10 CFR 50.55a

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102-06879-JJC/JHK/DCE
May 16, 2014

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References:

1. Arizona Public Service Company (APS) letter number 102-06794, *Palo Verde Nuclear Generating Station Unit 3, Docket No. STN 50-530*, American Society of Mechanical *Engineers (ASME) Code, Section XI, Request for Approval of an Alternative to Flaw Removal and Characterization - Relief Request 51*, dated November 8, 2013
2. NRC letter dated April 10, 2014, *Palo Verde Nuclear Generating Station, Unit 3 - Request for Relief from ASME Code, Section XI Requirements Regarding Half-Nozzle Repair and Flaw Evaluation as an Alternative to Flaw Removal and Flaw Characterization For Flaw in Bottom Mounted Instrument Nozzle Penetration No. 3*
3. APS letter number 102-06880, Palo *Verde Nuclear Generating Station Unit 3, Docket No. STN 50-530, Transmittal of Proprietary Documents for Relief Request 52,* dated May 16, 2014

Dear Sirs:

Subject: **Palo Verde Nuclear Generating Station (PVNGS) Unit 3**
Docket No. 50-530
American Society of Mechanical Engineers (ASME) Code, Section XI, Request for Approval of an Alternative to Flaw Removal, Flaw Characterization and Successive Examinations - Relief Request 52

Pursuant to 10 CFR 50.55a(a)(3)(i), Arizona Public Service Company (APS) requests NRC approval of Relief Request 52, which proposes an alternative to the ASME Code requirements of Section XI related to axial flaw indications identified in a Unit 3 reactor vessel bottom mounted instrument (BMI) nozzle. Specifically, APS is proposing a half-nozzle repair and a flaw evaluation as an alternative to the ASME Section XI requirements for flaw removal of IWA-4421, flaw characterization of IWA-3300, and successive examinations of IWB-2420.

APS submitted Relief Request 51 (Reference 1) for use of the proposed alternative to flaw removal of IWA-4421 and flaw characterization of IWA-3300 through the current 18th operating fuel cycle. Relief Request 51 was approved by the NRC staff on April 10, 2014 (Reference 2).

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The duration for Relief Request 52 is for the remainder of the Unit 3 licensed operating life which expires November 25, 2047. The duration is based on the attached analyses which demonstrate acceptability of the proposed alternative through the remainder of the Unit 3 licensed operating life.

A pre-submittal public meeting for Relief Request 52 was held between APS and the NRC staff on April 2, 2014 (ADAMS Accession number ML14099A469).

The enclosure includes redacted versions of supporting proprietary documents, specifically, Attachments 1 through 6 of the enclosure. The proprietary documents are provided separately by Reference 3.

No commitments are being made to the NRC by this letter.

APS requests approval of this relief request prior to commencement of the next Unit 3 refueling outage, currently scheduled to begin April 4, 2015.

Should you need further information regarding this relief request, please contact David H. Kelsey, Licensing Section Leader at (623) 393-5241.

Sincerely,

JJC/DHK/DCE/hsc

Enclosure: Relief Request 52 Proposed Alternative in Accordance with 10 CFR 50.55a(a)(3)(i)

cc:	M. L. Dapas	NRC Region IV Regional Administrator
	A. E. George	NRC NRR Project Manager for PVNGS
	J. K. Rankin	NRC NRR Project Manager for PVNGS
	M. A. Brown	NRC Senior Resident Inspector for PVNGS

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Enclosure
Relief Request 52 Proposed Alternative in Accordance with 10 CFR 50.55a(a)(3)(i)

Background Information

On October 6, 2013, Arizona Public Service Company (APS) identified evidence of leakage in the annulus of the Palo Verde Nuclear Generating Station (PVNGS) Unit 3 reactor vessel (RV) bottom mounted instrument (BMI) nozzle penetration 3. The leakage was identified during planned visual examinations of Unit 3 BMI nozzle penetrations conducted at the beginning of the Unit 3 Refueling Outage (3R17). The examinations were required, pursuant to American Society of Mechanical Engineers (ASME) Code Case N-722-1, *Additional Examinations for PWR Pressure Retaining Welds in Class 1 Components Fabricated with Alloy 600/82/182 Materials,* in accordance with 10 CFR 50.55a, *Codes and Standards.*

Ultrasonic (UT) and eddy current (ECT) examinations inside the bore of BMI nozzle 3 were performed. The ultrasonic examinations identified and characterized a group of axially-oriented flaws associated with the nozzle that appear to have originated in a void of the J-groove weld on the outside diameter (OD) of the BMI nozzle. The longest flaw was approximately 1.88 inches long and the deepest flaw penetrated approximately 0.378 inches into the 1.125 inch nozzle wall. The UT examination inside the bore could not reliably detect or characterize flaws beyond the OD of the nozzle to any measurable depth into the J-groove weld. No flaws were identified on the nozzle inside diameter (ID) as a result of the ECT examination. No circumferential flaws were identified.

Ultrasonic and eddy current examinations of the 60 remaining BMI nozzles in Unit 3 determined that there were no unacceptable indications.

A boat sample of the affected region of the BMI nozzle and J-groove weld was obtained for metallurgical analysis using electrostatic discharge machining in accordance with Section XI, Article IWA-4461. The volume of the boat sample was approximately 0.4 cubic inches and included a portion of the identified weld void. The flaw, which promoted the primary water stress corrosion cracking (PWSCC) observed in the boat sample, appeared to have originated in the weld void that had been wetted at some point during plant service. Electron dispersion spectroscopy performed on the boat sample did not identify any aggravating species, such as chlorides or flourides, within the void or deposits collected from the void.

Cracking grew downward from the base of the void in a predominantly axial direction. The cracking, once within the nozzle material, tended to progress radially across the nozzle wall in addition to its axial growth in response to the residual hoop stresses caused by welding and the applied operating stresses. Leakage occurred once the axial cracking extended below the J-groove weld root.

A helium leak test, from below the RV, pressurized the annulus bore between the RV and the nozzle OD and produced bubbles from a single point near the toe of the J-groove weld. The point where the bubbles appeared allowed a communication pathway between the primary coolant environment and the sub-surface weld void. Despite

targeted efforts in planning and executing the boat sample cut location, the specific point of connection between the weld void and the wetted surface of the boat sample was not identified during metallurgical analysis.

To restore the RV pressure boundary, a half-nozzle repair of BMI nozzle 3 replaced the lower portion of the nozzle. The repair moved the BMI nozzle penetration pressure boundary from the J-groove weld inside the RV to a J-groove weld outside the RV. This new J-groove weld joins a new Alloy 690 part-length half-nozzle to an Alloy 52M ambient temperature temper bead weld pad deposited on the outer surface of the reactor vessel bottom shell. The temper bead weld pad is addressed in ASME Code Case N-638-4, which is conditionally accepted in Regulatory Guide 1.147, *Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1*, Revision 16. The temper bead weld pad conforms to the conditions required by Regulatory Guide 1.147 for application of Code Case N-638-4, and therefore, the repair restored the RV pressure boundary in accordance with regulatory requirements.

APS submitted Relief Request 51 for use through the current 18th operating fuel cycle, which was formally approved by NRC staff on April 10, 2014 (Reference 5). Relief Request 51 did not address the successive examination requirements of Section XI IWB-2420 since the approval would expire prior to the successive examinations being required.

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1. ASME Code Components Affected

Components:	Reactor Vessel (RV) Bottom Mounted Instrumentation (BMI) Nozzle Penetration
Code Class:	Class 1
Examination Category:	B-P (Class 1 PWR Components Containing Alloy 600/82/182)
Code Item Number:	B15.80
Description:	RV BMI Nozzle Penetration Number 3
Size:	3 inch Nominal Nozzle OD at the BMI Nozzle-to-RV J-groove Weld
Material:	SB-166 Alloy 600 Nozzle and ERNiCr-3/ENiCrFe-3 Alloy 82/182 Buttering and Weld

There are 61 BMI nozzles welded to the inside surface of the RV with partial penetration J-groove welds.

2. Applicable Code Edition and Addenda

Palo Verde Nuclear Generating Station, Unit No. 3, Inservice Inspection Program (ISI) – Third Interval, ending January 10, 2018: American Society of Mechanical Engineers Boiler and Pressure Vessel Code Section XI, 2001 Edition including Addenda through 2003 (Reference 1) as supplemented by 10 CFR 50.55a(g)(6)(ii)(E), *Reactor Coolant Pressure Boundary Visual Inspections.*

3. Applicable Code Requirements

Section XI, Article IWA-4000 provides requirements for repair/replacement activities

IWA-4421 states, in part:

> Defects shall be removed or mitigated in accordance with the following requirements...

IWA-4422.1(a) states, in part:

> A defect is considered removed when it has been reduced to an acceptable size ...

IWA-4422.1(b) states, in part:

> Alternatively, the defect removal area and any remaining portion of the defect may be evaluated and the component accepted in accordance with the appropriate flaw evaluation provisions of Section XI ...

Section XI, Article IWA-3000 provides standards for examination evaluation.

IWA-3100(a) states, in part:

> Evaluation shall be made of flaws detected during an inservice examination as required by IWB-3000 for Class 1 pressure retaining components....

IWA-3300(b) states, in part:

> Flaws shall be characterized in accordance with IWA-3310 through IWA-3390, as applicable.

Section XI, Article IWB-3000 provides acceptance standards for Class 1 components.

IWB-3420 states:

> Each detected flaw or group of flaws shall be characterized by the rules of IWA-3300 to establish the dimensions of the flaws. These dimensions shall be used in conjunction with the acceptance standards of IWB-3500.

Section XI, Article IWB-2000 provides examination and inspection requirements for Class 1 components.

IWB-2420(b) states, in part:

> If a component is accepted for continued service in accordance with IWB-3132.3 or IWB-3142.4, the areas containing flaws or relevant conditions shall be reexamined during the next three inspection periods listed in the schedule of the inspection program of IWB-2400...

4. Reason for Request

Arizona Public Service Company (APS) conducted visual examinations of the RV BMI nozzle penetrations at the beginning of the PVNGS Unit 3 Refueling Outage (3R17). These examinations revealed evidence of leakage in the annulus at BMI nozzle penetration 3. Ultrasonic and eddy current examinations were conducted

in the nozzle bore using a UT/ECT probe combination. The UT examination identified a group of axially oriented cracks at the OD of the nozzle. No circumferential cracks were identified. Metallurgical analyses were performed to evaluate the cause of the cracking, which was determined to be the result of PWSCC. To evaluate the extent of the condition, UT and ECT examinations were conducted in the nozzle bore of each of the remaining 60 BMI nozzle penetrations. The examinations determined there were no unacceptable indications in the other 60 nozzles.

Due to radiological considerations, in-vessel repair of the original BMI nozzle and J-groove weld was not practical. Accordingly, a half-nozzle design repair was implemented such that the original BMI nozzle and J-groove weld no longer perform a pressure boundary function. APS is requesting to leave the upper portion of the original BMI nozzle and the J-groove weld containing the axial flaws in place (remnant nozzle and remnant weld). A fracture mechanics evaluation was performed to demonstrate the acceptability of the flaws and to quantify the potential for crack propagation into the RV low alloy steel for the remainder of the Unit 3 licensed operating life. The structural effect of the removal of the boat sample was considered in the evaluation. The ASME Code Section XI fracture mechanics evaluation is included in this enclosure as Attachment 1, *ASME Section XI End of Life Analysis of PVNGS UNIT 3 RV BMI Nozzle Repair.*

Flaw initiation and/or growth (axially and radially) in the remaining Alloy 600 nozzle material is not a concern from an ASME Code perspective as the remnant nozzle no longer performs a pressure boundary function and is physically separated from the new Alloy 690 half-nozzle. The remnant nozzle and weld will continue to have a structural function in support of the operability of the in-core instrumentation (ICI) cable. The remnant nozzle functions as a guide and external protection sheath for the ICI cable during its core insertion and during subsequent power operations. APS evaluated these functions for PVNGS Unit 3 and determined that the nozzle remnant will continue to maintain its structural integrity for the remainder of the Unit 3 licensed operating life (Attachment 6, *Natural Frequency and Structural Integrity Analysis for PVNGS Unit 3 RV BMI Nozzle Repair).*

While the axial flaws in the BMI nozzle were characterized, UT examination of the remnant J-groove weld from inside the nozzle is not feasible because of its configuration. If the UT examination of the remnant J-groove weld were attempted from the outside surface of the RV, the J-groove buttering interface would provide an acoustic mismatch that would limit this examination. These conditions make accurate detection, characterization, and sizing of flaws in the remnant J-groove weld problematic. Currently, an acceptable UT technique has neither been qualified nor demonstrated for examination of the remnant J-groove welds, buttering, or adjacent low alloy steel RV material from either the inside or outside of the RV. Radiography of this area is also precluded because of the inability to position either a source or film inside the RV. Additionally, other non-

destructive examination (NDE) methods, such as liquid penetrant, magnetic particle, and eddy current would not provide useful volumetric information.

The proposed alternative is for acceptance by analytical evaluation, based on an analysis postulating a maximum flaw in the remnant J-groove weld and butter, in accordance with IWB-3142.4.

Accordingly, this relief request seeks approval to leave the remnant J-groove weld at Penetration 3 in place without NDE characterization of embedded flaws. The request also seeks approval to leave the remnant BMI nozzle in place with its characterized axial flaws and without subsequent examination. The supporting basis is provided in the following section.

5. Proposed Alternative and Basis for Use

APS is proposing an alternative in accordance with 10 CFR 50.55a(a)(3)(i). The alternative consists of two main elements:

1. A completed half nozzle repair at BMI nozzle 3 using PWSCC resistant material relocated the pressure boundary weld from inside to outside the reactor vessel. The half-nozzle repair of BMI nozzle 3 will not remove the flaws in the original J-groove weld or Alloy 600 nozzle material near this weld. Crack propagation into the vessel wall can be addressed by analysis since low alloy base material is not susceptible to PWSCC, and effectively arrests as a propagation mechanism at the interface of the low alloy base material and the J-groove weld. The repair is described in Relief Request 51 (Reference 3).

2. Since current NDE procedures are not capable of sizing the extent of crack growth into the PWSCC susceptible weld material, the flaw evaluation postulated a maximum bounding flaw that extends through the J-groove weld and buttering. The analysis calculated further propagation of the flaw into the RV low alloy base material to a depth conservative with respect to the remaining Unit 3 licensed operating life.

   ASME Code Section XI flaw evaluations (Attachment 1) were performed to qualify the reactor vessel bottom head for the effects of the remnant J-groove weld flaw for the remaining life of the plant (until the expiration of the current operating license in 2047). Due to the unique profile of the J-groove partial penetration weld, explicit three-dimensional finite element crack models were developed to accurately characterize crack tip stress intensity factors for evaluating postulated flaws at the uphill and downhill sides of the weld. Flaw growth analysis, linear elastic, and elastic plastic fracture mechanics evaluations were performed to demonstrate that there is sufficient fracture toughness or ductile tearing resistance available for the RV to qualify the final flaw sizes for the remaining life of the plant.

The remnant nozzle J-groove weld flaw and its effect on the reactor vessel head were found to be acceptable for the remaining life of the plant. Flaw growth in the head low alloy base material was found to be small with a maximum value of 0.157 inch along the uphill side of the nozzle bore.

The flaw evaluation demonstrates that the postulated flaws are shown to be acceptable for the remaining Unit 3 licensed operating life using the safety factors listed below and the lower bound J-R Curve from Regulatory Guide 1.161, *Evaluation of Reactor Pressure Vessels with Charpy Upper-Shelf Energy Less Than 50 Ft-Lb.*

Safety Factors for Flaw Acceptance

Linear-Elastic Fracture Mechanics (LEFM)*			
Operating Condition	Evaluation Method	Fracture Toughness / K_I	
Normal/Upset	K_{Ia} fracture toughness	$\sqrt{10} = 3.16$	
Emergency/Faulted	K_{Ic} fracture toughness	$\sqrt{2} = 1.41$	
Elastic-Plastic Fracture Mechanics (EPFM)**			
Operating Condition	Evaluation Method	Primary	Secondary
Normal/Upset	J/T based flaw stability	3.0	1.5
Normal/Upset	$J_{0.1}$ limited flaw extension	1.5	1.0
Emergency/Faulted	J/T based flaw stability	1.5	1.0
Emergency/Faulted	$J_{0.1}$ limited flaw extension	1.5	1.0

*LEFM safety factors are from IWB-3612 of ASME Section XI
**EPFM safety factors used in previous flaw evaluations that have been approved by the NRC staff, for example, an Arkansas Nuclear One relief request in 2004 (Reference 4)

Three supporting analyses served as inputs for the Section XI flaw evaluation:

- A corrosion evaluation (Attachment 2) was performed to evaluate the potential for material degradation in the half nozzle repair configuration. This evaluation focused on 1) the exposed surfaces of the low alloy steel RV, 2) the new pressure boundary Ni-based alloy materials, and 3) the affected stainless materials. For the exposed low alloy steel, the evaluation considered general corrosion, crevice corrosion, stress corrosion cracking (SCC), hydrogen embrittlement, and galvanic corrosion. The evaluation of the new Ni-based alloy components focused primarily on the potential for PWSCC, while the stainless steel components were evaluated for their susceptibility to SCC. The results of the general corrosion evaluation (0.072 inches deep into the low alloy base steel surfaces over 40 years of operation) were used in the ASME

Section III end of life analysis (Attachment 4) and the structural integrity analysis for the remnant nozzle (Attachment 6).

- A three-dimensional finite element analysis was performed to determine residual stresses specifically in the remnant BMI nozzle 3 partial penetration J-groove weld and adjacent material (Attachment 3, *Weld Residual Stress Analysis for PVNGS Unit 3 RV BMI Nozzle Repair*). The analysis is based on information from the Unit 3 reactor vessel fabrication records, including the vessel bottom head and nozzle certified material test reports and post-weld heat treatment records.

  The residual stress analysis simulated the following:

  - Multi-pass welding of the Alloy 182 J-groove buttering
  - Post weld heat treatment (PWHT)
  - Multi-pass welding of the original Alloy 600 nozzle to the buttered low alloy steel head
  - A 180 degree partial arc repair of the J-groove weld above the butter. A total of 10 analytical weld beads covering half the circumference were removed and re-welded for the J-Groove weld repair
  - Hydrostatic pressure testing performed in the shop and field (total of two)
  - Three cycles of steady state pressure and temperature
  - Severance of the original Alloy 600 nozzle to facilitate the half nozzle repair
  - Removal of a boat sample from the original nozzle and adjacent weld metal

  Results from the residual stress analysis are used as input in the following two flaw evaluations: a Section XI crack growth analysis (Attachment 5) of postulated cracking in the remnant reactor vessel bottom head J-groove weld and an analysis of crack growth in the remnant nozzle.

- Three-dimensional finite element analysis was performed to demonstrate that the PVNGS Unit 3 half nozzle repair, performed in 2013, for BMI nozzle 3 meets the stress acceptance criteria and fatigue requirements of the 1998 Edition, with Addenda through 2000, of ASME Section III, Subsection NB of the ASME Code for Class 1 components. An ASME Code reconciliation was performed between the construction code of record for the reactor vessel (1971 Edition including Addenda through Winter 1973) and the code year used for design and implementation of this modification. Transient stresses developed in the ASME Section III qualification analysis (Attachment 4) for transient operating conditions

were also used in crack growth analyses for the remnant reactor vessel bottom head J-groove weld and the remnant nozzle. The analysis is provided in this enclosure under Attachment 4, *ASME Section III End of Life Analysis of PVNGS UNIT 3 RV BMI Nozzle Repair.*

The finite element analysis model included:

- new pressure boundary J-groove weld
- weld pad
- replacement nozzle
- remnant nozzle and associated J-groove weld inside the vessel, and
- the effects of boat sample removal

The PVNGS Unit 3 BMI nozzle 3 repair satisfied the ASME stress requirements and criteria to protect against fatigue failure.

Other Considerations

Although the remnant nozzle no longer serves as an ASME pressure boundary, the remnant nozzle serves two remaining functions:

1. To provide a path for the incore instrumentation cable.
2. To limit the size of a design basis accident break under a hypothetical failure of the J-groove weld on the new external pad pressure boundary.

The design functions are assured by demonstration of structural stability of the remnant nozzle and weld joint in two analyses:

- The effect of cracks in the nozzle on natural frequency were analyzed by modelling a localized loss of fusion in the degraded area of the remnant weld (Attachment 6). The results of this evaluation, using a conservative limit load methodology in accordance with the ASME Code Section III NB-3228, demonstrated that the nozzle and weld will maintain their structural integrity and stability. In addition, the natural frequencies remained well above the excitation frequency for vortex shedding and other hydraulic loads.
- A BMI nozzle crack growth analysis (Attachment 5, *Palo Verde Unit 3 - BMI Nozzle Crack Growth Analysis*) demonstrated that the observed cracking in the remnant nozzle will not result in the loss of a section of the remnant nozzle that could become a loose part. The results of the evaluation demonstrated that crack propagation above the remnant weld will not reach the end of the nozzle during the licensed operating life of Unit 3, thereby maintaining the structural integrity of the nozzle.

APS evaluated the potential for loose parts by postulating release of segments of the remnant weld, the size of which were conservatively assumed. The impact of these potential loose weld segments on the reactor vessel internals and fuel was

then assessed (Reference 2). The evaluation concluded that departure from nucleate boiling performance due to flow blockage would not be degraded nor would the safety functions of the control element assemblies be adversely affected as a result of the release of assumed remnant weld segments.

Summary

APS has determined that relief as allowed by 10 CFR 50.55a(a)(3)(i) is needed to address the ASME code requirements requiring defect removal, flaw characterization and flaw reexamination. Approval of this relief request will permit continued operation without removal, characterization or subsequent examination of the flaws in PVNGS Unit 3 BMI nozzle 3.

The alternative proposed by APS is a completed half-nozzle repair using PWSCC resistant material. The half nozzle repair is an industry standard, ASME Code compliant repair method that relocates the pressure boundary to the outside of the reactor vessel.

The proposed alternative also consists of a fracture mechanics evaluation of a postulated maximum flaw that could exist in the remnant J-groove weld. Flaw growth analysis, linear elastic, and elastic plastic fracture mechanics evaluations were performed to demonstrate that there is sufficient fracture toughness or ductile tearing resistance available such that flaw growth into the RV would be limited to 0.157 inch of the approximate 6.5 inch thick RV bottom head. The current evaluation demonstrates that the flaw will remain acceptable for the remainder of the Unit 3 licensed operating life.

This provides an acceptable level of quality and safety in accordance with 10 CFR 50.55a(a)(3)(i).

6. Duration of Proposed Alternative

The duration for Relief Request 52 is for the remainder of the Unit 3 licensed operating life which expires November 25, 2047. The duration is based on the attached analyses which demonstrate acceptability of the proposed alternative through the remainder of the Unit 3 licensed operating life.

7. Precedents

- South Texas Project Unit 1 – Request for Relief From ASME Section XI Requirements Associated with Characterizing Flaws in Bottom Mounted Instrument Penetration Welds (Relief Request RR-ENG-2-33), June 25, 2003, ADAMS Accession Number ML 031780006

- NRC letter dated September 29, 2004, Arkansas Nuclear One, Unit No. 1 - RE: Proposed Alternatives to Weld Repair and Examination Requirements for Repairs on Reactor Vessel Head Penetration Nozzles (TAC NO. MB9660) ADAMS Accession Number ML042890174

8. References

1. Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components, 2001 Edition, including Addenda through 2003
2. Westinghouse Document SFAD-13-130, Rev 0-A, *Fuel and CEA Assessment based on Loose Weld Material at Palo Verde Unit 3*
3. Arizona Public Service Company (APS) letter number 102-06794, *Palo Verde* Nuclear *Generating Station Unit 3, Docket Nos. STN 50-530, American Society of Mechanical Engineers (ASME) Code, Section XI, Request for Approval of an Alternative to Flaw Removal and Characterization - Relief Request 51,* date November 8, 2013, ADAMS Accession Number ML13317A071
4. NRC letter dated September 29, 2004, *Arkansas Nuclear One, Unit No. 1 - RE: Proposed Alternatives to Weld Repair and Examination Requirements for Repairs on Reactor Vessel Head Penetration Nozzles* (TAC NO. MB9660) ADAMS Accession Number ML042890174
5. NRC letter dated April 10, 2014, *Palo Verde Nuclear Generating Station, Unit 3 - Request for Relief from ASME Code, Section XI Requirements Regarding Half-Nozzle Repair and Flaw Evaluation as an Alternative to Flaw Removal and Flaw Characterization for Flaw in Bottom Mounted Instrument Nozzle Penetration No.3* (TAC NO. MF3051), ADAMS Accession Number ML14093A407
6. APS letter number 102-06880, *Palo Verde Nuclear Generating Station, Unit 3, Docket No. STN 50-530, Transmittal of Proprietary Documents for Relief Request 52*, dated May 16, 2014

9. ATTACHMENTS

Note: The attachments are non-proprietary versions of the analyses supporting this relief request. Proprietary versions are provided by Reference 6.

Attachment 1 - *ASME Section XI End of Life Analysis of PVNGS Unit 3 RV BMI Nozzle Repair,* AREVA Document 32-9222042-000

Attachment 2 - *Corrosion Evaluation for Palo Verde Unit 3 Reactor Vessel BMI Nozzle Modification,* AREVA Document 51-9214650-000

Attachment 3 - *Weld Residual Stress Analysis for PVNGS UNIT 3 RV BMI Nozzle Repair,* AREVA Document 32-9219662-000

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Attachment 4 - *ASME Section III End of Life Analysis of PVNGS Unit 3 RV BMI Nozzle Repair,* AREVA Document 32-9220625-000

Attachment 5 - *Palo Verde Unit 3 - BMI Nozzle Crack Growth Analysis, AREVA Document 32-9222043-000*

Attachment 6 - *Natural Frequency and Structural Integrity Analysis for PVNGS Unit 3 RV BMI Nozzle Repair,* AREVA Document 32-9220624-000