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U.S. Nuclear Regulatory Commission
Washington, DC 20555-001

Subject: ASME Comments on Draft Regulatory Guide DG-1159: "Design Limits, Loading Combinations, Materials, Construction, and Testing of Concrete Containments"

Ladies and Gentlemen:

This letter provides ASME comments on proposed Draft Regulatory Guide DG-1159 for consideration by the U.S. Nuclear Regulatory Commission (USNRC). ASME comments are provided in the Attachment.

ASME anticipates that individuals and organizations that are the constituents of our ASME Nuclear Codes and Standards volunteers may submit technical comments as individuals or from their respective organizations.

ASME commends the NRC for taking an active role in addressing the issue of concrete containments in requirements for construction of nuclear power plant components by establishing a position via Draft Regulatory Guide DG-1159 to establish one method that would be acceptable to the NRC to support new plant licensing.

Thank you for the opportunity to provide these comments. If there are any questions regarding these comments, please direct them to Mr. Kevin Ennis, ASME Director, Nuclear Codes and Standards by phone (212-591-7075) or e-mail (ennrisk@asme.org).

Sincerely,

Kenneth R. Balkey, PE
Vice President
Nuclear Codes and Standards

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- Mr. Richard Porco, Vice Chair, ASME Board on Nuclear Codes & Standards Operations
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- Mr. Robert Jessee, Vice Chair, ASME B&PV Subcommittee on Nuclear Power (SC III)
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SUNSI Review Complete
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ASME Comments on Draft Regulatory Guide DG-1159: "Design Limits, Loading Combinations, Materials, Construction, and Testing of Concrete Containments"

Regulatory Position	Comment
1. CC-2243	RG 1.107 is dated 1977. With advances in grout technology in the past 30 years, the exceptions noted in RG 1.107 should be confirmed that they are still valid.
2. CC-2433.2.3	No comment
3. CC-2434	No comment
4. CC-2463.1	The Code calls for "not less than two static tests". Determining what constitutes a "sufficient number of tests" as noted in this regulatory position will be subjective and difficult. We recommend the minimum required number of tests based on the available data be specified.
5A. CC-3000	<p>Based on a review of SRP 6.2.5, Revision 3, an accident that releases hydrogen, generated from 100 percent fuel clad-coolant reaction accompanied by combustible gas burning, is classified as "beyond design basis accident." As such, load combinations included in this regulatory position (also included in 10 CFR 50.34) to take into account hydrogen generation/burning are not applicable to CC-3000 which includes "design basis" load cases and combinations. Using factored load criteria to evaluate a "beyond design basis" condition is overly conservative. It is more appropriate to compare the loads due to hydrogen release with the containment ultimate capacity.</p> <p>Assuming that Regulatory Position 5 will remain as is:</p> <ol style="list-style-type: none"> 1. 5 A. (1) - SRP Section 3.8.1 appears to be intended to apply only for BWR Mark III type containments. Suggest to changing the DG words to "...combined according to the approach contained in the appendix to SRP Section 3.8.1." or suggest that the NRC revise SRP Section 3.8.1 to address other types of containments or clarify if/how the appendix can be used for other reactor types. 2. 5 A. (2) - F already is defined in the Code Section CC-3221.1 as prestress loads, not post-LOCA flooding. H_a is already defined in the Code in Section CC-3222.3 as "load on the containment resulting from internal flooding, if such an occurrence is defined in the Design Specification as a design basis event". 3. 5 A. (2) - It seems that the additional load combination defined here is already covered by the 3rd load combination listed under "Abnormal/severe environmental" in Table CC-3230-1 which includes H_a loads. Thus, possibly it would be sufficient for the NRC to endorse this combination as it already exists in Table CC-3230-1. If desired, supplemental clarification, such as inclusion of R_o loads with a 1.0 factor, could be added as note/footnote to Table CC-3230-1. 4. 5 A. (2) (1), (2) and (3) - Load combinations in this regulatory position only include "D" – Dead load. In a prestressed containment, the liner strain is also affected by the sustained prestress force. Therefore, true liner strain evaluation (as required per CC-3720) must include the effects of prestress and temperature. This should be noted and clarified. 5. It seems that the P_{g1}, P_{g2}, P_{g3} loads are already included in load combinations involving P_a as shown in Table CC-3230-1. Introducing these loads as a new combination with dead load is confusing since it is not clear how to work

	<p>this combination with the other loads/combinations. It is suggested that if it is desired to clarify P_a by including P_{g1}, P_{g2}, P_{g3} loads, then this might be best accomplished in the DG as a note/footnote to Table CC-3230-1 stating something like “P_a loads shall include the following P_{g1}, P_{g2}, P_{g3} loads, as applicable, defined as follows.....” Similar comment for the D+45psig combination – the minimum value should be imposed as a note/footnote rather than a D + pressure combination.</p> <ol style="list-style-type: none"> 6. The type of analysis to derive liner strains to meet the requirements of CC-3720 should be clarified. Should the liner strains be derived from an elastic basis analysis or a nonlinear analysis considering concrete, reinforcing and liner? 7. This regulatory guide only requires liner strain check per CC-3720. It is implied that evaluation and documentation of other design parameters (e.g., rebar and concrete stresses) is not required. This should be noted and clarified. 8. Regarding containment internal pressure loads, it seems that some cross-reference, explanation, and/or description consistent with RG 1.7 “Control of Combustible Gas Concentrations in Containment Following a Loss-of-Coolant Accident” (or its intended replacement/update) should be made on this page and/or in the References section of the DG.
5B. CC-3421.5	<p>A number of existing plants were designed in accordance with ACI 318-63 and included tangential shear and principal tensile stress requirements in their design basis which may or may not agree with the values noted in this regulatory position. The effects of this DG on the existing plants that did not use Section III, Div. 2 (CC-3000) should be clarified.</p>
6. CC-3542	<p>Reg. 1.35.1 addresses long term losses with a 40 year design life. New prestressed concrete containments consider a 60 year design life. This needs to be addressed in this regulatory position.</p>
7. CC-4240	<p>The sentence on page 5 “The Code does not have any provision for curing concrete at temperatures higher than 4.4° C (40° F).” is misleading/inaccurate. Code section 4240(a) defers requirements for curing and protection against damage to the Construction Specification. Suggest deleting this sentence and the first word of the following sentence.</p> <p>Curing times are to some extent dependent on the type of construction due to exposed surfaces of concrete (wall forms vs. exposed slabs, etc) and curing method (moisture-retaining covers, wet-curing, spray-on or roll-on curing compounds, etc.). Making a generic statement that “minimum period of curing should be 7 days after placing concrete” can be potentially misleading/inaccurate.</p> <p>If it is desired to make Section CC-4240 more explicit, suggest to reword something to the effect that “Curing and protection against physical and thermal damage from time of placement until end of minimum curing period shall be in accordance with ACI 308.1, and ACI 305R-99 or ACI 306.1-90(R2002) as applicable.”</p>
8. CC-4352	<p>In Discussion section, CC-4352 states that welded splices and other mechanical connections are allowed as long as they conform to ACI 349-01, Section 12.14.3. This statement goes beyond the purpose of CC-4352 which only provides spacing requirements.</p> <p>The discussion section should be revised to only address the spacing and its reference to ACI 349-01. For example, it should read: The spacing of welded splices and other mechanical connections should conform to ACI 349-01, Section 12.14.3.</p>

	<p>Is the intent to waive the recommendation for alternate bars splicing or adjacent splices staggering if certain mechanical splice deformation requirements are met? If so, then the words of the last sentence in this section might better be changed to "...then neither alternate bar splicing nor adjacent splices staggering need be used."</p>
9. CC-4470	<p>The relation between CC-3542 "Loss of prestress" and CC-4470, "Corrosion Protection" medium (grout or sheath filler) is not clear. More explanation should be added to clearly define what type of exception to section CC-4470 is taken.</p> <p>"DG-1159 recommends replacing CC-4470 with Reg Guide 1.35.1 without identifying what is deficient in CC-4470. We would like to understand what the deficiencies are in CC-4470."</p>
10. CC-5210	No Comment
11. CC-6430	<p>In accordance with CC-6430, if the measurements do not satisfy the requirements of CC-6410, further study is required to determine the root cause. If these studies still indicate that CC-6410 requirements are not satisfied, either remedial actions are taken or a retest is conducted. The added value of choosing one option (remedial action or retest) as noted in this regulatory position is not clear. It is recommended that the discussion section be expanded to provide additional information to further explain staff's position.</p>
Ultimate Capacity of Concrete Containment	<p>We recommend stating specific requirements on analytical techniques, loads to be considered and combinations and limiting stress and strain values for failure determination in lieu of referencing Appendix A to NUREG/CR-6906. To our knowledge, Appendix A to NUREG/CR-6906 was not written to provide guidance nor was it subject to a consensus peer review process.</p>
Backfit Analysis	<p>In the BACKFIT ANALYSIS section, it is stated " NRC staff considers acceptable for use in design and analysis of metal primary reactor containments in nuclear power plants." This statement should be changed to "... NRC staff considers acceptable for use in design and analysis of reinforced and prestressed concrete containments in nuclear power plants."</p>