APS

Palo Verde Nuclear
Generating Station

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October 28, 2004

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

Dear Sirs:

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Units 1, 2 and 3
Docket Nos. STN 50-528, 50-529, and 50-530
60-day Response to NRC Generic Letter 2004-01, "Requirements for Steam Generator Tube Inspections"

On August 30, 2004, the NRC issued Generic Letter (GL) 2004-01, "Requirements for Steam Generator Tube Inspections," and requested a response within 60 days of the GL date (by October 29, 2004). Arizona Public Service Company (APS) is providing the information requested by GL 2004-01 for PVNGS Units 1, 2, and 3 in Enclosure 2 to this letter. Enclosure 1 contains a notarized affidavit, and Enclosure 3 contains the regulatory commitment being made in this letter.

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

Sincerely,

David Mauldin

CDM/TNW/GAM

Enclosures:
1. Notarized Affidavit
2. 60-day Response to NRC Generic Letter 2004-01, "Requirements for Steam Generator Tube Inspections"
3. Regulatory Commitment

cc:	B. S. Mallett	NRC Region IV Regional Administrator
	M. B. Fields	NRC NRR Project Manager
	N. L. Salgado	NRC Senior Resident Inspector for PVNGS

A115

STATE OF ARIZONA)
) ss.
COUNTY OF MARICOPA)

I, David Mauldin, represent that I am Vice President Nuclear Engineering and Support, Arizona Public Service Company (APS), that the foregoing document has been signed by me on behalf of APS with full authority to do so, and that to the best of my knowledge and belief, the statements made therein are true and correct.

David Mauldin

Sworn To Before Me This 28th Day Of October, 2004.

Susie Lynn Ergish
Notary Public

SUSIE LYNN ERGISH
Notary Public - Arizona
Maricopa County
My Comm. Expires Jul 14, 2007

Notary Commission Stamp

ENCLOSURE 2

Arizona Public Service Company (APS) 60-day Response to NRC Generic Letter 2004-01, "Requirements for Steam Generator Tube Inspections"

Introduction

Palo Verde Nuclear Generating Station (PVNGS) consists of three Combustion Engineering (CE) two-loop nuclear units. PVNGS Units 1 and 3 have their original steam generators (SGs) containing Alloy 600 mill annealed (MA) tubing. PVNGS Unit 2 has replacement SGs, installed in fall 2003, containing Alloy 690 thermally treated (TT) tubing. PVNGS Units 1 and 2 are currently in mid-cycle operations; Unit 3 is currently in a refueling outage, with a scheduled start up around the end of November 2004.

A description of the SG tube inspections at each of the three PVNGS units is provided below. The SG inspections are performed in accordance with plant technical specifications and are consistent with NEI 97-06 and associated EPRI guidelines. The SG tube inspection methods ensure SG tube integrity, but the PVNGS Units 1 and 3 inspection methods are not consistent with the NRC's position in GL 2004-01. The nonconformance has been entered in the PVNGS corrective action program, and the corrective action to establish conformance will be to submit a TS amendment request as discussed in the response to NRC Question 2 below. Also, a safety assessment for Units 1 and 3 is provided in response to NRC Question 3 below. Unit 2 SG tube inspection methods are consistent with NRC's position in GL 2004-01.

NRC Request No. 1

> Addressees should provide a description of the SG tube inspections performed at their plant during the last inspection. In addition, if they are not using SG tube inspection methods whose capabilities are consistent with the NRC's position, addressees should provide an assessment of how the tube inspections performed at their plant meet the inspection requirements of the TS in conjunction with Criteria IX and XI of 10 CFR Part 50, Appendix B, and corrective action taken in accordance with Appendix B, Criterion XVI. This assessment should also address whether the tube inspection practices are capable of detecting flaws of any type that may potentially be present along the length of the tube required to be inspected and that may exceed the applicable tube repair criteria.

APS Response No. 1 for PVNGS Units 1 and 3

PVNGS Units 1 and 3 Steam Generator (SG) Description

Each PVNGS Unit utilizes two vertical recirculating U-tube SGs which are tube and shell heat exchangers with an integral economizer. The Units 1 and 3 SGs were designed and fabricated by Combustion Engineering (CE) and are the only operating units of the original CE System 80 design. Each SG contains 11,012, three-fourths inch OD, Alloy 600 mill annealed (MA) tubes. The tubes have a nominal wall thickness of 0.042 inch and an average heated length of 57.75 feet. The tubing was manufactured to the requirements of ASME SB-167 as supplemented by CE specification. The carbon content and maximum yield strength were restricted to 0.05 percent and 55,000 psi, respectively. These requirements assured a relatively high temperature final anneal of 1806 °F. The tubes are arranged in rows, with all tubes in a given row having the same length. The rows are staggered, forming a triangular pitch arrangement. The shorter tubes, which have 180° bends, are located in the first 18 rows at the center of the tube bundle. All tubes in the subsequent rows have double 90° bends. The horizontal tube supports located along the vertical section of the tubes are of the egg crate design. The bend and horizontal regions of the tubes are supported by batwing and vertical lattice supports, respectively. All the tube supports are manufactured from 409 ferritic stainless steel.

The SG tube supports are designed to provide support during operation or combined seismic and accident conditions while offering minimum restrictions to steam/water flow in the tube bundle. The large flow area in the CE System 80 support design provides better irrigation and reduces the potential for steam blanketing, and therefore the SGs are less likely to be blocked by crud, boiler water deposits and corrosion products. Since the support material is Type 409 ferritic stainless steel, it is not susceptible to magnetite corrosion which has resulted in denting and lockup at plants with carbon steel supports.

The SGs are of a stayed design to support the tubesheet, and as a result, the center of the bundle contains a cylindrical cavity. The stay cylinder is a hollow tube that supports the primary plenum plate, the divider plate separating economizer and evaporator region on the secondary side and provides rigidity to the tubesheet to minimize tubesheet bowing. The tubes were explosively expanded into the tubesheet for the entire tubesheet thickness of 23.5 inches.

Figure 1 provides a diagram representing the support structures and key locations for service induced tube degradation in the PVNGS Unit 1 and 3 SGs.

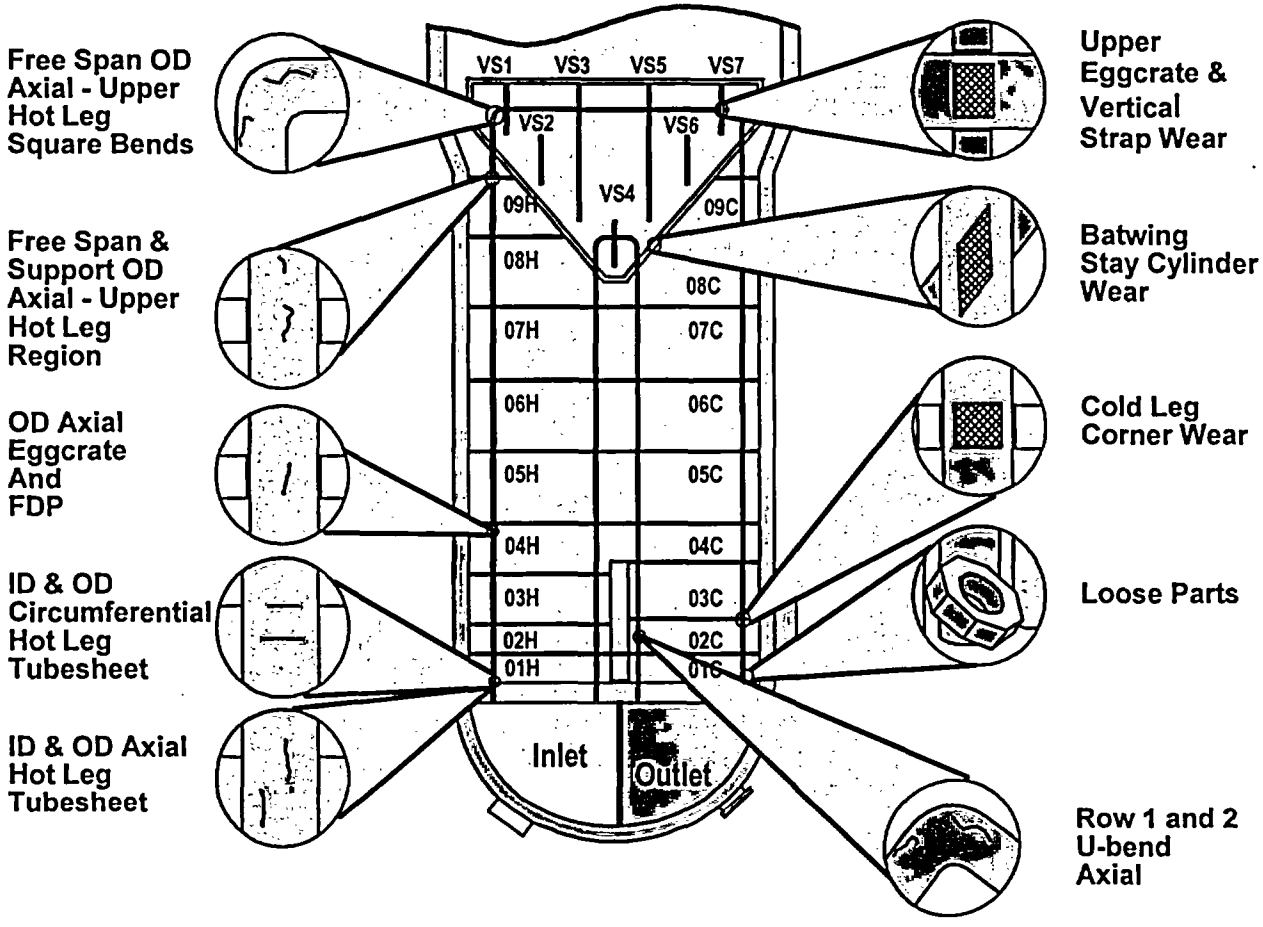

Figure 1

Unit 1 and 3 Steam Generator Damage Mechanisms

PVNGS Units 1 and 3 Inspection Program

Table 1 provides a description of the most recent SG tube inspections performed in the Unit 1 and Unit 3 SGs. These inspections are performed in accordance with PVNGS Technical Specifications and PVNGS Station Manual Procedures. Program elements are defined in the PVNGS Steam Generator Degradation Management Program and are consistent with NEI 97-06 and the associated EPRI Guidelines. As shown in Table 1, APS conducts a full length inspection of 100% of the SG tubes with the bobbin coil probe[1]. Rotating coil inspections using the Plus Point™ probe are conducted as stipulated by the PVNGS Steam Generator Degradation Assessment. The PVNGS Steam Generator Degradation Assessment is performed in accordance with plant procedures and is consistent with GL 2004-01 with respect to the description and use of such engineering evaluations to determine the type of probe and inspection extent. The assessment takes into account industry experience and plant-specific history to determine both active and potential degradation mechanisms and the location that they might occur within the SG. This information is used to define the inspection program with the objective of ensuring tube integrity and detecting flaws of any type that may be present along the length of the tube that may meet or exceed the applicable tube repair criteria.

The last PVNGS Unit 1 refueling outage and SG inspection was completed in spring 2004 (U1R11). PVNGS Unit 3 is currently in a refueling outage and SG inspection (U3R11), and is scheduled to start up around the end of November 2004. Prior to each SG inspection, the degradation assessment is updated to include most recent operating experience determined to be applicable to PVNGS. Additionally, a technique validation assessment is performed to verify that the eddy current techniques are capable of detecting the degradation based on type, location and the possible presence of interfering signals. Table 1 provides a program summary that specifies region, inspection method, extent by landmark (e.g., support, tubesheet), and program basis.

Review of Generic Letter Position for PVNGS Units 1 and 3

APS has reviewed the SG inspection program in PVNGS Units 1 and 3 against the position presented by the NRC Staff in GL 2004-01 and concludes that the inspection program meets or exceeds the NRC position with one exception. The PVNGS Unit 1 and Unit 3 SG tube inspection programs are not consistent with the NRC's position with respect to inspections performed within the tubesheet. The inspection program within the tubesheet region at PVNGS has been previously submitted to the USNRC in References 3, 4 and 7. As indicated in these submittals, the tubesheet inspection extent with the rotating coil was limited based on test data and analysis that demonstrated that the tube could not burst and that any potential accident leakage was within safety analysis limits.

1 Due to probe travel restrictions, the straight leg sections of tubes in Rows 1-5 are inspected with bobbin coil. The bends are inspected with rotating coil probes to meet the 100% coverage requirement.

Table 1
Palo Verde Unit 1 and Unit 3 Inspection Program

Location/Area	Inspection Method	Extent	Basis
Bobbin 100% Full Length Program	Bobbin	Full Length	Standard refueling outage bobbin program since 1993
Hot Leg Upper Bundle Region	+ Point	07H- VS3	100% of Critical Area and buffer zone of established dryout region based on PVNGS Degradation Assessment.
Cold Leg Upper Bundle	+ Point	VS5-07C	20% Sampling program to detect possible onset of free span cracking in cold leg.
Top of Tubesheet Hot Leg	+ Point	TSH (+2 -14) Unit 1 TSH (+2 -12) Unit 3	100% Inspection for circumferential indications in the transition region per response to GL 95-03. Critical Area Extent within the tubesheet in U1 was based on the most recent Westinghouse recommendations at the time, and exceeds the extent recommended in WCAP-16208 (Ref. 1). Critical Area Extent within the tubesheet in U3 was based on the recommendation in WCAP-16208.
Cold Leg Tubesheet	+ Point	TSH (+2 -14) Unit 1 TSH (+2 -12) Unit 3	20% sample Program based on PVNGS Degradation Assessment. Expand to 100% upon detection of SCC (none to date)
U-Bend Row 1 through 5	+ Point	07H-07C	100% of Critical Area and Buffer Zone for Short Radius U-bend
U-Bend Row 6 through 18	+ Point	07H-07C	20% Large Radius U-Bend inspection program based on PVNGS Degradation Assessment of industry events. Inspection to include 100% of all bends with Apex geometric anomalies (bobbin). Expand to 100% of U-bends if SCC detected (none to date).
Hot Leg Dents / Dings (DNT)	+ Point	02H-09H	100% Inspection of all hot leg dents at egg crate supports greater than 2 Volts
Manufacturing Buff Marks (MBM) and Bulge (BLG)	+ Point	Freespan and Support	Exploratory sample in lower Hot Leg Region to determine presence of corrosion indications.
Previous Wear Calls and I-Codes	+ Point	Freespan and Support	100% Inspection Program to verify defect characterization of previous bobbin wear Calls and historical distorted bobbin calls.
100% of all new bobbin calls	+ Point	Freespan and Support	100% Inspection Program to verify defect characterization of possible wear and all new distorted bobbin calls (I-Codes).

The basis of the PVNGS Unit 1 and Unit 3 tubesheet inspection programs is contained in Westinghouse Report WCAP-16208 (Ref. 1). The methodology applied is similar to WCAP-15947 (Ref. 2) that was submitted to the NRC in September 2002 to support a PVNGS Unit 1 technical specification amendment request (Ref. 3) to limit the SG tube inspections in the tube sheet region. WCAP-16208 incorporates additional test data and analyses designed to address NRC questions (RAIs) for similar industry submittals to limit tubesheet inspections. The last PVNGS Unit 1 SG inspection (U1R11) included 100% of all tubes inspected full length by bobbin coil and a minimum of 14 inches below the expansion transition with the Plus Point™ probe. The inspection performed in Unit 3 during the current refueling outage (U3R11) was similarly conducted with the exception that the Plus Point™ minimum extent was specified at 12 inches based on the WCAP-16208 results. Details on the assessment approach are provided in the response to NRC request no. 3 below.

APS Response No. 1 for PVNGS Unit 2

PVNGS Unit 2 SG Description

The PVNGS Unit 2 SGs were replaced during U2R11 in the fall 2003. The replacement SGs were designed by ABB/CE and manufactured in Italy by Ansaldo, and are considered a modified CE System 80 design. The tube bundle consists of 12,580, three-fourths inch OD, Alloy 690 thermally treated (TT) tubes with a nominal wall thickness of 0.042 inch and an average heated length of 63.9 feet. The tubes are hydraulically expanded into the tubesheet for the entire tubesheet thickness. The tube support system is similar to the original CE System 80 design, and, like the original design, is fabricated from 409 ferritic stainless steel. To minimize the potential for stress corrosion cracking, in addition to the tubing material change, the U-bend regions in the first 17 rows were stress relieved after bending. Figure 2 illustrates the configuration of the replacement SGs.

PVNGS Unit 2 Inspection Program

Prior to installation, a pre-service examination (PSE) was performed in accordance with the EPRI PWR Steam Generator Examination Guidelines on both new Unit 2 SGs. Table 2 contains a description of the PVNGS Unit 2 PSE tube inspection scope.

Review of Generic Letter Position for PVNGS Unit 2

APS has reviewed the inspections conducted to date in the Unit 2 SGs and concludes that the program is consistent with the NRC's position regarding tube inspections without exception.

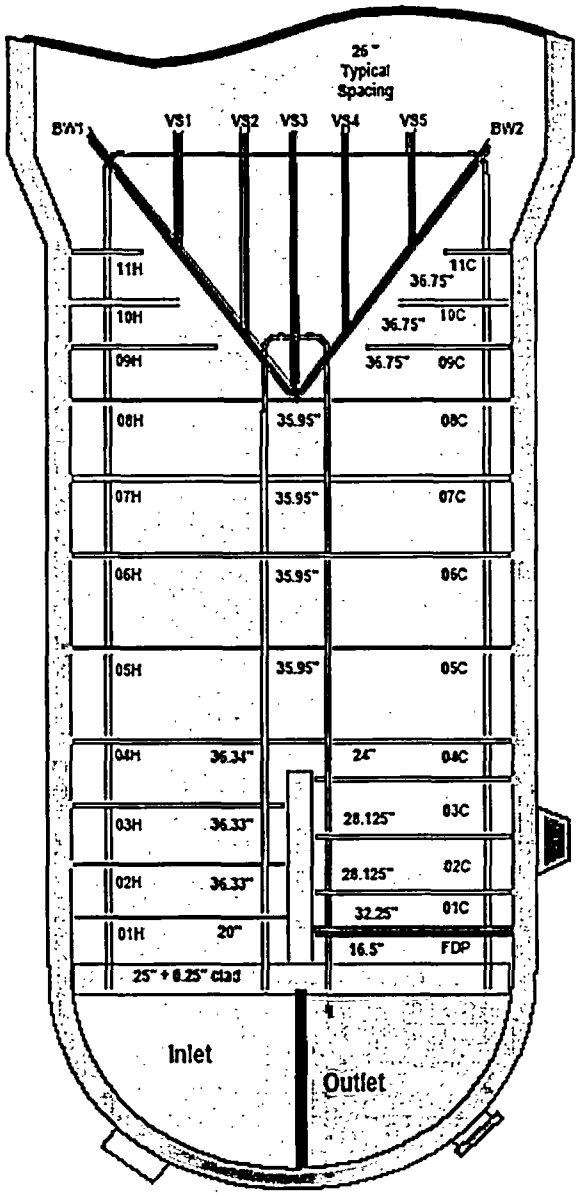

Figure 2

Unit 2 Replacement Steam Generator

Table 2

Palo Verde Unit 2 Steam Generator Preservice Inspection Program

Location/Area	Inspection Method	Extent	Basis
100% Full Length Bobbin Program	Bobbin	Full Length	Standard baseline examination and Pre-Service Bobbin Program
100% Top of Tubesheet Hot Leg Program	+ Point	TSH (+2 –3)	100% baseline inspection of tubesheet transition region.
Short Radius U-bends	+ Point	07H-07C	100% baseline inspection of Row 1 and 2 U-bends
Dents, Manufacturing Buff Marks (MBM) and Bulge (BLG) Indications	+ Point	Various	Baseline inspections sample of manufacturing related anomalies

NRC Request No. 2

If addressees conclude that full compliance with the TS in conjunction with Criteria IX, XI and XVI of 10 CFR Part 50, Appendix B, requires corrective actions, they should discuss their proposed corrective actions (e.g., changing inspection practices consistent with the NRC's position or submitting a TS amendment request with the associated safety basis for limiting the inspections) to achieve full compliance. If addressees choose to change their TS, the staff has included in the attachment suggested changes to the TS definitions for a tube inspection and for plugging limits to show what may be acceptable to the staff in cases where the tubes are expanded for the full depth of the tubesheet and where the extent of the inspection in the tubesheet region is limited.

APS Response No. 2 for PVNGS Units 1 and 3

The most recent SG tube inspections conducted in PVNGS Units 1 and 3, described in the APS response to NRC question no. 1 above, ensure SG tube structural and accident leakage integrity in accordance with NEI 97-06. However, APS has concluded that the Unit 1 and Unit 3 SG tube inspection programs are not consistent with the NRC's position with respect to inspections performed within the tubesheet. The proposed corrective action to establish conformance with the NRC position is to submit a TS amendment request consistent with the recommended changes in GL 2004-01 to limit the extent of the inspection in the tubesheet region where the tubes are expanded for the full depth of the tubesheet. APS commits to submit the proposed TS changes no later than May 31, 2005. It is expected that this proposed TS amendment will be included with an amendment request to implement the SG Generic Licensing Change Package (GLCP) that is discussed in SECY-03-0080 (Ref. 8).

It should be noted that the current operating cycle in Unit 1 is the last for the existing Alloy 600 MA-tube SGs. The Unit 1 SGs are scheduled to be replaced in fall 2005 (U1R12) with SGs of the same design and materials (Alloy 690 TT tubes) as Unit 2. The Unit 3 SGs will undergo one more tube inspection (spring 2006, U3R12) prior to replacement in fall 2007 (U3R13).

The basis of PVNGS Unit 1 and Unit 3 tubesheet region inspection program is contained in Westinghouse report WCAP-16208 (Ref.1). The methodology applied is similar to WCAP-15947(Ref. 2) that was submitted to the NRC in September 2002 to support a PVNGS Unit 1 technical specification amendment request (Ref. 3) to limit the SG tube inspections in the tube sheet region. WCAP-16208 incorporates additional test data and analyses designed to address NRC requests for additional information (RAIs) for similar industry submittals to limit tubesheet inspections. Details on the assessment approach are provided in APS response no. 3 below.

APS Response No. 2 for PVNGS Unit 2

The Unit 2 replacement SGs (Alloy 690 TT) are currently in their first cycle of service. The tube inspections conducted during the pre-service examination for Unit 2 SG installation are in conformance with the NRC position identified in GL 2004-01, and therefore no corrective action is required.

NRC Request No. 3:

> For plants where SG tube inspections have not been or are not being performed consistent with the NRC's position on the requirements in the TS in conjunction with Criteria IX, XI, and XVI of 10 CFR Part 50, Appendix B, the licensee should submit a safety assessment (i.e., a justification for continued operation based on maintaining tube structural and leakage integrity) that addresses any differences between the licensee's inspection practices and those called for by the NRC's position. Safety assessments should be submitted for all areas of the tube required to be inspected by the TS where flaws have the potential to exist and inspection techniques capable of detecting these flaws are not being used, and should include the basis for not employing such inspection techniques. The assessment should include an evaluation of (1) whether the inspection practices rely on an acceptance standard (e.g., cracks located at least a minimum distance of x below the top of the tube sheet, even if these cracks cause complete severance of the tube) which is different from the TS acceptance standards (i.e., the tube plugging limits or repair criteria), and (2) whether the safety assessment constitutes a change to the "method of evaluation" (as defined in 10 CFR 50.59) for establishing the structural and leakage integrity of the joint. If the safety assessment constitutes a change to the method of evaluation under 10 CFR 50.59, the licensee should determine whether a license amendment is necessary pursuant to that regulation.

APS Response No. 3 for PVNGS Units 1 and 3

As noted in responses above, APS has concluded that PVNGS Units 1 and 3 SG tube inspections are not consistent with the NRC's position on the requirements in the Technical Specifications (TS) in conjunction with Criteria IX, XI, and XVI of 10 CFR Part 50, Appendix B with respect to inspections conducted within the tubesheet region. Therefore, APS is providing a safety assessment based on the information provided to the NRC in the September 2002 Unit 1 TS amendment request to limit the SG inspections in the tubesheet region (Ref. 3) and supplemented by the test data and analyses performed in Westinghouse report WCAP-16208 (Ref 1). The safety assessment addresses the differences between the inspection program and the position promulgated in GL 2004-01, and demonstrates that tube structural and accident leakage integrity is assured by the inspection program that was conducted.

Safety Assessment – Steam Generator Tubesheet Region for PVNGS Units 1 and 3

PVNGS Units 1 and 3 Safety Assessment – Introduction

APS has concluded that the SG tube inspection programs at PVNGS were in compliance with the NRC's position in GL 2004-01 with one exception. The inspection program within the tubesheet region for Units 1 and 3 SGs (Alloy 600 MA tubes) of 100% full length bobbin and supplemented with a limited extent rotating coil exam was determined not to conform with the NRC position specified in the GL. Therefore, APS is providing information that demonstrates that SG tube structural and accident leakage integrity is assured for PVNGS Units 1 and 3 by the inspection program that was conducted.

The Unit 1 SGs maintain tube structural and leakage integrity based on the SG Condition Monitoring and Operational Assessment per NEI 97-06, and the testing and analysis performed in WCAP-16208. For the current operating cycle (cycle 12), the probabilistic analysis predicted a potential accident leakage of 0.002 gallons per minute (gpm) from both SGs, which is significantly less than the safety analysis assumption of 0.5 gpm per SG. The rotating coil inspection distance in the tube sheet region performed in the last SG tube inspection (U1R11) went beyond the inspection threshold specified in WCAP-16208. As such, there are no SG structural or leakage integrity issues for the current Unit 1 operating cycle.

Unit 3 is currently in a refueling outage and SG tube inspection (U3R11), with a scheduled start up around the end of November 2004. SG tube inspections are being conducted as part of the refueling outage activities. The SG tube inspection employed the technical approach described below for specifying a conservative SG inspection program. The rotating coil inspection distance in the tube sheet region went beyond the inspection threshold specified in WCAP-16208. The inspection program for U3R11 included a 100% inspection of the in-service tubes on the hot leg of both Unit 3 SGs. A 20% sample of the Cold Leg tubesheet region was also conducted. To date, no axial or

circumferential stress corrosion cracking has been detected in the cold leg tubesheet region of any of the PVNGS SGs. If any axial or circumferential stress corrosion cracking is detected, the PVNGS inspection program requires expansion to 100% of all inservice tubing in the cold leg. Despite no evidence of corrosion within the cold leg expansion transition, the rotating coil exams also extend to 12 inches below the bottom of the expansion transition in the cold leg tube sheet region.

All detected flaws within the tubesheet, regardless of location, are removed from service. All detected flaws are also evaluated for in situ pressure testing, with no credit taken for the tubesheet. Condition monitoring and operation assessments will be conducted for Unit 3 operating cycles 11 and 12 in accordance with PVNGS station manual procedures and NEI 97-06.

PVNGS Units 1 and 3 Safety Assessment - Background

In September 2002, APS submitted a Technical Specification Amendment Request for PVNGS Unit 1 that provided the basis for limiting inspections within the tubesheet region (Ref. 3). NRC questions regarding the technical basis of the amendment request were answered by APS in Reference 4. In Reference 5, the NRC indicated that upon completion of the review, the Staff had no objections to the inspection program conducted in Unit 1. In Reference 7, APS also provided, based on an NRC request, the scope and basis for the inspections contained within the tubesheet region. In evaluating GL 2004-01, a similar basis to that provided in References 3, 4 and 7 is used to demonstrate that the PVNGS inspection program assures SG tube integrity.

PVNGS Units 1 and 3 Safety Assessment - Discussion

The PVNGS Steam Generator Degradation Management Program has been evaluated in accordance with NRC GL 2004-01. The analyses performed with respect to determining the inspection extent limits for PVNGS supplementary exams are based on tube integrity requirements that confirm that structural and accident leakage integrity is assured per 10 CFR 50, Appendix A, General Design Criteria (GDCs) 14 and 32. For these analyses, the guidance with respect to safety margins and performance criteria is derived from Draft Regulatory Guide 1.121, NUREG 1022 and NEI 97-06. Consideration is given to probability of detection (POD), nondestructive examination (NDE) sizing capability and error, flaw growth rate, burst and leakage resistance. These assessments and consequential NDE inspection plans are performed for multiple areas of the SG (e.g., U-bends, sludge pile, dents/dings etc.). The examination program, including qualification of techniques and analysts, are performed in accordance with applicable requirements of EPRI PWR Steam Generator Examination Guidelines, ASME Section XI, and ANSI/ANST CP-189, and therefore are considered to meet the requirements of Criterion IX of 10 CFR 50, Appendix B, "Control of Special Processes." The inspection program within the tubesheet region is based on ensuring tube structural and accident leakage integrity. The program is not consistent with the position promulgated in GL 2004-01 in that the supplemental rotating coil exams are not conducted for the full tubesheet depth. Certain forms of degradation may exist in the

tubesheet region that are not detectable by the bobbin coil. The integrity analysis evaluates the collective detection capability of the bobbin and rotating coil, as well as the inspection extent. All potentially undetected flaws are evaluated for possible impact on tube integrity. In the case for undetected flaws in the tubesheet region below the rotating coil inspection, testing and analysis has shown that the tubing, tube-to-tubesheet expansion and the tubesheet provide resistance to burst and leakage. As such, credit is taken with respect to tube integrity.

The technical approach for defining the tubing inspections within the tubesheet has been provided to the NRC in References 3, 4, and 7. As part of a continuing effort to address NRC questions, APS has participated in a Westinghouse Owners Group (WOG) program of additional testing and analysis. The current basis for NDE inspection extent (with Plus Point™) within the tubesheet is found in Westinghouse report WCAP-16208 (Ref. 1). This program expanded on the testing and analysis performed in support of the September 2002 Unit 1 TS amendment request to limit the SG inspections in the tubesheet region (Ref. 3) and WCAP-15947 (Ref 2). The WOG program was intended to address the following areas based in industry-wide questions from the NRC Staff.

- Conducted parametric testing to evaluate the impact on leakage using simulated primary water rather than oxygenated deionized water used in the testing to support WCAP-15947. Results indicated higher leakage for prototypic reactor coolant. These results have been accounted for in a revised inspection extent.

- Conducted additional leakage tests to reduce data scatter.

- Conducted tests to evaluate the individual and collective effects of temperature, pressure and water chemistry on leak rate.

- Developed a more detailed finite element analysis of the tubesheet to determine the effects of tubesheet deflection.

- Defined inspection threshold at 95/50 probability and confidence bound.

- Performed a vertical constraint analysis based on the CE upper bundle support system. This analysis was performed to demonstrate added conservatism and was not credited in the required inspection length.

- Revised inspection extent conservatively accounts for tubesheet dilation, test uncertainties and NDE position uncertainty in establishing an inspection length that supports tube integrity.

Based on this assessment, PVNGS Units 1 and 3 rotating coil inspection thresholds in the tubesheet region, referred to as C*, satisfy integrity margins for extents of 10.4 and 11.6 inches, respectively, below the bottom of the expansion transition. PVNGS Unit 1 was inspected to a minimum of 14 inches during the last inspection (U1R11) and Unit 3

has been inspected to minimum of 12 inches during the current U3R11 refueling outage. Both inspection extents exceed the requirements and bases of WCAP-16208 (Ref. 1).

With regard to Condition Monitoring and Operational Assessments, APS performs the following program elements with respect to tubing within the tubesheet:

- WCAP-16208 supports tube integrity analysis for the life of the SG in that undetected defects below the rotating coil inspection threshold are assumed to exist and accumulate from the time primary stress corrosion cracking is detected in the SG and accounted for with respect to burst, pullout and accident leakage.

- All detected corrosion defects are plugged on detection regardless of location within the tubesheet.

- All flaws within the C* distance are evaluated for accident leakage integrity with no credit given to the tubesheet. Flaws that potentially exceed the leakage integrity threshold are in situ pressure tested. Table 3 lists seven tubes that APS has tested to date. All tests exhibited zero leakage.

- All operational assessments for Units 1 and 3 assume a cumulative projected leakage contribution of 0.1 gpm for undetected flaws within the tubesheet region. This is based on a conservative assumption that every tube is flawed. The WCAP-16208 analysis indicates that the contribution of a 100% through-wall, 360° circumferential flaw is 1.0E-5 gpm. Accident leakage for the rest of the SG damage mechanisms are shown to be less then 0.4 gpm, based on the performance criteria limit of 0.5 gpm, in the operational assessment. For both the current Unit 1 Cycle 12 and Unit 3 Cycle 11 operational assessments, the projected 95/50 leakage at main steam line break conditions for all other mechanisms in the SG was zero gpm.

- All tubes with circumferential flaws within the analyzed pullout distance are plugged and staked to eliminate the potential of damaging active tubes in the unlikely event of pullout.

Table 3
Tubesheet Region In Situ Pressure Tests

Number	Steam Generator	Flaw Code	Tube Number	Location	Date	Flaw Type	Sizing	Result Pressure	Result Leakage	Test Pressure
1	SG 2-2	TS	R2C55	TSH-5.28	Apr-99	Circ	100% TW PDA- 13.86 Volts - 2.33	N/A	Zero Leakage	2100 psig
2	SG 2-2	TS	R6C61	TSH-4.29	Apr-99	Circ	100% TW PDA- 14.6 Volts - 1.91	N/A	Zero Leakage	2100 psig
3	SG 2-2	TS	R53C74	TSH-7.14	Apr-99	Circ	100% TW PDA- 8.35 Volts - 1.33	N/A	Zero Leakage	2100 psig
4	SG 2-2	TS	R28C121	TSH-1.78	Apr-99	Circ	100% TW PDA- 25.28 Volts - 2.02	N/A	Zero Leakage	2100 psig
5	SG 2-2	TS	R33C112	TSH-3.05	Apr-99	Circ	100% TW PDA- 10.53 Volts - 1.23	N/A	Zero Leakage	2100 psig
6	SG 1-2	TS	R51C112	TSH-7.48	Apr-01	Circ	100% TW PDA- 6.89 Volts - 1.59	Pass	Zero Leakage	4500 psig
7	SG 3-2	TS	R75C30	TSH -6.76	Mar-03	Circ	100%TW PDA 76.18 Volts 21.9	N/A	Zero Leakage	3000 psig

PVNGS Units 1 and 3 Safety Assessment - Summary

APS has determined that no safety or operability issues exist for the PVNGS Unit 1 or 3 SGs based on current SG inspections and integrity assessments of the Units 1 and 3 SGs. The current enhanced SG tube assessment approach is consistent with previous submittals to the NRC. APS' nonconformance with the NRC position in GL 2004-01 has been documented and addressed in the PVNGS corrective action program (CRDR 2734928). The proposed corrective action to establish conformance with the NRC position in GL 2004-01 is to submit a TS amendment request consistent with the recommendation in GL 2004-01 to limit the extent of the inspection in the tubesheet region where the tubes are expanded for the full depth of the tubesheet. APS commits to submit the proposed TS changes no later than May 31, 2005. The license amendment is not required for start up or for continued operation.

Method of Evaluation

NRC request no. 3 asks licensees to evaluate whether the safety assessment performed for those conditions where tube inspections within the tubesheet are not being performed consistent with the NRC's position constitutes a change to the "method of evaluation" (as defined in 10 CFR 50.59) for establishing the structural and leakage integrity of the tube and/or tubesheet joint. In assessing this question, the GL inquires as to whether the safety assessment is redefining the ASME Section III pressure boundary and is using a different method of evaluation to demonstrate the structural and leakage integrity of the revised pressure boundary. APS has reviewed the NRC's position and has concluded that the analysis approach does not redefine the ASME

pressure boundary and is not a change in the method of evaluation per 10 CFR 50.59 based on the following:

1. APS does not consider the assessment approach, or the described inspection program scope, as redefining the ASME Section III pressure boundary. The selection of NDE techniques or extent of inspection does not, by itself, define the limits of the ASME pressure boundary. For example, the GL indicates that current technical specifications include language that excludes sections of cold leg tubing from inspection extent. The GL also states that the selection of NDE techniques is not specified in the Technical Specifications, but is governed by the provisions of 10 CFR Part 50 Appendix B, and as such, are not used to define pressure boundary limits. From an integrity assessment perspective, neither past NRC approval of Alternate Repair Criteria (ARCs) nor the suggested changes to the Technical Specification provided in the GL address or indicate that the basis for approval is a redefinition of the pressure boundary.

2. The NRC-endorsed guidance for 10 CFR 50.59 evaluations (NEI 96-07, Revision 1) defines "method of evaluation" and the associated 10 CFR 50.59 screening protocol. Section 4.3.8 of NEI 96-07 states that methods of evaluation that are not described, outlined or summarized in the UFSAR are excluded from consideration. The tube integrity assessments employed by APS consider the entire length of pressure boundary tubing. Undetected flaws and their impact on tube integrity are addressed. The assessments are consistent with industry standards. The analyses and analysis parameters are not described, outlined or summarized in ASME Section III, ASME Section XI or in the UFSAR, and therefore would not constitute a change/departure in the method of evaluation per 10 CFR 50.59.

3. The safety assessment was performed in accordance with the provisions of the EPRI Steam Generator Integrity Assessment Guidelines and the structural and accident leakage integrity performance criteria specified in NEI 97-06 and NUREG 1022. This ensures margins of safety consistent with the ASME Section III Code and Regulatory Guide 1.121 and that any potential accident leakage is within safety analysis limits.

Not withstanding the conclusion that the assessment does not constitute a change to the method of evaluation as described in 10 CFR 50.59, APS has concluded that the SG inspections within the tubesheet region are not consistent with the GL position and will submit a license amendment request as indicated in the response to NRC request no. 2.

APS Response No. 3 for PVNGS Unit 2

The Unit 2 replacement SGs (Alloy 690 TT tubes) are currently in their first cycle of service. The tube inspections conducted during the pre-service examination for Unit 2

installation (fall 2003) are in conformance with the NRC position identified in GL 2004-01. Therefore, NRC request no. 3 does not apply to PVNGS Unit 2.

References

1. Westinghouse Report WCAP-16208, Revision 0, "NDE Inspection Length for CE Steam Generator Tubesheet Region Explosive Expansions," October 2004
2. Westinghouse Report WCAP-15947, Revision 0, "NDE Inspection Strategy for the Tubesheet Region in Palo Verde Unit 1," September 2002
3. Letter 102-04844, dated September 26, 2002, from C.D. Mauldin, APS, to NRC, "Exigent Amendment Request to Technical Specification 5.5.9, Steam Generator (SG)Tube Surveillance Program"
4. Letter 102-04856, dated October 23, 2002, from C.D. Mauldin, APS, to NRC, "Response to Request for Additional Information to Proposed Exigent Amendment to Technical Specification 5.5.9, Steam Generator (SG)Tube Surveillance Program"
5. Letter dated October 25, 2002, from NRC to APS, "Palo Verde Nuclear Generating Station, Unit 1- Review Related to Steam Generator Tube Inspection (TAC NO. MB6378)"
6. Letter 102-04865, dated November 19, 2002, from C.D. Mauldin, APS, to NRC, "Request to Withdraw Proposed Exigent Amendment to Technical Specification 5.5.9, Steam Generator Tube Surveillance Program in accordance with 10 CFR 2.107(a)"
7. Letter 102-04915, dated March 28, 2003, from C.D. Mauldin, APS, to NRC, "Palo Verde Nuclear Generating Station (PVNGS) Units1, 2 and 3 Docket Nos. STN 50-528/529/530, Steam Generator Tubesheet Inspection Information"
8. SECY Letter SECY-03-0080, "Steam Generator Tube Integrity – Plans for Revising Associated Regulatory Framework," dated May 16, 2003

Enclosure 3

Regulatory Commitment

The following table identifies the action committed to by APS in this document. Any other statements in this submittal are provided for information purposes and are not considered to be regulatory commitments. Please direct questions regarding these commitments to Thomas N. Weber at (623) 393-5764.

REGULATORY COMMITMENT	DUE DATE
The proposed corrective action to establish conformance with the NRC position [in GL 2004-01] is to submit a TS amendment request consistent with the recommendation in GL 2004-01 to limit the extent of the inspection in the tubesheet region where the tubes are expanded for the full depth of the tubesheet. APS commits to submit the proposed TS changes no later than May 31, 2005.	No later than May 31, 2005