Palo Verde Nuclear
Generating Station

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102-05031-CDM/SAB/RJR
January 14, 2004

Secretary
Office of Secretary of the Commission
U.S. Nuclear Regulatory Commission
ATTN: Rulemakings and Adjudications Staff
Washington, DC 20555-0001

Reference: Letter 102-04894-GRO/SAB/RJR, "20-Day Answer to NRC Order Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads," dated February 28, 2003.

Dear Sirs:

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Units 1, 2, and 3
Docket Nos. STN 50-528, 50-529 and 50-530
License Nos. NPF-41, NPF-51 and NPF-74
Relief Request No. 24 - Request for Relaxation of NRC Order EA-03-009, Section IV.C. (1)(b) Requirements for the Reactor Head Vent Nozzle

Starting in the spring of 2004 the reactor heads at PVNGS will begin to exceed 12 effective degradation years (EDY) and will require both the visual and volumetric examinations identified in NRC Order EA-03-009, Section IV.C.(1).

APS is requesting approval of Relief Request No. 24, which proposes an alternative examination of the RPV head vent line nozzle than those prescribed in Order Section IV.C.(1)(b)(i) and (ii). The design of the vent line nozzle in each PVNGS Unit contains a one-inch long orifice plug welded inside the vent line nozzle and adjacent to the one-fourth inch J-groove weld attaching the vent line nozzle to the reactor pressure vessel head. The position of the welded orifice makes the inside diameter of the vent line nozzle inaccessible to volumetric examinations.

The attachment to this letter contains proposed Relief Request No. 24 including the basis for concluding that the level of quality and safety prescribed in Order Section IV.C.(1) is maintained.

A101

U. S. Nuclear Regulatory Commission
Office of Secretary of the Commission
Relief Request No. 25 - Request for Relaxation of NRC Order EA-03-009, Section IV.C. (1)(b) Requirements for the Reactor Head Vent Nozzle

APS requests review of this relaxation by April 01, 2004, to support the 2004 spring refueling outage for PVNGS Unit 1. No new commitments are being made to the NRC by this letter. If you have any questions concerning this matter, please contact Thomas N. Weber at (623) 393-5764.

Sincerely,

GRO/SAB/RJR/kg

Attachment: Relief Request No.24 - Request for Relaxation of NRC Order EA-03-009, Section IV.C. (1)(b) Requirements for the Reactor Head Vent Nozzle

cc:

J. E. Dyer	(w/attachment)
B. S. Mallett	(w/attachment)
M. B. Fields	(w/attachment)
N. L. Salgado	(w/attachment)

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ATTACHMENT

Relief Request No. 24 - Request for Relaxation of NRC Order EA-03-009, Section IV.C.(1)(b) Requirements for the Reactor Head Vent Nozzle

Relief Request No. 24

The reactor pressure vessel (RPV) heads at PVNGS contain two types of nozzles. The control element drive mechanism (CEDM) nozzles which have an interference fit and the head vent nozzle which has a slip fit. The head vent nozzle also contains an orifice plug welded inside the nozzle and adjacent to the J-groove weld attaching the vent line nozzle to the RPV. This relief request contains a proposed alternative RPV head vent nozzle examination to those prescribed in Order Section IV.C.(1)(b)(i) and (ii).

APS will also be submitting a relief request with a proposed alternative CEDM nozzle examination to those prescribed in Order Section IV.C.(1)(b)(i) and (ii).

I. ASME Code Component(s) Affected

Affected Units:	1, 2, and 3
Component number:	B4.11
Description:	Reactor Head Vent nozzle penetration
Code Class:	1

II. Applicable Code Addition and Addenda

Second 10-year inservice inspection interval code for Palo Verde Nuclear Generating Station (PVNGS) Units 1, 2, and 3: The American Society of Mechanical Engineers (ASME) Code, Section XI, 1992 Edition, 1992 Addenda.

Construction code for PVNGS Units 1, 2, and 3: ASME Section III, 1971 Edition, 1973 Winter Addenda.

Installation code for PVNGS Units 1, 2, and 3: ASME Section III, 1974 Edition, 1975 Winter Addenda.

III. Applicable Order Requirement

IV.C.(1)

Order Section IV.C.(1) states that for plants in the High susceptibility category, reactor pressure vessel (RPV) head and head penetration inspections shall be performed using the following techniques every refueling outage.

(a) Bare metal visual examination of 100% of the RPV head surface (including 360° around each RPV head penetration nozzle), AND

(b) Either:

(i) Ultrasonic testing of each RPV head penetration nozzle (i.e., nozzle base material) from two (2) inches above the J-groove weld to the bottom of the nozzle and an assessment to determine if leakage has occurred into the interference fit zone, OR

(ii) Eddy current testing or dye penetrant testing of the wetted surface of each J-groove weld and RPV head penetration nozzle base material to at least two (2) inches above the J-groove weld.

APS will perform a bare-metal visual examination of 100% of the reactor pressure vessel (RPV) head surface which will include 360° around each RPV head penetration nozzle for the 97 CEDM nozzles and 1 vent line nozzle in accordance with the requirements of Order Section IV.C.(1)(a).

IV. Proposed Alternative to IV.C.(1)(b)

A surface examination of the reactor head vent nozzle J-groove weld including the surface of the nozzle orifice attachment weld.

V. Basis of Alternative for Providing Acceptable Level of Quality and Safety

NRC Order EA-03-009 was issued to address the immediate concerns raised by the increasing discovery of circumferential cracking of RPV head nozzles and corrosion of the RPV head. Degradation of the RPV head and its associated nozzles poses a safety concern because of the possibility of a nozzle ejection or rupture. The two following sections address the PVNGS Design Basis Accidents (DBAs) that are potentially impacted by a postulated nozzle ejection or rupture: a Control Element Assembly (CEA) ejection event and a small break Loss-of-Coolant Accident (LOCA).

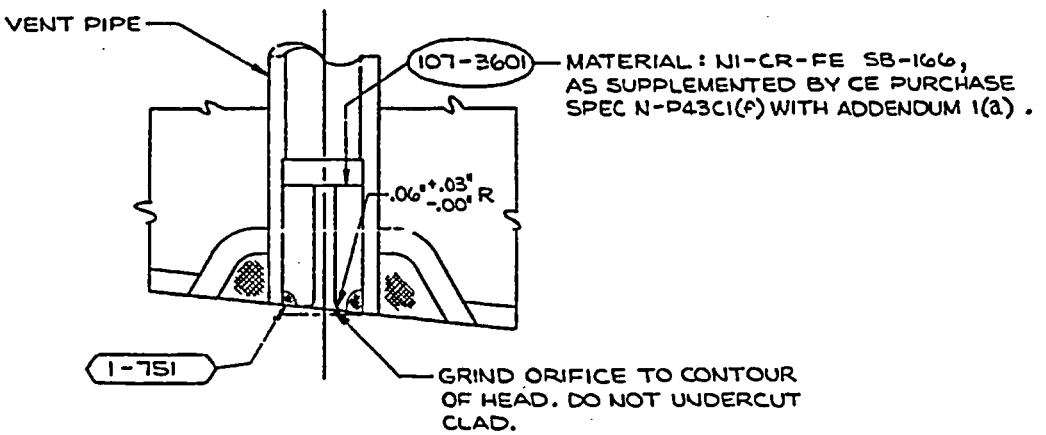
Control Element Assembly (CEA) Ejection

Section 15.4.8 of the PVNGS Updated Final Safety Analysis Report (UFSAR) states that a CEA ejection event may result from a circumferential rupture of a CEDM housing or of a CEDM nozzle. Because the RPV head vent nozzles are not associated with any CEDMs, the postulated ejection of a head vent nozzle would not result in a CEA ejection. Therefore, implementation of the proposed alternative examination would not affect the design basis CEA ejection event.

Relief Request 24

Small Break LOCA

The head vent provides a penetration through the RPV head, from which gasses are vented during plant start-up. The head vent line is 3/4-inch Schedule 80 pipe. The vent line nozzle is fabricated from Inconel 600 (SB-166) material. The nozzle is attached to the carbon steel RPV head with a partial penetration J-groove weld. Inconel 600 weld material is used for the J-groove weld material. The vent line nozzle for each PVNGS Unit contains a one-inch long orifice plug equipped with a 7/32-inch orifice. The orifice is welded inside the nozzle, in contour with the inner surface of the RPV head and adjacent to the 1/4-inch J-groove weld attaching the vent line nozzle to the RPV head (see figure below).



A small break LOCA may be postulated to occur as a result of a RPV head vent nozzle ejection, or due to degradation and rupture of the vent line downstream of the orifice plug.

For ruptures that may occur downstream of the vent line orifice plug, General Design Criterion (GDC) 33 requires that a reactor coolant makeup system be provided to protect against such small breaks in the Reactor Coolant Pressure Boundary (RCPB). Additionally, GDC 33 states that the makeup system safety function shall be to assure that Specified Acceptable Fuel Design Limits (SAFDLs) are not exceeded as a result of reactor coolant loss due to leakage from the RCPB, or due to rupture of small piping or other small components that are part of the RCPB. Section

9.3.4.4.11 of the PVNGS UFSAR states that small lines at PVNGS, such as those used for instrumentation and sample collection, are connected to the RCPB via 7/32-inch diameter by one-inch long flow restricting devices (orifice plugs). This UFSAR section further states that these orifice plugs limit the potential break flow to a value that is less than the nominal capacity of the minimum number of operable charging pumps in the Chemical and Volume Control System (CVCS), which provides reactor coolant makeup during normal plant operation. This PVNGS UFSAR analysis demonstrates that, in the event of a RPV head vent line rupture downstream of the orifice plug, the resulting small break LOCA can be successfully mitigated by the normal reactor coolant makeup system, with the Reactor Coolant System (RCS) stabilized above the pressurizer pressure Safety Injection Actuation Signal (SIAS) setpoint, i.e., without challenging the Emergency Core Cooling System (ECCS).

If a RPV head vent nozzle were ejected, however, the break flow from the resulting small break LOCA would exceed the capacity of the normal reactor coolant makeup water system, and pressurizer pressure would eventually decrease to the SIAS setpoint. Upon receipt of a SIAS, the High Pressure Safety Injection (HPSI) and Low Pressure Safety Injection (LPSI) ECCS subsystems would actuate and provide borated water flow to the RCS, in accordance with GDC 35. The size of the anticipated break is estimated to be approximately 0.006 square feet, which corresponds to the cross-sectional area at the outside diameter of the ¾" Schedule 80 vent pipe that is attached to the RPV head. Although this break area is more than 20 times larger than the flow area through the vent line's 7/32 inch orifice plug, it is still almost an order of magnitude smaller than the limiting small break LOCA, as shown in the ECCS performance analyses summarized in Section 6.3.3 and Table 6.3.3.3-5 of the PVNGS UFSAR. Furthermore, although the UFSAR Section 6.3.3 ECCS performance analyses consider breaks only in Reactor Coolant Pump (RCP) discharge legs and near the top of the pressurizer, they are bounding for a postulated ejection of a RPV head vent nozzle. That is, not only is the anticipated break size resulting from a RPV head vent nozzle ejection enveloped by the spectrum of small break LOCAs analyzed in the UFSAR, but the location of the break (i.e., downstream of the core outlet) would ensure a more benign plant response than a RCP discharge leg break (i.e., upstream of the core inlet). Indeed, for breaks less than 0.01 square feet in area, UFSAR Section 6.3.3.3.5 states that such breaks are too small to experience any core uncovery.

The proposed alternative of a surface examination of the reactor head vent nozzle J-groove weld including the surface of the nozzle orifice attachment

weld, in conjunction with a bare-metal visual examination of the RPV head vent nozzle annulus (360° around the nozzle), will allow detection of leakage from the nozzle base metal or incipient cracking in the J-groove weld area and would demonstrate the structural integrity of the head vent nozzle.

This proposed alternative examination will also allow timely repairs to prevent a small break LOCA associated with a rupture of the vent line nozzle. Therefore, implementation of the proposed alternative examination would not result in an increase in the frequency of occurrence or the consequences of a design basis small break LOCA.

VI. Assessment of Order Inspection Options

The installation of the vent line orifice makes internal volumetric or surface examination of the nozzle impractical and unusually difficult without a compensating increase in the level of quality and safety. APS estimates that removal of the vent line orifice would result in the following impacts:

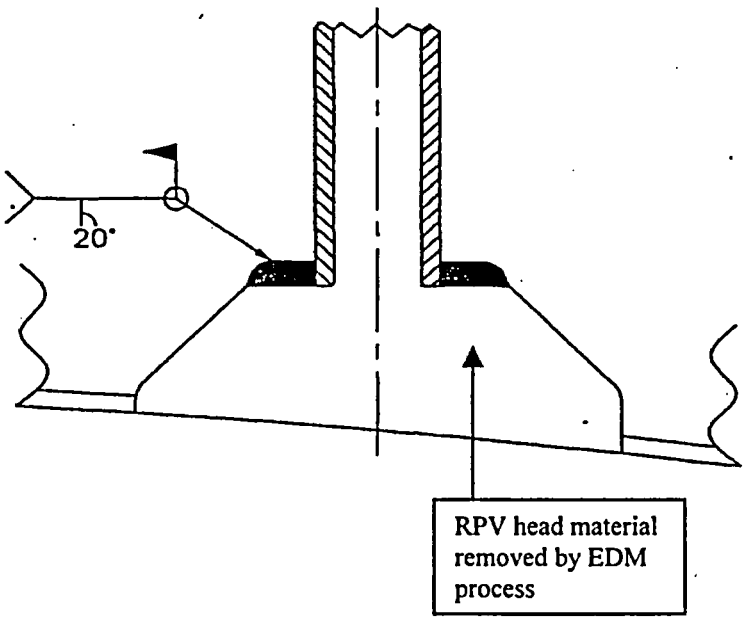
- Modification and machining of the area adjacent to the vent line J-groove weld, thereby removing over one-inch of nozzle base material as well as reducing local wall thickness for the reactor vessel head;
- An effort requiring 47 man-hours for orifice removal and NDE with an estimated minimum 3 Rem total job dose;
- The inside diameter area of interest would be removed as a result of electro-discharge machining (EDM);
- The process would have to be repeated in subsequent outages, thereby forcing a modification to weld build-up the reactor vessel head material.

Inspection Options IV.C.(1)(b)(i) and IV.C.(1)(b)(ii)

Order inspection options IV.C.(1)(b)(i) and IV.C.(1)(b)(ii) require UT, ET or PT of the wetted surface of each J-groove weld and RPV head penetration nozzle base material at least two inches above the J-groove weld.

The welded orifice, which is adjacent to the vent line tube inside diameter surface, makes it inaccessible to inside diameter volumetric examination. To make the vent line accessible for inside diameter volumetric examination the line would require machining to remove the orifice. However, EDM tooling available to machine the orifice would also require a concurrent machining of RPV head material as well (see figure below). This removal process would not only remove the orifice, but would also remove the

adjacent base metal, and vent line tube material, thereby making any follow-up volumetric examinations useless as the inside diameter tube area of interest would have been removed.



Currently, if machining operations were performed, the orifice would be required to be re-installed to be consistent with the small break LOCA analysis. This would require a repeat of the machining process, and additional reduction in reactor vessel base metal thickness during subsequent examinations.

As stated in References 1 and 2, the head vent pipe has been analyzed using a three-dimensional finite element model. The critical stress locations in the head vent are in the vicinity of the attachment weld, where residual and pressure stresses have the most impact. Similar to CEDM nozzles, the residual stresses dominate the stress field, however, the stresses quickly decrease as a function of distance up the pipe away from the weld. Therefore, the vent pipe material above the orifice is in a low stress field and cracking is not expected to initiate in this area and flaw propagation above the weld is expected to be limited. Should PWSCC occur in the high stress region, crack growth predictions for the head vent pipe show a period of greater than 2 years, from the time of initiation, before through-wall

cracking occurs. The fast growth is largely due to the thin wall.

The vent line is not an interference fit. Instead the vent line has a clearance fit with 0.004-0.006 inches radial clearance around the pipe. APS expects that, in the event of a through-wall crack, the vent line annulus will show leakage before any carbon steel degradation would occur. By performing a bare metal visual examination of 100% of the RPV surface (including 360° around the vent line nozzle annulus) and a qualified surface examination of the vent line nozzle J-groove weld and the nozzle orifice attachment weld, APS will be able to perform an assessment to determine if leakage has occurred and verify the integrity of the J-groove weld. This combined examination provides assurance that the reactor coolant pressure boundary integrity will be maintained.

APS has performed a detailed 360° visual examination of each PVNGS Units RPV head vent line. No evidence of leakage has been identified.

VII. Duration of Proposed Alternative

APS requests relaxation of Order Section IV.C.(1)(b) examination requirements for the head vent line nozzle be granted for each unit to cover operation beyond 12 EDY and that the relaxation remain in effect until such time as the Order is revised, rescinded, or APS replaces an inservice RPV head.

VIII. Conclusion

Section IV.F. of the Order states that conditions may be relaxed or rescinded upon demonstration by the Licensee of good cause. A request for relaxation regarding inspection of specific nozzles shall also address the following criteria:

1. The proposed alternative(s) for inspection of specific nozzles will provide an acceptable level of quality and safety, or

2. Compliance with this Order for specific nozzles would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

APS believes that the proposed alternative(s) for inspection of specific nozzles will provide an acceptable level of quality and safety and meet the underlying objective of this Order; demonstration of pressure boundary integrity. Therefore, we request that the proposed alternative be authorized pursuant to Order Section IV.F.1.

VIII. References

1. Westinghouse WCAP-15817, Revision 1, October 2003, Structural Integrity Evaluation of Reactor vessel Upper Head Penetrations to Support Continued Operation: Palo Verde Units 1 and 2

2. Westinghouse WCAP-16044-P, Revision 0, February 2003, Structural Integrity Evaluation of Reactor vessel Upper Head Penetrations to Support Continued Operation: Palo Verde Unit 3.