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10 CFR 50.90
10 CFR 50.91

102-04988-CDM/SAB/RJR
August 19, 2003

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

References: 1. APS letter 102-04668-CDM/TNW/RJR, "Proposed Alternative Repair Methods for Reactor Vessel Head Penetrations – Relief Requests No. 20 and No. 21," C. D. Mauldin, APS to USNRC, dated March 15, 2002.

2. NRC letter "Acceptance for Referencing – Topical Report WCAP-15987-P, Revision 2, 'Technical Basis for the Embedded Flaw Process for Repair of Reactor Vessel Head Penetrations'," dated July 3, 2003.

Dear Sirs:

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Units 1, 2, and 3
Docket Nos. STN 50-528/529/530
Response to Request for Additional Information on Relief Requests RR-20 and RR-21

In Reference 1 above, Arizona Public Service Company (APS) requested authorization to use an alternative repair method pursuant to 10 CFR 50.55a(a)(3)(i). Relief Requests 20 and 21 proposed an alternative to use an embedded flaw repair technique if cracks were found on the inside and/or outside diameter of the PVNGS control rod drive mechanism nozzles or on the J-groove attachment welds. During the review, the NRC Staff requested additional information related to the proposed alternative repair methods.

Enclosed, APS has provided the requested additional information. In July of this year, the NRC approved Westinghouse Topical Report WCAP-15987-P, Revision 2, as a reference for embedded flaw repairs (Reference 2). APS is using this Westinghouse topical report and will follow the Conditions and Limitations identified in Section 5.0 of Reference 2. APS requests the Staff's review to support the PVNGS Unit 2, 2003 fall steam generator replacement/refueling outage.

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No 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, Carl Churchman for David Mauldin

CDM/SAB/RJR/kg

Enclosure:

cc: Regional Administrator, NRC Region IV
J. N. Donohew
N. L. Salgado

ENCLOSURE

Response to Request for Additional Information on Relief Requests RR-20 and RR-21

Response to Request for Additional Information on
Relief Requests RR-20 and RR-21

NRC Question No. 1:

For Unit 2, the second 10-year inservice interval Code of record is the 1992 Edition with 1992 Addenda of Section XI of the ASME Code. The 1992 Edition with 1992 Addenda, IWA-4170(b) requires that repairs and replacements items be performed in accordance with the Construction Code or Section III. Identify your Construction Code, and identity later edition/addenda of Section III that are applicable to the repair/replacement Code applicable for Units 1 and 3.

APS Response:

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

The construction Code for PVNGS Units 1, 2, and 3 is ASME Section III, 1971 Edition, 1973 Winter Addenda.

The installation Code for PVNGS Unit s 1, 2, and 3 is ASME Section III, 1974 Edition, 1975 Winter Addenda.

NRC Question No. 2:

The proposal is to use Westinghouse's topical report LTR-SMT-01-74, "Ultrasonic Testing of CRDM Penetration Tubes for the Detection of Outer Surface Circumferential Cracking: Technical Justification and Qualification Information." The topical report is based on the 1989 Edition of Section XI. Identify the changes in the 1992 Edition/1992 Addenda that occurred after the 1989 Edition and are applicable to the proposed repair/replacement. Provide a technical discussion reconciling the topical report to the later edition/addenda of the Code.

APS Response:

This comparison was made between the Code sections identified in APS' original request, and the Code sections identified in the approved Westinghouse topical report. APS Codes for Section XI are the 1992 Edition, 1992 Addenda, and 1974 Edition, 1975 Winter Addenda for Section III. The Westinghouse Codes Section XI and Section III are the 1989 Edition.

IWA-4120

1989 Section XI, IWA-4120, "Rules and Requirements," states in part that repairs shall be performed in accordance with the Owner's Design Specification and the original Construction Code of the component or system. It also allows later editions and addenda of the construction code or of Section III, either in their entirety or portions thereof, and Code cases may be used. If repair welding cannot be performed in accordance with those requirements, the applicable alternative requirements of IWA-4500 and the following may be used (IWB-4000 for Class 1 components; IWC-4000 for Class 2 components; IWD-4000 for Class 3 components; IWE-4000 for Class MC components; or IWF-4000 for component supports).

1992 Section XI, IWA-4170, "Code Applicability," [equivalent Section to above] states in part that repairs and installation of replacement items shall be performed in accordance with the owner's Design Specification and the original Construction Code of the component or system. This version of the Code also allows later editions and addenda of the construction Code or of Section III to be used, either in their entirety or portions thereof, and Code Cases may be used. Again, if repair welding cannot be performed in accordance with these requirements, the applicable requirements of IWA-4200, IWA-4400, or IWA-4500 may be used.

Analysis of 1989 to 1992: No significant difference in the Code requirements.

NB-4453.1

1989 Section III, NB-4453.1, "Defect Removal, " states that defects may be removed by mechanical means or by thermal gouging processes. The area prepared for repair shall be examined by a liquid penetrant or magnetic particle method in accordance with NB-5110, and meet the acceptance standards of NB-5340 or NB-5350. This examination is not required where defect elimination removes the full thickness of the weld and where the backside of the weld joint is not accessible for removal of examination materials.

1974 with 1975 Winter Addenda Section III, NB-4453.1, "Defect Removal," states that unacceptable defects shall be removed by mechanical means or by thermal gouging processes. The area prepared for repair shall be examined and comply with the requirements of NB-5340 or NB-5350. Partial penetration welds, such as tube to tube sheet welds and those described in NB-3352.4 (d), where defect removal essentially removes the full thickness of the weld, need only be examined visually to the satisfaction of the Inspector to determine suitability of rewelding.

Analysis of 1989 to 1974 W75:

These two versions of the Code are essentially the same. The 1989 version is somewhat less restrictive in the requirement to remove defects. However, the

proposed method of repair is to embed the defect with a weld overlay which will prevent further growth of the defect. The defect will be isolated from the reactor coolant.

NB-4453.2

1989 Section III, NB-4453.2, "Requirements for Welding Material, Procedures, and Welders," states in part that the weld repair shall be made using welding material, welders, and welding procedures qualified in accordance with NB-4125 and NB-4300.

1974 with 1975 Winter Addenda Section III, NB-4453.2, "Requirements for Welding Material, Procedures, and Welders," states in part that the weld repair shall be made using welding material, welders, and welding procedures qualified in accordance with NB-4125 and NB-4300.

Analysis of 1989 to 1974 W75:

The wording is the same and there is no difference. The proposed repair process satisfies these requirements.

NB-4453.3

1989 Section III, NB-4453.3, "Blending of Repaired Areas," states that after repair, the surface shall be blended uniformly into the surrounding surface.

1974 with 1975 Winter Addenda Section III, NB-4453.3, "Blending of Repaired Areas," states that after repair, the surface shall be blended uniformly into the surrounding surface.

Analysis of 1989 to 1974 W75:

The wording is the same and there is no difference. The proposed repair process satisfies these requirements.

NB-4453.4

1989 Section III, NB-4453.4, "Examination of Repair Welds," requires that the examination of a weld repair shall be repeated as required for the original weld, except that when the defect was originally detected by the liquid penetrant or magnetic particle method, and when the repair cavity does not exceed the lesser of 3/8 in. or 10% of the thickness, it need only be reexamined by the liquid penetrant or magnetic particle method.

1974 with 1975 Winter Addenda Section III, NB-4453.4, "Examination of Repair Welds," requires the examination of weld repairs shall be repeated as required for the original weld except that repair of defects originally detected by magnetic particle or liquid penetrant methods, when the repair cavities do not exceed the lesser of 3/8 in. or 10% of the thickness, need only be reexamined by a magnetic particle or liquid penetrant method.

Analysis of 1989 to 1974 W75:

Section III, NB-4453.4 of the 1989 Code is the same as the 1974 W75 version. Both stipulate that the repairs be examined in accordance with the original weld requirements. However, APS will be using the table provided in Section 5.0 of NRC letter, "Acceptance for Referencing – Topical Report WCAP-15987-P, Revision 2, 'Technical Basis for the Embedded Flaw Process for Repair of Reactor Vessel Head Penetrations'," dated July 3, 2003, for determining the required repair examinations.

NB-4453.5

1989 Section III, NB-4453.5, "Heat Treatment of Repaired Areas," requires that repairs be heat treated in accordance with NB-4620.

1974 with 1975 Winter Addenda Section III, NB-4453.5, "Heat Treatment of Repaired Areas," requires that repairs be heat treated in accordance with NB-4620.

Analysis of 1989 to 1974 W75: There is no difference. The requirements of this section are satisfied by the proposed alternative method.

IWB-3600

1989 Section XI, Article IWB-3600, Analytical Evaluation of Flaws
1992 Section XI, Article IWB-3600, Analytical Evaluation of Flaws

The flaw evaluation rules given for "vessels" in IWB-3600 were compared and found to be identical between 1989 Edition and 1992 Edition/1992 Addenda. However, this article is not applicable to the proposed method of repair because it contains no acceptance criteria for the configuration and material type in question except that the limit load methodology and safety factors from this article have been used in the analysis.

APS will be using Reference 5 of the Westinghouse topical report Safety Evaluation: R. J. Barrett (NRC) letter to A. Marion (NEI), "Flaw Evaluation Guidelines," April 11, 2003. Repair examinations will be in accordance with Section 5.0 of NRC letter "Acceptance for Referencing – Topical Report WCAP-15987-P, Revision 2, 'Technical Basis for the Embedded Flaw Process for Repair of Reactor Vessel Head Penetrations'," dated July 3, 2003.

NRC Question No. 3:

The proposed alternative requested relief for IWA-4310 which requires the removal or reduction in size, and states that any remaining portion of the flaw may be evaluated and the component accepted in accordance with the appropriate flaw evaluation rules of Section XI or the design rules of either the Construction Code, or Section III, when the Construction Code was not Section III. The ASME Section IWA-3300 rules require characterization of flaws detected by ISI. Provide a discussion on the characterization of flaws detected by ISI and repair examinations.

APS Response:

APS will be using Reference 5 of the Westinghouse topical report Safety Evaluation: R. J. Barrett (NRC) letter to A. Marion (NEI), "Flaw Evaluation Guidelines," April 11, 2003. Repair examinations will be in accordance with Section 5.0 of NRC letter "Acceptance for Referencing – Topical Report WCAP-15987-P, Revision 2, 'Technical Basis for the Embedded Flaw Process for Repair of Reactor Vessel Head Penetrations'," dated July 3, 2003.

NRC Question No. 4:

The proposal is to use the embedded flaw repair technique to repair cracks on the inside diameter of the CEDM as presented in Westinghouse Electric Company, LLC. (The licensee's submittal dated March 15, 2002, referenced Westinghouse letter LTR-NRC-01-41, dated December 13, 2001). LTR-NRC-01-41 references Westinghouse's topical report LTR-SMT-01-74 repair on the outside diameter of the CEDM and J-groove weld. However, LTR-NRC-01-41 does not provide the technical justification and qualification information for repairs performed from the inside diameter of the CEDM. Provide the technical justification and qualification information for the acceptability of the embedded flaw repair technique that is proposed for the repairs on the inside diameter of the CEDM. If a topical report is referenced, reconcile any differences between the edition/addenda of the Code in the topical report with the edition/addenda of the Code (1992 Edition with 1992 Addenda for Unit 2) associated with the repair.

APS Response:

APS will be using the Westinghouse TR WCAP-15987-P Rev. 2, which is based on the 1989 Code. See the response to question 2 for the differences in the ASME Code years.

NRC Question No. 5:

The proposed repair provides an initiative discussion for repair longevity, but does not address reexamination of the repair after returning to service. Discuss the process Palo Verde will use to verify that embedded flaws are dormant as a result of the repairs.

APS Response:

As identified in LTR-NRC-01-41, the repair is made with Alloy 52 weld material. After the weld repair is completed, its integrity is verified by liquid penetrant inspection. The only known mechanisms for cracking of the weld used to embed a flaw, or the surrounding region, is fatigue. The calculated fatigue usage in this region is very low because the reactor vessel head region is isolated from the transients which affect the hot leg or cold leg piping. The thickness of the weld has been set to provide a permanent embedment of the flaw, without adding sufficient weld to increase the residual stresses. This ensures that the embedded flaw repair will not affect areas nearby to the repair.

However, APS will be implementing the conditions identified in Section 5 of the NRC Safety Evaluation of the Westinghouse topical report and as per the APS position on NRC order EA-03-009.

NRC Question No. 6:

The proposal is an alternative to removing flaws identified in the J-groove weld and/or CEDM tubes. Provide a discussion of the difficulties associated with a Code-required repair versus the proposed alternative. If radiation exposure is a consideration, estimate the differences between repairs performed by the Code and the proposed alternative.

APS Response:

The removal of the flaw and rewelding of the cavity will involve substantially more radiation exposure depending on the size and location of the flaw and whether temper bead welding rules have to be followed. The increase in exposure is estimated to be between 15 rem and 40 rem depending on radiation conditions and the complexity of the repair.

NRC Question No. 7:

On November 21, 2001, the staff issued flaw evaluation guidelines for CEDM cracking issues. The guidelines provided a framework for the industry. Discuss the application of these guidelines or other guidelines developed by consensus building organizations

that will be used by Palo Verde for the inspection and repair of the J-groove welds and CEDM tubes.

APS Response:

APS will be using Reference 5 of the Westinghouse topical report Safety Evaluation: R. J. Barrett (NRC) letter to A. Marion (NEI), "Flaw Evaluation Guidelines," April 11, 2003.

Summary:

APS will be using the Westinghouse topical report and will follow the Conditions and Limitations identified in Section 5.0 of the NRC letter "Acceptance for Referencing – Topical Report WCAP-15987-P, Revision 2, 'Technical Basis for the Embedded Flaw Process for Repair of Reactor Vessel Head Penetrations'," dated July 3, 2003. APS requests the Staff's review to support the PVNGS Unit 2, 2003 fall steam generator replacement/refueling outage.