Palo Verde Nuclear Generating Station

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102-06348-TNW/CJS
April 22, 2011

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

Dear Sirs:

Subject: Palo Verde Nuclear Generating Station (PVNGS) Unit 1
Docket No. STN 50-528
License No. NPF-41
Response to NRC Draft Request for Additional Information 2010 Steam Generator Tube Inspections

Attached please find Arizona Public Service Company's (APS) response to the March 8, 2011, Nuclear Regulatory Commission (NRC) Draft Request for Additional Information.

By letter dated November 8, 2010 (Agencywide Documents Access and Management Systems (ADAMS) Accession No. ML103210208), APS submitted information summarizing the results of the 2010 steam generator (SG) tube inspections at Palo Verde Nuclear Generating Plant (PVNGS) Unit 1.

The NRC staff reviewed the information provided by APS and determined that additional information was needed to complete its review of the SG tube inspections. On March 18, 2011, the NRC staff provided a Draft Request for Additional Information (RAI) to APS and requested that a response be submitted by April 19, 2011. APS requested and was subsequently granted until April 22, 2011, to respond to the Draft RAI. The APS response to the Draft RAI is provided in the Enclosure to this letter.

No commitments are being made to the NRC by this letter.

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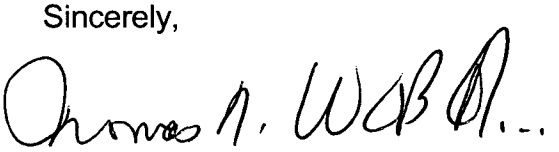
Should you need further information regarding this response, please contact Russell A. Stroud, Licensing Section Leader, at (623) 393-5111.

Sincerely,



DCM/RAS/CJS/gat

Enclosure: Response to Draft Request for Additional Information
Unit 1 2010 Steam Generator Tube Inspections

cc:	E. E. Collins Jr.	NRC Region IV Regional Administrator
	L. K. Gibson	NRC NRR Project Manager for PVNGS
	J. R. Hall	NRC NRR Senior Project Manager
	M. A. Brown	NRC Senior Resident Inspector for PVNGS
	A. V. Godwin	Arizona Radiation Regulatory Agency (ARRA)
	T. Morales	Arizona Radiation Regulatory Agency (ARRA)

Enclosure

Response to Draft Request for Additional Information
Unit 1 2010 Steam Generator Tube Inspections

Introduction:

On March 18, 2011, the NRC staff provided a Draft Request for Additional Information (RAI) to complete its review of the Unit 1 2010 Steam Generator Tube Inspection Report, submitted to the NRC by Arizona Public Service Company (APS) on November 8, 2010 [Agencywide Documents Access and Management Systems (ADAMS) Accession No. ML103210208].

APS's responses to the Draft RAI are provided as follows.

NRC Request 1:

APS indicated that the scope of the foreign objects search and retrieval (FOSAR) effort included an inspection of the blowdown patch plate welds and that the inspections confirmed that all four patch plates (two per SG) were cracked similar to what was found in the Unit 2 SGs. Additionally, APS stated that the patch plate to lug weld was completely compromised and the patch plate to divider plate welds were completely intact. Please provide a description of the blowdown plate assembly, as well as a more complete description of the cracking found in the blowdown patch plate welds. Please summarize the basis of the conclusion that the cracking will not affect the functionality of the blowdown patch plates and that the probability of loose parts being formed is remote. Please describe any long term follow up actions planned to confirm the conclusions.

APS Response:

During Foreign Object Search and Retrieval (FOSAR) on the secondary side of the PVNGS Unit 2 replacement steam generators (RSGs) during the 15th refueling outage in Unit 2 (U2R15), cracked welds were observed on the (blowdown duct) patch plates, which are located on the secondary divider plate assembly near the 90-degree and 270-degree handholes (See Figures 1 and 2). Similar cracks were confirmed to exist on the twelve blowdown duct patch plates in each of the six RSGs. This condition is documented in the PVNGS corrective action program (Condition Report / Disposition Request (CRDR) 3395100).

The following figures are still photographs from Unit 2, which are similar to Unit 1. The video inspection results for Unit 1 are in DVD format and, therefore, are not included in the RAI response.

Figure 1
View of Patch Plate to Lug Weld Crack in RSG 21 at 90° Handhole Hot Leg Side

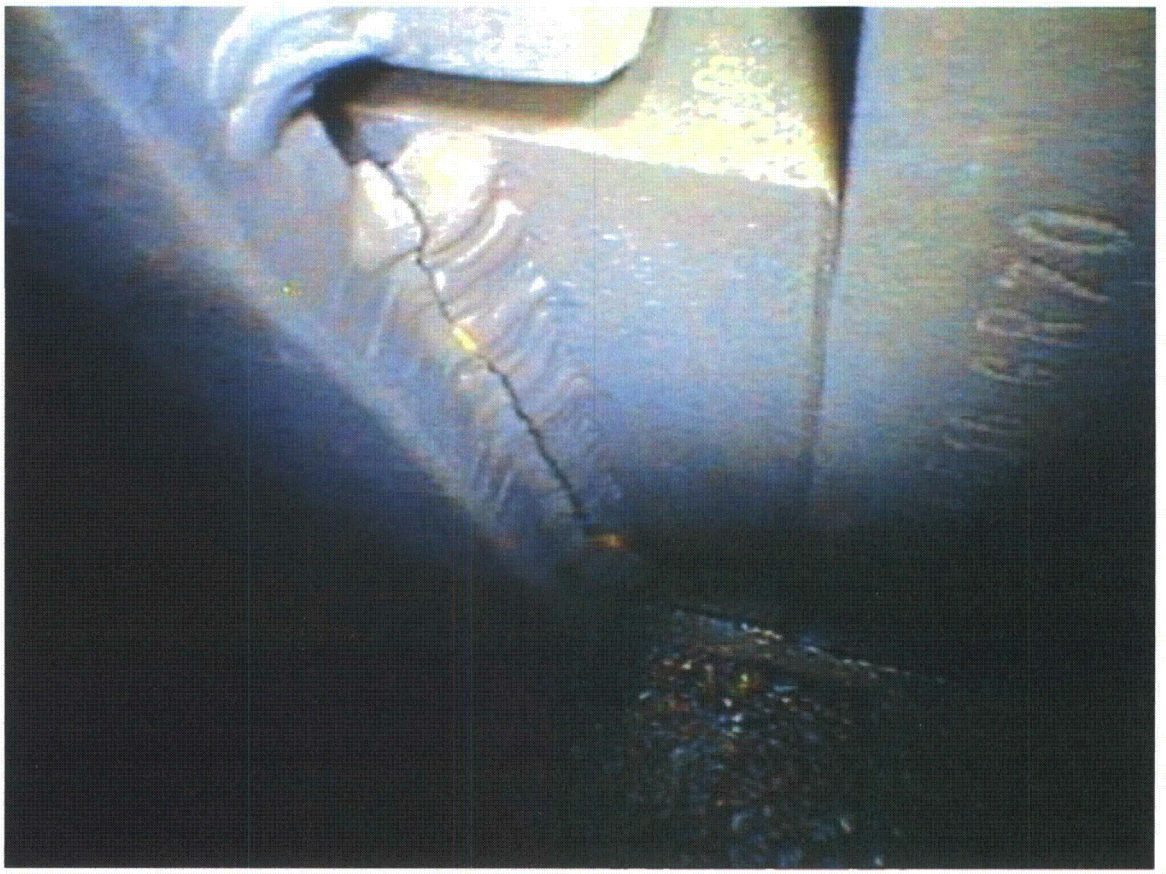


Figure 2
Alternate View of Patch Plate to Lug Weld Crack in RSG 21 at 90° Handhole Hot Leg Side

The design basis for the blowdown duct patch plate is to minimize the amount of feedwater flow that can escape from the economizer (preheater) and enter the hot leg side of the steam generator. As shown in Figure 3, the divider plate has a cutout for a capped cylinder that connects to the interior blowdown piping. The cylinder is inserted into the tubesheet and allows the blowdown flow to exit the steam generator through the

tubesheet and out the blowdown nozzle exterior to the steam generator. The cutout contains several square inches of uncovered opening, which is covered by the patch plate.

Figure 3
View of Secondary Divider Plate Cutout before Patch Plate Installation

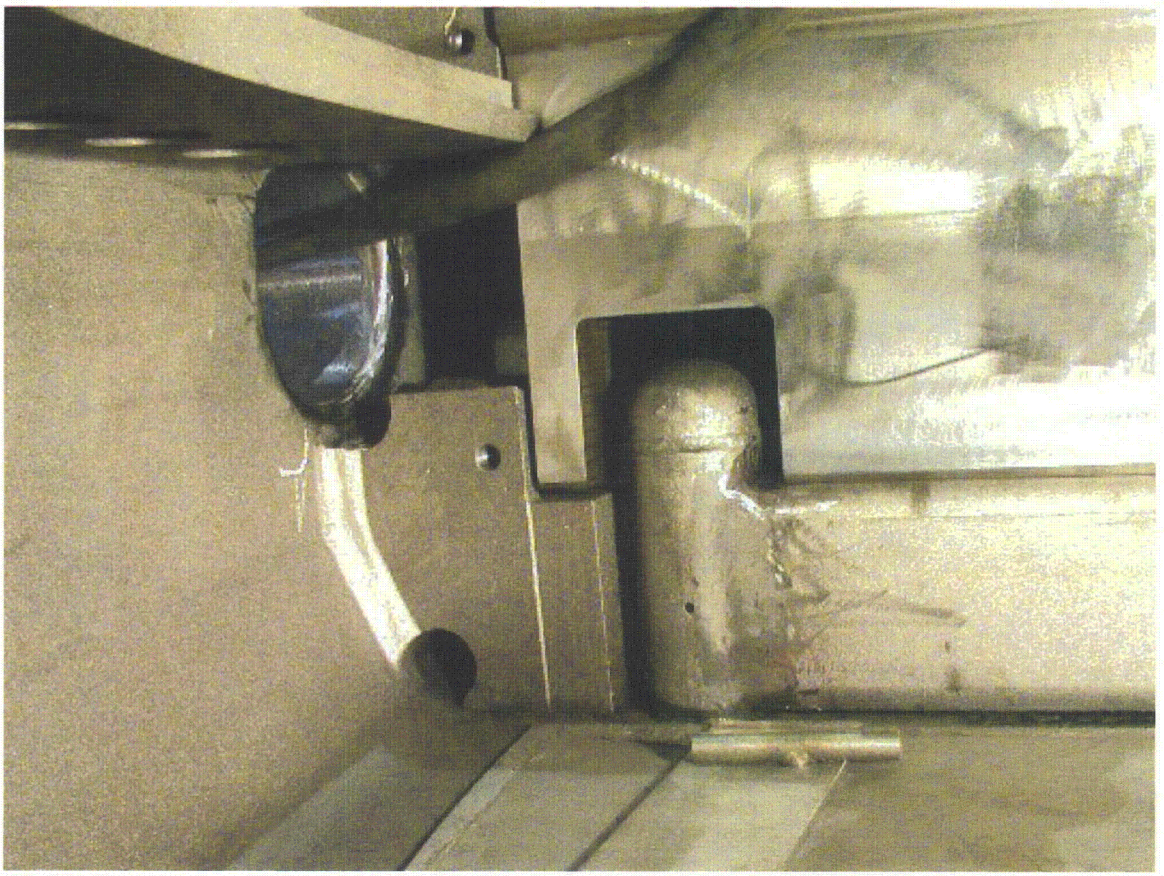


Figure 4 shows the lower shell divider plate lugs. Both the upper lug and lower lug are full penetration welded to the steam generator shell. The divider plate, which is full-penetration welded to the central stay cylinder, has only a tongue-and-groove attachment to the upper and lower divider plate lugs. Since the divider plate can move relative to the lugs, the design should not have specified the patch plate to be rigidly connected to the lower divider plate lug. However, Figures 1 and 2 show that the patch plate was welded to both the divider plate and the lower lug. Movement of the divider plate relative to the lower lug is the likely cause of the cracked weld.

Figure 4
View of Secondary Divider Plate Lugs before Divider Plate Installation

The patch plate is designed to minimize the amount of feedwater that can exit the preheater region of the steam generator and does not provide structural support to any steam generator component. As long as it is free to move with the divider plate, it has no significant loads on it and the remaining weld is sufficient to hold it in place. As a result, it will continue to perform its design function and no actions are required to remediate this condition.

Another issue associated with the cracked weld is the potential for loose parts to be generated. An analysis has been performed to demonstrate that the remaining weld is structurally adequate to retain the plate in its design configuration in the worst case flow conditions. As a result, there are no concerns that the patch plate itself could become a loose part. A calculation was prepared by Westinghouse engineering to confirm this conclusion.

A review of Figures 1 and 2 shows the cracked weld metal remains attached to either the patch plate or the lug at every location except at the bottom. At this location there is a small section of the weld that is attached only to the patch plate. A close review of

where the cracked weld remains attached to the lug and patch plate does not show any indication of cracking or any other indication that it would become loose. This has been verified on all 12 patch plates at PVNGS. Since the crack has relieved any significant loadings on the weld, the likelihood that a piece would fall off is remote. As a result, there is a minimal risk that the cracked weld could cause a loose part that could affect the structural or leakage integrity of the tubes.

To confirm these conclusions, APS will inspect the patch plates whenever a top of tubesheet FOSAR is performed. These inspections will examine the remaining welds and verify they are intact and that the cracked welds are not disintegrating (chipping away) or forming a loose parts concern.

The cracks in the PVNGS blowdown duct patch plates were also evaluated by Westinghouse engineering. The results of these analyses support the conclusions described above.

NRC Request 2:

FOSAR identified two small indications on tubes above the hot leg top of tubesheet. Rotating probe examination identified a third tube with an indication. Please discuss the cause of these three indications (presumably the three tubes identified in Table 2 as volumetric indications). If attributed to a loose part, discuss whether the part was identified and removed. If not identified, please discuss the extent of the rotating probe examinations near these tubes.

APS Response:

During the 15th refueling outage in Unit 1 (U1R15), bobbin eddy current testing identified indications on the R1C178 and R2C179 tubes just above the hot leg top of tubesheet in the blowdown lane in SG12. It is suspected that these wear indications were caused by a loose part. Rotating pancake coil (RPC) testing was performed on tubes that surround (or cage) the tubes with loose parts wear to ensure the full impact of the loose part was identified. This testing confirmed volumetric degradation on these two tubes and another adjacent tube (R3C178).

FOSAR also observed two small indications on these tubes. No foreign objects were observed in the vicinity of the observed indications. This is the first instance of loose parts wear that has been encountered in the Unit 1 RSGs. As a conservative measure, all three tubes were plugged and staked.

Since a comprehensive FOSAR and 100 percent eddy current testing (ECT) were performed during the previous outage (U1R14), APS concluded that the tube wear observed in U1R15 was most likely induced by parts introduced from an unknown source during the operating cycle. The actual source, since the part was not retrieved, cannot be determined.

Similarly, a comprehensive FOSAR and 100% ECT were performed in the steam generator during U1R15. Sludge lancing was performed which, in addition to removing sludge, is effective at removing small loose parts. These activities provide adequate assurance that the loose part that generated this wear has either migrated to a low flow field area (where it is unlikely to cause tube wear) or it is no longer located in the SG. This condition was entered in the PVNGS corrective action program as CRDR 3472165.

NRC Request 3:

You indicated that this examination was considered a 100% full length tubing inspection. In reviewing Table 1, it does not appear that the bend region (or horizontal run region) of approximately 900 tubes in each steam generator were inspected. Please clarify.

APS Response:

Section 2.0, *Scope of examinations Performed,* states in part:

> "The plan was finalized to include 100% bobbin examinations"

As described, 100% full length tubing inspections were performed. Table 1 reads, in part:

Scope Description		SG11	SG12
Exam Description	Extents	Scope	Scope
COLD STRAIGHT SECTION	TEC-08C	952	952
BOBBIN	TEC-BW1	276	278
HOT STRAIGHT SECTION	TEH-08H	952	952
BOBBIN	TEH-BW1	276	278

The examination description and extents should read as follows, to be consistent with the examinations performed:

COLD LEG	TEC-VS3	952	952
BOBBIN	TEC-BW1	276	278
HOT LEG	TEH-VS3	952	952
BOBBIN	TEH-BW1	276	278

NRC Request 4:

Besides the FOSAR, please discuss whether any other secondary side inspections were performed. If inspections were performed, please discuss the scope and results.

APS Response:

The only secondary side inspections that were performed during U1R15 were the top of the tubesheet FOSAR and blowdown lane FOSAR.

NRC Request 5:

In reviewing the list of tubes that were plugged, the most severe indications do not always appear to have been plugged. Please briefly describe the basis for choosing the tubes that were plugged (e.g., high growth rates, etc.).

APS Response:

The plugging criteria utilized during U1R15 were based upon both observed flaw depth and historical growth rates, which are location and support type specific. In some high growth rate regions, no flaws of a specific support type are returned to service. In regions of historically low growth rates, more severe indications can be safely returned to service.

Prior to U1R15, Westinghouse engineering performed a series of SG tube integrity projections assuming that eddy current inspection will not be performed at the U1R16 outage. The Unit 2 wear growth rate data was projected for this assessment, since the Unit 2 SGs have similar wear mechanisms and the longest operational history. An acceptance criterion of maintaining burst probability of <5% for a performance criterion of 3750 psi was applied. The U1R15 Degradation Assessment presented a series of growth statistics for each region of the SGs examined. The preventive repair plugging limit used for U1R15 was defined based on the observed Unit 1 Cycle 15 growth distribution. The plugging criteria are consistent with the guidelines given in NEI 97-06, *Steam Generator Program Guidelines,* and the EPRI *Steam Generator Integrity Assessment Guidelines.*