



A subsidiary of Pinnacle West Capital Corporation

Palo Verde Nuclear  
Generating Station

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102-05958-DCM/SAB/RJR  
February 17, 2009

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

- References:
- 1) Letter from the NRC to APS dated November 8, 2004, 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)
  - 2) Letter from the NRC to APS dated February 23, 2005, Palo Verde Nuclear Generating Station (Palo Verde), Unit 2 - Relaxation Request from U.S. Nuclear Regulatory Commission (NRC) First Revised Order EA-03-009 RE: Reactor Pressure Vessel Head Inspections (TAC No. MC2398)

Dear Sirs:

**Subject: Palo Verde Nuclear Generating Station (PVNGS)  
Units 1, 2, and 3  
Docket Nos. STN 50-528, 529, and 530  
Relief Request 41 – Request to use Appendix I of ASME Code Case N-729-1**

Pursuant to 10 CFR 50.55a(a)(3)(i), Arizona Public Service Company (APS) hereby requests Nuclear Regulatory Commission (NRC) approval of Relief Request 41 to use the methodology of Appendix I of Code Case N-729-1 to define an alternative examination area or volume definition for reactor head penetrations. APS requests approval of this relief until the end of the third inspection interval or until the Unit 1, 2 and 3 reactor vessel heads have been replaced, whichever occurs first. Reactor vessel head replacements are scheduled to begin with Unit 2 during the fall 2009 refueling outage followed by Unit 1 in the spring of 2010 and Unit 3 in the fall of 2010.

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Changes to 10 CFR 50.55a published in the Federal Register (73 FR, Page No. 52730, dated September 10, 2008) included a new rule for reactor vessel head inspection in 10 CFR 50.55a(g)(6)(ii)(D). Implementation of this new rule was required by December 31, 2008, and once implemented, the First Revised NRC Order EA-03-009 no longer applies and is deemed to be withdrawn. As a result, the previously approved NRC relaxations from the requirements of the Order no longer apply. References 1 and 2 document the NRC approval for relaxation to the Order which demonstrated that flaws in the unexamined areas of the reactor head penetrations would not propagate to the toe of the J-groove weld prior to the performance of the next scheduled examination.

The proposed alternative discussed in this relief request meets the requirements of Section I-3200 of Code Case N-729-1 and provides an acceptable level of quality and safety. The proposed alternative demonstrates, in a manner similar to the previously approved relaxations from the First Revised NRC Order EA-03-009, that flaws in the unexamined areas of the reactor head penetrations will not propagate to the toe of the J-groove weld prior to the next scheduled inspection. Therefore, APS requests that the use of Appendix I to Code Case N-729-1 and the proposed inspection alternative be authorized pursuant to 10 CFR 50.55a(a)(3)(i).

APS is requesting approval by May 7, 2009, (Mode 4 entry preparations) to support the Unit 3 spring 2009 refueling outage.

There are no new commitments being made in this letter.

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

Sincerely,



DCM/RAS/RJR/gat

Enclosure    Relief Request 41 - Proposed Alternative in Accordance with 10 CFR  
50.55a(a)(3)(i) - Alternative Provides Acceptable Level of Quality and  
Safety

cc:    E. E. Collins Jr.    NRC Region IV Regional Administrator  
      R. Hall            NRC NRR Project Manager  
      R. I. Treadway    NRC Senior Resident Inspector

**ENCLOSURE**

**Relief Request 41**

**Proposed Alternative in Accordance with 10 CFR 50.55a(a)(3)(i)  
Alternative Provides Acceptable Level of Quality and Safety**

## Relief Request 41

### Proposed Alternative in Accordance with 10 CFR 50.55a(a)(3)(i) Alternative Provides Acceptable Level of Quality and Safety

#### Applicable Unit(s)

Palo Verde Units 1, 2, and 3

#### ASME Code Components Affected

ASME Item Number: B3.90

Description: Control Element Drive Mechanism (CEDM) Nozzle Penetrations

Code Class: 1

#### Applicable Code Editions and Addenda

Third 10-year Inservice Inspection Interval Code for Palo Verde Nuclear Generating Station (PVNGS) for Units 1, 2, and 3: American Society of Mechanical Engineers (ASME) Code, Section XI, 2001 Edition through 2003 Addenda.

#### Applicable Code Requirement

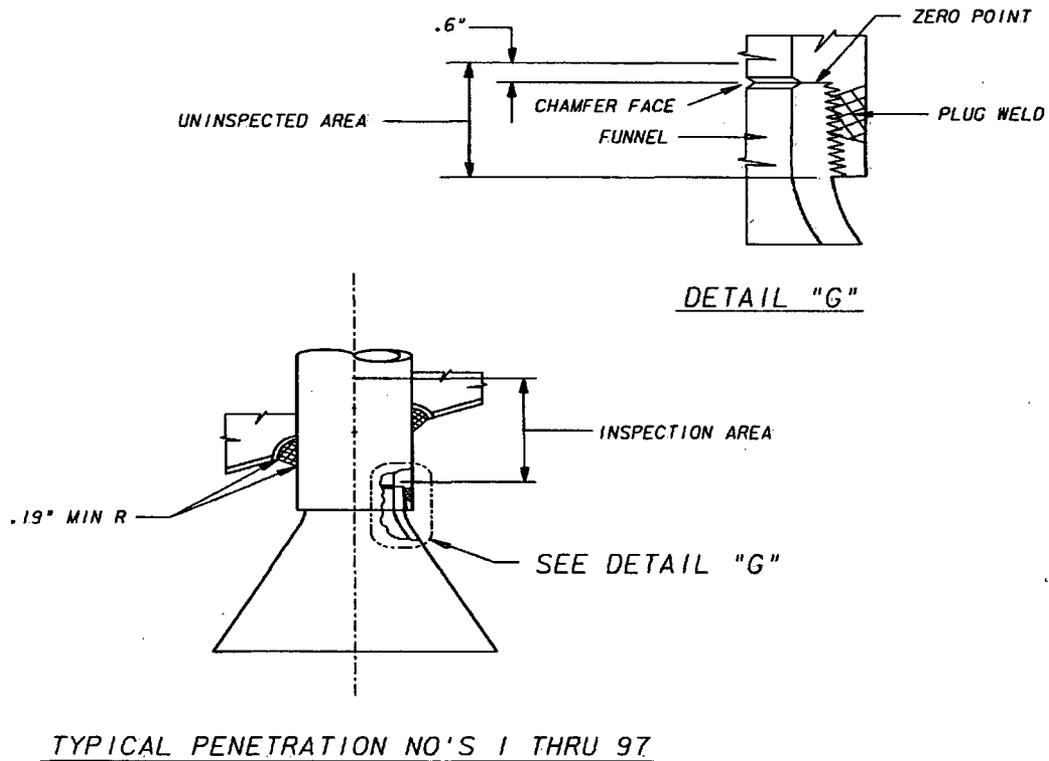
Code Case N-729-1, Section 2500 states, in part, that components shall be examined as specified in Table 1 [of the Code Case] and if obstructions or limitations prevent examination of the volume or surface required by Figure 2 [of the Code Case] for one or more nozzles, the analysis procedure of Appendix I shall be used to demonstrate the adequacy of the examination volume or surface of each nozzle. 10 CFR 50.55a(g)(6)(ii)(D)(6) (73 FR, Page No. 52730, dated September 10, 2008) states that Appendix I of ASME Code Case N-729-1 shall not be implemented without prior NRC approval.

Code Case N-729-1, Figure 2, Examination Volume for Nozzle Base Metal and Examination Area for Weld and Nozzle Base Metal, identifies the examination volume or surface as "a = 1.5 in. (38 mm) for Incidence Angle,  $\theta$ ,  $\leq 30$  deg and for all nozzles  $\geq 4.5$  in. (115 mm) OD or 1 in. (25 mm) for Incidence Angle,  $\theta$ ,  $> 30$  deg; or to the end of the tube, whichever is less."

#### Reason for Request

Due to the design of the funnel attachment to the CEDM nozzles (i.e., inside threaded connection with plug weld, see the figure below), APS is unable to fully comply with the requirement to perform a volumetric examination to the end of the tube [nozzle] (A-B-C-D = Extent of volumetric examination for the tube [base metal]) as defined in Figure 2 of the Code Case N-729-1.

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### **Proposed Alternative and Basis For Relief**

APS proposes to perform ultrasonic testing of each reactor pressure vessel (RPV) head CEDM penetration nozzle (i.e., nozzle base material) for a distance equal to "a" as defined by Figure 2 of Code Case N-729-1 above the J-groove weld on the uphill slope and to the minimum required inspection distances below the J-groove weld on the downhill slope as identified in the following tables (Tables 1, 2, and 3, including footnote 1 on Table 1). APS procedures require examination of each CEDM nozzle as far down as practical. If inspection limitations prevent examination to the minimum distances identified in the following tables, (Tables 1, 2, and 3, including footnote 1 on Table 1) then a surface examination of the remaining wetted surface will be conducted on the effected nozzle(s). The minimum inspection coverage required by Tables 1, 2, and 3 results in a minimum of 1.7 effective full power years (EFPY) before a postulated axial through-wall flaw in the un-inspected area of the CEDM penetration nozzle would propagate into the pressure boundary formed by the J-groove weld. This time estimate is longer than the current operating cycle. Therefore, this exam will continue to provide

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reasonable assurance that safety significant circumferential flaws do not exist at or above the weld root and assure that operation between refueling outages can be accomplished without pressure boundary leakage from the examined nozzles.

Tables 1, 2, and 3, including supporting documentation, were previously provided to the NRC in the submittals listed in the reference section of this request. The NRC reiterated these tables in the approved relaxations dated November 8, 2004, and February 23, 2005 (see Precedents).

Table 1  
Palo Verde Unit 1 CEDM Nozzle Minimum Required Inspection Coverage

Nozzle Angle (°)	Penetration No. Applicability	Minimum Inspection Coverage Required Below the Weld on the Downhill Side (in)	EPFY for Upper Crack Tip to Reach the Bottom of Weld
0	1	0.45	1.7
7.5	2-21	0.45	1.7
28.0	22-45	0.45	1.8
35.7	46-85, 90-97 <sup>1</sup>	0.40	1.7
51.5	86-89 <sup>1</sup>	0.35	1.9

<sup>1</sup> Nozzles 84, 87 and 93 actual inspection coverage was 0.24", 0.16", and 0.32", respectively where no propagation was predicted. This included a 0.04" instrument uncertainty. This information was provided in APS Letter 102-05123, (Enclosure Reference 3) which included Westinghouse letter PAFM-04-39, Rev. 1.

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Table 2  
Palo Verde Unit 2 CEDM Nozzle Minimum Required Inspection Coverage

Nozzle Angle (°)	Penetration No. Applicability	Minimum Inspection Coverage Required Below the Weld on the Downhill Side (in)	EFPY for Upper Crack Tip to Reach the Bottom of Weld
0	1	0.45	1.7
7.5	2-21	0.45	1.7
28.0	22-45	0.45	1.8
35.7	46-55, 57-85, 90-97	0.40	1.7
35.7	56	0.36	No Propagation Predicted
51.5	86-89	0.35	1.9

Table 3  
Palo Verde Unit 3 CEDM Nozzle Minimum Required Inspection Coverage

Nozzle Angle (°)	Penetration No. Applicability	Minimum Inspection Coverage Required Below the Weld on the Downhill Side (in)	EFPY for Upper Crack Tip to Reach the 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

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10 CFR 50.55a(g)(6)(ii)(D)(6) states that Appendix I of Code Case N-729-1 can not be used without prior NRC approval. APS has reviewed the analyses previously provided to the NRC in Relief Request 25, as supplemented in response to NRC requests for additional information, and has concluded that the previous completed analyses meet the requirements of the methodology described in Code Case N-729-1, Appendix I, Section I-3200, Zones Below the J-Groove Weld.

### Summary of the APS Review

The relaxation from NRC First Revised Order EA-03-009 was based on APS Letter 102-05075 (Enclosure Reference 1) which provided the Westinghouse analysis letter PAFM-04-23 and APS letters 102-05101 and 102-05182 (Enclosure References 2 and 4) which provided Westinghouse analysis letters PAFM-04-35 and PAFM-04-54, Revision 1, respectively. APS letter 102-05123, (Enclosure Reference 3) included Westinghouse letter PAFM-04-39, Revision 1, and revised Unit 1 nozzles 84, 87 and 93 inspection coverage.

Code Case N-729-1, Appendix I states that for alternative examination zones that eliminate portions of Figure 2 examination zones below the J-groove weld (Figure I-2), the analysis shall be performed using the stress methodology of I-2000 or the deterministic fracture mechanics analysis method of I-3000. APS used deterministic fracture mechanics analysis methodology similar to that of Code Case N-729-1, Section I-3200 for the previously approved relaxations to demonstrate that an axial crack in the unexamined zone will not grow to the toe of the J-groove weld prior to the next schedule examination.

APS has reviewed its previous analysis against the requirements of I-3200. The following are the Appendix I requirements and the results of APS' review.

- 1) The initial crack size shall be determined by assuming its upper extremity at the end of the alternative inspection zone and the bottom portion of the crack where either inside or outside surface hoop stresses become compressive (Figure I-2).

Results: The Westinghouse analysis prepared as part of the initial submittal meets this requirement (Enclosure Reference 1).

- 2) If the hoop stress remains tensile for the entire portion of the nozzle below the weld, an axial through wall crack shall be postulated from the bottom of the edge of the alternative examination zone to the bottom of the nozzle (Figure I-3).

Results: The analysis provided as part of the Order relaxation request resulted in the lower extremity of the crack at the zero stress field, thus demonstrating that the hoop stresses on the nozzle do not remain tensile over its entire length.

- 3) The average of inside and outside surface hoop stresses shall be applied along the entire length of the assumed through wall crack.

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Results: Both the Westinghouse reports (WCAP-15817, Agencywide Documents Access and Management System [ADAMS] Accession Nos. ML041700124 and ML041400050 and WCAP-16044, ADAMS Accession Nos. ML043020268 and ML050820294) and the supplemental analyses submitted as part of the relaxation request meet this requirement.

Note: APS' initial examinations of the nozzles, revealed that some nozzles could not be examined for the full estimated distances. This resulted in additional analysis being submitted (Enclosure References 2, 3, and 4).

- 4) The postulated axial flaw shall be located in the unexamined zone at the azimuthal location that results in the shortest time to re-examination.

Results: The Westinghouse reports and analyses submitted as part of the Order relaxation request utilized the maximum stresses at the outside and inside diameters to calculate the stress intensity at the postulated crack and the corresponding crack extension.

- 5) The stress intensity factor for an axial through wall crack in a cylinder shall be used.

Results: The additional analyses submitted as part of the Order relaxation request are in compliance as the stress intensity factor for an axial through wall crack in a cylinder was used.

- 6) Crack growth rate determination shall be in accordance with Appendix O of Section XI in the 2004 Edition.

Results: A review of Appendix O, Section O-3230, crack growth rate model for stress corrosion cracking revealed that it is the same model developed in MRP-55, Rev 01 which APS used. Thus, the analyses submitted as part of the Order relaxation request are in compliance and so are the Westinghouse reports. Note that the Unit 1 and 2 analyses utilized a more conservative crack growth rate coefficient.

Conclusion: The analyses submitted in support of the relaxation request for the First revised NRC Order EA-03-009 meet the requirements of Section I-3200 of Code Case N-729-1. Accordingly, APS is requesting NRC approval to use Appendix I of Code Case N-729-1 to define an alternative examination area or volume definition to that defined in Figure 2 of the Code Case.

### Duration of Propose Alternative

APS requests approval of this relief until the end of the third inspection interval or until the Unit 1, 2 and 3 reactor vessel heads have been replaced, whichever occurs first. Reactor vessel head replacements are currently scheduled to begin with Unit 2 during the fall 2009 refueling outage followed by Unit 1 in the spring of 2010 and Unit 3 in the fall of 2010.

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### Commitments

No new commitments are being made in this request.

### Conclusion

10 CFR 50.55a(a)(3) states:

“Proposed alternatives to the requirements of paragraphs (c), (d), (e), (f), (g), and (h) of this section or portions thereof may be used when authorized by the Director of the Office of Nuclear Reactor Regulation. The applicant shall demonstrate that:

- (i) The proposed alternatives would provide an acceptable level of quality and safety, or
- (ii) Compliance with the specified requirements of this section would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.”

The proposed alternative discussed in this relief request meets the requirements of Section I-3200 of Code Case N-729-1 and provides an acceptable level of quality and safety. Therefore, APS requests that the use of Appendix I to Code Case N-729-1 and the proposed inspection alternative be authorized pursuant to 10 CFR 50.55a(a)(3)(i).

### Precedents

NRC relaxation approval for Units 1 and 3 dated November 8, 2004, (ADAMS Accession No. ML043140259).

NRC relaxation approval for Unit 2 dated February 23, 2005 (ADAMS Accession No. ML050540726).

### References

1. APS letter dated March 19, 2004, (102-05075) (ADAMS Accession Nos. ML041680293 and ML041800200) (Units 1, 2, and 3) APS informed the NRC that due to the design of the funnel attachment to the CEDM nozzles and the as-welded condition of nozzle J-groove weld fillet sizes, APS requested relaxation from fully complying with the requirement to perform UT to 1.0-inch below the lowest point of the toe of the J-groove weld for all CEDM nozzles. Ultrasonic testing of each RPV head CEDM penetration nozzle (i.e., nozzle base material) from 2-inches above the J-groove weld to the minimum required inspection distances identified in Tables 1 and 2. The analysis, Westinghouse LTR-PAFM-04-23, “Palo Verde Units 1, 2 & 3 Head Penetration Minimum Inspection Coverage with Crack Growth Curve for 0 ksi Case,” was included as part of the enclosure to this letter.

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2. APS letter dated May 3, 2004, (102-05101) (ADAMS Accession No. ML041320466) (Units 1, 2, and 3). APS provided the information requested in a telephone call on April 30, 2004, with the NRC. The requested analysis substantiated that the distances inspected for penetrations 84, 87, and 93 were acceptable. The analysis, Westinghouse LTR-PAFM-04-35, "Revised Analysis for Palo Verde Unit 1 CEDM Penetrations 84, 87, and 93," was included as an enclosure to this letter.
3. APS letter dated July 1, 2004, (102-05123) (ADAMS Accession Nos. ML041950341 and ML041910397) (Units 1, 2, and 3). APS provided an additional finite element stress analysis for Unit 1 CEDM nozzles 84, 87, and 93 using the as-built J-groove weld configuration for these nozzles. The revised analysis, Westinghouse LTR-PAFM-04-35, Revision 1 "Palo Verde Unit 1 Hoop Stress Distribution for As-Built Weld Configuration," was included as an enclosure to this letter.
4. APS letter dated November 24, 2004 (102-05182) (ADAMS Accession No. ML043420167) (Unit 2) APS reported completing a review of the previous inspection data available for the Unit 2 CEDM penetration nozzles. Based upon that review, the penetrations in Unit 2, with the exception of penetration number 56, appeared to have sufficient inspection coverage below the weld in order to perform the inspection distance. Nozzle 56 is the only nozzle requiring a revised analysis. The revised analysis, Westinghouse LTR-PAFM-04-54, Revision 1, "Palo Verde Units 1, 2 & 3 Head Penetration Minimum Inspection Coverage," was incorporated into the enclosure of this letter.