APS

Palo Verde Nuclear Generating Station

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EA-03-009

102-05100-CDM/TNW/RJR
April 29, 2004

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

References:
1. 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.
2. APS letter 102-05086-CDM/SAB/RJR, "Response to Request for Additional Information – Request for Relaxation of First revised NRC Order EA-03-009, Section IV.C.(5)(b) Requirements for CEDM Nozzles," dated April 16, 2004.
3. APS letter 102-05094-CDM/SAB/RJR, "Second Request for Additional Information – Request for Relaxation of First revised NRC Order EA-03-009, Section IV.C.(5)(b) Requirements for CEDM Nozzles – Relief Request No. 25," dated April 22, 2004.
4. APS letter 102-05099-CDM/SAB/RJR, APS' Commitment for CEDM Nozzle Inspections for First Revised NRC Order EA-03-009," dated April 28, 2004.

Dear Sirs:

Subject: **Palo Verde Nuclear Generating Station (PVNGS)**
Units 1, 2 and 3
Docket No.s STN 50-528, 50-529 and 50-530
Additional Information Request for CEDM Nozzle Inspections for First Revised NRC Order EA-03-009

In Reference 1, Arizona Public Service Company (APS) requested relaxation of the requirements of Order Section IV.C.(5)(b). In References 2, 3, and 4, APS provided responses to NRC questions regarding the relaxation request for the CEDM nozzles. In a telephone call on April 29, 2004, the NRC requested additional information related to the requested relaxation.

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The following information was requested for penetrations 84, 87, and 93. Items 1, 2 and 3 are provided in the table.

1. The distances inspected below the weld on the inside diameter and outside diameter.

2. The stress levels of the inside diameter for the distance inspected.

3. Yield strength of the nozzles.

4. Additional justification for the acceptance of the distances inspected on the inside diameter of the nozzle.

Nozzle	Angle	ID Distance Covered by UT	PT Exam Coverage Downhill Side (OD)	Minimum Inspection Coverage Required Below the Weld on the Downhill Side (Note 1)	Stress at the Minimum Distance Inspected by UT (ID) (Note 2)	Stress @ OD of Nozzle at the Minimum Distance Inspected by UT (Note 2)	PT Exam Coverage Uphill side (OD)	EFPY for Crack Tip to Reach Bottom of J-groove Weld (Note 1)	Material Yield Strength of CEDM Nozzle (Note 2)
84	35.7	0.28"	1.0"	0.40"	25 ksi	45 ksi	1.2"	1.7	37-51 ksi
87	51.5	0.20"	0.8"	0.35"	19 ksi	50 ksi	1.3"	1.9	
93	35.7	0.36"	0.7"	0.40"	20 ksi	30 ksi	1.1"	1.7	

Note 1 – Provided in Table 1 of submittal dated March 19, 2004.
Note 2 – Provided in Attachment 3 to submittal dated March 19, 2004.
Note 3 - All distances in the table are below the J-groove weld.

APS Response to NRC Question 4

The following additional justification is provided as to why the distances inspected are acceptable.

1. The minimum required inspection coverage is based upon a Linear Elastic Fracture Mechanics model. An actual through-wall flaw is conservatively postulated with its upper crack tip assumed to be located at the end of the inspection zone, while its lower crack tip is assumed to be located where the hoop stress drops below 0 ksi on either the inside or the outside surface of the CEDM penetration nozzle. The length of the flaw assumed in the nozzle analysis is significantly larger than the nozzle material available for these three nozzles which results in conservative stress intensity values and larger inspection coverage than it would otherwise be required.

2. The crack growth curves do not include the time that would be required for an axial crack to propagate through the attachment weld and result in a leakage path. Additional operating time would be required for a safety concern (ejection of a nozzle or substantial corrosion of the low-alloy steel reactor pressure vessel head) to develop as a result of that leak. Multiple intervals would be available to detect a flaw that initiates in the uninspected region to potential development of a safety concern.

3. The highest stress area of the nozzles is located on the outside diameter (downhill side). This would be the most likely location for a crack to initiate and propagate. The outside diameters of penetration No.s 84, 87 and 93 were inspected for the full length (from the J-groove weld to the bottom of the nozzle) using the combination of UT and PT. No indications were found.

4. The inside diameter of the nozzle on the downhill side was inspected by UT and ET down to the chamfer. The distance between the required inspection coverage and the actual distance inspectedsd 0.04 to 0.12 nominally. However, the stresses for these nozzles (No.s 84, 87 and 93) in this area of the nozzle are significantly lower that at the outside diameter (downhill side) and range in value from 19 to 25 ksi. There is nearly universal agreement that high stresses, on the order of the material yield strength, are necessary to initiate primary water stress corrosion cracking (PWSCC). For instance, the yield strength of the PVNGS Units 1 and 2 CEDM nozzles are in the range of 37 ksi to 51 ksi while the maximum hoop stresses at the ID surface (downhill) are much lower than the yield strength. A stress level of 20 ksi is a conservative value below which PWSCC initiation is extremely unlikely. Therefore the assumption of any PWSCC crack initiation in the region of the penetration nozzle with a stress level of 20 ksi or less is very conservative.

Ultrasonic and eddy current examination of penetrations 84, 87, and 93 did cover the available distance to the top of the chamfer on the inside diameter of each nozzle leaving no additional distance for surface examination. The manual dye penetrant examination performed on the outside diameter of the nozzles went from below the J-groove weld (overlapping the volumetric examination) to the bottom of the nozzle.

The examination distance on the inside diameter for these 3 nozzles is reduced due to a shaft guide cone attached to the end of each CEDM nozzle. Beginning at the chamfer face, each CEDM nozzle has shaft guide cone threads. The guide cones are threaded into the inside diameter of the CEDM nozzle. The guide cones are staked with a screw which is plug welded. The current radiation field in the area of the guide cones is approximately 5R/hr. Any work in the area of the cones would result in a significant radiological dose. Additionally, neither the UT nor the surface examination methods specified in the Order would effectively examine the threaded surface that would be exposed as a result of guide cone removal.

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

Sincerely,

Robert J. Wuis for CDM

CDM/STNW/RJR

cc: J. E. Dyer
B. S. Mallett
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