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January 2, 2007

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
One White Flint North
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Rockville, MD 20852-2738

Serial No.	06-1074
NL&OS/PRW	R0
Docket No.	50-423
License No.	NPF-49

DOMINION NUCLEAR CONNECTICUT, INC.
MILLSTONE POWER STATION UNIT 3
SUPPLEMENT TO A REQUEST FOR BRAZED JOINT STRUCTURAL INTEGRITY ASSESSMENT METHODOLOGY, REQUEST IR-2-38, (TAC NO. MC8893)

In a letter dated June 9, 2005, Dominion Nuclear Connecticut, Inc. (DNC) requested approval for the use of an alternative structural integrity assessment methodology for brazed joints in accordance with the provisions of 10 CFR 50.55a(a)(3)(i). The proposed methodology would enable evaluation of nonconforming conditions on ASME Code Class 3, moderate energy system piping with brazed joints, as a part of the inservice inspection (ISI) program at Millstone Power Station Unit 3 (MPS3). In a letter dated September 14, 2006, DNC provided additional information in response to NRC staff questions. This letter supplements DNC Request IR-2-38 for an alternative brazed joint assessment methodology consistent with subsequent telephone conferences held with the NRC staff on December 4, 2006, December 6, 2006, and on December 14, 2006. The attachment to this letter contains the most recent supplement to the request and adds clarifications that were discussed with NRC staff in the teleconferences.

If you have any questions in regards to this supplement, please contact Mr. Paul R. Willoughby at (804) 273-3572.

Very truly yours,

Gerald T. Bischof
Vice President – Nuclear Engineering

Commitments in this letter: None

Attachments: (1)

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ATTACHMENT 1

SUPPLEMENT TO A REQUEST FOR BRAZED JOINT STRUCTURAL INTEGRITY ASSESSMENT METHODOLOGY, REQUEST IR-2-38, (TAC NO. MC8893)

DOMINION NUCLEAR CONNECTICUT, INC.
MILLSTONE POWER STATION UNIT 3

SUPPLEMENT TO A REQUEST FOR BRAZED JOINT STRUCTURAL INTEGRITY ASSESSMENT METHODOLOGY, REQUEST IR-2-38, (TAC NO. MC8893)

BACKGROUND:

In a letter dated June 9, 2005, Dominion Nuclear Connecticut, Inc. (DNC) requested approval for the use of an alternative structural integrity assessment methodology for brazed joints in accordance with the provisions of 10 CFR 50.55a(a)(3)(i). The proposed methodology would enable evaluation of nonconforming conditions on ASME Code Class 3, moderate energy system piping with brazed joints, as a part of the inservice inspection (ISI) program at Millstone Power Station Unit 3 (MPS3). In a letter dated September 14, 2006, DNC provided additional information in response to NRC staff questions. This letter supplements DNC Request IR-2-38 for an alternative brazed joint assessment methodology consistent with subsequent telephone conferences held with the NRC staff on December 4, 2006 and on December 6, 2006. The balance of this attachment contains the most recent supplement to the request and adds clarifications that were discussed with NRC staff in the teleconferences.

This attachment supplements the Request IR-2-38 with the following three discussion items:

- Periodic ultrasonic test examinations (UT) are used to re-confirm the percentage of bonding.
- Additional minimum brazed joint shear stress experimental values are provided.
- Proposed use of brazed joint shear strength and safety factor is revised.

DISCUSSION ITEMS THAT SUPPLEMENT REQUEST IR-2-38:

1. Periodic UT Confirmation of a Percentage of Bonding:

   The DNC procedure that is used to evaluate the structural integrity of existing brazed joints in ASME Class 3 piping is consistent with the intent of Generic Letter 90-05. Accordingly, the methodology that is proposed in the DNC Request IR-2-38 will also require a periodic UT of the affected brazed joint at least once every three months. The periodic UT will be used to re-confirm the percentage of bonding is input into the evaluation of brazed joint structural integrity.

2. Minimum Brazed Joint Shear Stress Experimental Values:

   The test data in Table 1 supports the proposed methodology in Request IR-2-38 for evaluating the structural integrity of brazed joints. Table 1 was derived from existing ASME Brazing Procedure Qualification Records of qualification tests performed in accordance with the ASME Boiler and Pressure Vessel Code, Section IX. Each test includes a set of either reduced or full section tensile tests. In order to pass these tests the brazed joint must be at least as strong as the specified minimum tensile strength of the weaker of the two base metals joined. Figure 1 shows a simple schematic of a tensile test specimen. The tensile test specimen loads the braze bond in shear. The shear stress data in Table 1 was calculated by dividing the ultimate load by the theoretical shear area of each braze joint instead of the cross-sectional area of the pipe. Where failure occurred in the base metal (as was the case in all but two of the reported tests) the ultimate shear strength of the brazed joint was not measured but must be greater than the reported values.

TABLE 1: MINIMUM BRAZE JOINT SHEAR STRESS

Specimen	Pipe O.D.(1)	Lap Length	Shear Area	Load (lbs)	Shear Stress	Type and Location of failure
BPQR 112: 3-inch P-110 Pipe to P-107 Fitting with Pre-placed BAg-1a Insert Ring Reduced Section tensile test data						
V-T1	0.750 (1)	0.570	0.428	5,600	13,100	Ductile - Fitting
V-T2	0.752 (1)	0.570	0.429	4,800	11,200	Ductile - Fitting
H-T1	0.753 (1)	0.570	0.429	4,300	10,000	Ductile - Fitting
H-T2	0.753 (1)	0.570	0.429	4,800	11,200	Ductile - Fitting
BPQR 113: 3/4-inch P-107 Pipe to P-110 Fitting with Pre-placed Bag-7 Insert Ring Full Section tensile test data						
V-1	1.050	0.305	1.006	14,100	14,000	Ductile - Pipe
V-2	1.050	0.305	1.006	14,800	14,700	Ductile - Pipe
H-1	1.050	0.305	1.006	14,900	14,800	Ductile - Pipe
H-2	1.050	0.305	1.006	15,100	15,000	Ductile - Pipe
BPQR 113: 3/4-inch P-107 Pipe to P-101 Fitting Face Fed Bag-7 filler metal Full Section tensile test data						
V-1	1.040	0.250	0.817	12,900	**15,800**	**Ductile - Braze**
V-2	1.040	0.250	0.817	14,700	18,000	Ductile - Pipe
H-1	1.040	0.250	0.817	14,500	17,700	Ductile - Pipe
H-2	1.040	0.250	0.817	12,900	**15,800**	**Ductile - Braze**

NOTE: (1). A pipe O.D. is used unless the value given is annotated with this note. This note denotes the value shown is a dimension of width.

In all but two of the reported tensile tests, the specimens failed in the base material and therefore do not provide an ultimate shear strength for the brazed joint. With a failure in the base material, the reported values demonstrate that the brazed joint was capable of carrying at least the reported shear stress without failure. Therefore, ultimate shear stress for brazed joints in specimens that failed in base material was actually higher than the reported values.

In the two joints where failure occurred in the braze, the ultimate shear strength of the braze was 15,800 psi. Values of the other 10 specimens range from 10,000 to 18,000 psi. These values do not take into account any loss of shear area due to voids, inclusions or other flaws, which typically exceed 10 percent and may include up to 25 percent of the braze area and are still acceptable to ASME IX criteria.

Considering the data from failures in either pipe of fitting base materials, and the ideal assumptions of shear area that are used to derive shear stress of Table 1, the data reasonably supports a conclusion that the ultimate shear strength of these brazed joints is much greater than where failure occurred in pipe of fitting base materials.

The indicated ultimate shear strength from the actual brazed joint failures is shown to be greater than 15,000 psi. As a conservative measure, a '2 times' margin has been used. This will result in a usable allowable shear stress value of 7,500 psi as input to the evaluation of the structural integrity of the braze joints using the methodology described in DNC request IR-2-38.

3. Brazed Joint Shear Strength and Safety Factor Use in Evaluation:

DNC will revise the brazed joint evaluation procedure previously described in Request IR-2-38 in the following manner:

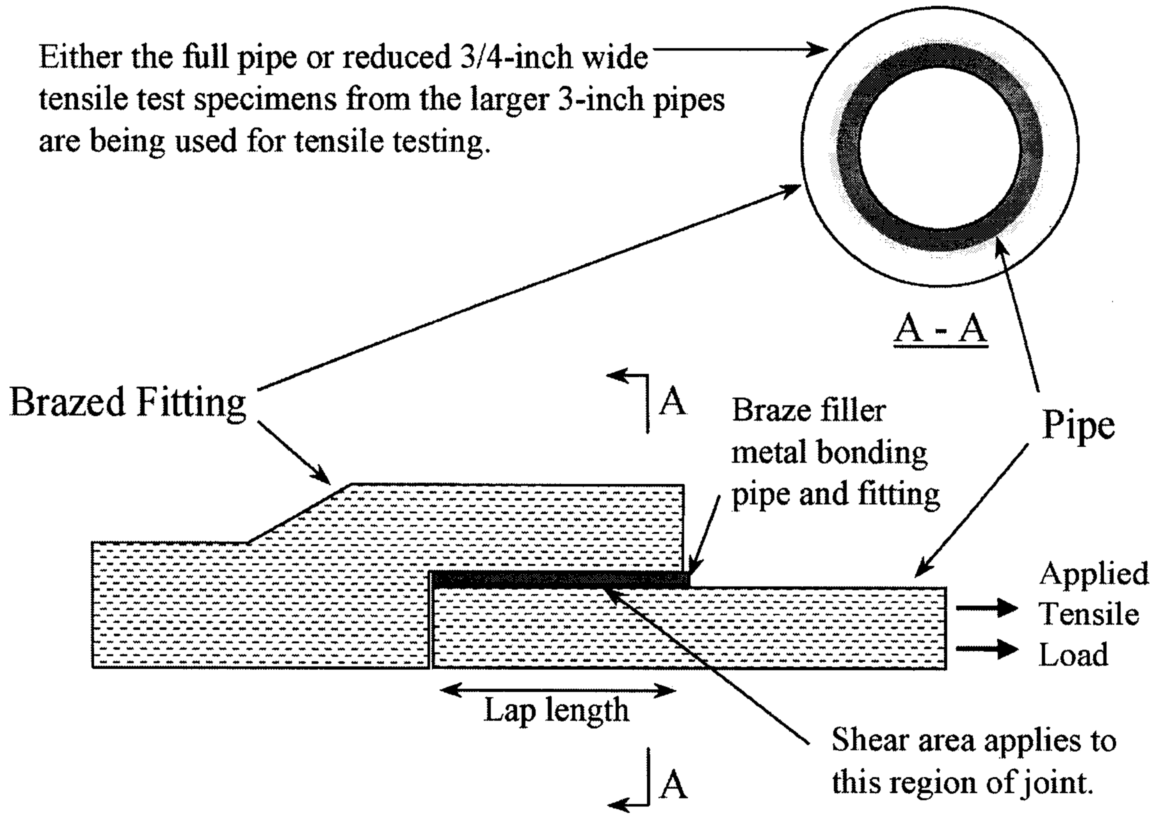
(a) The braze joint shear strength assumed for evaluation purposes will be changed to 7,500 psi, as justified above. Thus, in Enclosure 1, Attachment A, Figure 2 of the original submittal, the parameter τ_{max} in Equation 3 is revised to 7,500 psi.

(b) The piping analysis loads and equivalent stresses used to evaluate the braze joint will be multiplied by a safety factor of 1.5, consistent with ASME III Code Case N-513-1. Thus, in Enclosure 1, Attachment A, Figure 2 of the original submittal, Equation (1) is revised to read

$$1.5\ S_{eq} < S_{max}(b_{adj})$$

(c) Corresponding changes will be made to the "Braze Bond Structural Assessment", shown by example in the original submittal, to implement (a) and (b) above.

FIGURE 1: TENSILE TEST SPECIMEN SCHEMATIC



NOTE: This schematic shows how the tensile test specimens that are described in Table 1 load the braze bond in shear.