August 7, 2002

Mr. P. E. Katz
Vice President - Nuclear Energy
Calvert Cliffs Nuclear Power Plant, Inc.
Calvert Cliffs Nuclear Power Plant
1650 Calvert Cliffs Parkway
Lusby, MD 20657-4702

SUBJECT: REQUEST FOR RELIEF FOR TEMPORARY INSTALLATION OF MECHANICAL NOZZLE SEAL ASSEMBLIES AT THE CALVERT CLIFFS NUCLEAR POWER PLANT, UNIT NOS. 1 AND 2 (TAC NOS. MB0557 AND MB0558)

Dear Mr. Katz:

By letter dated November 17, 2000, as supplemented on February 27, March 14, and December 11, 2001, Calvert Cliffs Nuclear Power Plant, Inc. submitted a request for relief to use mechanical nozzle seal assembly (MNSA) devices as an alternate method of repair for the restoration of the structural integrity and leak tightness of Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2, reactor coolant system instrument and sampling nozzle penetrations. Your submittal requested approval to install MNSAs as an alternative to certain requirements of Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code). As discussed in your letter dated February 27, 2001, the use of the MNSAs was proposed as a temporary repair for a time period not to exceed two operating cycles.

The U.S. Nuclear Regulatory Commission staff has completed its review of the subject relief request. The staff's safety evaluation (SE) is enclosed. Our SE concludes that the proposed alternative to the ASME Code requirements will provide an acceptable level of quality and safety in lieu of the Alloy 600 nozzles for the purpose of maintaining the structural integrity of the reactor coolant pressure boundary for a time period not to exceed two operating cycles. Therefore, the alternative is authorized pursuant to Section 50.55a(a)(3)(i) of Title 10 of the *Code of Federal Regulations* for up to two operating cycles.

Please note that the staff has not reviewed the relief request for operation extending beyond the two approved operating cycles. Therefore, if relief is requested for operation beyond these two cycles in the future, the staff will need to review all current and any new data, including stress and fatigue calculations, that may pertain to the extended operation before approval will be granted.

Sincerely,

/RA/

Richard J. Laufer, Chief, Section 1
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-317 and 50-318

Enclosure: Safety Evaluation

cc w/encl: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

FOR APPROVAL TO USE MECHANICAL NOZZLE SEAL ASSEMBLIES

AT THE CALVERT CLIFFS NUCLEAR POWER PLANT, UNIT NOS. 1 AND 2

DOCKET NOS. 50-317 AND 50-318

1.0 INTRODUCTION

The inservice inspection (ISI) of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Class 1, 2, and 3 components is to be performed in accordance with Section XI of the ASME Code and applicable edition and addenda as required by Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.55a(g), except where specific written relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). Pursuant to 10 CFR 50.55a(a)(3), alternatives to the requirements of paragraph (g) may be used, when authorized by the U.S. Nuclear Regulatory Commission (NRC), if the licensee demonstrates that: (i) the proposed alternatives would provide an acceptable level of quality and safety, or (ii) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

By letter dated November 17, 2000, as supplemented on February 27, March 14, and December 11, 2001, Calvert Cliffs Nuclear Power Plant, Inc. (CCNPPI, the licensee), submitted a request for relief to use mechanical nozzle seal assembly (MNSA) devices supplied by ABB/CE, the vendor, as an alternate method of repair for the restoration of the structural integrity and leak tightness of Calvert Cliffs Nuclear Power Plant (CCNPP), Unit Nos. 1 and 2, reactor coolant system (RCS) instrument and sampling nozzle penetrations. The submittal requested approval to install MNSAs as an alternative to certain requirements of Section XI of the ASME Code. As discussed in the licensee's letter dated February 27, 2001, the use of the MNSAs was proposed as a temporary repair for a time period not to exceed two operating cycles.

2.0 BACKGROUND

The RCS at CCNPP contains small bore ($\leq$1½-inch outside diameter) nozzles that are used for instrumentation and sampling purposes. These nozzles are attached to the RCS internal components by partial penetration welds (i.e., j-groove welds). The material used in both the nozzles and welds is Alloy 600. Due to high operating temperatures and high residual stresses, the weld interfaces are susceptible to primary water stress corrosion cracking (PWSCC) which could conceivably lead to a leak in the reactor coolant pressure boundary (RCPB).

Historically, there have been two methods for repairing leaking nozzles. Both entail replacement of the nozzle by welding. The first replaces the entire nozzle and weld with an

Alloy 690 nozzle, which is less susceptible to PWSCC. This repair utilizes the identical geometry as the original design. The second method is similar in that the nozzle is replaced with an Alloy 690 half nozzle, where the attachment is made from the outside surface of the RCS component using a weld pad. Both of these repair methods are time consuming and costly. Furthermore, because the nozzle must be removed and replaced, these methods require complete depressurization and draining of the affected components. For hot leg installations, this means that the entire RCS must be drained below the hot leg nozzles.

As an alternative, the licensee proposed that MNSAs be used to repair these nozzles. The advantages of the MNSAs are that they are relatively quick to install, they require no welding, and they can be installed without draining or depressurizing the affected components. As a result, the radiation dose associated with MNSA installation is much less than with traditional repairs.

MNSAs are mechanical devices that are designed to fit around ASME Code, Section III, Class 1, Alloy 600 nozzles as a means of preventing leakage past the nozzles. The MNSA design consists of two split gasket/flange assemblies. A gasket made from Grafoil packing, a graphite compound, is compressed within the gasket assembly to prevent RCS pressure boundary leakage past the nozzle. The gasket assembly is bolted in place into holes that are drilled and threaded on the outer surface of the RCS pressure boundary wall. A second assembly is bolted to the flanges which serves to prevent ejection of the nozzle in case of total failure. The flange assembly serves to carry the loads in lieu of the partial penetration J-groove welds used to adjoin the nozzles to the particular RCS pressure boundary vessel or piping component of interest.

2.1 Licensee's Relief Request

2.1.1 Components for Which Relief is Requested

All RCS instrument and sampling nozzles.

2.1.2 Applicable Code Requirement From Which Relief is Requested

Subsection IWA-4000 of ASME Code, Section XI, and, by reference, ASME Code, Section III, 1989 Edition, Article NB-3300, Paragraph NB-3337.1 requires that nozzles be attached to the shell or head of the vessel by one of the following methods in NB 3352, "Permissible Types of Welded Joints."

2.1.3 Licensee's Proposed Alternative Examination

The licensee proposes to use an MNSA as a repair to restore integrity and prevent leakage of nozzle assemblies for up to two cycles of operation.

2.1.4 Licensee's Basis for Relief Request

The licensee stated that mechanical nozzle seal assembly devices provide an acceptable level of quality and safety in lieu of meeting the rules of the ASME Code. In order to ensure that MNSA devices provide an acceptable level of quality and safety, CCNPP procured MNSA devices that are designed as fully qualified ASME Code nozzles. The MNSA devices are designed, fabricated, and constructed using ASME Code materials in accordance with the applicable rules of ASME Code, Section III, Subsection NB. The MNSA devices are designed to prevent separation of the joint under all service loadings. Additionally, MNSA installations are accessible for examination, maintenance, removal, and replacements.

The licensee provided information which demonstrates that stresses under all service conditions do not exceed the Code allowables as stated in ASME Code, Section III, Subsection NB and that fatigue limits are not exceeded using the conditions in the CCNPP design specification. The licensee also provided an evaluation to address potential corrosion of the nozzle bore holes, corrosion of the pipe outside diameter surface, galvanic corrosion, and stress corrosion cracking of the MNSA fasteners. Based on the evaluation of potential corrosion effects, CCNPPI concluded that there are no significant corrosion issues associated with the application of the MNSA devices to vessels or piping at CCNPP.

The licensee stated that the MNSA devices would be used if nozzle leaks are identified. The MNSA devices are faster to install, no welding is required, and they can be installed without draining the affected component. As a result, nuclear safety is enhanced because of the elimination of a fuel offload/reduced inventory requirement, and the occupational exposure to radiation associated with the MNSA device installation is lower than that accrued during more traditional repairs. Unplanned replacement of these nozzles could significantly increase plant outage duration for no significant safety benefit in comparison to the use of MNSA devices for up to two cycles of operation.

The licensee provided proposed inspections for MNSA devices installed on leaking nozzles. The inspections provide assurance of proper installation of the MNSA devices for their intended use and duration. Prior to exceeding two operating cycles, MNSA devices installed on leaking nozzles will be removed and nozzle replacement activities will be implemented.

2.2 Regulatory Bases

MNSA devices are designed and fabricated in accordance with the 1989 Edition of the ASME Code, Section III Subsection NB requirements. These devices have been classified as Class 1 components (i.e., reactor coolant pressure boundary) in accordance with the criteria in 10 CFR 50.55a.

The following regulatory bases apply to all instrumentation and sampling nozzles located within the CCNPP RCS pressure boundary.

2.2.1 Applicable Regulations

- Criterion 14 of Appendix A to Part 50 of Title 10 of the *Code of Federal Regulations* (Appendix A to Part 50) requires that the RCPB “shall be designed, fabricated, erected, and tested so as to have an extremely low probability of abnormal leakage, of rapidly propagating failure, and of gross rupture.”

- Criterion 32 of Appendix A to Part 50 requires, in part, that components which are part of the RCPB “shall be designed to permit (1) periodic inspection and testing of important areas and features to assess their structural and leak tight integrity ...”

- Paragraph NB-3337.1, General Requirements, to the 1989 Edition of the ASME Code, Section III, requires that ASME Code, Class 1 nozzles be attached using permissible weld joint configurations identified in Paragraph NB-3552.

- Section 50.55a(g)(4) requires that throughout the service life of a boiling- or pressurized-water-cooled nuclear power generation facility, components (including supports) which are classified as ASME Code, Section III, Class 1, 2, and 3 must meet the requirements, except design and access provisions and preservice examination requirements, set forth in Section XI.

- Table IWB-2500-1 to Section XI, Article IWB-2500, requires that partial penetration welded nozzles to ASME Code, Section III, Class 1 components be inspected according to the appropriate inspection Items in Examination Category B-P, "All Pressure Retaining Components." Table IWB-2500-1 to Section XI, Article IWB-2500, also requires that partial penetration welded nozzles to ASME Code, Section III, Class 1 pressure vessels be inspected according to Item B4.11 of Examination Category B-E, "Pressure Retaining Partial Penetration Welds in Vessels."

- Section XI, Paragraphs IWB-3132 (Class 1 volumetric or surface examination provisions) and IWB-3142 (Class 1 visual examination provisions) require that flaws in ASME Code, Section III, Class 1 components that are unacceptable for further service under the applicable flaw size acceptance standards identified in Table IWB-3410-1, or applicable acceptance-by-analysis provisions of Article IWB-3600 be corrected by an appropriate repair or replacement activity that meets the acceptance standards of Article IWB-3000.

- The repair/replacement activity and re-examination criteria of Article IWB-3000 require, in part, that repair/replacement activities and re-examination activities be in compliance with the general requirements of Article IWA-4000.

- The defect and removal provisions of Section XI, Article IWA-4000 (i.e., Paragraphs IWA-4421, IWA-4422, IWA-4460, and IWA-4611 in the 1998 Edition of Section XI) require that defects be removed by a metal removal process to an acceptable flaw size prior to implementation of any repair or replacement process.

- The repair/replacement requirements of Article IWA-4000 also allow licensed nuclear utilities to reconcile a repair/replacement of a component in the RCPB with the design rules of the Construction Code of record for the component; for CCNPP, the alternative repairs of Alloy 600 instrumentation and sampling nozzles to the RCPB may, therefore, be designed in accordance with applicable criteria of Subarticles NB-3200 and NB-3300 to Section III of the ASME Code.

- The applicable edition of Section XI for CCNPP is the 1998 Edition of Section XI. The applicable edition of Section III of the ASME Code for CCNPP includes the 1989 Edition of Section III.

3.0 EVALUATION

The licensee requested the use of MNSAs pursuant to 10 CFR 50.55a(a)(3)(i), stating that this alternative provides an acceptable level of quality and safety. In order to determine if the MNSAs would provide an acceptable level of quality and safety, the staff compared the MNSA design and operational characteristics to the applicable ASME Code requirements, reviewed the MNSA's resistance to corrosion for the intended period, and evaluated the licensee's commitments associated with the use of the MNSAs.

The MNSAs are designed, fabricated, and constructed using approved ASME Code materials (except for the Grafoil gasket, which is a non-Code material), in accordance with the applicable rules of ASME Code, Section III. The MNSAs are designed to prevent separation of the joint under all service loadings. This design is supported by manufacturers technical analysis and tests that meet the design criteria specified in ASME Code, Section III, Subsection NB, 1989 Edition, no Addenda. Additionally, MNSA installations are accessible for maintenance, removal, and replacement. The provisions of NB-3671.7 of the ASME Code, Section III, are, therefore, satisfied.

MNSAs have been approved for installation on a temporary basis at other nuclear power plants (e.g., Palo Verde Nuclear Generating Station (References 1 and 2) and San Onofre Nuclear Generating Station (Reference 3)). The acceptance was based on industry experience which demonstrated that the structural integrity and leak tightness of the MNSAs, and the structural integrity of the components to which the MNSAs are attached, was maintained at least through one or two cycles. The staff has also reviewed calculations and tests performed by the manufacturer for installations at other plants that demonstrate the structural integrity of the MNSAs, and the conformance of the component fatigue calculations with the ASME Code, Section III, Class 1 design fatigue limit. Based on experience at other plants, the staff considers the probability of exceeding the ASME Code, Section III, Class 1 fatigue cumulative limit of 1.0 in the short-term operation of two cycles to be very low.

3.1 Design Report

In support of its relief request, CCNPPI submitted design reports and engineering service packages to demonstrate that stresses under all service conditions do not exceed the Code allowable as stated in ASME Code, Section III, and that fatigue limits are not exceeded using the conditions in the CCNPP design specification.

In References 4 and 5, CCNPPI provided detailed analyses of MNSA devices fastened to the hot leg and the pressurizer. The objective was to demonstrate compliance of the MNSA designs with ASME Code, Section III, Class 1 design criteria under current licensing basis (CLB) operating conditions. These are specified in the Baltimore Gas and Electric Company (BGE) Design Specification (Reference 6), which states that MNSA devices shall be designed to withstand the loading conditions at the frequencies specified under transient operating conditions, including seismic conditions for operating basis earthquake and safe shutdown earthquake. The MNSAs were designed to the design pressure of 2500 psia and the operating temperature of 653 °F.

3.1.1 Stress Analysis

The analysis provided in references 4 and 5 is similar for all MNSAs, and is based on basic strength-of-materials principles. The MNSAs are characterized by a simplified model consisting of linear-elastic uni-axial springs representing the MNSA metal member stiffness. These springs are arranged in series and in parallel to form a model of the MNSA. Except for the graphite gasket, the material properties for calculating the stiffness were obtained from ASME Code, Section III, 1989 Edition. The analyses consist of the following steps: 1) calculation of the hex head bolt forces as a result of preloading the clamp; 2) calculation of the impact force on the restraining structure and the upper flange due to ejection of the sleeve or nozzle; 3) calculation of incremental internal forces in the MNSA load-bearing components, as a result of this force. For the hex head bolts, the total force on the hex bolts is the sum of the pre-load and the incremental force due to impact; and 4) calculation of member stresses and comparison with the corresponding allowable stresses or other criteria in ASME Code, Section III, Class 1, 1989 Edition.

With no leakage, the only load-bearing members are the hex head bolts, the upper flange, the compression collar, and the graphite gasket. The loads in these members are caused by thermal expansion and by pre-loading of the bolts. The analysis assumes an instantaneous failure of the J-weld or the sleeve that impacts the top plate and the rest of the restraining structure. It also places additional loading on the load-bearing members. The tensile load in the bolts increases, and the compressive load in the compression collar and the graphite gasket decreases. After this event occurs, the internal pressure is assumed to maintain the sleeve positioned against the top plate. The MNSA is, therefore, subjected to all normal operating conditions that are specified in the BGE Specifications (Reference 6).

The staff performed a selective assessment of the stresses in the MNSA members using conservative design assumptions similar to those used by ABB/CE. Based upon the staff's analysis and the ABB/CE test results given in Section 3.2 of this safety evaluation, the staff concluded that there is reasonable assurance that the MNSAs are qualified to the ASME Code, Section III, Class 1 stress criteria. The staff also concluded that the MNSA hex head bolts meet the ASME Code, Section III, Class 1 fatigue criterion for interim operation not to exceed two operating cycles.

3.1.2 Fatigue Analyses

An MNSA device is fastened to the RCS component at the outside surface by ½-inch diameter bolts and screwed into blind threaded holes more than 1 1/8-inch deep in the component wall. The bolts are pre-loaded, thus compressing the graphite gasket causing it to seal and to prevent RCS coolant leakage. The MNSA devices are fastened to the pressurizer upper and bottom head walls with four bolts. Two other bolts that are also pre-loaded are used to position various components during assembly to the curved surfaces. For other components, the MNSA devices are fastened with four pre-loaded bolts. These threaded holes represent stress risers in the wall metal.

In Reference 7, the licensee presented an analysis of the structural integrity of the pressurizer top head, shell and bottom head with MNSA devices bolted to the wall. In Reference 8, ABB/CE presented a similar analysis for the hot leg piping. A prime objective of the analysis was to show that cumulative fatigue usage factor (CUF) in the pressurizer or hot leg walls with threaded holes does not exceed the specified limit of 1.0 for ASME Code, Section III, Class 1 components, 1989 Edition. To demonstrate Code compliance, the licensee performed fatigue analyses in accordance with the provisions of ASME Code, Section III, NB-3222.4(e).

For an interim period defined as two operating cycles, the staff performed a selective assessment which indicated that the components to which the MNSAs are attached are in compliance with the ASME Code, Section III, Class 1 fatigue criterion.

3.2 Hydrostatic and Thermal Testing

In Reference 9, ABB/CE reported the results of hydrostatic and thermal testing of MNSA seal assemblies. These seal assemblies represented the pressure portions of the MNSA devices, containing the pre-loaded parts and the flexible graphite seal that attach to the hot leg and pressurizer walls. The objective of these tests was to demonstrate the structural integrity of an MNSA seal for a pressurizer bottom head instrument nozzle and an MNSA seal for a hot leg nozzle. These clamps have different attachment configurations. The hot leg nozzle seal attaches perpendicularly to the hot leg surface, while the pressurizer bottom head nozzle seal attaches at some angle to the curved surface of the pressurizer bottom head, parallel to the pressurizer axis.

The tests consisted of bolting the seal assemblies on fixtures attached to an autoclave filled with borated water that could be pressurized and heated to the desired pressure and temperature. To perform the hydrostatic test on each assembly, the autoclave was pressurized to 3,175 psig ± 50 psig at room temperature. After three preliminary tests, a test was performed where the pressure was maintained for a 3-hour period. Over this period, the pressure decayed by 100 psi, but no signs of leakage from the seal or traces of moisture were detected. For the pressurizer bottom head assembly, the hydrostatic test was performed at 3,175 psig, with a duration of 26 minutes, during which the pressure decayed less than 50 psi, due to a small leak in a fitting. No moisture was detected outside of the seal.

A total of three thermal cycle tests were performed, after the hydrostatic test, on each seal assembly. Each test consisted of heating the autoclave from ambient temperature (less than 200 °F) to 650 °F ± 10 °F, establishing a pressure equal to 2500 psig ± 50 psig, maintaining these pressure/temperature conditions for at least 60 minutes, and then cooling back down to ambient conditions. There were no observed leaks, and no signs of boric acid crystals were found outside of the seal boundary formed by the graphite seal for either assembly. Therefore, CCNPPI concluded that the MNSA design is not sensitive to thermal cycling effects.

The staff has examined the test report and finds the test procedures and results acceptable to demonstrate the structural integrity of an MNSA seal for two cycles of operation.

3.3 Proposed Inservice Inspection (ISI) Program

CCNPPI proposed to update the ISI Program as follows:

a. The MNSA installation will change the ASME Code, Section XI examination inspection category of the instrument nozzles from B-E (Item B4.13) to B-G-2 (Item B7.20) since the MNSA is a bolted joint. This revised category will require a VT-1 inspection of the bolting. Additionally, a pre-service examination in accordance with IWA-7530 shall also be performed as applicable.

b. The ASME Code, Section XI examination inspection category B-P, specifically item B15.20 and B15.21 will remain unchanged. Each of these items are VT-2 inspections which address system leakage tests and hydrostatic tests.

c. All MNSA locations shall be inspected as part of the Boric Acid Inspection Program. If any leakage is found, the hex head bolting and tie rods (including nuts) shall be replaced.

The staff finds the proposed ISI Program for the MNSAs acceptable.

3.4 Corrosion Resistance and System Leakage

The licensee submitted an evaluation to address potential corrosion of the nozzle bore holes, corrosion of the pipe outside diameter surface, galvanic corrosion, and stress corrosion cracking of the MNSA fasteners. The licensee concluded that there are no significant corrosion issues associated with application of the MNSA devices to vessels or piping at CCNPP.

A history of galvanic corrosion problems in applications where low alloy steel is in contact with a Grafoil seal in an environment of an electrically conductive fluid (water) exists. This particular combination is used in other applications where the low alloy (or carbon steel) is frequently inspected. The Grafoil seal, grade GTJ, is chemically resistant to attack from nearly all organic and inorganic fluids, and is very resistant to borated water. The MNSA application is similar (i.e., Grafoil material is in contact with low alloy steel and visual inspections will be conducted to identify signs of leakage) and for these reasons significant galvanic corrosion is not expected.

Since the MNSAs will be temporarily replacing the Alloy 600 nozzles as the RCPB component, these components will be subject to CCNPP Reactor Coolant System Technical Specification (TS) 3.4.4.6. TS 3.4.4.6 does not allow for any leakage past the RCPB. Therefore, should CCNPPI determine that there is reactor coolant pressure boundary leakage past a MNSA[1] during reactor modes 1, 2, or 3, the TS would require CCNPPI to place the affected CCNPP unit in the hot standby operating mode within 6 hours, and in the cold shutdown operating mode within 24 hours of the time the leakage is noticed. CCNPPI would also be required to report the event pursuant to the licensee event report requirements of 10 CFR 50.73(a)(2)(i). Furthermore, ASME Code, Section XI, Table IWB-2500-1, Inspection Category B-P, requires U.S. nuclear licensees to perform system leakage tests and VT-2 type examinations of all pressure retaining components in their RCPBs once every refueling outage. CCNPPI will therefore be required to perform these tests and examinations on any MNSA that is temporarily installed over a leaking Alloy 600 nozzle as the pressure retaining component in the RCPB. Leakage of borated reactor coolant past an MNSA design would be an indication for CCNPPI to dismantle and examine the MNSA subcomponents for corrosion and material degradation.

[1] This does not include leakage past a MNSA that is a result of a degraded Grafoil seal. Grafoil seals are not considered to be part of the RCPB consistent with ASME Section III.

4.0 CONCLUSION

Based on the preceding evaluation, the staff finds that for the interim period not to exceed two operating cycles, the MNSAs are in compliance with ASME Code, Section III allowable stresses and that the RCS components for which the MNSAs are to be attached will not exceed ASME Code, Section III, Class 1 fatigue qualification requirements.

Pursuant to the provisions of 10 CFR 50.55a(3)(i), the staff concludes that installation of MNSAs is acceptable as a temporary alternative repair method for cracked Alloy 600 instrumentation and sampling nozzles in the CCNPP RCPBs for up to two operating cycles. The staff also concludes that, for the function of maintaining the structural integrity of the RCPB, the MNSAs will temporarily provide an acceptable level of quality and safety in lieu of the Alloy 600 nozzles themselves. Therefore, the alternative is authorized pursuant to 10 CFR 50.55a(a)(3)(i) for up to two operating cycles.

However, the staff has not reviewed the design stress reports for usage extending beyond the two approved operating cycles. Therefore, if relief is requested for operation beyond these two cycles in the future, the staff will need to review all current and any new data, including stress and fatigue calculations, that may pertain to the extended operation before approval will be granted.

5.0 REFERENCES

1. Letter from William H. Bateman, Director, Project Directorate IV-2, Division of Reactor Projects III/IV, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, to H. B. Ray, Executive Vice President, Southern California Edison Company, “Use of the Mechanical Nozzle Seal Assembly for the San Onofre Nuclear Generation Station, Units 2 and 3 (TAC Nos. M99558 and M99559),” February 17, 1998.

2. Letter from William H. Bateman, Director, Project Directorate IV-2, Division of Reactor Projects III/IV, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, to H. B. Ray, Executive Vice President, Southern California Edison Company, “Use of the Mechanical Nozzle Seal Assembly for the San Onofre Nuclear Generation Station, Units 2 and 3 (TAC Nos. MA1776 and MA1777),” January 29, 1999.

3. Letter from S. Dembek, Chief, Section 2, Project Directorate IV and Decommissioning, Division of Licensing Project Management, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, to G. R. Overbeck, Senior Vice President - Nuclear, Arizona Public Service Company, “Palo Verde Nuclear Generating Station, Units 1, 2, and 3 - Use of Mechanical Nozzle Seal Assemblies (TAC Nos. MA7737, MA7738, and MA7740),” March 16, 2000.

4. Proprietary ABB Design Report No. B-PENG-DR-005, Rev. 01, “Addendum to CENC-1179 Analytical Report for BGE CCNPP Units 1 and 2 - Piping,” March 1, 2000.

5. Proprietary ABB Design Report No. B-PENG-DR-006, Rev. 02, “Addendum to CENC-1179 Analytical Report for BGE CCNPP Units 1 and 2 - Pressurizers,” April 6, 2000.

6. BGE Design Specification No. SP-0846, Rev. 01, “Mechanical Nozzle Seal Device,” dated November 17, 2000.

7. Attachment D to Reference 4, "Calculation No. A-CCNPP-9449-1230, Rev. 00, Evaluation of Attachment Locations for Mechanical Nozzle Repair Devices on BGE CCNPP Units I and II Hot Leg Piping RTD and PDT/Sampling Instrument Nozzles," December 1, 1999.

8. Attachment D to Reference 5, "Calculation No. A-CCNPP-9449-1229, Rev. 01, Evaluation of Attachment Locations for Mechanical Nozzle Repair Devices on BGE CCNPP Units I and II Pressurizer Top Head, Shell and Bottom Head Instrument Nozzles and Heater Sleeves," April 5, 2000.

9. Proprietary Vendor Report TR-PENG-042, "Test Report of MNSA Hydrostatic and Thermal Tests," dated July 1997.

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Date: August 7, 2002