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U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
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Rockville, Maryland 20852-2738

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DOMINION NUCLEAR CONNECTICUT, INC.
MILLSTONE POWER STATION UNIT 2
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION ON THE USE OF ALTERNATIVE EXAMINATION TECHNIQUE OF SELECT CLASS 1 PIPING DISSIMILAR METAL WELDS (REQUEST NO. RR-89-64, TAC NO. MD6911)

In a letter dated September 27, 2007, (Serial No. 07-0533) Dominion Nuclear Connecticut, Inc. (DNC) submitted Millstone Power Station Unit 2 Alternative Request RR-89-64. DNC requested Nuclear Regulatory Commission (NRC) approval of an alternative for use of a limited one-sided ultrasonic examination technique for eight 36-inch outside diameter reactor coolant system cold leg dissimilar metal welds with cast austenitic stainless steel safe ends that are welded with Alloy 82/182 material. On January 30, 2008, the NRC issued a request for additional information (RAI) containing nine questions related to the DNC request. The response to those questions is provided in the attachment to this letter.

Should you have further questions, please contact Margaret Earle at (804) 273-2768.

Sincerely,

Gerald T. Bischof
Vice President – Nuclear Engineering

Commitments in this letter: None

Attachment

cc: U.S. Nuclear Regulatory Commission
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ATTACHMENT

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In a letter dated September 27, 2007, (Serial No. 07-0533) Dominion Nuclear Connecticut, Inc. (DNC) submitted Millstone Power Station Unit 2 (MPS2) Alternative Request RR-89-64. DNC requested Nuclear Regulatory Commission (NRC) approval of an alternative for use of a limited one-sided ultrasonic examination (UT) technique for eight 36-inch outside diameter (OD) reactor coolant system (RCS) cold leg dissimilar metal (DM) welds with cast austenitic stainless steel (CASS) safe ends that are welded with Alloy 82/182 material. On January 30, 2008, the NRC issued a request for additional information (RAI) containing nine questions related to the DNC request. Responses to those questions are provided in the balance of this attachment.

NRC QUESTION 1:

In DNC's submittal dated September 27, 2007, Relief Request (RR)-89-64, Section 1.0, "Reason for the Request," DNC states "These requirements cannot be met because of the cast austenitic stainless steel safe end base material and the weld design configuration."

Discuss further the reason(s) why the weld design configuration prevents essentially 100% UT examination coverage.

RESPONSE:

The weld configuration will limit the effective examination of the required volume due to the short safe-end and adjacent pump to safe-end weld. This configuration will limit the ability to scan in the axial beam direction (i.e., detection of circumferential reflectors) from only the pipe or elbow side of the weld. The transition from different ODs between the pipe/elbow to the safe-end results in a tapered weld surface. A tapered weld surface limits effective coupling between the transducer and the surface for both the axial and circumferential scan directions. The transducer selections are based upon optimal parameters that provide the most coverage of the examination volume for these configuration limitations.

NRC QUESTION 2.A:

In Section 3.0 of RR-89-64, "Code Requirements for which the Alternative is requested," DNC states "A similar Figure 2-3 is depicted on page 2-2 of the enclosure to this submittal. The required examination volume in Figure 2-3 is shown as C-D-F-E."

DNC's basis refers to multiple recommended search units and calculated coverage depicted and described in the enclosure. Discuss further how DNC's basis will demonstrate that the proposed one-sided UT examination will provide reasonable assurance that flaws will be detected throughout the entire required examination volume.

RESPONSE:

Figure 2-3 is the required examination volume for the MPS2 Risk-Informed Inservice Inspection (RI-ISI) program,[1] and it meets industry guidance of the Materials Reliability Program (MRP): MRP-139, "Primary System Piping Butt Weld Inspection and Evaluation Guideline," mandated by the Nuclear Energy Institute (NEI) 03-08 initiative, which has made DM Alloy 82/182 inspection and evaluation guidelines a high priority.

The examination of the RCS cold leg DM welds will be performed utilizing UT procedures that are qualified for DM welds with single side scanning access, in accordance with the U.S. American Society of Mechanical Engineers (ASME), Boiler and Pressure Vessel Code, Section XI, Appendix VIII, Supplement 10 requirements, as modified by the industry's Performance Demonstration Initiative (PDI) Program. The same procedure will provide coverage of the CASS material on a best effort basis for the small portion of the required examination volume that is outside the PDI Program qualified material, (i.e., the CASS safe-end).

Considering the use of optimized transducer parameters, (i.e., size, frequency, contouring, focusing, and angle), and the optimized scanning parameters, (i.e., sensitivity, overlap, and coverage), for the configuration of these DM welds with the limited scan access, the PDI qualified procedure that will be used for these examinations exceeds the ASME Code Section XI, Appendix III, Supplement 4 requirements. Examination coverage of the required volume will be documented as a percentage of volume completely examined with the requirements of the qualified procedure. Best effort coverage obtained will also be documented, where a portion of the volume examined is not necessarily examined with each of the parameters of the qualified procedure, (e.g., for examination of a limited portion of the DM weld where only one beam angle in the axial scan direction was achievable, or in the CASS volume with only one direction achievable).

NRC QUESTION 2.B:

Provide the volume area or amount (%) of CASS material required to be covered as part of the RI-ISI UT examination volume.

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[1] NRC letter, "Safety Evaluation for Millstone Power Station, Unit No. 2 – Risk Informed Inservice Inspection Program (TAC No. MC1284)," dated April 1, 2005, (ADAMS Accession No. ML050740463).

RESPONSE:

The volume of the CASS material to be examined as part of the RI-ISI examination volume consists of the inner 1/3 thickness of the safe-end extending 1/4 inch from the weld toe, as shown in Figure 2-3 on the C-F side of the weld [in the Alternative Request RR-89-64].

NRC QUESTION 3.A:

In Section 4.0 of RR-89-64, "Proposed Alternatives and Supporting Information," DNC states that ". . . to perform a UT examination of the eight welds in this request with a PDI demonstrated procedure from the ferritic pipe or elbow side of the welds; and, perform a bare metal visual examination to provide the needed defense-in-depth in support of the limited UT for axial PWSCC [primary water stress corrosion cracking] when UT examination is not performed on these welds during a refueling outage."

Discuss how the examination personnel are qualified and by what requirements.

RESPONSE:

Bare metal visual examination personnel are qualified and certified in accordance with ASME Code Section XI, VT-2 visual examination requirements. Additionally, visual examination personnel are trained and qualified to the Millstone Station Boric Acid Corrosion Control Program. UT examination personnel are qualified and certified in accordance with ASME Code Section XI, Appendix VII requirements. In addition the UT examination personnel for dissimilar metal welds are qualified in accordance with Appendix VIII, Supplement 10 requirements as modified by the PDI Program.

The DNC statement regarding defense-in-depth is a reference to the manner in which the planned examination techniques of a bare metal visual and a UT will complement each other to ensure the continued leak tight integrity of these welds. Complete coverage of the Alloy 82/182 weld material for circumferential flaws is expected with the UT examination. Some limited coverage for axial flaws is also expected. Because limited coverage is expected for axial flaws, a possibility could exist where an axial flaw could be missed by the UT examination. Operating experience shows that axial flaws, however, will not result in a catastrophic rupture of the pipe and, therefore, if one is missed, the bare metal visual examination on these welds performed during outages when UT is not performed will provide a needed check for leakage.

The UT examinations of all eight welds are planned for the upcoming Spring 2008 refueling outage. Bare metal visual examinations of the same welds are planned for the Fall 2009 refueling outage.

NRC QUESTION 3.B:

Provide the requirements and criteria that will be used to perform the bare metal visual examination and discuss further how a visual examination on the external surface of the dissimilar metal welds (DMWs) will provide defense-in-depth for the proposed alternative one-sided volumetric examination as visual examination cannot detect subsurface flaws and/or some small surface flaws.

RESPONSE:

A direct visual examination of the bare metal surfaces of the weld will be performed near the beginning of each outage in which UT is not performed. The examination is performed after plant cool down following insulation removal for each subject weld. The visual examination is a VT-2 type of examination performed at static system pressure to identify and report any indication of leakage including boric acid deposits or residue. Any indication of through wall leakage would be found unacceptable for continued service and reported in the Millstone Station Corrective Action Program to evaluate for appropriate corrective measures. Each examination is performed utilizing personnel and procedures that meet the applicable Section XI VT-2 examination requirements. Additionally, it is understood that a visual examination cannot detect subsurface flaws and/or some small surface flaws but there is value and defense-in-depth in performing this bare metal visual examination. Please refer to the response provided above for NRC Question 3.A.

NRC QUESTION 3.C:

In the above statement, clarify what is meant by ". . .when UT examination is not performed on these welds during a refueling outage. . ." This implies that you would use visual examination in lieu of UT, which would be inadequate considering the limitation of the visual examination.

RESPONSE:

The UT of the eight welds described by this request and the bare metal visual examinations of these same welds are separate examinations, consistent with current requirements in the MPS2 RI-ISI program and the schedule of MRP-139.

MPS2 will meet the industry guidance of MRP-139, which does recommend bare metal visual examination of these eight welds once every 3 refueling outages, in outages where UT is not performed, until the weld is mitigated or replaced. UT examination is required under the MPS2 RI-ISI program once every 10-year interval. Per the requirements of RI-ISI program, these eight welds must be UT examined by the end of the 10-year interval, which is March 31, 2010. Under MRP-139, UT examination of these welds is recommended every 6 years after they are inspected once under MRP-139, and they must be UT examined by

December 31, 2010. Thus, MPS2 RI-ISI program requirements and industry benchmarks will be met by performing UT examination on all the eight welds of this request during the Spring 2008 refueling outage. Bare metal visual examinations will be performed during the Fall 2009 refueling outage, which exceeds the requirements of the MPS2 RI-ISI program and meets the MPS2 industry benchmarks for MRP-139 bare metal visual examinations of these welds.

NRC QUESTION 3.D:

DNC states, "Due to the size of these welds, additional time is needed to determine the appropriate mitigation strategy for these welds in the future." Please discuss your repair strategy should your inspection reveal defects within the Alloy 600 DMW and/or surrounding base metal. Discuss why you require additional time to determine the appropriate mitigation strategy of the subject DMWs.

RESPONSE:

MPS2 has an aggressive Alloy 600 Control and Remediation Program in place to address PWSCC. The plant has replaced the pressurizer and performed half nozzle repairs on all the hot leg instrumentation nozzles. Over the next two refueling outages MPS2 plans to perform full structural weld overlays on the remaining Alloy 82/182 butt welds except for the eight welds in this request.

To further support additional time that is necessary to develop repair/mitigation strategy and a contingency plan for examinations on these welds, the following information applies. All eight welds are subject only to cold leg temperatures, they are all shop welds, and have never been field weld repaired during service. There is no operating experience at this time to indicate these cold leg welds should be considered at a higher level of susceptibility to PWSCC. The use of this proposal that permits the UT examinations to proceed in the Spring 2008 refueling outage remains consistent with the MPS2 RI-ISI program and industry benchmarks that are described in MRP-139. Additionally, because of the current full structural weld overlay limitations that the thickness of these welds would require, it is most likely that an optimized weld overlay applied under the requirements of draft Code Case N-754 would be used. Considering the status of that Code Case development effort, it is too early for MPS2 to determine how this request would affect future flaw sizes to be used to determine the thickness of an optimized weld overlay for these welds.

Currently, MPS2 has no contingency in place should the inspection identify defects within the Alloy 600 DM weld and or surrounding base metal. Vendors have been contacted in regards to the possibility of applying a full structural weld overlay on these welds. The full structural weld overlay approach would be difficult with a low confidence of success because of the needed thickness of these welds. A weld overlay vendor will, however, be on-site in the Spring 2008 refueling outage.

Secondly, mechanical stress improvement (MSIP™) is another option for mitigating these welds, but that should be done with a UT examination prior to the process to adequately address any pre-existing flaws before the weld is squeezed. Pre-existing flaw identification before performance of MSIP™ is a reasonable basis to support the DNC proposal to perform the UT examinations requested. Thirdly, an optimized weld overlay, one that is of reduced thickness and is not full structural, is also a possibility for a repair or mitigation technique. The rules are still, however, under development within ASME for a draft Code Case N-754. The Code Case N-754 and these rules are not expected to be complete for at least 2 years. Performance of the UT examinations requested in this proposal will obtain better information with which to plan these repair/mitigation strategies.

NRC QUESTION 3.E:

Discuss the inspection requirement (frequency) of the subject welds using UT and/or bare-metal visual examination per your RI-ISI program and/or the MRP-139.

RESPONSE: Please refer to the response provided above for NRC Question 3.C.

NRC QUESTION 3.F:

Discuss whether examining the subject welds from the elbow side would provide sufficient coverage given the elbow configuration.

RESPONSE:

Weld profile data has been collected during a previous outage to assist with an assessment of feasible coverage and transducer selection. Based upon this data, effective coverage of the near side base material, buttering and weld metal is expected with significant "best effort" coverage of the far side (CASS) base material for circumferential reflectors. The weld taper will restrict the amount of effective coverage for axial reflectors. However, based upon scan surface variations, the actual amount of coverage may vary from the initial coverage assessment taken from the weld profile data collected during a previous outage, when scanned with the selected transducers.

NRC QUESTION 4.A:

Section 8.0 of RR-89-64, Conclusion: DNC states, "The information outlined above and in the enclosure supports the DNC conclusion that a one-sided UT examination from the ferritic pipe or elbow side of the subject welds will provide detection capability for circumferential PWSCC. Additionally, it provides an increased frequency for bare metal visual examination that will be used to address the limitations for UT examination coverage for the detection of axial PWSCC."

Discuss further what you mean by providing an increased frequency for bare metal visual examination.

RESPONSE:

Please refer to the response provided above for NRC Question 3.C.

NRC QUESTION 4.B:

Discuss further axial and circumferential PWSCC in terms of the inspection methods.

RESPONSE:

The inspection procedure has been demonstrated to detect both axial and circumferential oriented flaws based upon proper transducer selection and scan access. The circumferential oriented flaws are detected upon a combination of refracted longitudinal beam angles directed perpendicular to the weld axis (axial beam direction). The combination of beam angles is selected based on a corner trap response (45 degree) from flaws at the inside diameter (ID) surface of the component being examined and a response from the flaw face or tip (60 degree). A combination of these beam angles from at least one beam direction provides effective coverage for the detection of circumferential oriented flaws. Axial flaw detection is provided with a 45 degree refracted longitudinal wave transducer with the sound beam directed in the circumferential direction of the component being examined. Scanning is normally performed from the adjacent base material and weld crown surfaces where configuration allows.

NRC QUESTION 4.C:

DNC states that a one-sided UT examination will provide detection capability for circumferential PWSCC. DNC also states that axial PWSCC may be missed by UT examination. Discuss how the detection capability of the one-sided UT examination will be able to detect axial PWSCC.

RESPONSE:

The one-sided UT examination discussed is used to describe the examination for circumferentially oriented flaws as detailed in the qualified ultrasonic examination procedure for qualification limitations. The required examination volume can be effectively examined from a single side of the weld when looking for circumferentially oriented flaws. However, the examination for axially oriented flaws requires scanning access to the weld crown and adjacent base material on both sides of the weld to effectively examine the required volume. For the MPS2 DM welds, the weld crown and adjacent base material will be scanned in the circumferential direction for axial flaws to the extent possible. However, the weld taper provides a transition between the varying diameters of the safe-end and elbow/pipe components that causes the transducer to lose contact when it bridges this transition. The loss of contact restricts the amount of the examination volume that can be effectively examined for axially oriented flaws. The effects of this bridging have been taken into account with the transducer design and selection to optimize the coverage of the required examination volume in this direction by using a tandem element arrangement where applicable. The use of the narrow tandem element transducer will reduce the amount of limited coverage of the examination volume for axially oriented flaws, however less than 100% coverage is still expected.

NRC QUESTION 5:

DNC stated that no UT technique requirements exist to qualify by performance demonstration the UT examination of CASS material. Discuss whether a "best effort" UT examination will be performed on the CASS per the ASME Code, Section XI, Appendix III.

RESPONSE:

The examination of these welds will be performed utilizing UT procedures qualified for DM welds with single side scanning access in accordance with ASME Code Section XI, Appendix VIII, Supplement 10 requirements (PDI Program). For the small portion of the required examination volume outside of the PDI Program qualified material, (i.e., the CASS safe-end), the same UT procedures qualified for DM welds with single side scanning access will be utilized to provide coverage of the CASS material on a best effort basis.

The PDI qualified procedure that will be used for these examinations exceeds the ASME Code Section XI, Appendix III, Supplement 4 requirements for the configuration of these welds with their limited scan access based on the optimized transducer parameters (i.e., size, frequency, focusing, angle) and scanning parameters (i.e., sensitivity, overlap, coverage). Examination coverage of the required volume will be reported as percentage of volume completely examined with the requirements of the qualified procedure, as well as "best effort" coverage

obtained for the portion of the volume examined to the extent possible but not necessarily with all the parameters of the qualified procedure. For example, a "best effort" examination may only be achieved with one beam angle in the axial scan direction for a limited portion of the weld, or the examination of the CASS volume may only be achieved from one direction.

NRC QUESTION 6:

Discuss the examination history of the subject DMWs.

RESPONSE:

The subject welds were last ultrasonically examined in the previous 10-year inspection interval during the period between 1989 and 1994 prior to the implementation of Appendix VIII requirements. The examination data reflects that the welds were found to be acceptable with no relevant indications reported. Bare Metal visual examination has been performed on these welds for the previous two outages and found to be acceptable with no evidence of leakage reported.

NRC QUESTION 7:

Discuss how approval of this relief request will affect the mitigation of these DMWs to PWSCC.

RESPONSE:

MPS2 is planning to use the UT examination results from the welds in this request to develop technical improvements in designing a strategy for their ultimate repair/mitigation. Please refer to the DNC response above to NRC Question 3.D.

NRC QUESTION 8:

Discuss how approval of this relief request will affect the assumed flaw size, used to size the overlay and used in the fatigue analysis, if weld overlays are to be applied on these DMWs.

RESPONSE:

Because of the current full structural weld overlay limitations that the thickness of these welds would require it is most likely that an optimized weld overlay applied under the requirements of draft Code Case N-754 would be used. It is much too early for MPS2 to determine how this request would affect future flaw sizes to be used to determine the thickness of an optimized weld overlay for these welds at this time.

NRC QUESTION 9:

Discuss how approval of this relief request will affect the inspection categorization of these DMWs under MRP-139.

RESPONSE:

Current MPS2 requirements for implementing MRP-139 benchmarks would place these welds after a limited UT examination into a Category I inspection program. That results in a UT examination of these welds every six years and a Category K bare metal visual examination every three refueling outages. However, these programs for inspection are subject to change based on the development of ASME Code requirements that will become effective through NRC rulemaking.