EA-03-009
Bulletin 2003-02
Bulletin 2004-01

Palo Verde Nuclear
Generating Station

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102-05529-CDM/SAB/RJR
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ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Dear Sirs:

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Unit 3
Docket No. STN 50-530
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 – U3R12

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 after returning Unit 3 to operation. On May 12, 2006, Arizona Public Service Company (APS) completed Unit 3's 12th refueling outage.

The enclosure to this letter contains the following requested information.

First Revised NRC Order EA-03-009, Unit 3 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.

Additionally, this section of the enclosure contains a discussion of a leak above the reactor pressure vessel head that occurred during a venting operation of the control element drive mechanisms.

NRC Bulletin 2003-02, Unit 3 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.

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- 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

By letter dated June 15, 2006, the NRC staff notified APS that the staff had closed their efforts with regard to the review of APS' Bulletin 2004-01 responses for PVNGS Units 1, 2, and 3 (ADAMS Accession No. ML061520459). Therefore, no summaries of the Bulletin 2004-01 Unit 3 pressurizer Alloy 82/182/600 penetrations and steam space piping connection inspections are being reported.

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,

David D Mauldin

CDM/SAB/RJR/gt

Enclosure: PVNGS' Unit 3 Refueling 12 60-day Report Detailing the Inspection Results of the Reactor Pressure Vessel Head and the Bottom Mounted Instrumentation Nozzles

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Enclosure

PVNGS' Unit 3 Refueling 12 60-day Report Detailing the Inspection Results of the Reactor Pressure Vessel Head and the Bottom Mounted Instrumentation Nozzles

First Revised NRC Order EA-03-009

At the start of the Unit 3 12th refueling outage (U3R12) in April 2006, the effective degradation years (EDY) were calculated as 13.09 EDY, which is in the High Susceptibility category as defined in First Revised NRC Order EA-03-009 IV.B.

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, reactor pressure vessel (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.

(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. No cleaning of the RPV head was necessary during U3R12. The visual examination of the "bare-metal" surface of the reactor head found no evidence of boron or corrosion.

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 restated below:

NRC letter dated November 8, 2005, "Palo Verde Nuclear Generating Station (Palo Verde), Units 1 and 3 - Relaxation Request from U.S. Nuclear Regulatory Commission (NRC) First Revised Order EA-03-009 Re: Reactor Pressure Vessel Head Inspections (TAC Nos. MC2388 And MC2390)," defines a successful inspection as inspecting the minimum required nozzle distances for all CEDM nozzles in accordance with the Order. Each successful inspection will allow Palo Verde Unit 3 to operate for an additional 1.7 EFPYs, for the life of the First Revised Order.

The minimum required inspection coverage for Palo Verde Unit 3 is:

Nozzle Angle (E)	Penetration No. Applicability	Minimum Inspection Coverage Required Below the Weld on the Downhill Side (in)	EFPYs for Upper Crack Tip to Reach Bottom of Weld
0	1-29	0.40	1.7
31.5	30-81	0.35	2.0
47.6	82-85	0.30	2.4
49.5	90-97	0.30	3.4
51.5	86-89	0.20	2.4

By supplemental letter dated April 28, 2004, APS committed to determine that the minimum required distances listed above were examined in accordance with the requirements of the Order. On CEDM nozzles where the minimum required distances below the J-groove weld were not examined, APS committed to perform a surface examination below the affected nozzle J-groove welds to as low as practical on the affected nozzle inner diameter (ID) and outer diameter (OD) surfaces prior to plant startup.

Reactor Head Vent Nozzle:

The vent line penetration J-weld and orifice J-weld were examined with automated eddy current (ET) and ultrasonic (UT) techniques from the ID surface, in addition manual ET techniques were applied to the OD surface of the vent line penetration J-weld. The results of the examinations are acceptable with no detectable defects.

Control Element Drive Mechanism Nozzles:

Ninety seven CEDM penetrations were examined using automated UT and ET techniques from the ID surface. The results of all CEDM examinations are acceptable with no detectable defects.

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 U3R12 refueling outage using Work Order 2842141. 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. Three previously reported leak sites above the reactor head were identified (Versa-Vents 2, 17 and 22) at the start of the outage. No new leak sites were identified. At the end of the outage during the Mode 3 walkdown, two additional leak sites above the reactor head were identified (Versa-Vents 7 and 34). The following describes the findings:

<u>CEDM Versa-Vents No. 2, 17, and 22</u>

- U3 CEDM Versa-Vents # 17 and # 22 were previously reported under APS letter 102-05330-CDM/CKS/DGM/DFH, "Special Report 3-SR-2005-002 Report of Boron Deposit at Control Element Drive Mechanism Vent," dated August 23, 2005.

- U3 CEDM Versa-Vents # 2 was previously reported under APS letter 102-05384-CDM/SAB/DGM/DFH, "Special Report 3-SR-2005-003 Report of Boron Deposit at Control Element Drive Mechanism Vent," dated December 5, 2005.

No active leaks were identified. The leakage from these three Versa-Vents 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 under work orders 2833953, 2813533, 2813535 during U3R12.

CEDM Versa-Vents No. 7 and 34

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 were no non-conforming condition. The leak trails were not cleaned as cleaning would have required a major disassembly of the CEDM main power and position indication cables. These Versa-Vents will be reworked under Work Orders 2893168 and 2893169.

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 an APS Level III VT-2 qualified examiner using remote operated robotic camera equipment with zoom capabilities. This included a "bare-metal" inspection on 23 previously cleaned nozzles (U3R11) before cleaning of the remaining 38 was started. Cleaning of the nozzle-head interface area was completed on the remaining 38 nozzles during this outage.

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. The thirty-eight nozzles that remain to be cleaned from the previous outage were cleaned and reinspected.

Inspection Methods Used

The "as-found" 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 capabilities. The post cleaning "bare-metal" inspection was also performed by an APS Level III VT-2 qualified examiner using robotic equipment with zoom capabilities.

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

As seen in the previous Unit 3 inspections performed in the spring of 2003 and the fall of 2004, a residual spray-lat coating, caulking, and other foreign material were found adhered to some of the previously uncleaned Unit 3 BMI nozzles in the area of the nozzle-bottom head interface. Some minor bridging and blockage of the nozzle annulus was observed on these 38 nozzles. However, the bridging/blockage did not restrict the visual inspection. The BMI 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.

Streaks and stains were again observed on the outside of the bottom head from previous fuel pool seal leakage. Corrective Action document 2600546 contains the

evaluation of this condition and is described below. No corrosion of the carbon steel shell was observed.

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 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. Corrective action document CRDR 2600546 evaluated 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 in 1988 and leakage from a heated junction thermo-couple seal weld in 1987.

Based on the current visual inspection, APS concludes that PVNGS Unit 3 meets applicable regulatory requirements related to the structural and leakage integrity of the RPV lower head penetrations.