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To: <nrcrep@nrc.gov>
Date: Mon, Jan 1, 2007 11:58 PM
Subject: RG Comments

Please find comments to DG-1133 attached.

<<Comment to RG DG-1133.pdf>>

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January 1, 2007

RE: Comments to Draft Regulatory Guide DG-1133 supplemented by FR Notice, Vol. 71, No. 208; Conditions on use of Code Case N-659

References:
1. Code Case N-659, Use of Ultrasonic Examination in Lieu of Radiography for Weld Examination, Section III, Division 1
2. Draft Regulatory Guide DG-1133, Revision 34 of RG 1.84, dated October 2006
3. FR Notice, Vol. 71, No. 208, "Incorporation by Reference of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code Cases" (beginning on page number 62947) dated October 27, 2006
4. E-mail from S. Williams, NRC, to F. White, General Electric, dated November 7, 2006, Subject: Request for Supplemental Information Concerning Chapter 5.2 RAIs

Dear Sir:

The purpose of this letter is to provide comments relative to the NRC concerns and proposed additional requirements on Code Case N-659 (Reference 1), which allows ultrasonic examination (UT) in lieu of radiography (RT) for butt-type welded joints in Class 1, 2, and 3 pressure boundary components under Section III of the ASME B&PV Code. Code Case N-659 was conditionally accepted in DG-1133 (Reference 2) with additional requirements for the calibration block. DG-1133 was later supplemented by the October FR Notice (Reference 3), which included additional concerns and restrictions. As explained in the specific comments below, those additional restrictions are not justified: they add great cost to the process without a demonstrated corresponding increase in safety, they are inconsistent with current 10CFR50 regulations and licensing correspondence from the NRC staff. Collectively, implementation of the proposed conditions will render Code Case N-659 unusable for practical purposes. The specific comments in this letter address the concerns and restrictions (as proposed conditions) described in Reference 3.

Comment 1: The proposed conditions in the FR Notice (Reference 3) to be imposed on the use of UT under Code Case N-659 are not needed based on past and current NRC regulations on UT. Assertions in the commentary for Code Case N-659 in Reference 3 conflict in principle with uses of UT already approved by the NRC in 10CFR50 by reference to Section III of the ASME Code and are misleading and they are incorrect with respect to the capability of UT (as explained in comments 2 and 3). The most significant proposed condition is a costly additional performance

demonstration regimen for UT when applied under Code Case N-659. The commentary discusses RT and UT broad terms, but does not address the issue of why such a costly performance demonstration regimen is needed for Code Case N-659, which applies only to examination of butt-type welded joints, while existing Code UT requirements that are less restrictive than Code Case N-659 have been accepted for years and continue to be accepted without reservation by the NRC for Class 1, 2, and 3 pressure boundary corner-type welded joints and for all types of welded joints (except electroslag welds) for Core Support Structures in 10CFR50 by reference to Section III of the ASME Code.

Comment 2: The explanation in the commentary provided on page 62948 of Reference 3 (just under the heading *Code Case N-659*) is insufficient to support imposing the costly proposed additional performance demonstration requirements because it does not relate the need for those requirements to the capability of UT to detect actual fabrication defects. The explanation in the commentary of Reference 3 does not distinguish between flaws, i.e., any imperfection, and defects, i.e., flaws significant enough to render a part unsuitable for service. There is no challenge made in the commentary to the ability of UT to detect and reject actual defects nor is there a citation of any component failure caused by fabrication defects missed by UT. Both RT and UT are capable of detecting volumetric and planar flaws, each with a greater or lesser degree of sensitivity based on flaw shape and orientation due to the physics of the examination method. But the costly proposed additional UT performance demonstration requirements are not justified by mere differences in the sensitivity to individual fabrication flaws between the RT and UT methods. They could only be justified by a deficiency in the capability of UT to find and reject actual defects, but the commentary neither asserts nor offers support for an assertion that the UT performed under current Code requirements or the enhanced requirements under Code Case N-659 would miss actual fabrication defects. The commentary only states "RT and UT are not equally effective for flaw detection" citing minor differences between the responses of the two test methods to different types of imperfections found in weldments. This concept error is pervasive and continues in the explanation of the first concern where the statement is made that "Section V prescriptive-based requirements are less effective in detecting flaws than performance based (Section XI) Appendix VIII requirements." Despite some differences in the response to different types of imperfections, the field history has shown that both RT and UT methodologies as described in Section V and referenced by Section III for many years are an effective means for identifying and rejecting fabrication defects to ensure the integrity of nuclear construction as evidenced by the NRC's approval of both RT and UT for detection of fabrication defects under 10CFR50 by reference to the Section III of the ASME Code. However, the commentary in Reference 3 fails to even acknowledge the NRC endorsement of UT under current ASME Code rules for defect detection and its technical basis.

Comment 3: The statements in the commentary on Code Case N-659 in the FR Notice (Reference 3) offer only qualitative generalities, and implied facts, but no actual data is provided to support the need for the costly proposed additional UT performance demonstration requirements. For example, as a basis for the proposed additional performance demonstration the commentary states that "RT is effective ... in detecting planar type flaws with large openings (i.e., lack of fusion and large cracks in high stressed areas)" and states that "UT is effective in detecting and sizing planar type flaws in ferritic steels and to a lesser extent in wrought austenitic steels." The implication is that RT is less effective than UT in detecting planar flaws, but the fact is that both RT and UT have been used for

ASME Code, Section III applications for many years and no failure root cause has been attributed to fabrication defects missed by RT or UT performed properly in accordance ASME Code, Section III rules. The field history, therefore supports that both RT and UT performed in accordance with current Code rules are sufficiently effective at detecting and rejecting fabrication defects, including planar defects. Code Case N-659 enhances already those effective Code rules, by requiring the use of computerized, automated UT and a qualification on a representative sample with a modest set of actual flaws. Further, the Code Case N-659 qualification requires that all flaws in the sample be detected, while the proposed "statistical approach" to performance demonstration described in Reference 3 allows 2 out of 10 flaws to be missed completely. The commentary states "Section V prescriptive-based requirements are less effective in detecting flaws than performance based (Section XI) Appendix VIII requirements." However, Section XI Appendix VIII is used only for inservice examination for service-induced flaws (e.g., intergranular stress corrosion cracking) and does not even apply to examination of newly fabricated components, so the analogy is inappropriate and does not support the need for the costly proposed additional performance demonstration requirements for fabrication defects. Also, although it claims that the costly additional performance demonstration requirements are a "statistical approach," the commentary offers no probability of detection and confidence interval relating those additional performance demonstration requirements to an improvement factor in the detection and rejection of actual fabrication defects over the expected performance of using Code Case N-659 without modification. Thus, the commentary in Reference 3 fails to show how, despite the field history and prior NRC approval of existing Code requirements for examination of corner-type welded joints and all types of welded joints (except electroslag welds) in Core Support Structures, the requirements of Code Case N-659, which enhance the existing Code rules, are insufficient. Further, the commentary in Reference 3 fails to show or even claim that a significant level of improvement in detection of actual fabrication defects in the field would be achieved by imposition of the costly proposed additional performance demonstration requirements.

Comment 4: The capability of UT as described in the commentary of Reference 3 (just under the heading *Code Case N-659*) is inaccurate and misleading because it states, "with specific technique development and personnel training on construction flaws UT can also be used to detect volumetric type flaws such as slag or porosity." The statement is inaccurate and misleading with respect to the capability of UT for the following reasons:

(a) It implies, incorrectly, personnel trained and certified under current Code requirements using current Code UT procedures are somehow not capable of detecting flaws such as slag and porosity. Under current Code UT methodology and personnel requirements, volumetric flaws can be and are detected and evaluated to the Code acceptance standards for UT. Those methodology and personnel requirements have already been accepted by the NRC for Class 1, 2, and 3 pressure boundary corner-type welded joints and for all types of welded joints (except electroslag welds) for Core Support Structures in 10CFR50 by reference to Section III of the ASME Code. No known problems have resulted from using current Code UT methodology and personnel requirements as approved by the NRC, and the commentary does not make any statements to the contrary.

(b) Characterization of flaws as slag or porosity flaw types is not required or necessary under the Code UT acceptance standards. The only specific flaw types characterized under Code acceptance standards are cracks, lack of fusion, and incomplete penetration, and all of those

flaw types are considered defects regardless of UT signal response. Other flaws are evaluated based on their signal amplitude response and length regardless of their type. Those acceptance standards have already been accepted by the NRC for Class 1, 2, and 3 pressure boundary corner-type welded joints and for all types of welded joints (except electroslag welds) for Core Support Structures in 10CFR50 by reference to Section III of the ASME Code.

Comment 5: The extent of the proposed additional performance demonstration requirements imposed on UT used in lieu of RT under Code Case N-659 as described in the FR Notice (Reference 3) is inconsistent with positions expressed by the NRC staff in recent licensing correspondence (Reference 4). For example, UT is so highly regarded by the NRC staff that supplemental RAI 5.2-53 states that components should be designed to provide access for UT even when the component is accessible for RT, despite the fact that RT is an NRC accepted alternative volumetric examination method under 10CFR50 by reference to the ASME Code. The supplemental RAI states "Given that it has been shown that a PDI qualified UT examination far more likely to detect and size fabrication and service induced flaws, provide a justification for designing a component that does not allow adequate access to perform a PDI qualified UT examination." The staff clearly states in the supplemental RAI that a PDI (Appendix VIII) qualified UT is capable without question or additional demonstration of detecting fabrication flaws (despite the fact that the PDI qualification demonstration contains no fabrication flaws). Yet the commentary in Reference 3 criticizes as too meager the requirement already in Code Case N-659 that a PDI (Appendix VIII) qualified UT be subject to a supplemental demonstration on three fabrication flaws. The commentary in Reference 3 states "The addition of only two or three flaws is not sufficient to capture the variety of flaws common to construction..." The recognition of the capability of UT in the supplemental RAI acknowledges the field history and endorsement in 10CFR50 by reference to the ASME Code of even non-PDI qualified UT to reliably detect fabrication defects under existing Code rules. That the proposed additional demonstration requirements in Reference 3 would subject even a PDI qualified UT to yet even more demonstrations than already required by Code Case N-659 is overreaching and clearly in conflict with the expressed staff position in the supplemental RAI, and, as previously stated, in conflict with the NRC endorsement of UT under current Code rules in 10CFR50 by reference to Section III of the ASME Code for Class 1, 2, and 3 pressure boundary corner-type welded joints and for all types of welded joints (except electroslag welds) for Core Support Structures.

Comment 6: The proposed performance demonstration requirements in the FR Notice (Reference 3) to be imposed on the use of UT under Code Case N-659 are so onerous and expensive that it would not be practical to use the Code Case. There is already a substantial cost associated with using Code Case N-659 because the Case requires the use of computerized and automated UT systems and requires qualification on a representative sample with a modest set of actual flaws. The cost of performing UT under the current requirements of Code Case N-659 is already 20 to 30 times the cost of performing RT. Due to the high cost, the use of the Code Case is restricted to limited applications where a substantial ALARA or schedule benefit could be realized. Those applications are limited to a few components under special circumstances since use of UT under the Code Case is generally too expensive for any typical production situation. Those applications usually involve a single examiner qualifying a procedure on a sample applicable to a single component and using that procedure in a one-time application for that component. The proposed

performance demonstration described in Reference 3 increases the minimum qualification requirement for a procedure from one examiner qualifying on a sample containing two or three flaws to three examiners qualifying on a sample set containing a minimum of ten flaws (or a sample set of 30 flaws if only a single examiner is used). Under those proposed performance demonstration requirements, the cost of performing UT under the Code Case would be increased by a factor of two to three, increasing the cost of UT under Code Case N-659 to around 40 to 90 times the cost of performing RT. A cost of that magnitude would completely outweigh the benefits that could otherwise be achieved using the Code Case and render the Case unusable for any application except perhaps for the most extreme situations in which RT simply could not be performed.

Comment 7: The proposed additional UT demonstration requirements described in the FR Notice (Reference 3) to be imposed on the use of UT under Code Case N-659 require without justification that the capability requirements of UT substantially exceed the capability requirements for the RT that would otherwise be performed. Under the proposed UT demonstration requirements, flaws must be located within 10% of true through-wall depth (page 62949), whereas a typical RT technique performed under NRC-accepted ASME Code rules would provide no through-wall depth information. Further, the demonstration for UT must show the capability to detect flaws having a minimum of 2% through wall depth, whereas for RT, the 2% factor relates only to the thickness of a penetrameter shim used as an image quality indicator that has no direct relationship whatsoever to the sizes of flaws that can be detected by RT nor to the acceptance standards in Section III of the ASME Code. Such additional requirements are superfluous with respect to verifying the necessary capability of UT to detect fabrication defects in welds in ASME Code components.

Comment 8: The proposed performance demonstration described in the FR Notice (Reference 3) to be imposed on the use of UT under Code Case N-659 is based on RT acceptance standards in Subsection NB, Article 2000 (Material), specifically for seamless and welded tubular products that do not even apply to the scope of Code Case N-659. Code Case N-659 is not used for Article 2000 applications, it is used only for fabrication examinations under Article 5000 of Subsections NB, NC, and ND. Any demonstrations for UT under Code Case N-659 should be based on the UT acceptance standards in Article 5000 of Subsections NB, NC, and ND to which Code Case N-659 is applicable. (The demonstration already required in Code Case N-659 is based on those acceptance standards.) The NRC has already recognized those Article 5000 UT acceptance standards as being sufficient for examination of weldments for fabrication defects by accepting them in 10CFR50 by reference to Section III of the ASME Code for evaluation of Class 1, 2, and 3 pressure boundary corner-type welded joints.

Comment 9: The second concern expressed regarding the use of Code Case N-659 in the FR Notice (Reference 3) relating to the use of the second leg of the ultrasound metal path is already sufficiently addressed by the Code Case. That concern is based on demonstrations of single-sided examinations for service-induced flaws in austenitic stainless steels. (The commentary in reference 3 states that "single side (UT) has not been demonstrated reliably on austenitic stainless steels and not demonstrated for construction flaws for any material.") The concern is not valid for Code Case N-659 because the Code Case already requires that the capability of the second leg UT examination be demonstrated; if it is not successfully demonstrated, it cannot be used.

Comment 10: The additional base metal examination volume proposed in the FR Notice (Reference 3) imposed on UT when using Code Case N-659 is excessive because the examination volume currently imposed in Code Case N-659 for UT already far exceeds the Section III examination volume for the RT that it is intended to replace. The Section III examination volume for RT of butt-type welded joints is limited to the weld and includes no base metal. Further, the proposed additional base metal examination volume is inconsistent with the current regulation because the NRC has accepted the existing Section III examination volume for RT for years in 10CFR50 by reference to Section III of the ASME Code. The commentary in Reference 3 offers no justification for the need to have a larger examination volume for UT of butt-type welded joints than is required for RT of similar joints.

If you have any questions regarding these comments, please contact me at 925-200-0281.

Sincerely,

D. Henry

Douglas Henry
Principal Engineer