



Palo Verde Nuclear  
Generating Station

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102-05311-CDM/SAB/RJR  
July 18, 2005

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

Dear Sirs:

**Subject: Palo Verde Nuclear Generating Station (PVNGS)  
Unit 2  
Docket No. STN 50-529  
APS' 60-Day after Plant Restart Letter in Response to First Revised  
NRC Order EA-03-009, Item IV.E, NRC Bulletin 2003-02, Commitment  
No. 3 and NRC Bulletin 2004-01, Commitment No. 2 – U2R12**

First Revised NRC Order EA-3-009, Item IV.E, NRC Bulletin 2003-02, Item (2) and NRC Bulletin 2004-01, Item 2(a) requested that a report detailing the inspection results of the reactor pressure vessel (RPV) head, the bottom mounted instrumentation (BMI) nozzles and pressurizer Alloy 82/182/600 penetrations be submitted to the NRC within 60 days of returning the unit to operation. On May 20, 2005, Arizona Public Service Company (APS) completed Unit 2's 12<sup>th</sup> refueling outage.

The enclosure to this letter contains the following requested information.

First Revised NRC Order EA-03-009, Unit 2 Reactor Pressure Vessel Head:

- Inspection results for each inspection required by Paragraph C of the Order.
- Inspection results for each inspection required by Paragraph D of the Order.

NRC Bulletin 2003-02, Unit 2 BMI inspection:

- A summary of the inspections performed.
- The extent of the inspections.
- The inspection methods used.
- A description of the "as-found" condition of the lower head.

A101  
A109  
A110

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APS' 60-Day after Plant Restart, U2R12

First Revised NRC Order EA-03-009 IV.E, Bulletin 2003-02, and Bulletin 2004-01

- Any findings of relevant indications of through-wall leakage.
- A summary of the disposition of any findings of boric acid deposits and any corrective actions taken as a result of indications found.

NRC Bulletin 2004-01, Unit 2 pressurizer Alloy 82/182/600 penetrations and steam space piping connections:

- A statement indicating that the inspections described in the APS response to item (1)(c) of NRC Bulletin 2004-01 was completed.
- A description of the as-found condition of the pressurizer shell.
- A description of any findings of relevant indications of through-wall leakage.
- A description of follow-up NDE performed to characterize flaws in leaking penetrations or steam space piping connections.
- A summary of all relevant indications found by NDE.
- A summary of the disposition of any findings of boric acid.
- A description of any corrective actions taken and/or repairs made as a result of the indications found.

No new commitments are being made to the NRC by this letter. Should you have any questions, please contact Thomas N. Weber at (623) 393-5764.

Sincerely,



CDM/SAB/RJR/ca

Enclosure: PVNGS' Unit 2 60-day Report Detailing the Inspection Results of the Reactor Pressure Vessel Head, the Bottom Mounted Instrumentation Nozzles and the Pressurizer Alloy 82/182/600 Penetrations and Steam Space Piping Connections During the 12<sup>th</sup> Refueling Outage

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

## U2R12 Inspection Results

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### Enclosure

**PVNGS' Unit 2 60-day Report Detailing the Inspection Results of  
the Reactor Pressure Vessel Head, the Bottom Mounted  
Instrumentation Nozzles and the Pressurizer Alloy 82/182/600  
Penetrations and Steam Space Piping Connections During the  
12<sup>th</sup> Refueling Outage**

## U2R12 Inspection Results

### First Revised NRC Order EA-03-009

For the inspections conducted during the Unit 2 12<sup>th</sup> refueling outage (U2R12) in the spring of 2005, the effective degradation years (EDY) were calculated as 12.71 EDY. In accordance with the First Revised NRC Order, this places Unit 2 in the high susceptibility category.

#### **Results of the Inspection Required by the First Revised NRC Order, EA-03-009**

First Revised NRC Order EA-03-009 IV.C.(1) states that:

For those plants in the High Susceptibility category, RPV head and head penetration nozzle inspections shall be performed using the techniques of paragraph IV.C.(5)(a) and paragraph IV.C.(5)(b) every refueling outage.

- IV.C.(5)(a) Bare metal visual examination of 100 percent of the RPV head surface (including 360° around each RPV head penetration nozzle). For RPV heads with the surface obscured by support structure interferences which are located at RPV head elevations down slope from the outermost RPV head penetration, a bare metal visual inspection of no less than 95 percent of the RPV head surface may be performed provided that the examination shall include those areas of the RPV head upslope and down slope from the support structure interference to identify any evidence of boron or corrosive product. Should any evidence of boron or corrosive product be identified, the licensee shall examine the RPV head surface under the support structure to ensure that the RPV head is not degraded.
- (b) For each penetration, perform a nonvisual NDE in accordance with either (i), (ii) or (iii):
- (i) Ultrasonic testing of the RPV head penetration nozzle volume (i.e., nozzle base material) from 2 inches above the highest point of the root of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) to 2 inches below the lowest point at the toe of the J-groove weld on a horizontal plane perpendicular to the nozzle axis (or the bottom of the nozzle if less than 2 inches [see Figure IV-1]); OR from 2 inches above the highest point of the root of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) to 1.0-inch below the lowest point at the toe of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) and including all RPV head penetration nozzle surfaces below the J-groove weld that have an operating stress level (including all residual and normal operation stresses) of 20 ksi tension and greater (see Figure IV-2). In addition, an assessment shall be made to determine if leakage has occurred into the annulus between the RPV head penetration nozzle and the RPV head low-alloy steel.

## U2R12 Inspection Results

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- (ii) Eddy current testing or dye penetrant testing of the entire wetted surface of the J-groove weld and the wetted surface of the RPV head penetration nozzle base material from at least 2 inches above the highest point of the root of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) to 2 inches below the lowest point at the toe of the J-groove weld on a horizontal plane perpendicular to the nozzle axis (or the bottom of the nozzle if less than 2 inches [see Figure IV-3]); OR from 2 inches above the highest point of the root of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) to 1.0-inch below the lowest point at the toe of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) and including all RPV head penetration nozzle surfaces below the J-groove weld that have an operating stress level (including all residual and normal operation stresses) of 20 ksi tension and greater (see Figure IV-4).
  
- (iii) A combination of (i) and (ii) to cover equivalent volumes, surfaces and leak paths of the RPV head penetration nozzle base material and J-groove weld as described in (i) and (ii). Substitution of a portion of a volumetric exam on a nozzle with a surface examination may be performed with the following requirements:
  - 1. On nozzle material below the J-groove weld, both the outside diameter and inside diameter surfaces of the nozzle must be examined.
  - 2. On nozzle material above the J-groove weld, surface examination of the inside diameter surface of the nozzle is permitted provided a surface examination of the J-groove weld is also performed.

### IV.C.(5)(a) Bare Metal Visual Examination Results

This examination was conducted in accordance with the requirements of the First Revised Order with no relaxations. No cleaning of the RPV head was necessary during U2R12. The visual examination of the "bare-metal" surface of the reactor head found no evidence of boron or corrosion.

## U2R12 Inspection Results

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### IV.C.(5)(b) Nonvisual Nondestructive Examination (NDE) Results:

Nonvisual NDE was performed in accordance with the requirements of the First Revised NRC Order EA-03-009 Section IV.C.(5)(b) and approved relaxations and commitments.

#### Reactor Head Vent Nozzle:

In preparation for the inspection identified in Section IV.C.(5)(b) of the First Revised NRC Order, APS modified the reactor head vent nozzle. The completed modification of the head vent nozzle removed and permanently relocated the internal orifice. Upon removal of the orifice, APS performed a surface examination (eddy current) of the J-groove weld and inside nozzle surface as required. The head vent nozzle does not protrude below the surface of the RPV head. As a result, there is no material below the J-groove weld to be examined. As reported in Licensee Event Report (LER) 50-529/2005-001-00, dated June 20, 2005, while performing reactor vessel head vent eddy current examinations and data evaluation, two (2) axial indications were confirmed on the vent ID surface, indicating potential primary water stress corrosion cracking (PWSCC) and degradation of the vent penetration. The axial indications were repaired prior to Unit 2 resuming power operation.

The indications were characterized as axial, estimated less than 0.080 inch deep, approximately 0.1 inch long, and oriented at approximately 90 degrees from each other. The indications were not through-wall. There was no evidence of RCS pressure boundary leakage.

A request was submitted (Reference APS letter Number 102-5259 CDM/CKS/TNW dated April 29, 2005) and approved by the NRC staff (Reference NRC letter dated May 9, 2005) to allow the use of the 1998 Edition, No Addenda of the ASME Code Section XI which authorizes the use of an eddy current examination as an acceptable surface examination technique. The indications found in the reactor head vent line nozzle were removed and verified to be acceptable using the eddy current surface examination technique.

#### Control Element Drive Mechanism Nozzles:

As previously communicated to the NRC<sup>1</sup>, APS stated that nozzles receiving the minimum inspection coverage, but less than 1-inch inspection coverage, will be reported in accordance with First Revised NRC Order Section IV.E. This information is provided in the attachment to this enclosure.

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1. Letter 102-05182-CDM/SAB/RJR, "Relief Request No. 25 for Unit 2: Relaxation of First Revised NRC Order EA-03-009 – Additional Analysis information for Control Element Drive Mechanism (CEDM) Nozzles," dated November 24, 2004.

## U2R12 Inspection Results

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The minimum required inspection coverage was obtained for all nozzles using ultrasonic or eddy current examination. No flaws were identified. First Revised NRC Order EA-03-009 Section IV.D. states that:

During each refueling outage, visual inspections shall be performed to identify potential boric acid leaks from pressure-retaining components above the RPV head. For any plant with boron deposits on the surface of the RPV head or related insulation, discovered either during the inspections required by this Order or otherwise and regardless of the source of the deposit, before returning the plant to operation the Licensee shall perform inspections of the affected RPV head surface and penetrations appropriate to the conditions found to verify the integrity of the affected area and penetrations.

### Results:

APS personnel performed a Boric Acid Walkdown (BAW) for the U2R12 refueling outage using Work Order 2759376. Potential boric acid leak sites from pressure retaining components above the RPV Head were examined using PVNGS procedure 70TI-9ZC01, Boric Acid Corrosion Prevention Program. One leak site above the reactor head was identified (Versa-Vent 08) at the start of the outage. This indication was reported in Special Report 2-SR-2004-02 during the mid-cycle short notice outage in July of 2004. All of the U2 Versa-Vent assemblies were reworked during U2R12 using Work Order 2773815. At the end of the outage during the Mode 3 walkdown, an additional leak site above the reactor head was identified (Versa-Vent 53). The following describes the findings:

#### CEDM Versa-Vent No. 08

No active leak was identified. The leakage stayed in the area of the vent and did not contact the reactor head or insulation. The boric acid did not affect any carbon steel and there was no non-conforming condition. The dry boric acid residue was cleaned and all of the Versa-Vent assemblies were reworked during U2R12.

#### CEDM Versa-Vent No. 53

No active leak was identified. The leakage stayed in the area of the vent and did not contact the reactor head or insulation. No carbon steel was affected and there was no non-conforming condition. This leak trail was not cleaned as cleaning would have required a major disassembly of the CEDM main power and position indication cables. This Versa-Vent will be reworked under Work Order 2800393.

## U2R12 Inspection Results

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### NRC Bulletin 2003-02 Bottom Mounted Instrumentation (BMI) Inspection

#### **Summary of the Inspections Performed**

An "as-found" inspection of all 61 penetrations (360° around each nozzle-bottom head interface) was performed by a qualified VT-2 examiner using remote operated robotic camera equipment with zoom capabilities. Cleaning of the nozzle-head interface area was continued during this outage. APS was able to complete the cleaning process of the 22 nozzles that remained from the R11 outage to allow performance of a "bare-metal" visual inspection of all 61 bottom mounted nozzles. A "bare-metal" zone has now been achieved on all of the 61 nozzles and a baseline examination completed.

No boric acid deposits were noted in the area of the nozzle annulus during the "as-found" inspection.

#### **Extent of the Inspections**

An initial visual inspection of all 61 penetrations was performed using a robot-mounted camera. The camera included a zoom feature. The maneuverability of the robot allowed the inspection 360° coverage around each nozzle-bottom head interface and was completed prior to any cleaning being attempted. A "bare-metal" zone has now been achieved on all of the 61 nozzles.

#### **Inspection Methods Used**

The "as-found" inspection of all 61 penetrations (360° around each nozzle-bottom head interface) was performed by a qualified VT-2 examiner using robotic equipment with zoom capabilities. The post cleaning "bare-metal" inspection was also performed by a qualified VT-2 examiner using robotic equipment with zoom capabilities.

#### **Description of the "As-found" Condition of the Lower Head**

As expected, there was some minor bridging and blockage of the nozzle annulus observed, on the 22 previously uncleaned nozzles. The bridging/blockage did not restrict the visual inspection. The CEDM nozzles are assembled with a clearance fit. This type of fit provides sufficient radial clearance around the nozzle to perform the required visual inspection. No boric acid deposits were noted in the area of the nozzle annulus during the "as-found" inspection. The 39 nozzles cleaned during U2R11 showed no evidence of leakage.

#### **Any Findings of Relevant Indications of Through-wall Leakage**

There was no indication of through-wall leakage.



## U2R12 Inspection Results

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### **Summary of the disposition of any Findings of Boric Acid Deposits and any Corrective Actions Taken as a Result of Indications Found**

As stated above, there were no boric acid deposits noted in the area of the nozzle annulus during the "as-found" inspection and there was no evidence of leakage from any bottom-mounted nozzle. As previously reported in letter 102-05050, corrective action document CRDR 2638613 evaluated the streaks and stains observed on the outside of the bottom head. No additional staining or evidence of leakage was identified during this inspection.

Based on the current visual inspection, APS concludes that PVNGS Unit 2 meets applicable regulatory requirements related to the structural and leakage integrity of the RPV lower head penetrations.

## U2R12 Inspection Results

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### NRC Bulletin 2004-01 Pressurizer Alloy 82/182/600 Penetrations and Steam Space Piping Connection Inspections

During the Unit 2 Refueling Outage 12, APS completed the inspections described in letter 102-05130, APS' 60-Day Response to the Information Requested by NRC Bulletin 2004-01, dated July 22, 2004.

#### **Description of the as-found condition of the pressurizer shell**

Pressurizer bare-metal inspections found no evidence of leakage.

#### **Description of any findings of relevant indications of through-wall leakage**

No relevant indications of through-wall leakage was identified during this inspection.

#### **Description of follow-up NDE performed to characterize flaws in leaking penetrations or steam space piping connections**

No additional follow-up NDE was required.

#### **Summary of all relevant indications found by NDE**

No relevant indications.

#### **Summary of the disposition of any findings of boric acid**

No boric acid residue was identified during the inspection of the Unit 2 pressurizer.

#### **Description of any corrective actions taken and/or repairs made as a result of the indications found**

No corrective actions were required.

**Attachment**

**Unit 2 Table of Examination Distances below the J-Groove  
Weld on the Downhill Side of the CEDM Nozzles**

Unit 2 Table of Examination Distances below the J-Groove Weld  
on the Downhill Side of the CEDM Nozzles

PEN NO	Lower Exam Extent	Minimum Required	PEN NO	Lower Exam Extent	Minimum Required	PEN NO	Lower Exam Extent	Minimum Required
1	1.42	0.45	46	1.02	0.4	91	0.42	0.4
2	1.54	0.45	47	1.18	0.4	92	0.54	0.4
3	1.42	0.45	48	1.1	0.4	93	0.82	0.4
4	1.34	0.45	49	0.86	0.4	94	0.62	0.4
5	1.66	0.45	50	1.14	0.4	95	0.66	0.4
6	1.34	0.45	51	0.9	0.4	96	0.54	0.4
7	1.18	0.45	52	1.1	0.4	97	0.82	0.4
8	1.34	0.45	53	0.9	0.4			
9	1.34	0.45	54	0.94	0.4			
10	1.34	0.45	55	1.22	0.4			
11	1.3	0.45	56	0.82	0.36			
12	1.5	0.45	57	0.86	0.4			
13	0.94	0.45	58	0.9	0.4			
14	1.43	0.45	59	0.98	0.4			
15	1.02	0.45	60	0.94	0.4			
16	1.5	0.45	61	1.1	0.4			
17	1.22	0.45	62	0.86	0.4			
18	1.38	0.45	63	0.86	0.4			
19	1.22	0.45	64	0.86	0.4			
20	1.14	0.45	65	1.02	0.4			
21	1.14	0.45	66	0.98	0.4			
22	1.3	0.45	67	0.78	0.4			
23	0.98	0.45	68	0.78	0.4			
24	1.22	0.45	69	0.94	0.4			
25	0.98	0.45	70	0.98	0.4			
26	1.22	0.45	71	1.1	0.4			
27	0.9	0.45	72	0.82	0.4			
28	1.22	0.45	73	0.9	0.4			
29	1.14	0.45	74	0.74	0.4			
30	1.14	0.45	75	0.66	0.4			
31	0.86	0.45	76	0.62	0.4			
32	1.22	0.45	77	0.86	0.4			
33	1.02	0.45	78	0.9	0.4			
34	0.94	0.45	79	0.74	0.4			
35	1.14	0.45	80	0.74	0.4			
36	1.1	0.45	81	0.86	0.4			
37	1.26	0.45	82	0.62	0.4			
38	1.14	0.45	83	0.5	0.4			
39	1.14	0.45	84	0.7	0.4			
40	0.98	0.45	85	0.58	0.4			
41	0.94	0.45	86	0.42	0.35			
42	1.34	0.45	87	0.42	0.35			
43	1.02	0.45	88	0.7	0.35			
44	1.18	0.45	89	0.38	0.35			
45	1.06	0.45	90	0.66	0.4			