PROPOSED AMENDMENT TO 10 CFR 50.55a, "CODES AND STANDARDS"

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BACKGROUND

This is a Category 3 meeting. The public is invited to participate in this meeting by providing comments and asking questions throughout the meeting.

Section 50.55a requires the use of Section III, Division 1, and Section XI, Division 1, of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (BPV CODE).

The National Technology Transfer and Advancement Act of 1995, Pub. L. 104-113, requires government agencies to use technical standards that are developed or adopted by voluntary consensus standards bodies.

Section 50.55a was most recently updated on September 26, 2002 (67 FR 60520).

PROPOSED RULE

Amend § 50.55a to incorporate by reference the 2001 Edition and the 2002 and 2003 Addenda of Section III, Division 1, and Section XI, Division 1, of the ASME BPV CODE.

Issue proposed rule for public comment - January 2004

Issue final rule - Summer 2004

SECTION III (one condition with six parts)

The proposed rule would prohibit or supplement the use of certain provisions of the alternative method for evaluation reversing dynamic piping loads in the 2001 Edition and the 2002 and 2003 Addenda.

The alternative method for evaluating reversing dynamic loads was added to Section III in the 1994 Addenda. The alternative method for evaluating reversing dynamic loads was based, in part, on industry evaluations of the data from tests performed under sponsorship of the Electric Power Research Institute and NRC. After reviewing changes in the 1994 Addenda, the NRC determined that the alternative method was unacceptable because evaluation of the test data did not support the changes.
Section 50.55a(b)(1)(iii) was added in the final rule dated September 22, 1999 (64 FR 51370) to prohibit the use of the alternative method for evaluating reversing dynamic loads.

An ASME special working group was established to reevaluate the bases for the alternative method for evaluating reversing dynamic loads. An NRC sponsored research program was also initiated to evaluate the technical issues regarding the adequacy of the new provisions in the 1994 Addenda. These technical issues are summarized in NUREG/CR-5361, "Seismic Analysis of Piping," dated June 1998. The technical issues summarized in NUREG/CR-5361 were subsequently evaluated by ASME committees, and Section III of the ASME BPV Code has been revised to resolve the technical issues in NUREG/CR-5361. However, in the NRC's view, several technical issues in NUREG/CR-5361 have not been satisfactorily resolved. Technical issues that have not yet been fully resolved include validation of high sensitivity solutions to the nonlinear material modeling (constitutive relationships) for the performance of dynamic inelastic piping analyses; adequate design margin at high temperatures; and adequate design margin for seismic anchor motions.

This proposed rule will allow the use of the alternative method for evaluating reversing dynamic loads when using the 2001 Edition through 2003 Addenda of Section III subject to the following condition with multiple parts.

Loads generated by reflected waves caused by flow transients (NB-3200, NB-3600, NC-3600, and ND-3600).

NB-3200, NB-3600, NC-3600, and NC-3600 of the 2001 Edition and the 2002 and 2003 Addenda allow the alternative method for evaluating reversing dynamic loads to be applied to calculations for piping subject to loads generated by reflected waves caused by flow transients (sudden closure of a valve is an example of a condition that could create a flow transient). Members on ASME committees used data from tests performed under the sponsorship of Electric Power Research Institute and NRC that focused on seismic loading conditions to demonstrate that use of the alternative method for evaluating reversing dynamic loads for piping subject to loads provided acceptable design margins. The NRC is proposing to disallow the use of the alternative method for evaluating reversing dynamic loads for piping subject to loads generated by reflected waves caused by flow transients in NB-3200, NB-3600, NC-3600, and NC-3600 because the NRC's and industry's review of the limited amount of test data does not support a finding that the design margin is adequate for these types of loadings.

Alternative provisions for performing an inelastic analysis for evaluating reversing dynamic loads (NB-3228.6).

NB-3228.6 of the 2001 Edition and the 2002 and 2003 Addenda provides alternative provisions for performing an inelastic analysis for evaluating reversing dynamic loads. The NRC is proposing to disallow the use of NB-3228.6. As discussed in NUREG/CR-5361, the NRC's and industry's review of the limited amount of test data does not support a finding that the design margin is adequate. In addition, it would require validation of the nonlinear material modeling (constitutive relationships) in order to justify selection of the material models because of the high sensitivity of the dynamic analysis to these material models.

Allowable bending stresses (NC-3653.2(d) and ND-3653.2(d)).

NC-3653.2(d) and ND-3653.2(d) of the 2001 Edition and the 2002 and 2003 Addenda provide provisions for determining allowable bending stresses when using the alternative method for evaluating reversing dynamic loads. The NRC is proposing to disallow the use of NC-3653.2(d) and ND-3653.2(d) because it has not been demonstrated that these provisions provide an adequate design margin. The NRC is proposing the use of NC-3653.1 and NC-3653.2 instead of NC-3653.2(d), and ND-3653.1 and ND-3653.2 instead of ND-3653.2(d). Analysis using NC-3653.1 or ND-3653.1 must include pressure and reversing dynamic loads that are not required to be combined with nonreversing dynamic loads, and the allowable B_2' stress indices defined in NC-3655(b)(3) may be used in these analyses. The anchor motions associated with reversing dynamic loads must be included as an anchor displacement in the definition of M_C when applying NC-3653.2 or ND-3653.2.

Linear elastic response spectrum analysis (NB-3656(b)(3), NC-3655(b)(3), and ND-3655(b)(3)).

NB-3656(b)(3), NC-3655(b)(3), and ND-3655(b)(3) of the 2001 Edition and the 2002 and 2003 Addenda provide a definition of the moment, $M_{E,}$ to be used in the evaluation of reversing dynamic loads. The moment definition states that reversing dynamic loads must be computed from a linear elastic response spectrum analysis as defined in Appendix N of Section III. Linear elastic response spectrum analysis requirements are also addressed in the licensing basis for each nuclear power plant. Appendix N linear elastic response spectrum analysis provisions may be less conservative than licensing basis linear elastic response spectrum analysis provisions. The NRC is proposing to disallow the use of Appendix N in applications when Appendix N linear elastic response spectrum analysis provisions are less conservative than licensing basis linear elastic response spectrum analysis provisions. A licensee would be required to compare the Appendix N linear elastic response spectrum analysis provisions to its licensing basis linear elastic response spectrum analysis provisions, and use the provisions that provide the most conservative calculation of M_E.

Allowable B_2' stress indices for tees and elbows (NB-3656(b)(3), NC-3655(b)(3), and ND-3655(b)(3)).

NB-3656(b)(3), NC-3655(b)(3), and ND-3655(b)(3) of the 2001 Edition and the 2002 and 2003 Addenda specify the maximum allowable B_2' stress indices for tees and elbows when using the alternative method for evaluating dynamic reversing loads. The allowable B_2' stress indices specified in ND-3655(b)(3) are not consistent with the allowable B_2' stress indices specified in NB-3656(b)(3) and NC-3655(b)(3). The allowable B_2' stress indices of 3/4 up to B_2 for tees and elbows as specified in NB-3656(b)(3) and NC-3655(b)(3) are acceptable. The NRC is proposing to disallow the use of the B_2' stress indices specified in ND-3655(b)(3), and to require that the allowable B_2' stress indices specified in NB-3656(b)(3) and NC-3655(b)(3) be used instead of the allowable B_2' stress indices specified in ND-3655(b)(3). The NRC is disallowing the use of the B_2' stress indices specified in ND-3655(b)(3) for tees and elbows because the safety margins associated with this application have not been established.

Evaluation of anchor motions (B-3656(b)(4), NC-3655(b)(4), and ND-3655(b)(4)).

NB-3656(b)(4), NC-3655(b)(4), and ND-3655(b)(4) of the 2001 Edition and the 2002 and 2003 Addenda provide provisions for evaluating anchor motions when using the alternative method for evaluating reversing dynamic loads. The NRC is proposing that the provisions in NB-3656(b)(4), NC-3655(b)(4), and ND-3655(b)(4) be supplemented with a requirement to perform a demonstration that the global piping system response to the anchor movement does not create significant inelastic strain concentrations. The NRC is proposing that an allowable stress limit of $3S_M$ may be used instead $6S_M$ in the evaluation of the range of resultant moment as an alternative to the performance demonstration that the global piping system response to the anchor movement does not create significant inelastic strain concentrations. The allowable bending stress ranges in NB-3656(b)(4), NC-3655(b)(4), and ND-3655(b)(4) only result in acceptable strains when the global piping system determinations are not underestimated by the elastic analysis. Therefore, the evaluation of anchor motions must include a demonstration that the global piping system response to the anchor movement does not create significant inelastic strain concentrations in the piping system. The use of an allowable stress limit of $3S_M$ instead of $6S_M$ is an acceptable alternative to demonstrating that the global response of the piping does not create an inelastic strain concentration because the adequacy of the $3S_M$ stress limit has been demonstrated by actual operating experience for thermal loads.

SECTION XI (five separate conditions)

Ultrasonic surface examination (IWA-2220).

The proposed rule would prohibit the use of a new provision in IWA-2220. The provisions of Code Case N-615, "Ultrasonic Examination as a Surface Examination Method for Category B-F and B-J piping Welds," were incorporated into IWA-2220 in the 2001 Edition of Section XI of the ASME BPV Code. Code Case N-615 and IWA-2220 (2001 Edition and the 2002 and 2003 Addenda) allow a surface examination to be conducted using an ultrasonic (UT) examination method. The UT examination is conducted from the inside surface of certain piping welds. Other allowable surface examination methods (magnetic particle or liquid penetrant) are conducted from the outside surface of certain piping welds. The purpose of the these surface examinations is to identify flaws in the outer surface of the weld. The NRC disallowed the use of Code Case N-615 and is proposing to prohibit the use of the same type of UT examination specified in IWA-2220 because there are no provisions in Section XI that address how to ensure proper consideration of flaws in the outer surface of a piping weld when conducting a UT examination from the inside surface of the piping weld. Provisions for a demonstrated, and standardized repeatable UT methodology for this type of UT examination should be added to Section XI in order to ensure consistent implementation among all licensees.

Thermally cut surfaces (IWA-4461.4.2).

The proposed rule would prohibit the use of the new provisions in IWA-4461.4.2 that allow the elimination of mechanical processing of thermally cut surfaces. Subsection IWA-4461.4.2 was added in the 2001 Edition to allow the elimination of mechanical processing of thermally cut surfaces when, due to field conditions, mechanical processing is deemed impractical. Thermal cutting is a process for removing metal from a weld or base metal. Thermal cutting includes processes such as oxy-acetylene cutting, plasma-arc cutting, laser-beam cutting, and air-carbon arc gouging. These processes can leave cracks, stress risers, very rough surfaces, or heavy oxidation on the cut surface that can seriously degrade the material toughness or corrosion resistance of the material or leave large residual stresses in the material. If the thermally disturbed surface is not removed by mechanical processing, such as, grinding, machining, or filing, these defects could be incorporated into the final weld, possibly compromising the integrity and quality of the weld.

The new provisions in IWA-4461.4.2 allow the elimination of mechanical processing of thermally cut surfaces provided that certain criteria are considered by an evaluation. The NRC finds that the evaluation requirements specified in IWA-4461.4.2 do not address all the critical elements associated with the elimination of mechanical processing of thermally cut surfaces. For example, the evaluation in IWA-4461.4.2 does not address specific surface examination requirements, thermal cutting qualification requirements for notch toughness, corrosion tests, and requirements for analyzing stresses induced by the cutting process. Without a proper evaluation, cracks, stress risers, oxidation, or other contamination of cut surfaces could exist in the final weld which would seriously degrade the material toughness or corrosion resistance of the material.

Exemption of concrete containment post-tensioning system corrosion protection medium from repair/replacement activities (IWL-4110(b)(3)).

The proposed rule would prohibit the use of a new provision in IWL-4110(b)(3) that exempts concrete containment post-tensioning system corrosion protection medium (CPM) repair/replacement activities from the requirements in IWL-4000. The ASME Code, Section XI, IWL-4110 defines the scope of the repair and replacement activities and specifies those items that are exempt from the scope of repair and replacement activities. A new provision, IWL-4110(b)(3), was added in the 2002 Addenda exempting the removal, replacement, or addition of concrete containment post-tensioning system CPM from the repair/replacement requirements in IWL-4000. Article IWL-4000 requires that repair/replacement activities be accomplished in accordance with a repair/replacement plan. The ASME Code, Section XI, in IWA-4150 requires that the repair/replacement plan include the essential requirements for the completion of the repair/replacement activity. The NRC is disallowing the use of IWL-4110(b)(3) because it believes there are essential requirements associated with the removal, replacement or addition of concrete containment post-tensioning system CPM that must be specified in the repair/replacement plan. For example, an essential element of a repair/replacement plan for the removal, replacement or addition of concrete containment post-tensioning system CPM would include specifying the acceptable level of water content and the concentration of water soluble chlorides, nitrates and sulfides of the CPM. Other essential requirements of a repair/replacement plan would include the specification of the maximum pressure for the application of the CPM and the method used for applying the CPM. Thus, the removal, replacement, or addition of concrete containment post-tensioning system CPM is a necessary part of the Code-required repair/replacement plan because it contains essential requirements.

Performance demonstration initiative and examination coverage criteria (Article I-3000 and Appendix VIII).

The proposed rule would prohibit the use of Appendix VIII and the supplements to Appendix VIII, and Article I-3000 in the 2002 and 2003 Addenda of Section XI of the ASME BPV Code. Appendix VIII and its supplements were revised in the 2002 Addenda to incorporate the most recent provisions of the Performance Demonstration Initiative (PDI) program to implement Appendix VIII. The PDI is an organization formed for the express purpose of developing efficient, cost-effective, and technically sound UT performance demonstration methods to meet Appendix VIII requirements. The PDI program has evolved as programs were developed for each Appendix VIII supplement. Article I-3000, Examination Coverage, was added in the 2002 Addenda to provide UT examination coverage criteria for certain welds.

The final rule dated September 22, 1999 (64 FR 51370), requires licensees to implement Appendix VIII and its supplements. Because PDI is not a voluntary consensus standards body, its program document could not be incorporated by reference in the final rule. Thus, the essential elements of the PDI program were added to the final rule as § 50.55a(b)(2)(xv). Licensees may use § 50.55a(b)(2)(xv) as an alternative to the UT performance methods in Appendix VIII and its supplements. Section § 50.55a(b)(2)(xv) also contains UT examination coverage criteria. Licensees are currently implementing Appendix VIII and its supplements in accordance with § 50.55a(b)(2)(xv).

The incorporation of the PDI program and the addition of UT examination coverage criteria into Section XI are not complete at this time. As a result, conflicts exist between the modifications in § 50.55a(b)(2)(xv) and the 2002 and 2003 Addenda of Section XI of the ASME BPV Code. Consequently, the NRC plans to defer incorporating by reference Appendix VIII and its supplements and Article I-3000 beyond the 2001 Addenda until the addition of the entire PDI program and the addition of UT examination coverage criteria into Section XI are complete. At that time, the NRC will amend § 50.55a to incorporate by reference the edition and addenda of Appendix VIII and its supplements and Appendix I-3000 that complete these actions.

Mitigation of flaws by modification (IWA-4340).

The proposed rule would prohibit the use of the provisions in IWA-4340 when using the 2001Edition and the 2002 and 2003 Addenda of Section XI of the ASME BPV Code. The new provisions in IWA-4340 were added in the 2000 Addenda to provide requirements for the mitigation of flaws by "modification". Earlier editions and addenda of Section XI require that certain flaws be repaired. Paragraph IWA-4340 allows a flaw to remain in a component provided that the flaw can be isolated by "modification". However, the term "modification" as used in IWA-4340 is not defined in Section XI of the ASME BPV Code. Therefore, the scope of the activity permitted by this paragraph is not clear to the NRC. In addition, IWA-4340(c) identifies reexamination provisions that may be used instead of the reexamination provisions of IWA-4530(a). However, IWA-4530(a) does not provide reexamination provisions, but, rather, preservice inspection and testing requirements. It is not clear to the NRC what provisions must be used for the preservice inspection and testing of the repair/replacement activity or if the wrong subsubarticle is referenced in IWA-4340(c).

Paragraph IWA-4340 also states that each licensee must determine what additional examinations are needed to monitor the propagation of the flaw. Each licensee would be responsible for determining the method of examinations to be performed and the frequency at which the examinations would be performed. In addition, each licensee would be permitted to define the acceptance criteria for these examinations. Each licensee could then re-define its examination criteria at any time. Because a set of minimum requirements has not been defined, the NRC is unable to determine whether the examinations prepared by each licensee would maintain safety and ensure the protection of public health and safety. Furthermore, the provisions of IWA-4340 would result in inconsistent examination requirements being applied at different facilities for the same type of mitigating action. For these reasons, the NRC is proposing to prohibit the use of IWA-4340 when using the 2001 Edition and the 2002 and 2003 Addenda.