10 CFR 50.55a

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Palo Verde Nuclear Generating Station

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ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Reference: APS letter 102-06009, dated May 22, 2009, Subject: Inservice Testing Relief Request for High Pressure Safety Injection Pump Testing – Pump Relief Request PRR-08

Dear Sirs:

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Unit 3
Docket No. STN 50-530
Inservice Testing Relief Request for High Pressure Safety Injection Pump Testing – Pump Relief Request PRR-08, Revision 1

This correspondence revises the referenced Arizona Public Service Company (APS) request for relief from the comprehensive full flow pump testing requirements of the American Society of Mechanical Engineers (ASME) Code for Operation and Maintenance of Nuclear Power Plants (OM) Code 2001 Edition, 2003 Addenda.

Specifically, on May 22, 2009, APS requested and was granted verbal authorization for this relief request. The enclosure, "Inservice Testing Relief Request for High Pressure Safety Injection Pump Testing - Relief Request PRR-08, Revision 1," incorporates the additional information requested by the NRC staff during the teleconference on May 22, 2009. APS requests approval of the proposed alternative for the duration of the fifteenth operating cycle of Unit 3.

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NRR

No commitments are being made to the NRC by this letter. Should you need further information regarding this submittal, please contact Russell A. Stroud, Licensing Section Leader, at (623) 393-5111.

Sincerely,

D. C. Mims

DCM/TNW/RJR/gat

Enclosure: Inservice Testing Relief Request for High Pressure Safety Injection Pump Testing - Relief Request PRR-08, Revision 1

cc: E. E. Collins Jr. NRC Region IV Regional Administrator
J. R. Hall NRC NRR Project Manager
R. I. Treadway NRC Senior Resident Inspector

Enclosure

Inservice Testing Relief Request
for High Pressure Safety Injection Pump Testing
Relief Request PRR-08, Revision 1

Proposed Alternative
in Accordance with 10 CFR 50.55a(a)(3)(ii)
Relief Request PRR-08, Revision 1

Background

During the Palo Verde Unit 3 fourteenth refueling outage (U3R14), the High Pressure Safety Injection (HPSI) B pump outboard mechanical seal was replaced, which required the removal of the outboard bearing. A comprehensive full flow test was satisfactorily performed following that maintenance with the reactor vessel head removed and the reactor defueled. Approximately 2 weeks later on May 20, 2009, during preparation to enter Mode 4 and while using the pump to fill the Safety Injection Tanks, excessive leakage was observed which subsequently subsided. An investigation identified a misalignment of the mechanical seal. At the recommendation of the vendor, a new mechanical seal and outboard bearing were installed. The scope of work performed was reviewed and Arizona Public Service Company (APS) engineering determined that a comprehensive full flow test was necessary and that the test procedure could not be performed in the current plant configuration.

Due to circumstances that would delay the timely resumption of Palo Verde Unit 3 operation, APS requested, and was granted, verbal authorization for a relief request to test the HPSI B pump using the recirculation line back to the Refueling Water Tank (RWT) in lieu of performing the comprehensive full flow test into the reactor vessel. During the verbal authorization of Relief Request PRR-08, the NRC asked that APS revise the relief request to include the following additional information discussed during the teleconference:

- Why it would be acceptable to test the Unit 3 HPSI B pump at flow rates lower than the comprehensive full flow test flow rates.
- Why it would be acceptable to test the Unit 3 HPSI B pump using instrument uncertainties greater than allowed by the American Society of Mechanical Engineers (ASME) Code for Operation and Maintenance of Nuclear Power Plants (OM) Code 2001 Edition, 2003 Addenda. It was requested that this include a discussion of the existing relief request that Palo Verde has for instrument uncertainty on the miniflow line.
- A discussion on the use of spectrum analysis for the vibration measurements.

The revised portions of the May 22, 2009, Relief Request have been identified by revision bars.

1. ASME Code Component(s) Affected

Pump 3MSIBP02 is the train B HPSI pump in Palo Verde Nuclear Generating

Station (PVNGS) Unit 3. This is a safety-related centrifugal pump model 4X11CA-8 manufactured by Ingersol–Rand.

2. Applicable Code Edition and Addenda

ASME OM Code 2001 Edition, 2003 Addenda.

3. Applicable Code Requirements

ASME OM Code Subsection ISTB, *Inservice Testing of Pumps in Light-Water Reactor Nuclear Power Plants*

ISTB-3310 Effect of Pump Replacement, Repair, and Maintenance on Reference Values. When a reference value or set of values may have been affected by repair, replacement, or routine servicing of a pump, a new reference value or set of values shall be determined in accordance with ISTB-3300, or the previous value reconfirmed by a comprehensive or Group A test run before declaring the pump operable. The Owner shall determine whether the requirements of ISTB-3100, to reestablish reference values, apply. Deviations between the previous and new set of reference values shall be evaluated, and verification that the new values represent acceptable pump operation shall be placed in the record of tests (see ISTB-9000).

ISTB-3510 General (a) Accuracy - Instrument accuracy shall be within the limits of Table ISTB-3500-1. If a parameter is determined by analytical methods instead of measurement, then the determination shall meet the parameter accuracy requirement of Table ISTB-3500-1 (e.g., flow rate determination shall be accurate to within ± 2% of actual). For individual analog instruments, the required accuracy is percent of fullscale. For digital instruments, the required accuracy is over the calibrated range. For a combination of instruments, the required accuracy is loop accuracy.

Table ISTB-3500-1 Required Instrument Accuracy – Flow Rate for Comprehensive and Preservice Tests, ± 2%.

4. Reason for Request

The Unit 3 HPSI B pump falls under the Group B categorization in the applicable ASME OM Code. The ASME OM Code ISTB-3310 requires that a comprehensive or Group A pump test be performed when a reference value may have been affected by repair, replacement, or routine servicing of a pump. The HPSI pump comprehensive full flow test would necessitate the removal of the reactor head to create an adequate flow path to achieve the required test flow rate. This test is normally performed with the reactor defueled. To perform the

comprehensive full flow test in the plant conditions existing on May 22, 2009, would require a temporary procedure change with associated training to enable the test to be performed without removing the reactor head and defueling the reactor. The test would require a unique alignment and the control room operators would be required to react quickly in the event of a flow imbalance in the Reactor Coolant System (RCS).

The risk imposed by performing the comprehensive full flow test in strict accordance with the ASME OM Code would not provide an increase in the level of quality and safety over the proposed test method and is therefore not warranted.

5. Proposed Alternative and Basis for Use

Proposed Alternative

The proposed alternative is to test the Unit 3 HPSI B pump on the larger (non-orifice) recirculation line to the Refueling Water Tank (RWT), which can be performed safely in Mode 5 in lieu of the comprehensive full flow test which requires flow back to the reactor vessel. Running the pump on the larger recirculation line produces a flow (at least 750 gpm) close to the comprehensive full flow of 1040 gpm. The proposed alternative is applicable until the comprehensive full flow test can be performed during the next refueling outage.

Basis for Use

The maintenance performed on the pump for the additional seal replacement activities would not adversely impact the hydraulic characteristics of the pump due to the limited scope of work and the controls used during the maintenance. The controls included maintaining the pump shaft in place during the pump seal and outboard bearing replacement. The purpose of performing the comprehensive full flow pump test following maintenance is to determine if the vibration reference value was impacted to the degree that would require the acceptance criteria to be adjusted. As discussed below, this determination can be made from the results of testing at flow rates lower than the comprehensive full flow test.

The ASME OM Code ISTB 3300(e)(1) states that reference values shall be established within ± 20% of pump design flow for the comprehensive full flow test. The design flow for the PVNGS HPSI pumps is 1040 gpm. The flow rate during the performance of this alternative is expected to be at least 750 gpm which would be greater than 70% of the comprehensive full flow test point. Performing the alternative testing at flow rates that are 70% of the

comprehensive full flow test point provides sufficient vibration data to assess HPSI pump operation. Performing the test at flow rates greater than the 750 gpm anticipated during the alternative testing would not provide any additional information that would improve the assessment capability since pumps operate more efficiently at flow rates closer to the design point.

The flowmeter on the larger (non-orifice) recirculation line to the RWT has an accuracy of ± 5.0% and is a digital flow measuring device. While this does not meet the ± 2% accuracy requirements of the ASME OM Code, it is the optimal accuracy that can presently be achieved given the piping geometry and technological limitations of the equipment available. The flowmeter utilizes ultrasonic technology to monitor flow and can be unfavorably influenced by turbulent conditions, similar to other flow measuring devices commercially available. The purpose of the flow measurement is to ensure there is adequate flow in order to obtain representative vibration data to assess HPSI pump operation. The comprehensive full flow pump test value is 1040 gpm, which is the design flow rate necessary for accident mitigation. The alternative test proposed in this relief request will be performed to measure vibration at flow rates near the comprehensive full flow value to support confidence of operational capability for the duration of the operating cycle. Due to the limited scope of work and the controls used during maintenance, the hydraulic characteristics (including flow rate) were not adversely impacted. On this basis, the ultrasonic flowmeter is sufficiently accurate for the purposes of the alternative test.

Additionally, sufficient test trend data exists at full flow conditions and at mini-flow conditions to allow a comparison of vibration data taken during the alternative test.

The testing will be performed by running the pump for 1 hour at normal recirculation flow (approximately 150 gpm) to verify acceptable seal and bearing operation. The oil will be changed and the pump run for another 2 hours on the larger recirculation flow path. The oil will be changed a second time and the pump run for another 2 hours on the larger recirculation flow path. Vibration data will be collected at initial pump start-up after stable flow conditions are achieved. During the subsequent pump runs vibration data will be collected in a similar manner.

Vibration frequency analysis will be conducted to ensure there are no indications of unacceptable pump performance and that the performance data is within the expected range. Vibration frequency spectrum analysis ensures that the maintenance performed does not result in a condition that is detrimental to pump health.

During the next Unit 3 refueling outage, the comprehensive full flow pump test

will be performed in accordance with ISTB-3310. During the fifteenth operating cycle, the quarterly Group B surveillance tests will be performed. Vibration data will be collected during these Group B surveillance tests and analyzed to provide assurance of acceptable HPSI pump operation.

Relief Request PRR-04, approved on April 24, 2008, (Agencywide Documents Access and Management System (ADAMS) No. ML081050003) discusses the accuracy limitation of the same flow measuring instrument which will be used for the proposed alternative test. However, the flow path discussed in PRR-04 uses the minimum flow recirculation line that includes a flow limiting orifice for Group B testing. Repeatability of the Group B testing is assured by using the installed orifice to establish the flow. The purpose of using the installed ultrasonic flow measurement device during the alternative test for PRR-08 is to establish a flow rate close to the comprehensive full flow test value to ensure representative vibration data can be obtained in order to assess HPSI pump operation. It is not anticipated that APS will perform routine tests at this same flow rate and compare test data. Therefore, there is no need to adhere to the instrument uncertainty requirements specified in the ASME OM Code for this alternative test.

Vibration readings will be taken during the alternative testing and analyzed using vibration frequency spectrum analysis. Vibration frequency spectrum analysis is superior at detecting pump problems when compared to the simple overall measurement of vibration displacement or velocity. The spectrum analysis method utilizes a Fast Fourier Transform to convert accelerometer information from the time domain to the frequency domain. The information is collected using a hand-held data acquisition system that is later downloaded into a computer. The vibration data is then compared in the frequency domain to identify increasing trends at specific frequencies that would otherwise be undetected by evaluating the simple value of overall vibration. Vibration spectrum analysis is a proven technology for determining the health of rotating equipment.

In conclusion, the alternate testing proposed in this relief request to demonstrate the acceptable operation of the Unit 3 HPSI B pump is:

- Vibration can be measured at a comparable flow rate to the comprehensive full flow point which provides an acceptable condition for assessment of pump vibration.
- The flowmeter is sufficiently accurate to ensure there is adequate flow to obtain representative vibration data to assess HPSI pump operation.
- Vibration frequency spectrum analysis is superior to the method of simple overall vibration value measurement required by the ASME OM Code. This provides the capability to detect degradation in pump performance through identification of increases in vibration amplitudes at specific

frequencies which enables early detection of problems in rotating equipment.

The performance of this test and quarterly Group B tests will provide additional assurance of acceptable HPSI pump operation until the comprehensive full flow test can be performed at the next available opportunity to meet the requirements of ASME OM Code ISTB-3310. During the quarterly Group B surveillance tests, vibration data will be collected and spectrum analyses will be performed to provide assurance of continued pump operability.

6. Duration of Proposed Alternative

The duration of the proposed alternative will be for the fifteenth operating cycle of PVNGS Unit 3.

7. Update of Test Results

Due to the unique nature of this situation, revision 1 to Pump Relief Request PRR-08 is being provided subsequent to the performance of the alternative test, such that the results are available. The actual flow rate achieved by the HPSI B pump on the larger recirculation line was approximately 840 gpm. In addition, the data obtained from the Unit 3 HPSI B pump vibration spectrum analysis was well within the expected range and was acceptable.