



Palo Verde Nuclear
Generating Station

A subsidiary of Pinnacle West Capital Corporation

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U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Reference: "Industry Actions Associated with Potential Generic Implications of Wolf Creek Inspection Finding," Nuclear Energy Institute to U.S. Nuclear Regulatory Commission, letter dated January 26, 2007

Dear Sirs:

**Subject: Palo Verde Nuclear Generating Station (PVNGS)
Units 1, 2, and 3
Docket Nos. STN 50-528/529/530
Mitigation of Alloy 600/82/182 Pressurizer Butt Welds**

In October of 2006, while performing inspections of its pressurizer Alloy 600/82/182 butt welds in accordance with the Electric Power Research Institute (EPRI) Material Reliability Program (MRP), "Primary System Piping Butt Weld Inspection and Evaluation Guideline (MRP-139)," a PWR licensee discovered several circumferential indications in its pressurizer surge, safety and relief nozzles. Because of the potential importance of this issue, Arizona Public Service Company (APS) is notifying the NRC of the actions that have been taken or are planned for inspecting or mitigating Alloy 600/82/182 butt welds on pressurizer spray, surge and relief lines for Palo Verde Units 1, 2 and 3.

This letter contains new commitments as described in Table 1. Table 2 provides an inspection and mitigation summary of pressurizer Alloy 600/82/182 butt welds and Table 3 provides the results of inspections completed within the preceding two operating cycles of each unit.

Palo Verde Units 1 and 3

Mitigation of pressurizer Alloy 600/82/182 butt welds at Palo Verde Units 1 and 3 will be completed during U1R13, scheduled to begin in May 2007 and U3R13, scheduled to begin in September 2007. Palo Verde has also performed Bare Metal Visual (BMV) inspections on all the pressurizer Alloy 600/82/182 butt welds as required by MRP-139 (Table 3, VT-2 inspection). Future inspections of pressurizer butt welds at Palo Verde Units 1 and 3 will be performed in accordance with industry guidance issued by the MRP. Post mitigation inspections will be performed and results reported to the NRC within 60 days after startup following the inspections.

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Palo Verde Unit 2

Mitigation activities at Palo Verde Unit 2 are scheduled to be completed during U2R14 which is scheduled to start March 29, 2008. This represents an extension of approximately 3 months beyond December 31, 2007, the MRP-139 deadline. This deviation from the MRP-139 deadline applies to the following pressurizer weld locations; spray nozzle (1), surge nozzle (1) and safety/relief nozzles (4). Our scheduled date is justifiable based on the information provided below.

Previous Inspection Results

These welds are inspected per American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code Section XI. The Unit 2 surge line nozzle dissimilar metal weld (DMW) received an ASME Section XI Appendix VIII Code inspection in the spring of 2005. The inspections were conducted using ASME Section XI techniques and no recordable indications were found. Palo Verde also performed BMV inspections on all the pressurizer Alloy 600/82/182 butt welds as required by MRP-139 during U2R13 (September 30, 2006) with no evidence of leakage. Table 3 tabulates the inspections performed within the preceding two operating cycles by scope, method, qualification, coverage, limitations and findings.

Fabrication Records Review

Plants with significant Alloy 600/82/182 butt weld indications or leaks have a history of extensive weld repairs. Construction and fabrication records for the Palo Verde Unit 2 piping and pressurizers were reviewed to find inspection records such as rejection notices which would indicate a repair to a weld made with nickel based alloy weld filler material. The results of this search showed no evidence of any inside diameter weld repairs done during fabrication. The only repair was in the butter of one of the safety/relief valve nozzles. Weld repairs performed to the butter of this nozzle are not considered relevant because this repair received post weld heat treatment (PWHT).

Leak Detection Capability

Palo Verde's Nuclear Administrative and Technical Manual (NATM) 40ST-9RC02, "ERFDADS (Preferred) Calculation of RCS Water Inventory" contains instructions for reactor coolant system leakage monitoring. The procedure directs reactor operators in the performance of site specific calculations and the initiation of investigations when established acceptance criteria are exceeded. NATM 40OP-9RC03, "RCS Leakage Source Determination" provides instructions for determination of the leakage out of the RCS or a connecting system. The Shift Technical Advisor tracks and trends RCS leakage on a periodic basis and it is reported daily in the PVNGS Daily Status Report. RCS leakage monitoring capabilities, methods, action levels, and responses are described below:

Current monitoring capabilities:

- PVNGS uses a linear regression algorithm to calculate RCS mass balance and from it derives Total Leak Rate, Identified Leak Rate, and Unidentified Leak Rate. The surveillance is required to be performed every 72 hours but is scheduled to be performed every 48 hours.
- Containment Sump rate of change is checked by linear regression every 12 hours in accordance with Technical Requirements Manual (TRM) Surveillance Requirement (SR) 3.4.203.1.
- The Containment Building Atmosphere radiation monitors are trended shiftly. Containment atmosphere is routinely sampled every 7 to 10 days as part of the Containment vent process (containment pressure control). Response to containment building atmosphere radiation monitor alarms requires performance of an RCS water balance and analysis of a containment atmosphere grab sample.

The following describes our sensitivity to RCS leakage. The average unidentified leak rates and standard deviation for the current fuel cycle in each unit is shown below:

Unidentified Leak Rates

Unit	Average (gpm)	Std
1	0.053	0.030
2	0.057	0.035
3	0.042	0.036

- 40ST-9RC02 directs the operator to determine the source of leakage when unidentified RCS leakage exceeds the Alert level of 0.12 gpm. Also, this surveillance procedure directs interconnected system leakage that exceeds 0.3 gpm to be corrected because of its potential to mask Unidentified Leakage.

Currently Palo Verde has no procedurally prescribed escalation based on increasing leak rates, but will adopt the general approach in Pressurized Water Reactor Owners Group (PWROG) WCAP-16465-NP, "Pressurized Water Reactor Owners Group Standard RCS Leakage Action Levels and Response Guidelines for Pressurized Water Reactors," and revise plant procedures by June 30, 2007.

APS is currently evaluating the PVNGS leak monitoring processes and program to determine if any changes should be made. APS will inform the NRC by March 31, 2007, if any additional changes result from this evaluation.

Diverse Leakage Detection Capabilities:

APS is evaluating the feasibility of plant modifications to install diverse leakage detection capability. Plans for any additional capability which reliably and meaningfully add to APS' ability to diagnose primary system leakage, as well as installation schedules as appropriate, will be submitted to the NRC by May 31, 2007.

Susceptibility

The susceptibility to primary water stress corrosion cracking (PWSCC) of Alloy 600/82/182 is largely a function of time at temperature when all other variables are constant. Due to the high temperature, the pressurizer is the most highly susceptible location in an operating plant. However, Palo Verde Unit 2 is a relatively young plant. At the start of U2R14 outage, scheduled for March 29, 2008, PVNGS Unit 2 will have operated for approximately 17.2 EFPYs. Unit 2 is ranked 56th out of 69 operating PWRs in operating hours, which is considered relatively low (MRP-48).

Supplemental Justification

MRP-109, "Alloy 82/182 Pipe Butt Weld Safety Assessment for US PWR Plant Designs" provides the bounding analysis for circumferential crack growth for Combustion Engineering (CE) fleet plants. This analysis shows that for all nozzles, with the exception of the pressurizer spray nozzle, an assumed 1 gpm through-wall flow would take more than one operating cycle (18 months) to reach critical flow length. The analysis shows that for the pressurizer spray nozzle, the time for an assumed 1 gpm through-wall flow to reach critical flow length is less than 1 year. This analysis was performed based on the limiting data which was particular to Plant "R". APS Engineering verified that Palo Verde Unit 2 was not Plant "R".

To evaluate the impact on the Palo Verde Unit 2 pressurizer spray nozzle, the crack growth curve for Plant "R" was used to extrapolate backwards to smaller crack sizes. The extrapolation showed it would take longer than 18 months for a 0.1 gpm crack size to grow to the critical size. APS performed a BMV inspection and a digital radiography examination (RT) of the pressurizer spray nozzle weld during U2R13 (Fall 2006). The results were a leak free BMV and a digital RT with no evidence of through wall or significant subsurface flaws.

Since there is no existing through wall flaws in the pressurizer spray nozzle, there is reasonable assurance of the weld joint integrity of this limiting weld until the application of a full structural weld overlay during the spring 2008.

Additionally, EPRI Report MRP2007-003, Implications of Wolf Creek Pressurizer Butt Weld indications Relative to Safety Assessment and Inspection Requirements," dated January 2007, determined that there is nothing regarding the Wolf Creek indications that would invalidate the safety assessment of MRP-139 butt weld inspection requirements.

Contingency Planning

APS is continuing to evaluate the basis for performing inspections after December 31, 2007, and is following the industry actions outlined in the Nuclear Energy Institute (NEI) letter dated January 26, 2007 (Reference).

If analytical results do not demonstrate that current schedules are adequate or if new information is obtained during upcoming inspections that challenge current assumptions, APS will accelerate the Unit 2 weld overlays currently scheduled for the spring of 2008.

APS will revise plant procedures by March 31, 2007, to state that if a shutdown of a unit should occur due to excessive primary system unidentified leakage, and if the leakage cannot be confirmed to originate from a source other than the pressurizer, perform a bare metal visual examination of the Alloy 600/82/182 butt weld locations on the pressurizer to determine whether the leakage originated from those locations.

The justification to deviate from the MRP-139 UT inspection deadline by approximately 12 weeks meets the intent of performing timely dissimilar metal weld mitigation with a reasonable degree of margin before PWSCC degradation would lead to a pressure boundary leak or a safety issue. APS is committing to mitigate all six (6) Alloy 600/82/182 pressurizer butt welds in U2R14 (Spring 2008) to come into full compliance with MRP-139. Mitigation will be implemented by applying a full structural weld overlay. Post mitigation inspections will be performed and results reported to the NRC within 60 days after startup following the inspections.

Table 1 – Commitments Made by this Letter

COMMITMENT	Committed Date/Outage/Condition
Mitigation of pressurizer Alloy 600/82/182 butt welds at Palo Verde Unit 1 will be completed by U1R13 (Spring 07)	Scheduled Start May 2007
Mitigation of pressurizer Alloy 600/82/182 butt welds at Palo Verde Unit 2 will be completed by U2R14 (Spring 08)	Scheduled Start March 2008
Mitigation of pressurizer Alloy 600/82/182 butt welds at Palo Verde Unit 3 will be completed by U3R13 (Fall 07),	Scheduled Start September 2007
U1 post mitigation inspections will be performed and results reported to the NRC within 60 days after startup following the inspections.	Estimated Date 08/19/2007
U2 post mitigation inspections will be performed and results reported to the NRC within 60 days after startup following the inspections.	Estimated Date 07/06/2008
U3 post mitigation inspections will be performed and results reported to the NRC within 60 days after startup following the inspections.	Estimated Date 02/11/2008
Evaluate the PVNGS leak monitoring processes and program to determine if any changes should be made. APS will inform the NRC by March 31, 2007, if any additional changes result from this evaluation.	March 31, 2007
Adopt the general approach in Pressurized Water Reactor Owners Group (PWROG) WCAP-16465-NP, "Pressurized Water Reactor Owners Group Standard RCS Leakage Action Levels and Response Guidelines for Pressurized Water Reactors," and revise plant procedures.	June 30, 2007
Revise plant procedures to state that if a shutdown of a unit should occur due to excessive primary system unidentified leakage, and if the leakage cannot be confirmed to originate from a source other than the pressurizer, perform a bare metal visual examination of the Alloy 600/82/182 butt weld locations on the pressurizer to determine whether the leakage originated from those locations.	June 30, 2007
Evaluate the feasibility of plant modifications to install diverse leakage detection capability. Plans for any additional capability which reliably and meaningfully add to APS' ability to diagnose primary system leakage, as well as installation schedules as appropriate, will be submitted to the NRC.	May 31, 2007
If analytical results do not demonstrate that current schedules are adequate or if new information is obtained during upcoming inspections that challenge current assumptions, APS will accelerate the Unit 2 weld overlays currently scheduled for the spring of 2008	Notification by industry or the NRC

Table 2- Inspection and Mitigation Summary for Alloy 82/182 Pressurizer Butt Welds

Unit	Weld Component	Susceptible Material Description	MRP-139 Volumetric Inspection Requirement to be Met after Mitigation		Mitigation to Be Completed (Outage Designation)	Comments
			Outage Designation	Scheduled Start Date		
1	PZR Surge (PZR Side), PZR Safety/Relief (4) PZR Spray	82/182	U1R13	May 2007	U1R13	FSWO*
3	PZR Surge (PZR Side), PZR Safety/Relief (4) PZR Spray	82/182	U3R13	September 2007	U3R13	FSWO*
2	PZR Surge (PZR Side) PZR Safety/Relief (4) PZR Spray	82/182	U2R14	March 2008	U2R14	FSWO*

* Full structural Weld Overlay

Table 3 - Results of Inspections Completed within the Preceding Two Operating Cycles of Each Unit

Unit 1 Refuel 11 date 4/3/04

Weld	Inspection Scope	Method	PDI Qualified	Coverage Obtained	Limitations	Findings
4" Spray	Sec. XI	VT-2	N/A	100%	None	None
6" Safety/Relief	Sec. XI	VT-2	N/A	100%	None	None
6" Safety/Relief	Sec. XI	VT-2	N/A	100%	None	None
6" Safety/Relief	Sec. XI	VT-2	N/A	100%	None	None
6" Safety/Relief	Sec. XI	VT-2	N/A	100%	None	None
12" Surge	Sec. XI	VT-2	N/A	100%	None	None

Unit 1 Refuel 12 date 10/01/05

Weld	Inspection Scope	Method	PDI Qualified	Coverage Obtained	Limitations	Findings
4" Spray	Sec. XI	UT VT-2	No	N/A 100%	N/A None	None
6" Safety/Relief	Sec. XI	UT RT VT-2	No	N/A 100% 100%	N/A None None	None
6" Safety/Relief	Sec. XI	UT RT VT-2	No	N/A 100% 100%	N/A None None	None
6" Safety/Relief	Sec. XI	UT RT VT-2	No	N/A 100% 100%	N/A None None	None
6" Safety/Relief	Sec. XI	UT RT VT-2	No	N/A 100% 100%	N/A None None	None
12" Surge	Sec. XI	UT VT-2	Yes	>90% 100%	None None	None

Table 3 - (continued)

Unit 2 Refuel 12 date 4/2/05

Weld	Inspection Scope	Method	PDI Qualified	Coverage Obtained	Limitations	Findings
4" Spray	Sec. XI	UT VT-2	No	N/A 100%	N/A None	None
6" Safety/Relief	Sec. XI	UT RT VT-2	No	N/A 100% 100%	N/A None None	None
6" Safety/Relief	Sec. XI	UT RT VT-2	No	N/A 100% 100%	N/A None None	None
6" Safety/Relief	Sec. XI	UT RT VT-2	No	N/A 100% 100%	N/A None None	None
6" Safety/Relief	Sec. XI	UT RT VT-2	No	N/A 100% 100%	N/A None None	None
6" Safety/Relief	Sec. XI	UT RT VT-2	No	N/A 100% 100%	N/A None None	None
12" Surge	Sec. XI	UT VT-2	Yes	>90% 100%	None None	None

Unit 2 Refuel 13 date 9/30/06

Weld	Inspection Scope	Method	PDI Qualified	Coverage Obtained	Limitations	Findings
4" Spray	Sec. XI	RT VT-2	N/A	100%	None	None
6" Safety/Relief	Sec. XI	VT-2	N/A	100%	None	None
6" Safety/Relief	Sec. XI	VT-2	N/A	100%	None	None
6" Safety/Relief	Sec. XI	VT-2	N/A	100%	None	None
6" Safety/Relief	Sec. XI	VT-2	N/A	100%	None	None
12" Surge	Sec. XI	VT-2	N/A	100%	None	None

Table 3 - (continued)

Unit 3 Refuel 11 date 10/2/04

Weld	Inspection Scope	Method	PDI Qualified	Coverage Obtained	Limitations	Findings
4" Spray	Sec. XI	UT RT VT-2	No	N/A 100% 100%	N/A None None	None
6" Safety/Relief	Sec. XI	UT PT VT-2	No	N/A 100% OD 100%	N/A None None	None
6" Safety/Relief	Sec. XI	UT PT VT-2	No	N/A 100% OD 100%	N/A None None	None
6" Safety/Relief	Sec. XI	UT PT VT-2	No	N/A 100% OD 100%	N/A None None	None
6" Safety/Relief	Sec. XI	UT PT VT-2	No	N/A 100% OD 100%	N/A None None	None
12" Surge	Sec. XI	VT-2	N/A	100%	None	None

Unit 3 Refuel 12 date 4/01/06

Weld	Inspection Scope	Method	PDI Qualified	Coverage Obtained	Limitations	Findings
4" Spray	Sec. XI	VT-2	N/A	100%	None	None
6" Safety/Relief	Sec. XI	VT-2	N/A	100%	None	None
6" Safety/Relief	Sec. XI	VT-2	N/A	100%	None	None
6" Safety/Relief	Sec. XI	VT-2	N/A	100%	None	None
6" Safety/Relief	Sec. XI	VT-2	N/A	100%	None	None
12" Surge	Sec. XI	VT-2	N/A	100%	None	None

If you have any questions, please contact Thomas N. Weber at (623) 393-5764.

Sincerely,



CDM/SAB/RJR

cc: B. S. Mallett NRC Region IV Regional Administrator
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