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RECIP.NAME RECIPIENT AFFILIATION
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SUBJECT: Requests approval of alternative to repair requirements of 10CFR50.55a,authorizing alternative use of mechanical nozzle seal assemblies,as described in encl,for RCS hot leg instrumentation & sampling nozzles for two operating cycles.

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MA2

10 CFR 50.55a

Palo Verde Nuclear Generating Station

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September 24, 1999

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Dear Sirs:

References:

1. Letter from W. H. Bateman, NRC, to H. B. Ray, Southern California Edison Company, dated February 17, 1998, Use of Mechanical Nozzle Seal Assemblies for the San Onofre Nuclear Generating Station, Units 2 and 3.

2. Letter from G. F. Dick, NRC, to C. M. Dugger, Entergy Operations Incorporated, dated March 25, 1999, Use of Mechanical Nozzle Seal Assemblies at Waterford Steam Electric Station, Unit 3.

Subject: **Palo Verde Nuclear Generating Station (PVNGS)**
Units 1, 2, and 3
Docket Nos. STN 50-528/529/530
Request for Code Alternative for the Use of Mechanical Nozzle Seal Assemblies

Pursuant to the provisions of 10 CFR 50.55a(a)(3)(i), Arizona Public Service Company (APS) hereby requests NRC Staff approval of an alternative to the repair requirements of 10 CFR 50.55a as implemented through the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code Section XI. Specifically, APS requests authorization for alternative use of Mechanical Nozzle Seal Assemblies (MNSAs), as described in the enclosure, for Reactor Coolant System (RCS) hot leg instrumentation and sampling nozzles for an installation duration not to exceed two operating cycles. As demonstrated in the enclosure, use of MNSAs for restoring structural integrity and leak tightness to the RCS provides an acceptable level of quality and safety. Similar requests have been previously approved by the NRC Staff on two occasions as described in references 1 and 2 above.

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Consistent with station procedures, PVNGS performs dedicated walk-downs of the RCS hot legs at the start of each outage. Based on the results of these walk-

downs, there are currently no identified nozzle leaks at PVNGS. However, ongoing review of industry experience and APS engineering analysis of PVNGS RCS hot leg nozzle material properties, RCS service temperatures, and time in-service indicates that a reasonable potential exists for nozzle leakage in the future. Consequently, APS has taken a proactive approach to management of Alloy 600 RCS nozzle corrosion cracking at PVNGS. Although Alloy 600 cracking is not a safety significant issue (reference IEN 90-10), APS has implemented a proactive plan which calls for replacement of Alloy 600 RCS hot leg instrumentation and sampling nozzles by the completion of the twelfth cycle Unit refueling outages.

To date, APS has replaced all Alloy 600 pressurizer instrumentation nozzles (seven per Unit) with corrosion resistant Alloy 690 nozzles. Additionally, APS has replaced the Alloy 600 RCS hot leg pressure instrumentation and sampling nozzles in Unit 2 with Alloy 690 nozzles. As APS moves forward in implementing its long-term nozzle replacement plan, we believe it is necessary to request NRC Staff approval for the use of MNSAs in the likelihood that RCS hot leg nozzle leakage is identified during a plant outage for which the leaking nozzle(s) is not part of the planned replacement scope for that outage, and where replacement of the leaking nozzle(s) would greatly extend the outage duration.

APS requests the Staff's review and response by February 1, 2000, to support the PVNGS Unit 3 eighth refueling outage. However, should APS identify hot leg nozzle leakage during the PVNGS Unit 1 eighth refueling outage, which is scheduled to begin October 2, 1999, APS may request expedited approval of this Code alternative request.

Please note that while APS is currently subject to the 1989 Edition of ASME Section XI for the second 10-year Inservice Inspection interval, relief is currently pending NRC staff approval which would allow APS to use the 1992 Edition, 1992 Addenda of the ASME Code.

The following Commitments are being made by this letter:

1. **As required by IWA-4820, a VT-1 pre-service inspection will be performed on all MNSA installations in accordance with IWB-2200.**

2. **During plant startup (Mode 3) after initial MNSA installation and during subsequent plant re-starts following outages, the MNSAs will be VT-2 examined at normal operating pressure (without insulation) for leakage. Additionally, VT-3 exams will be performed to verify general structural and mechanical condition of the MNSAs.**

3. **Prior to exceeding two operating cycles, MNSAs will be removed and nozzle replacement activities will be implemented as part of APS' long-term Alloy 600 nozzle replacement strategy.**

4. **APS will verify pipe wall thickness prior to machining MNSA bolt holes to further assure that adequate pipe wall reinforcement exists.**

Please contact Mr. Scott Bauer at (623) 393-5978 if you have any questions.

Sincerely,

David D Mauldin

Enclosure

CDM/SAB/RKB/mah

cc: E. W. Merschoff
J. H. Moorman
N. Kalyanam

ENCLOSURE

Alternative Request for the Temporary Use of Mechanical Nozzle Seal Assemblies for Palo Verde Nuclear Generating Station Second 10-Year Inservice Inspection Interval Units 1, 2 and 3

Palo Verde Nuclear Generating Station
Second 10-Year Inservice Inspection Interval
Alternative Request for the Temporary Use of
Mechanical Nozzle Seal Assemblies

Code Class	1
Code Reference	IWA-4170, 1992 Edition, 1992 Addenda
Examination Category	n/a
Item Numbers	n/a
System/Component	Reactor Coolant System (RCS) Pressure Boundary Piping – RCS Hot Leg Instrumentation and Sampling Nozzles
PVNGS Units	ALL

Requirement

ASME Section XI, IWA-4170 requires repairs and installation of replacement items to be performed in accordance with the Owner's Design Specification and the original Construction Code. The affected system (RCS) piping was designed and constructed to the rules of ASME Section III, 1974 Edition through and including the Summer 1974 Addenda.

Alternate Requirement

The potential exists for leaks to occur in RCS hot leg Alloy 600 instrumentation and sampling nozzles due to Primary Water Stress Corrosion Cracking (PWSCC). The typical repair of these nozzles utilizes either an internal or external weld repair, or a half nozzle replacement. As an alternative under the provisions of 10 CFR 50.55a(a)(3)(i), the use of a Mechanical Nozzle Seal Assembly (MNSA) is proposed as a repair to restore nozzle integrity and prevent leakage of nozzle assemblies for up to two cycles of operation.

The proposed Code alternative will facilitate APS' long-term Alloy 600 nozzle replacement strategy for RCS hot leg nozzles where leakage is identified for a nozzle that is not part of the Alloy 600 nozzle replacement scope for the particular outage, and where replacement activities would result in extending the outage duration.

Palo Verde Nuclear Generating Station
Second 10-Year Inservice Inspection Interval
Alternative Request for the Temporary Use of
Mechanical Nozzle Seal Assemblies

Basis For Relief

The nozzles of interest are those Alloy 600 instrumentation and sampling nozzles that are in the ASME Code Class 1 portions of the RCS piping (i.e., RCS hot leg nozzles). These nozzles are welded to the RCS hot leg piping walls with inner diameter J-groove welds. These nozzles have been found to be susceptible to inside diameter initiated, axial orientated, stress corrosion cracking.

Although there are currently no identified nozzle leaks at Palo Verde Nuclear Generating Station (PVNGS), APS has undertaken a proactive long-term Alloy 600 nozzle replacement plan. The nozzle replacement plan calls for APS to replace Alloy 600 RCS hot leg instrumentation and sampling nozzles by the completion of the twelfth cycle Unit refueling outages. APS believes the use of MNSAs would be necessary if nozzle leaks are identified that would require full core offload and drain down to facilitate weld repair and replacement. Unplanned replacement of these nozzles could significantly increase plant outage duration for no significant safety benefit in comparison to the use of MNSAs combined with a well-planned nozzle replacement effort.

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 design is supported by technical analysis and tests that meet the design criteria specified in ASME Section III. Additionally, MNSA installations are accessible for maintenance, removal and replacement.

The Combustion Engineering (CE) Design Report No. V-PENG-DR-007, Addendum to CENC-1500, CENC-1590 and CENC-1642, Analytical Reports for Arizona Units 1, 2, and 3 Piping, is provided as attachment A.

This addendum to CE RCS Piping Stress Reports CENC-1500, CENC-1590 and CENC-1642 for PVNGS Units 1, 2 and 3, respectively, has been completed assuring stresses under all service conditions do not exceed the Code allowables as stated in ASME Section III and that fatigue limits are not exceeded using the conditions in the original PVNGS Design Specification.

Modification of the RCS hot leg for MNSA installation has been analyzed in accordance with the Original Construction Code for the PVNGS Main Loop Piping (ASME Section III, 1974 Edition, Summer 1974 Addenda). The analysis included the following items and documented the required ASME Section XI reconciliation for the use of a component built to a later edition of the Code. The analysis is provided in the attached CE Report.

- Fatigue analysis to demonstrate that the Code prescribed cumulative usage factor of 1.0 is not exceeded (NB-3222.4)
- Analysis to demonstrate adequate reinforcement in the wall of the RCS piping for the bolt holes (NB-3643.3)
- Analysis to demonstrate stresses do not exceed the allowables as stated in the Code.

APS contracted with ABB-CE to document a detailed corrosion analysis to address potential corrosion of the nozzle bore holes, corrosion of the pipe outside diameter (O.D.) surface, galvanic corrosion and stress corrosion cracking (SCC) of the MNSA fasteners. The results of the evaluation are summarized as follows:

- Laboratory corrosion data and service experience indicate that any corrosion of the carbon steel in the hot leg Alloy 600 nozzle holes will be minor and will not affect the requested duration of the MNSA repair (i.e., not to exceed two cycles).

- Boric acid corrosion of the materials of construction for the MNSA and the O.D. piping surfaces have been addressed by testing and analysis. With the inspections currently performed, a leaking MNSA would be detected before significant corrosion of the piping occurs.

- There is no history of galvanic corrosion problems in similar applications where carbon steel is in contact with a grafoil seal. This particular combination is used in other applications where the low alloy (or carbon steel) is frequently inspected (for example, steam generator secondary side manway and hand hole applications). The

MNSA application is similar and for these reasons significant galvanic corrosion is not expected. In addition, the Grafoil used in the MNSA is Grade GTJ, which has been treated with ammonium phosphate to inhibit corrosion. The corrosion protection provided by this inhibitor is comparable to sacrificial inhibitors such as zinc or aluminum. Testing has shown that GTJ Grafoil significantly reduces the galvanic corrosion process. It should also be noted that, in the absence of leakage past the Grafoil seal, the annulus will become stagnant and will not allow replenishment of the boric acid or oxygen.

- Testing in Pressurized Water Reactor environments and concentrated boric acid solutions and service experience indicate that A-286 bolts in the MNSA application will operate indefinitely without SCC failures under normal conditions. If the MNSA device leaks, the bolts may be exposed to borated water or steam under conditions in which deposits or slurries will develop. Under these conditions and at stress levels present in the MNSA application, these bolts will operate satisfactorily for more than one fuel cycle. A leaking MNSA will be discovered and repaired as part of the walk-down inspections performed in response to Generic Letter 88-05, *Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants*. These walk-down inspections are performed prior to entering Unit outages. Therefore, the existence of leaking MNSA conditions would be limited to one cycle.

In summary, there are no potential corrosion problems associated with the application of the mechanical nozzle seal assemblies to hot leg piping at Palo Verde. The data indicates that corrosion of the nozzle hole will be acceptable over the requested two-cycle period of use.

Additional Information

MNSAs have been successfully implemented for similar applications at both San Onofre Nuclear Generating Station (SONGS), Units 2 and 3, and Waterford Steam Electric Station, Unit 3.

The MNSAs proposed for use at PVNGS have been designed in accordance with the same CE design that was used to qualify the MNSAs for use at SONGS Units 2 and 3, and Waterford Unit

3. The design and testing of the MNSA has been previously reviewed by the NRC Staff and accepted as providing a reasonable demonstration of the response of the MNSA design to anticipated service conditions. Any minor deviations in the MNSA design for applications at PVNGS are accounted for in APS' plant specific design calculations for the MNSAs, as provided in attachment A.

Should APS identify the need to utilize MNSAs, the following actions will be performed.

1. As required by IWA-4820, a VT-1 pre-service inspection will be performed on all MNSA installations in accordance with IWB-2200.

2. During plant startup (Mode 3) after initial MNSA installation and during subsequent plant re-starts following outages, the MNSAs will be VT-2 examined (without insulation) for leakage. Additionally, VT-3 exams will be performed to verify general structural and mechanical condition of the MNSAs.

   In accordance with ASME Section XI, IWA-4710(b)(5), component connections, piping and associated valves that are NPS 1 and smaller are exempt from pressure testing. However, to ensure quality of installation and continued operation with the absence of leakage, a pressure test with visual inspection will be performed on each of the installed MNSAs with the 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 PVNGS Pressure and Temperature Limits as stated in the PVNGS Technical Specifications.

3. This request for alternative is for up to two cycles of operation. Prior to exceeding two operating cycles, installed MNSAs will be removed and nozzle replacement activities will be implemented as part of APS' long-term Alloy 600 nozzle replacement strategy.

4. APS will verify pipe wall thickness prior to machining MNSA bolt holes to further assure that adequate pipe wall reinforcement exists.

Approval

50.55a(a)(3) of Title 10 of the Code of Federal Regulations states that alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if "(i) The proposed alternatives would provide an acceptable level of quality and safety, or (ii) Compliance with the specified requirements of this section would result in hardship or unusual difficulty without compensating increase in the level of quality and safety."

The proposed alternative to use MNSAs on RCS hot leg instrumentation and sampling nozzles provides an acceptable level of quality and safety.

References

1. ASME Section XI, Rules for Inspection and Testing of components of Light Water Cooled Plants 1992 Edition and 1992 Addenda.
2. Letter from W. H. Bateman, NRC, to H. B. Ray, Southern California Edison Company, dated February 17, 1998, Use of Mechanical Nozzle Seal Assemblies for the San Onofre Nuclear Generating Station, Units 2 and 3.
3. Letter from G. F. Dick, NRC, to C. M. Dugger, Entergy Operations Incorporated, dated March 25, 1999, Use of Mechanical Nozzle Seal Assemblies at Waterford Steam Electric Station, Unit 3.
4. Letter from J. M. Burger, ABB-CE to R. Meeden, APS, dated July 23, 1999, Corrosion Issues Associated with the Installation of Mechanical Nozzle Seal Assemblies (MNSAs) on Potentially Leaking Hot Leg Nozzles at Palo Verde.

ATTACHMENT A

Combustion Engineering Design Report

for

Mechanical Nozzle Seal Assemblies

At Palo Verde Nuclear Generating Station

Units 1, 2 and 3

V-PENG-DR-007, Rev. 01