



Palo Verde Nuclear
Generating Station

David Mauldin
Vice President
Nuclear Engineering
and Support

TEL (623) 393-5553
FAX (623) 393-6077

EA-03-009
Bulletin 2003-02
Mail Station 7605
P.O. Box 52034
Phoenix, AZ 85072-2034

102-05126-CDM/SAB/RJR
July 9, 2004

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
APS' 60-Day after Plant Restart Letter in Response to NRC Bulletin
2003-02, Commitment No. 3 and First Revised NRC Order EA-03-009,
Item IV.E – U1R11**

NRC Bulletin 2003-02, Item 1(c) and First Revised NRC Order EA-3-009, Item IV.E both requested that a 60-day report detailing the inspection results of the bottom mounted instrumentation (BMI) nozzles and the reactor pressure vessel (RPV) head be submitted to the NRC upon returning Unit 1 to operation. On May 10, 2004, Arizona Public Service Company (APS) completed Unit 1's 11th refueling outage.

The enclosure to this letter contains the following information on the Unit 1 BMI inspection:

- a summary of the inspections performed,
- the extent of the inspections,
- the methods used,
- a description of the "as-found" condition of the lower head,
- any findings of relevant indications of through-wall leakage, and
- a summary of the disposition of any findings of boric acid deposits and any corrective actions taken as a result of indications found.

The enclosure also contains the following information in response to First Revised NRC Order EA-03-009:

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

A member of the **STARS** (Strategic Teaming and Resource Sharing) Alliance

Callaway • Comanche Peak • Diablo Canyon • Palo Verde • South Texas Project • Wolf Creek

A109

First Revised NRC Order EA-03-009 Section IV.E requires licensees to provide the results of their reactor pressure vessel head inspections within 60 days after returning a plant to operation

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/

Enclosure: PVNGS' Unit 1 60-day Report Detailing the Inspection Results of the Bottom Mounted Instrumentation Nozzles and the Reactor Pressure Vessel Head

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

Assistant General Counsel for Materials Litigation and Enforcement
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Secretary,
Office of Secretary of the Commission
ATTN: Rulemakings and Adjudications staff
Washington, DC 20555-001

Enclosure

**PVNGS' Unit 1 60-day Report Detailing the Inspection Results of
the Bottom Mounted Instrumentation Nozzles and the Reactor
Pressure Vessel Head**

U1R11 60-Day After Outage Report

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

Summary of the Inspections Performed

APS performed a visual examination of all 61 bottom mounted instrumentation (BMI) nozzles at PVNGS Unit 1 during the 11th refueling outage. An APS Level III VT-2 qualified examiner using remote operated robotic camera equipment with zoom capabilities performed the "as-found" examination of all 61 penetrations (360° around each nozzle-bottom head interface). APS personnel found small flakes of "spray-lat" in the annulus of some of the BMI nozzles. These flakes did not obstruct the examination. APS personnel did not find any boric acid deposits, but observed minor staining from the fuel pool seal on the vessel bottom⁽¹⁾. APS personnel noted some dry red oxide deposits on a third of the BMI nozzles in the area of the annulus. No cleaning of the interface was required.

Extent of the Inspections

APS conducted a visual inspection of all 61 penetrations using a robot-mounted camera. The camera included a zoom and tilt feature calibrated to APS-VT-001 calibration standard. The maneuverability of the robot allowed a complete 360° inspection around each nozzle-bottom head interface and was completed and no cleaning was required.

Inspection Methods Used

The visual inspection of all 61 penetrations (360° around each nozzle-bottom head interface) was performed by an APS Level III VT-2 qualified examiner using robotic equipment with zoom and tilt capabilities. APS performed the examination with the incore instruments inserted into the vessel.

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

- Small flakes of "spray-lat" in some of the BMI annulus, but did not obstruct the examination
- No boric acid deposits
- Minimal staining from previous fuel pool seal leakage on the vessel bottom ⁽¹⁾
- Small amounts of dry red oxide deposits noted on a third of the BMI nozzles in the area of the annulus from previous leakage from CEDM Air Conditioning Units (ACU) and temporary pool seals (CRDR 2638613).

No cleaning of the nozzle-head interface was required.

U1R11 60-Day After Outage Report (continued)

- (1) As stated above, there was no boric acid deposits noted in the area of the nozzle annulus during the "as-found" inspection. There was no evidence of leakage from any bottom-mounted nozzle. However, as in the Unit 2 inspection and previously reported in APS letters 102-04885, dated January 31, 2003 and 102-05050, dated February 17, 2004, corrective action documents CRDR 2600546 and 2638613 were previously initiated to evaluate the streaks and stains observed on the outside of the bottom head. The Engineering evaluation performed concluded that the staining observed was from leakage caused by loss of air to the temporary pool seals and spillage from the control rod drive mechanism air conditioning units during the early outages in Unit 1.

Any Findings of Relevant Indications of Through-wall Leakage

There was no indication of through-wall leakage.

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 and there was no evidence of leakage from any bottom-mounted nozzle. The NRC Resident Inspector reviewed the examination results and no corrective actions were taken.

Based on the current visual inspection, APS concludes that PVNGS Unit 1 meets applicable regulatory requirements related to the structural and leakage integrity of the RPV lower head penetrations.

U1R11 60-Day After Outage Report (continued)

First Revised NRC Order EA-03-009

At the start of the Unit 1 11th refueling outage (U1R11) in the spring of 2004, the effective degradation years (EDY) were calculated as 12.30 EDY, which places Unit 1 in the high susceptibility category.

Results of the Inspection Required by Paragraph IV.C

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 downslope 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 downslope 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

U1R11 60-Day After Outage Report (continued)

into the annulus between the RPV head penetration nozzle and the RPV head low-alloy steel.

- (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. During the visual inspection of the RPV head surface, APS identified some staining from Nalco. Nalco is an additive used in the nuclear cooling water system that produces a non-crystalline residue. APS cleaned the stain with a steam cleaner. A visual examination of the "bare-metal" surface of the reactor head after cleaning found no evidence of boron or corrosion.

U1R11 60-Day After Outage Report (continued)

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

Nonvisual NDE 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 as identified in References 1 and 2.

Reactor Head Vent Nozzle:

In addition to the visual examination of the reactor head vent nozzle performed for Order section IV.C.(5)(a), APS also performed a surface examination (manual eddy current) of the J-groove weld, nozzle bottom, orifice attachment weld and orifice bottom surfaces. No indications were found during this examination.

Control Element Drive Mechanisms:

In Reference 3 of this enclosure, APS stated that nozzles receiving the minimum inspection coverage, but less than 1-inch inspection coverage, will be reported in accordance with Order Section IV.E. Attachment 1 to this enclosure contains a table identifying the lower examination extent and the minimum inspection coverage required from Table 1 of Reference 3.

For penetration No.s 84, 87, and 93, the minimum required inspection coverage described in Table 1 of Reference 3 could not be obtained using ultrasonic or eddy current examination. The exam coverage for penetration No. 79 was determined to be at the minimum required distance. Ultrasonic and eddy current examination of penetrations 79, 84, 87, and 93 did cover the available distance on the inside diameter of each nozzle leaving no additional distance for examination. APS performed a manual dye penetrant examination from below the J-groove weld (overlapping the volumetric examination) to as low as practical on the outside diameter of these four identified penetration nozzles. No indications were identified. This information was provided to the NRC in Reference 4. As a result, the NRC concluded that APS' proposed alternative examination of the CEDM nozzles for PVNGS Unit 1 provided reasonable assurance of the structural integrity of the reactor pressure vessel head, nozzles and welds for a limited operating time of 7.7 effective full power months.

APS has provided additional information that supports a full cycle of operation for Unit 1 in APS letter 102-05123, dated July 1, 2004.

U1R11 60-Day After Outage Report (continued)

Results of the Inspection Required by Paragraph D of First Revised NRC Order EA-03-009

First Revised NRC Order EA-03-009 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.

APS personnel performed a Boric Acid Walkdown (BAW) for the U1R11 refueling outage on April 3, 2004. 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. No leak sites above the reactor head were identified. However, at the end of the outage during the Mode 3 walkdown, APS identified two sites with boron residue (Versa Vents 18 and 62). The following describes the findings:

CEDM Versa Vent No. 18

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 not cleaned during U1R11, as this would have required a major disassembly of the CEDM main power and position indication cables. Work Order 2707365 tracks this work. The versa vent ball/seat is scheduled to be worked during the next available short notice outage (SNOW) when plant conditions permit or during U1R12.

CEDM VERSA VENT No. 62

No active leak was identified. The leakage stayed in the area of the vent and did not contact the reactor head or insulation. This leak was cleaned since the location is near the periphery and accessible. No carbon steel was affected and there was no non-conforming condition. The dry boric acid residue was cleaned but the vent was not reworked during U1R11 and is being tracked in the work control process under Work Order 2707367. The versa vent ball/seat is scheduled to be worked during the next available short notice outage (SNOW) when plant conditions permit or during U1R12.

U1R11 60-Day After Outage Report (continued)

Follow-up on Special Report No. 1-SR-2004-001

On February 3, 2004, Palo Verde Unit 1 was manually shutdown due to an RCS pressure boundary leak. Subsequent to the reactor shutdown, APS personnel performed visual inspections in accordance with the Boric Acid Corrosion Prevention Program (APS procedure 70TI-9ZC01). The inspection identified the versa-vent for control element drive mechanism (CEDM) No. 88 as having boric acid residue. Versa-vents are located above the RPV head. At the time of discovery, the site exhibited no evidence of being an active leak and the boric acid residue had not contacted the RPV head or related insulation. Since there was no evidence of boron deposits on the surface of the RPV head or related insulation, no inspection of the head surface or penetrations were required or performed. APS maintenance completed cleaning of the versa-vent for CEDM 88 shortly after discovery since this location is near the periphery and accessible. After the shutdown for U1R11, APS personnel inspected CEDM 88 again with no evidence of further leakage. APS maintenance reworked the versa-vent during this refueling outage.

References:

1. Letter from the NRC to PVNGS, "Palo Verde Nuclear Generating Station, Unit 1 – Relaxation of the Requirements of the First Revised Order Modifying Licenses EA-03-009 Regarding Reactor Pressure Vessel Head Inspections (TAC NO. MC1835)," dated April 30, 2004.
2. Letter from the NRC to PVNGS, "Palo Verde Nuclear Generating Station, Unit 1 – Relaxation of the Requirements of the First Revised Order Modifying Licenses EA-03-009 Regarding Reactor Pressure Vessel Head Inspections (TAC NO. MC2388)," dated May 5, 2004.
3. APS letter 102-05075-CDM/SAB/RJR, "Relief Request No. 25 – Request for Relaxation of First Revised NRC Order EA-03-009, Section IV.C.(5)(b) Requirements for CEDM Nozzles," dated March 19, 2004.
4. APS letter 102-05100-CDM/TNW/RJR, "Additional Information Request for CEDM Nozzle Inspections for First Revised NRC Order EA-09-003," dated April 29, 2003.
5. Letter from the NRC to APS, "Palo Verde Nuclear Generating Station Unit 1 – Relaxation of the Requirements of First Revised NRC Order EA-03-009 Required Reactor Pressure Vessel Head Inspections (TAC No. MC2388)," dated May 5, 2004.
6. APS letter 192-01134-CDM/DFH, "Special Report 1-SR-2004-001 - Report of Boron Deposit at Control Element Drive Mechanism Vent," dated March 18, 2004.

Attachment 1

**Unit 1 Table of Examination Distances below the J-groove Weld
on the Downhill Side of the Nozzle**

**Unit 1 Table of Examination Distances below the J-groove Weld on the Downhill
Side of the Nozzle**

	Lower Exam Extent	Minimum Required
Pen 01	1.24	0.45
Pen 02	1.12	0.45
Pen 03	1.04	0.45
Pen 04	1.20	0.45
Pen 05	1.32	0.45
Pen 06	1.08	0.45
Pen 07	1.12	0.45
Pen 08	0.96	0.45
Pen 09	0.92	0.45
Pen 10	1.20	0.45
Pen 11	1.28	0.45
Pen 12	1.20	0.45
Pen 13	1.20	0.45
Pen 14	1.12	0.45
Pen 15	0.84	0.45
Pen 16	1.00	0.45
Pen 17	1.20	0.45
Pen 18	0.72	0.45
Pen 19	0.88	0.45
Pen 20	1.08	0.45
Pen 21	1.04	0.45
Pen 22	1.04	0.45
Pen 23	0.76	0.45
Pen 24	0.80	0.45
Pen 25	1.00	0.45
Pen 26	1.04	0.45
Pen 27	1.16	0.45
Pen 28	1.12	0.45
Pen 29	1.24	0.45
Pen 30	0.76	0.45
Pen 31	0.80	0.45
Pen 32	1.00	0.45
Pen 33	1.08	0.45
Pen 34	0.64	0.45
Pen 35	0.80	0.45
Pen 36	0.80	0.45

	Lower Exam Extent	Minimum Required
Pen 37	0.92	0.45
Pen 38	1.04	0.45
Pen 39	0.72	0.45
Pen 40	1.20	0.45
Pen 41	1.12	0.45
Pen 42	1.04	0.45
Pen 43	0.96	0.45
Pen 44	0.64	0.45
Pen 45	0.96	0.45
Pen 46	0.84	0.40
Pen 47	0.72	0.40
Pen 48	0.96	0.40
Pen 49	0.64	0.40
Pen 50	0.96	0.40
Pen 51	0.96	0.40
Pen 52	1.04	0.40
Pen 53	1.04	0.40
Pen 54	1.12	0.40
Pen 55	0.72	0.40
Pen 56	0.84	0.40
Pen 57	0.84	0.40
Pen 58	0.84	0.40
Pen 59	0.80	0.40
Pen 60	0.72	0.40
Pen 61	0.88	0.40
Pen 62	0.56	0.40
Pen 63	0.64	0.40
Pen 64	1.00	0.40
Pen 65	0.88	0.40
Pen 66	1.00	0.40
Pen 67	0.84	0.40
Pen 68	0.84	0.40
Pen 69	0.64	0.40
Pen 70	0.60	0.40
Pen 71	0.84	0.40
Pen 72	0.88	0.40
Pen 73	1.40	0.40
Pen 74	0.64	0.40
Pen 75	1.00	0.40

	Lower Exam Extent	Minimum Required
Pen 76	0.76	0.40
Pen 77	0.76	0.40
Pen 78	0.60	0.40
Pen 79	0.44*	0.40
Pen 80	0.68	0.40
Pen 81	0.96	0.40
Pen 82	0.76	0.40
Pen 83	0.76	0.40
Pen 84	0.28*	0.40
Pen 85	0.52	0.40
Pen 86	0.84	0.35
Pen 87	0.20*	0.35
Pen 88	0.56	0.35
Pen 89	0.76	0.35
Pen 90	0.80	0.40
Pen 91	0.56	0.40
Pen 92	0.60	0.40
Pen 93	0.36*	0.40
Pen 94	0.64	0.40
Pen 95	0.60	0.40
Pen 96	0.56	0.40
Pen 97	0.96	0.40