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U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: Robert C. Pierson, Director
Standardization and Non-Power Reactor Project Directorate

Subject: **Piping Design Inspections, Tests, Analyses and Acceptance Criteria (ITAAC)**

Enclosed are thirty-four (34) copies of the subject ITAAC. This piping design ITAAC will be included as part of the Generic ITAAC.

Sincerely,

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3.0 GENERIC ITAAC'S

3.3 PIPING DESIGN

3.3.1 Description:

Piping associated with hydraulic and pneumatic systems is categorized as either nuclear safety related or non-safety related. Piping systems that must remain functional following a safe shutdown earthquake (SSE) are designated as Seismic Category I. Depending on the intended service conditions and system design functions, piping is further classified as ASME Code Class 1, 2, 3, or non-Code Class. NRC regulations govern piping designations and piping in the certified design may further be classified as Quality Group A, B, C, or D.

All ABWR piping components will be designed, fabricated, installed and examined to confirm full compliance with all applicable regulatory requirements and industrial codes and standards.

3.3.2 Inspections, Tests, Analyses, and Acceptance Criteria:

Table 3.3 provides a definition of the inspections, tests and analyses, together with the acceptance criteria, which will be performed for ABWR piping in order to demonstrate compliance with the certified design commitments. The information in Table 3.3 is intended to be generic and to apply to all safety related piping governed by Quality Group A, B, or C and ASME Code Class 1, 2, or 3 designations. Not all of the entries in Table 3.3 apply to all piping classifications. Appropriate applicability, based on designation, will be incorporated at the time the inspections, tests, and analyses are implemented.

Table 3.3 GENERIC PIPING DESIGN

Inspections, Tests, Analyses and Acceptance Criteria

	Certified Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1	The piping, its appurtenances, and its supports, shall satisfy the ASME Class, Seismic Category, and Quality Group requirements commensurate with its classification.	Inspections will be conducted of ASME Code required documents and the Code stamp on the components.	Existence of ASME Code required documents and the Code stamps on the components confirms that the piping and components have been designed, analyzed, fabricated, and examined in accordance with the applicable requirements.
2	The piping shall be designed for a fatigue life of 60 years. This design shall account for the cyclic stresses resulting from the expected pressure/temperature cycles and loads in the required combinations. For ASME Class 1 piping systems, a fatigue analysis will be performed in accordance with ASME III requirements. For ASME Class 2 & 3 piping, ASME Code rules will be followed using a stress range reduction factor of 1.0, based on fewer than 7000 cycles. These fatigue analyses results shall be documented in a certified stress report.	An inspection of the certified stress report will be conducted to assure that the fatigue evaluation is consistent with the ASME Code requirements and with the 60 year design life.	All ASME requirements shall be satisfied, including the cumulative fatigue usage factor, which shall be less than or equal to 1.0.

3	Pipe mounted equipment and attachment interface allowable loads, accelerations and stresses shall be satisfied. The loads, accelerations, and stresses that the piping system imposes on its pipe mounted equipment and on its interfaces shall be determined by analyses of the piping systems and compared to the allowable values. These results of these analyses shall be documented as interface requirements to assure design compatibility with the equipment and interfaces.	Inspections will be conducted to confirm that the as-designed interface loads, accelerations and stresses are consistent with the interfacing vendor's / constructor's specified hardware allowables.	The vendor designed allowables for pipe mounted equipment and interfacing equipment shall be met. The installer's designed allowables at attachment interfaces shall be met.
4	Analytical methods shall be specified in a certified Design Specification for each piping system. The following analysis parameters shall be addressed: a. Mathematical models of piping, supports, and pipe mounted equipment. b. Damping coefficients. c. Cut-off frequency. d. High frequency modes. e. Combination of group responses when multiple response spectra are used. f. Combination of modal results. g. Combination of response spectra analysis results with differential building movement analysis results.	Inspection (review) of the certified Design Specification will be conducted.	Methods shall be in compliance with all applicable regulatory requirements.

5	For those piping systems using ferritic materials, the ferritic materials shall not be susceptible to brittle fracture under pressure during the expected service conditions. Only intrinsically tough grades of ferritic materials conforming to the ASME III SA specifications shall be used.	Fracture toughness tests will be performed in accordance with ASME III, Subsection NB-2332.	Records of the fracture toughness tests must confirm that the requirements of Appendix G of ASME III are satisfied.
6	For those piping systems using austenitic stainless steel materials, all stainless steel piping shall be selected to minimize the possibility of cracking during service. Special chemical, fabrication, handling, welding, and examination requirements that minimize cracking shall be met.	Inspections of Code required documents and other pertinent records will be conducted to confirm that all manufacture, fabrication, welding, and examination were performed in accordance with the committed requirements.	Records of the materials and processes must confirm that the committed requirements to avoid the potential of stainless steel to crack in service are satisfied
7	The reactor coolant pressure boundary (RCPB) of the respective piping systems shall retain its pressure integrity under all internal pressures that will be expected during its design lifetime. All piping and piping components shall be designed and analyzed to show compliance with all pressure integrity requirements of ASME Code.	◆Inspections of Code required documents will be conducted to confirm that the piping system was designed/analyzed in compliance with requirements that assure pressure integrity. ◆A hydrostatic test of the RCPB will be conducted in accordance with the ASME Code requirements.	◆For safety class 1, 2, & 3 piping, the required allowables in the applicable subsections of ASME III Code shall be satisfied. ◆The results of the hydrostatic test must conform with the requirements in the ASME Code.

8	The piping system designer shall confirm that the as-built piping system is consistent with the as-designed piping system, or that any deviations do not invalidate the design.	◆Pipe routing will be confirmed by inspecting isometric drawings containing verification stamps from field visual inspections by Quality Control. This documentation will also confirm that no interferences exist.	◆The pipe routing is consistent with the as-designed routing, or is within the tolerances allowed on the as-designed drawings. The piping system has the minimum specified clearance from all neighboring hardware.
		◆The exact location, orientation, and size of snubbers and struts; the location and size of hangers; the location and weight of valves, pumps, and heat exchangers; the location and configuration of anchors; and the location of guides and pipe whip restraints, will be confirmed by reviewing isometric drawings containing verification stamps from field Quality Control, or by taking the as-built measurements.	◆The location, size, orientation of all pipe mounted components are consistent with the as-designed drawings, or are within the tolerances allowed thereon.
		◆All deviations from the as-designed condition will be documented and evaluated. If acceptance limits are not satisfied in the reevaluation, a reanalysis of the as-built condition will be performed, the stress report and design drawings will be revised, and the final stress report will be certified.	◆For safety class 1, 2, & 3 piping, the required allowables in the applicable subsections of ASME III Code shall be satisfied.

9	The piping systems, including all necessary pipe whip restraints, shall be designed to protect against the dynamic effects associated with the postulated rupture of high energy and moderate energy fluid systems. A pipe break analysis report shall be generated to confirm that the piping system is acceptable for all postulated breaks.	Inspections of Code required documents and the pipe break analysis report will be conducted to confirm that the piping system was designed/analyzed in compliance with requirements that assure postulated pipe breaks will not unduly impact the safety of the plant..	The essential functions of structures, systems, and components shall not be precluded by the postulated pipe breaks. For those components required for safe shutdown, limits to meet the ASME Code requirements for faulted conditions and limits to ensure required operability shall be met. Offsite dose limits shall be satisfied.