the NRC as applicable for exclusion of pipe breaks, and (2) certain conditions which limit the LBB applicability. Appendix 3E provides guidelines for LBB applications describing in detail the following necessary elements of an LBB report to be submitted by a COL applicant for NRC approval: fracture mechanics methods, leak rate prediction methods, leak detection capabilities and typical special considerations for LBB applicability. Also included in Appendix 3E is a list of candidate piping systems for LBB qualification. The LBB application approach described in this subsection and Appendix 3E is consistent with that documented in Draft SRP 3.6.3 (Reference 4) and NUREG-1061 (Reference 5). (See Subsection 3.6.4.2 for COL license information requirements.)

3.6.3.1 Scope of LBB Applicability

The LBB approach is not used to replace existing regulations or criteria pertaining to the design bases of emergency core cooling system (Section 6.3), containment system (Section 6.2) or environmental qualification (Section 3.11). However, consistent with modified GDC-4, the design bases dynamic qualification of mechanical and electrical equipment (Section 3.10) may exclude the dynamic load or vibration effects resulting from postulation of breaks in the LBB-qualified piping. This is also reflected in a note to Table 3.9-2 for ASME components. The LBB-qualified piping may not be excluded from the design bases for environmental qualification unless the regulation permits it at the time of LBB qualification. For clarification, it is noted that the LBB approach is not used to relax the design requirements of the primary containment system that includes the primary containment vessel (PCV), vent systems (vertical flow channels and horizontal vent discharges), drywell zones, suppression chamber (wetwell), vacuum breakers, PCV penetrations, and drywell head.

3.6.3.2 Conditions for LBB Applicability

The LBB approach is not applicable to piping systems where operating experience has indicated particular susceptibility to failure from the effects of intergrannular stress corrosion cracking (IGSCC), water hammer, thermal fatigue, or erosion. Necessary preventive or mitigation measures are used and necessary analyses are performed, as discussed below, to avoid concerns for these effects. Other concerns, such as creep, brittle cleavage type failure, potential indirect source of pipe failure, and deviation of as-built piping configuration, are also addressed.

(1) Degradation by erosion, erosion/corrosion and erosion/cavitation due to unfavorable flow conditions and water chemistry is examined. The evaluation is based on the industry experience and guidelines. Additionally, fabrication wall thinning of elbows and other fittings is considered in the purchase specification to assure that the code minimum wall requirements are met. These evaluations demonstrate that these mechanisms are not potential sources of pipe rupture

(2) The ABWR plant design involves operation below 700 ^{0}F in ferritic steel piping and below 800 ^{0}F in austenitic steel piping. This assures that creep and creep-fatigue are not potential sources of pipe rupture.

(3) The design also assures that the piping material is not susceptible to brittle cleavage-type failure over the full range of system operating temperatures (that is, the material is on the upper shelf).

(4) The ABWR plant design specifies use of austenitic stainless steel piping made of material (e.g., nuclear grade or low carbon type) that is recognized as resistant to IGSCC. The [illegible] major high energy piping in the [illegible] and secondary containments [illegible] steel or ferritic steel, except for [illegible] ustenitic stainless reactor water cleanup piping in the primary containment.

(5) A systems evaluation of potential water hammer is made to assure that pipe rupture due to this mechanism is unlikely. Water hammer is a generic term including various unanticipated high frequency hydrodynamic events such as steam hammer and water slugging. To demonstrate that water hammer is not a significant contributor to pipe rupture, reliance on historical frequency of water hammer events in specific piping systems coupled with a review of operating procedures and conditions is used for this evaluation. The ABWR design includes features such as vacuum breakers and jockey pumps coupled with improved operational procedures to reduce or eliminate the potential or water hammer identified by pa[illegible]

experience. Certain anticipated water hammer events, such as a closure of a valve, are accounted for in the Code design and analysis of the piping.

(6) The systems evaluation also addresses a potential for fatigue cracking or failure from thermal and mechanical induced fatigue. Based on past experience, the piping design avoids potential for significant mixing of high- and low- temperature fluids or mechanical vibration. The startup and preoperational monitoring assures avoidance of detrimental mechanical vibration.

(7) Based on experience and studies by Lawrence Livermore Laboratory, potential indirect sources of indirect pipe rupture are remote causes of pipe rupture. Compliance with the snubber surveillance requirements of the technical specifications assures that snubber failure rates are acceptably low.

(8) Initial LBB evaluation is based on the design configuration and stress levels that are acceptably higher than those identified by the initial analysis. This evaluation is reconciled when the as-built configuration is documented and the Code stress evaluation is reconciled. It is assured that the as-built configuration does not deviate significantly from the design configuration to invalidate the initial LBB evaluation, or a new evaluation coupled with necessary configuration modifications is made to assure applicability of the LBB procedure.

3.6.4 See attach B

3.6.4 COL License Information

3.6.4.1 Details of Pipe Break Analysis Results and Protection Methods

The following shall be provided by the COL applicant (See Subsection 3.6.2.5):

(1) A summary of the dynamic analyses applicable to high-energy piping systems in accordance with Subsection 3.6.2.5 of Regulatory Guide 1.70. This shall include:

(a) Sketches of applicable piping systems showing the location, size and orientation of postulated pipe breaks and the location of pipe whip restraints and jet impingement barriers.

(b) A summary of the data developed to select postulated break locations including calculated stress intensities, cumulative usage factors and stress ranges as delineated in BTP MEB 3-1, as modified by subsection 3.6.1.1.

(2) For failure in the moderate-energy piping systems listed in Tables 3.6-5 and 3.6-6, descriptions showing how safety-related systems are protected from the resulting jets, flooding and other adverse environmental effects.

(3) Identification of protective measures provided against the effects of postulated pipe failures for protection of each of the systems listed in Tables 3.6-1 and 3.6-2.

(4) The details of how the MSIV functional capability is protected against the effects of postulated pipe failures.

(5) Typical examples, if any, where protection for safety-related systems and components against the dynamic effects of pipe failures include their enclosure in suitably designed structures or compartments (including any additional drainage system or equipment environmental qualification needs).

(6) The details of how the feedwater line check and feedwater isolation valves functional capabilities are protected against the effects of postulated pipe failures.

(7) see attach B

Att. B

3.6.4 As-Built Inspection of High Energy Pipe Break Mitigation Features

An as-built inspection of the high energy pipe break mitigation features shall be performed. The as-built inspection shall confirm that systems, structures and components, that are required to be functional during and following an SSE, are protected against the dynamic effects associated with high energy pipe breaks. An as-built inspection of pipe whip restraints, jet shields, structural barriers and physical separation distances shall be performed.

For pipe whip restraints and jet shields, the location, orientation, size and clearances to allow for thermal expansion shall be inspected. The locations of structures, identified as a pipe break mitigation feature, shall be inspected. Where physical separation is considered to be a pipe break mitigation feature, the assumed separation distance shall be confirmed during the inspection.

3.6.5 COL License Information

3.6.5.1 Details of Pipe Break Analysis Results and Protection Methods

(7) An inspection of the as-built high energy pipe break mitigation features shall be performed. The pipe break analysis report or leak-before-break report shall document the results of the as-built inspection of the high energy pipe break mitigation features. (See Subsection 3.6.4, for a summary of the as-built inspection requirements.)