Dominion Nuclear Connecticut, Inc.
Millstone Power Station
Rope Ferry Road
Waterford, CT 06385

Dominion

AUG 11 2003

Docket No. 50-336
B18937

RE: 10 CFR 50.55a(a)(3)(i)

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

Millstone Power Station, Unit No. 2
Request RR-89-43 to Use an Alternative to ASME Code Section XI for
Temporary Installation of Mechanical Nozzle Seal Assemblies on
Pressurizer Heater Penetration Nozzles

Pursuant to the provisions of 10 CFR 50.55a(a)(3)(i), Dominion Nuclear Connecticut, Inc. (DNC) requests U.S. Nuclear Regulatory Commission (NRC) approval for the temporary use of Mechanical Nozzle Seal Assemblies (MNSAs) in the repair of degraded Reactor Coolant System (RCS) pressurizer heater penetration nozzles. Installation of MNSAs is an alternative to certain requirements of Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) that have been demonstrated by industry experience to provide an acceptable level of quality and safety for restoring structural integrity and leak tightness to the RCS.

There is a precedent for the use of these MNSAs at Millstone Unit No. 2. During the previous refueling outage, DNC requested and was granted Code relief for this type of installation on two degraded pressurizer heater penetration nozzles.[(1),(2)] This relief request proposes to expand the applicability of the previously approved use of the MNSA at Millstone Unit No. 2 to the remaining pressurizer heater penetration nozzles. Attachment 1 to this letter describes the temporary installation of these MNSAs and the basis for the ASME Code relief request.

This request is submitted in support of inspection activities required to be performed during future refueling outages. The next refueling outage is scheduled for the Fall of 2003. Accordingly, DNC requests review and approval of this alternative by October 2003.

There are no regulatory commitments contained within this letter.

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(1) NRC letter, "Safety Evaluation of Relief Request RR-89-35, Temporary Installation of Mechanical Nozzle Seal Assemblies on Pressurizer Heater Penetration Nozzles, Millstone Nuclear Power Station, Unit No. 2 (TAC No. MB4039)," dated March 22, 2002, Accession No. ML020730271.

(2) NRC letter, "Correction to Safety Evaluation and Review of Design Stress Report Related to Relief Request RR-89-35, Temporary Installation of Mechanical Nozzle Seal Assemblies on Pressurizer Heater Penetration Nozzles, Millstone Nuclear Power Station, Unit No. 2 (TAC No. MB4039 and MB4655)," dated June 19, 2002, Accession No. ML021500433.

A047

If you should have any questions regarding this submittal, please contact Mr. David W. Dodson at (860) 447-1791, extension 2346.

Very truly yours,

DOMINION NUCLEAR CONNECTICUT, INC.

J. Alan Price
Site Vice President - Millstone

Attachment (1)

cc: H. J. Miller, Region I Administrator
R. B. Ennis, NRC Senior Project Manager, Millstone Unit No. 2
Millstone Senior Resident Inspector

Attachment 1

Millstone Power Station, Unit No. 2

Request RR-89-43 to Use an Alternative to ASME Code Section XI for Temporary Installation of Mechanical Nozzle Seal Assemblies on Pressurizer Heater Penetration Nozzles

Millstone Power Station, Unit No. 2

Request RR-89-43 to Use an Alternative to ASME Code Section XI for Temporary Installation of Mechanical Nozzle Seal Assemblies on Pressurizer Heater Penetration Nozzles

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Millstone Power Station, Unit No. 2

Request RR-89-43 to Use an Alternative to ASME Code Section XI for Temporary Installation of Mechanical Nozzle Seal Assemblies on Pressurizer Heater Penetration Nozzles

Proposed Alternative
in Accordance with 10 CFR 50.55a(a)(3)(i)
- Alternative Provides Acceptable Level of Quality and Safety -

1.0 ASME CODE COMPONENT(S) AFFECTED

System: Reactor Coolant System (RCS)

Component: Pressurizer Heater Penetration Nozzles

Code Class: Pressurizer heater penetration nozzles are in the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) Class 1 portions of the RCS.

2.0 CODE REQUIREMENTS

2.1 Applicable Code Edition and Addenda

The ASME Code Section XI repair and replacement program at Millstone Unit No. 2 is in accordance with the 1989 Edition, no Addenda. Millstone Unit No. 2 is currently in the Third Ten-Year Interval of the Inservice Inspection (ISI) Program, which began on April 1, 1999.

2.2 Applicable Code Requirement(s)

Existing flaws in ASME Code Class components must be removed by mechanical means, or the components be repaired or replaced to the extent necessary to meet the acceptance standards in ASME Code Section XI, Article IWB-3000. Detection of leaks in the structural portion of an ASME Code Class 1, 2, or 3 component is direct evidence of a flaw in a component.

Paragraphs IWA-4120 and IWA-7210 of Section XI require that repairs and the installation of replacements to the RCS pressure boundary be performed and reconciled in accordance with the Owner's Design Specifications and Original Code of Construction for the component or system. The RCS pressurizer was designed and constructed to the rules of ASME Section III, 1968 Edition with Addenda through Summer 1969 (hereinafter referred to as the Construction Code).

3.0 REASON FOR REQUEST

This request is submitted in support of inspection activities required during future refueling outages that involve on-going inspections of the pressurizer heater penetrations. Dominion Nuclear Connecticut, Inc. (DNC) requests approval to implement additional temporary repairs using Mechanical Nozzle Seal Assemblies (MNSAs) in the event that degraded RCS pressurizer heater penetration nozzles are encountered. During the last refueling outage at Millstone Unit No. 2, evidence of Primary Water Stress Corrosion Cracking (PWSCC) was detected and temporary repairs were made in two pressurizer heater penetration nozzles. These nozzles are welded to the pressurizer bottom head with internal J-groove welds. DNC requested and was granted Code relief to use the MNSAs specifically for the temporary repairs on both nozzles.

MNSAs are an alternative to certain requirements of Section XI of the ASME Code that have been demonstrated by industry experience to provide an acceptable level of quality and safety for restoring structural integrity and leak tightness to the RCS. Based on experience with Alloy 600 nozzles at Millstone Unit No. 2 and throughout the industry, DNC believes a reasonable potential exists for future degradation from PWSCC in other pressurizer heater penetration nozzles as the service life of these components increases.

4.0 PROPOSED ALTERNATIVE

Pursuant to the provisions of 10 CFR 50.55a(a)(3)(i), DNC requests U.S. Nuclear Regulatory Commission (NRC) authorization to use MNSAs as a temporary alternative repair method to ASME Code Section XI requirements for the repair of pressurizer heater penetration nozzles. The proposed use of MNSAs is intended to repair leaks attributed to PWSCC that may be detected while performing inspections during future refueling outages, and to restore the heater penetration nozzle pressure boundary integrity. This request, therefore, proposes to expand the applicability of the previously approved use of the MNSA at Millstone Unit No. 2 to the remaining pressurizer heater penetration nozzles.

4.1 Mechanical Nozzle Seal Assembly (MNSA) Details

The pressurizer heater penetration nozzles consist of a sleeve made of SB-167, (Inconel 600) and an internal diameter J-Groove weld (Inconel) joining the sleeve to the bottom head of the pressurizer made of SA533-Gr. B CL1 (Alloy Steel). The Inconel J-Groove weld provides the primary system pressure boundary. Figure 1 shows the typical concept of the MNSA replacement for a pressurizer heater penetration nozzle.

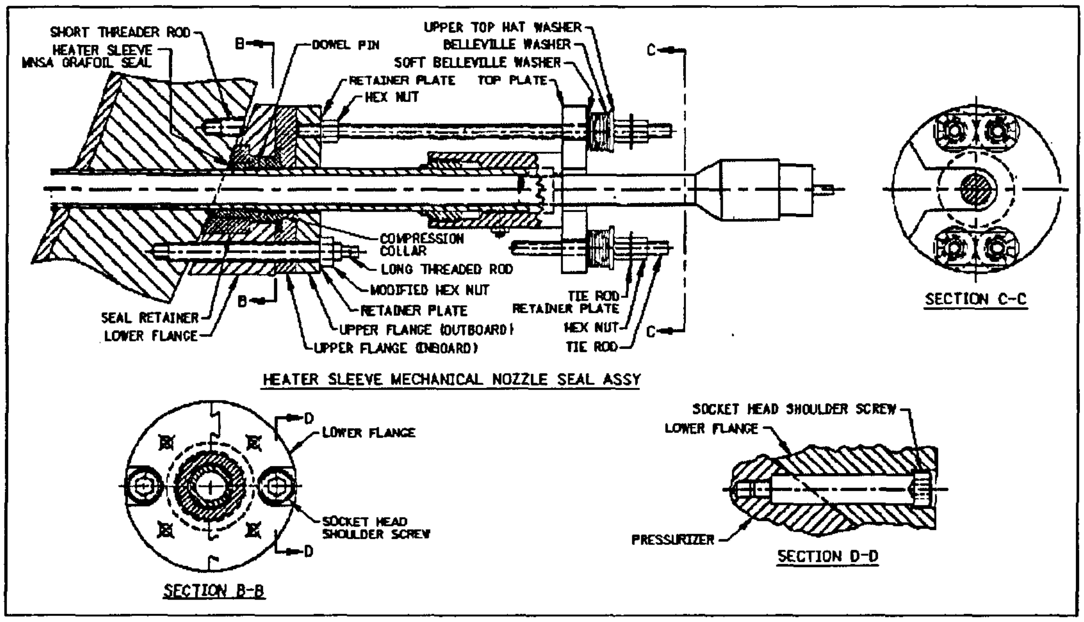

Figure 1: Typical Assembly Drawing of a MNSA Replacement for a Pressurizer Heater Penetration Nozzle

The MNSA is a mechanical device that acts as a complete replacement of the "J" weld between an Inconel 600 nozzle and the pressurizer bottom head, to prevent leakage from cracks caused by Stress Corrosion Cracking. It also acts to restrain the nozzle from ejecting if the "J" weld or the heater penetration sleeve completely fails (360 degree circumferential crack). Therefore, the MNSA replaces both the sealing and structural integrity functions of the existing weld.

The seal is created by compressing the Grafoil Split Packing against the nozzles at the nozzle to head Outside Diameter (OD) interface. The compression collar transmits the load to the Grafoil split packing, while the packing is retained within the seal retainer and compression collar. The compressive load is generated when the hex head bolts are threaded into the pressurizer bottom head and torqued. The installation of the hex head bolts does not violate the primary system pressure boundary. The compressive load is then transmitted to the compression collar through the upper flange. No additional load is imparted on the existing J-weld by application of the MNSA.

The nozzle is held from ejecting by the top plate that is anchored to the upper flanges through tie rods, and secured in place by hex nuts. The top plate is installed with a small gap between the nozzle and its bottom surface. Only if the nozzle-to-bottom head weld completely fails will the top plate act as a restraint; otherwise, it is subject to no load during operating conditions.

5.0 BASIS FOR ALTERNATIVE

The typical repair methods for degraded pressurizer heater penetration nozzles are extremely difficult to implement on an emergent basis due to the system conditions required to perform the work and the limited time in which those conditions exist during an outage. These repairs would require the unplanned extension of drained down or defueled conditions and a significant increase in worker radiation exposure to perform the work on an emergent basis. The temporary use of MNSAs will provide DNC with a contingency to address emergent repair of pressurizer heater penetration nozzles while DNC is evaluating various long-term Alloy 600 pressurizer heater penetration nozzle repair/replacement solutions. MNSAs can be effectively installed under various plant conditions and thus would provide outage schedule flexibility while not requiring the scheduled drained down or defueled work window to be challenged unnecessarily.

The MNSAs are designed, fabricated and constructed using approved ASME Code materials in accordance with the applicable rules of ASME Section III. The MNSAs are designed to prevent separation of the joint under all service loadings. This is supported by technical analysis and tests that meet the design criteria specified in the ASME Code Section III. Additionally, MNSA installations would be accessible for inspection, maintenance and removal.

5.1 Potential for Corrosion or Material Stress Issues

There are no potential corrosion or material stress issues associated with the application of the MNSAs to the pressurizer bottom head at Millstone Unit No. 2. Degradation mechanisms for the intended service period were considered and addressed in the design of the MNSA as follows:

5.1.1 Erosion/Corrosion of Low Alloy Steel Components

A through-wall crack in the nozzle could be a source of erosion/corrosion. However, the borated water will stagnate in the annulus between the Inconel 600 nozzle sleeve and the low alloy steel component. In the absence of a replenishment mechanism, the boric acid and available oxygen will be consumed, and eventually the corrosion process will stop.

5.1.2 "J"-Weld Cracking

"J"-Weld cracking is fully addressed by the MNSA design, since the MNSA takes over the sealing and anti-ejection functions if the weld fails. The MNSA design qualification test runs included simulated partial cracks and complete 360 degree cracks in the nozzles.

5.1.3 Grafoil Seal Corrosion

The Grafoil seal material that is used in nuclear applications is composed of 99.5% graphite, with the remaining 0.5% made up of ash, halides, and sulfur (concerns for corrosion of low alloy steel). The Grafoil seal itself is chemically resistant to attack from nearly all organic and inorganic fluids, and is very resistant to borated water.

Galvanic corrosion can occur between two materials that are electrically connected and have a measurable voltage potential difference as noted by the two materials positions in the electromotive series. Graphite is very high on the electromotive series (cathode) and carbon steel is much lower on the electromotive series (anode). However the conductivity of primary water is quite low so that there is not enough of a current flow to cause galvanic corrosion. Graphite gaskets and seals are used extensively in both the primary and secondary systems of PWRs without galvanic corrosion.

5.1.4 Hardware Corrosion

All the components of the MNSA are fabricated from corrosion resistant materials. Most components are 300 series stainless steel. Fasteners and tie rods are made from SA-453 Grade 660 (a percipitation hardened austenitic stainless steel). Boric acid corrosion of the materials of construction for the MNSA and the outer surfaces of the vessel has been assessed by Combustion Engineering Owners Group (CEOG) and through other testing and analysis. With the current ASME Section XI required inspections, a leaking MNSA would be detected before significant corrosion of the pressurizer bottom head occurs. If the MNSA device leaks, the bolts may be exposed to borated water or steam under conditions in which deposits or slurries will develop. At stress levels present in the MNSA application, these bolts will operate satisfactorily for more than one fuel cycle. The leaking MNSA will be discovered and repaired as part of the Boric Acid Corrosion Control Program walk-down inspections, limiting the exposure to these conditions to a cycle or less.

5.1.5 Design Stress Report

The MNSA is designed as a "safety-related" primary pressure boundary component in accordance with the rules of NB-3200. Modification of the RCS pressurizer for MNSA installation has been analyzed in accordance with the Original Construction Code. In a letter dated March 15, 2002,[(1)] DNC submitted a Design Stress Report[(2)] that was prepared by Westinghouse Electric Company for the pressurizer as an "Addendum to the Pressurizer Analytical Stress." The Design Stress Report demonstrates that the use of the MNSA on the pressurizer heater penetration nozzles will comply with the ASME Code Section III requirements. The Design Stress Report considered criteria that are bounding for the spectrum of pressurizer heater penetration nozzles at Millstone Unit No. 2 and included the following items:

a. analysis of the component being built to a later edition of the Code;
b. analysis of fatigue to demonstrate that the Code prescribed cumulative usage factor of 1.0 is not exceeded;
c. analysis that there is adequate reinforcement in the wall of the pressurizer bottom head for the bolt holes;
d. analysis that stresses under all service conditions do not exceed allowable values as stated in the ASME Code Section III.

5.2 Installation, Inspection, and Testing of the MNSAs

In preparation for a MNSA repair, DNC will perform a visual examination of any leaking nozzles. An informational ultrasonic test (UT) will be performed to determine a thickness measurement near the nozzles. A comparison of the data will be made between the leaking and non-leaking penetrations to evaluate if any measurable corrosion damage is present around a leaking nozzle.

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(1) DNC letter, "Request RR-89-35 Modifications Regarding Use of Mechanical Nozzle Seal Assemblies for Pressurizer Heater Penetration Nozzles (TAC No. MB4039)," dated March 15, 2002, Accession No. ML020850718

(2) Westinghouse Electric Company, Design Report No. DAR-CI-02-3, Rev. 0, dated 03/05/2002.

The installation procedure for the MNSAs has a step to check that the surface of the pressurizer around the nozzle is suitable for the Grafoil seal. The technicians are instructed on what constitutes an acceptable surface. Remedial action to improve surface conditions will be specified if necessary. This guidance has previously been demonstrated to be effective for successful installations of the MNSAs at Millstone Unit No. 2.

Millstone will perform system leak checks and bolting checks in accordance with ASME Section XI requirements. These checks will include the following:

a. As required by IWA-4600, Section XI, 1989 Edition, DNC will perform a VT-1, preservice inspection, on all MNSA installations in accordance with IWB-2200.

b. During plant startup (Mode 3), after initial MNSA installation and during subsequent plant restarts following a refueling outage, the pressurizer heater penetration nozzle MNSAs will be pressure tested and inspected for leakage. To ensure quality of the installation and continued operation with the absence of leakage, a pressure test with VT-2 visual examination will be performed on each of the installed MNSAs with any insulation removed. The test will be performed as part of plant re-start and will be conducted at normal operating pressure with the test temperature determined in accordance with the Millstone Unit No. 2 pressure and temperature limits as stated in the Millstone Unit No. 2 Technical Specifications. Additionally, VT-3 exams will be performed to verify general structural and mechanical condition of the MNSAs.

6.0 DURATION OF PROPOSED ALTERNATIVE

The proposed alternative for the use of MNSAs is as a temporary repair for leakage from cracking between the alloy 600 penetrations and the J-welds to the base material. DNC requests that the staff approve its interim use, through two refueling outages, contingent on acceptable visual inspection results of the MNSAs, conducted in accordance with ASME Code, Section XI. This results in a request for the use of the MNSAs for a period that does not exceed two operating cycles in each application. Prior to exceeding two operating cycles, MNSAs will be removed and appropriate repair or replacement activities will be implemented.

7.0 PRECEDENTS

There is a precedent for the use of MNSAs at Millstone Unit No. 2. During the previous refueling outage, DNC requested and was granted Code relief for this type of installation on two leaking pressurizer heater penetration nozzles.[(3),(4)] This relief request proposes to expand the applicability of the previously approved use of the MNSA at Millstone Unit No. 2 to the remaining pressurizer heater penetration nozzles. In addition, the NRC in a Safety Evaluation, dated October 1, 2001,[(5)] approved a similar request for the temporary repair of pressurizer heater sleeves using MNSAs at Palo Verde Nuclear Generating Station.

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(3) NRC letter, "Safety Evaluation of Relief Request RR-89-35, Temporary Installation of Mechanical Nozzle Seal Assemblies on Pressurizer Heater Penetration Nozzles, Millstone Nuclear Power Station, Unit No. 2 (TAC No. MB4039)," dated March 22, 2002, Accession No. ML020730271.

(4) NRC letter, "Correction to Safety Evaluation and Review of Design Stress Report Related to Relief Request RR-89-35, Temporary Installation of Mechanical Nozzle Seal Assemblies on Pressurizer Heater Penetration Nozzles, Millstone Nuclear Power Station, Unit No. 2 (TAC No. MB4039 and MB4655)," dated June 19, 2002, Accession No. ML021500433.

(5) NRC letter, "Palo Verde Nuclear Generating Station Units 1, 2 and 3 - Request for Code Alternative for the Use of Mechanical Nozzle Seal Assemblies - Relief Request No. 17 (TAC Nos. MB1618, MB1619, and MB1620)," dated October 1, 2001, Accession No. ML012680076.