UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

July 2, 2009

Mr. Randall K. Edington
Executive Vice President Nuclear/
Chief Nuclear Officer
Mail Station 7602
Arizona Public Service Company
P. O. Box 52034
Phoenix, AZ 85072-2034

SUBJECT: PALO VERDE NUCLEAR GENERATING STATION, UNITS 1, 2, AND 3 – RELIEF REQUEST NO. 39, ASME CODE, SECTION XI, ALTERNATIVE REPAIR METHOD FOR SAFETY INJECTION TANKS (TAC NOS. MD9306, MD9307, AND MD9308)

Dear Mr. Edington:

By letter dated July 11, 2008, Arizona Public Service Company (APS) submitted a request for approval of an alternative to the weld repair methods of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI for Palo Verde Nuclear Generating Station (PVNGS), Units 1, 2, and 3. Specifically, in Relief Request No. 39, APS asked for approval of an alternative repair method for the Safety Injection Tanks (SITs) instead of following the ASME Code requirements for flaw evaluation of the original, pressure boundary weld. A conference call was held on November 6, 2008, to communicate with APS management the results of U.S. Nuclear Regulatory Commission (NRC) staff review of the application. Based on the results of the review, the NRC staff concluded that in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(a)(3)(i), the licensee provided information to demonstrate that the proposed alternative would maintain an acceptable level of quality and safety with regard to ensuring the integrity of the PVNGS, Unit 1 SIT 1A-to-vent line nozzle pressure boundary weld and verbally authorized implementation of the proposed alternative.

The NRC staff has completed its review of the licensee's proposed relief for an alternative weld repair from the ASME Code, Section XI requirements. Based on the enclosed safety evaluation (SE), the NRC staff determined that the proposed alternative weld repair for PVNGS, Unit 1 SIT 1A, provides an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the NRC staff authorizes the use of the proposed alternative for PVNGS, Unit 1 SIT 1A for the remainder of the operating license which ends on June 1, 2025. The NRC staff has only authorized this Relief Request for PVNGS, Unit 1 SIT 1A and denies the Relief Request No. 39 for the remaining SITs in PVNGS Units 1, 2, and 3. This alternative repair is not approved for any subsequent similar repairs for the remaining SITs in Unit 1 or the SITs in Units 2 or 3 because the alternative can only be authorized after a thorough evaluation of each individual event to ensure that quality and safety are at acceptable levels.

A copy of the related SE is enclosed. All other ASME Code, Section XI, requirements for which relief has not been specifically requested and approved remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

If you have any questions, please contact Randy Hall at (301) 415-4032 or via email at randy.hall@nrc.gov.

Sincerely,

Michael T. Markley, Chief
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. STN 50-528, STN-529,
and STN-530

Enclosure:
Safety Evaluation

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UNITED STATES
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUEST NO. 39, ASME CODE, SECTION XI,

ALTERNATIVE REPAIR METHOD FOR SAFETY INJECTION TANKS AT

PALO VERDE NUCLEAR GENERATING STATION, UNITS 1, 2, AND 3

DOCKET NOS. STN-50-528, STN-50-529 AND STN-50-530

1.0 INTRODUCTION

By letter dated July 11, 2008 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML082250675), Arizona Public Service Company (APS) submitted for U.S. Nuclear Regulatory Commission (NRC) staff review a request for an alternative (Relief Request No. 39), under the provisions of Title 10 of the *Code of Federal Regulations* (10 CFR), paragraph 50.55a(a)(3)(i), from the requirements for flaw evaluation found in American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, "Rules for In-service Inspection of Nuclear Power Plant Components," for Palo Verde Nuclear Generating Station (PVNGS), Units 1, 2, and 3. Specifically, the licensee has proposed an alternative to the flaw characterization requirements of ASME Code, Section XI, IWC-3420 and IWA-3300 as they apply to the original PVNGS, Unit 1 Safety Injection Tank (SIT) 1A-to-vent line nozzle pressure boundary weld described below in Section 2.0.

2.0 REGULATORY REQUIREMENTS

ASME Code, Section XI, 2001 Edition, 2003 Addenda requires that the flaw or flaws associated with the nitrogen gas leak be identified and repaired so that the leak is stopped and the level of quality and safety is restored to the design requirements.

ASME Code, Section XI, Subarticle IWA-3300 and Paragraph IWC-3420, are applicable to any flaws discovered during inservice inspection (ISI) of a Class 2 component. Specifically, as stated in the licensee's submittal:

> IWC-3420, Characterization, states that each detected flaw or group of flaws shall be characterized by the rules of IWA-3300 to establish the dimensions of the flaw(s). These dimensions shall be used in conjunction with the acceptance standards of IWC-3500.
>
> IWA-3300, Flaw Characterization, states that flaws detected by inservice examinations shall be sized by the bounding rectangle or square for the purpose of description and dimensioning.

The provisions in 10 CFR 50.55a(a)(3) allow alternatives to the ASME Code, Section XI requirements when the licensee can demonstrate that either (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 a compensating increase in the level of quality and safety.

3.0 ALTERNATIVE PROPOSED BY APS

3.1 Description of Proposed Alternative

Sizing the flaw responsible for the leak, its removal, and the repair to the partial penetration, pressure boundary weld is the process which the ASME Code would require APS to follow. Past experience has shown that for partial penetration welds, an alternative process can provide an acceptable level of quality and safety. Instead of fully characterizing/sizing of the existing flaw that is responsible for the nitrogen gas leak, APS has assumed that the partial penetration, pressure boundary weld on the inner diameter is completely cracked to the depth of the partial penetration weld. Given this worst-case flaw in the partial penetration weld (and the potential for it to grow into the SIT 1A shell), the new pressure boundary weld on the outer diameter will provide acceptable levels of quality and safety so that the unit can resume operation.

3.2 Components for which Relief is Requested

The request was written to cover an immediate event that was discovered on June 5, 2008 (described below in Section 4.0 for which the repair has already been made), and any similar, future leaks on any other SITs from PVNGS, Units 1, 2, or 3.

3.3 Basis for Proposed Alternative

The basis for this alternative is 10 CFR 50.55a(a)(3)(i) that allows alternatives to the ASME Code, Section XI in cases where the proposed alternative would provide an acceptable level of quality and safety. The details that support the request for alternative are found in two attachments to the July 11, 2008, letter.

The first attachment presents a thermal and mechanical stress analysis that assumes linear elastic behavior of the configuration after the proposed alternative repair to the SIT vent relief nozzle. The second attachment performs a flaw tolerance evaluation, which was made up of four subtasks. First, the analysis determines the bounding through-wall stress distribution based on the stress analysis generated in the first attachment. In the second step, the stress intensity factors are determined as a function of crack depth for the assumed worst-case flaw in the original, partial penetration pressure boundary weld on the inner diameter (ID) between the shell and the vent relief nozzle. For the third step, the analysis calculates the allowable flaw size based on the ASME Code, Section XI guidelines and the material properties of the shell. Finally, the potential growth of the worst-case flaw due to fatigue loading is accounted for according to the design specifications for the SIT.

3.4 Duration of Proposed Alternative

The licensee has requested that the alternative remain in effect for the duration of the units' current operating licenses, which will expire on June 1, 2025, April 24, 2026, and November 25, 2027, for PVNGS, Units 1, 2, and 3, respectively.

4.0 TECHNICAL EVALUATION

A nitrogen gas leak (2 bubbles per second) at the annulus between the vent line nozzle and the shell of SIT 1A was discovered at PVNGS, Unit 1 during an ISI on June 5, 2008. The leak was most likely due to porosity and/or slag inclusions in the Alloy 82/182 weld metal of the pressure boundary weld on the inner diameter of the tank. APS stopped the leak by making a partial penetration nozzle attachment weld on the outer diameter (OD) of the shell, leaving the flawed, original pressure boundary weld in place on the ID. This effectively moved the pressure boundary from the ID to the OD of the shell. However, this represents an alternative repair to ASME Code, Section XI, Subarticle IWA-3300 and Paragraph IWC-3420.

The licensee's bases for this request for alternative to the ASME requirements for flaw evaluation are discussed in the enclosure to its July 11, 2008, letter and Section 3.3 of this SE. The licensee has stated that:

1) the leak was most probably associated with the partial penetration, pressure boundary weld on the ID of the PVNGS, Unit 1 SIT 1A,

2) inspecting the weld and then repairing the defective weld would present safety concerns for the plant personnel, and

3) assuming the original pressure boundary weld is cracked to the depth of the weld, would be the worst-case scenario that could come out of the required flaw evaluation described in Paragraphs IWC-3420 and IWA-3300 in Section XI of the ASME Code.

The NRC staff has reviewed the above and agrees with the licensee's conclusions regarding the bases for this request for alternative.

With the assumption (3) of the worst-case flaw, to justify a request for alternative pursuant to 10 CFR 50.55a(a)(3)(i), the licensee must prove that the proposed alternative weld repair provides an acceptable level of quality and safety. The licensee's stress analysis has characterized the system given the new pressure boundary weld on the outside of the shell. The method used to estimate fracture toughness of the shell steel from the measured Charpy impact properties was chosen based on the assumption that the steel in service would be operating in the toughness transition region where brittle fracture could occur. In reality, the service temperature is high enough to ensure ductile behavior and a higher fracture toughness for the shell could be justified, although not necessary for the purposes of this analysis. The NRC reviewed the licensee's fatigue analysis and confirmed the basic conclusions from the analysis that the worst-case assumed flaw will not grow significantly for the projected 40 years of anticipated service and that the flaw at the end of 40 years of service will be less than the allowable flaw size for the shell material. Therefore, the licensee's flaw tolerance analysis results satisfy the ASME Code, Section XI requirements.

In summary, for PVNGS, Unit 1, SIT 1A, the licensee has demonstrated with the stress and flaw tolerance analyses that the proposed alternative provides for an acceptable level of quality and safety for the system with the assumed, worst-case flaw and new pressure boundary weld on the outside. This approved alternative is for the Unit 1 SIT 1A-to-vent line nozzle pressure boundary weld only and cannot be applied to any subsequent similar repairs to PVNGS, Units 1, 2, or 3, because the alternative can only be granted after thorough evaluation of each individual event to ensure that quality and safety are maintained at acceptable levels.

5.0 CONCLUSION

The NRC staff has reviewed the licensee's relief request and determined that the proposed alternative weld repair for PVNGS, Unit 1 SIT 1A, provides an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the NRC staff authorizes the use of the proposed alternative for PVNGS, Unit 1 SIT 1A for the remainder of the Unit 1 operating license, which ends on June 1, 2025. The NRC staff has only authorized this Relief Request for PVNGS, Unit 1 SIT 1A and denies the Relief Request No. 39 for the remaining SITs in PVNGS Units 1, 2, and 3. This alternative repair is not approved for any subsequent similar repairs for the remaining SITs in Unit 1 or the SITs in Units 2 or 3 because the alternative can only be authorized after a thorough evaluation of each individual event to ensure that quality and safety are maintained at acceptable levels.

All other ASME Code, Section XI, requirements for which relief has not been specifically requested and approved remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector. This approval does not affect any of the future ISI requirements of the ASME Code, Section XI for SIT 1A at PVNGS, Unit 1.

Principal Contributor: P. Purtscher

Date: July 2, 2009

If you have any questions, please contact Randy Hall at (301) 415-4032 or via email at randy.hall@nrc.gov.

Sincerely,
/RA/

Michael T. Markley, Chief
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. STN 50-528, STN-529,
and STN-530

Enclosure:
Safety Evaluation

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ADAMS Accession No.: ML091700197 (*) Concurrence via SE (**) See previous concurrence

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