APS

Palo Verde Nuclear
Generating Station

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10 CFR 50.54(f)

102-05000-CDM/SAB/RJR
September 19, 2003

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Station P1-37
11555 Rockville Pike
Rockville, MD 20852

Dear Sirs:

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Units 1, 2, and 3
Docket Nos. STN 50-528/529/530
APS' 30-Day Response to the Information Requested by NRC Bulletin 2003-02

In accordance with 10 CFR 50.54(f), the attached enclosure contains the Arizona Public Service Company (APS) 30-day response to U.S. Nuclear Regulatory Commission (NRC) Bulletin 2003-02, "Leakage from Reactor Pressure Vessel Lower Head Penetrations and Reactor Coolant Pressure Boundary Integrity," dated August 21, 2003.

This response contains the following commitments:

1. APS will perform bare-metal visual examinations of the Reactor Pressure Vessel (RPV) lower head penetrations at PVNGS Units 1, 2, and 3 during the next refueling outage in each unit (Unit 2 Fall 2003, Unit 1 Spring 2004, Unit 3 Fall 2004) and subsequent outages until a complete as found bare-metal examination of all Bottom Mounted Instrument (BMI) penetrations has been performed in all three units. APS will then evaluate the results of the RPV lower head examinations from the three PVNGS units as well as those performed by other utilities, as well as inspection results accumulated by the MRP, and take into consideration any additional regulatory guidance for determining if additional examinations are required to continue to meet ASME Code/Regulatory requirements.

2. If APS is unable to perform a bare-metal visual examination of each penetration, APS will provide the information requested in Bulletin 2003-02, Item 1(c), within 60 days of determining that the examination could not be performed.

3. APS will provide the information requested in Bulletin 2003-02, Item 2, within 60 days of a plant restart in which a RPV lower head penetration examination was performed in response to Bulletin 2003-02.

Should you have any questions, please contact Thomas N. Weber at (623) 393-5764.

Sincerely,

CDM/SAB/RJR/kg

Enclosure:
Affidavit
APS' 30-Day Response to the Information Requested by NRC Bulletin 2003-02

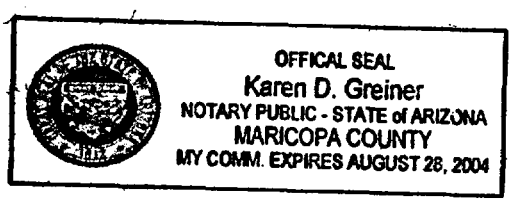
cc: Regional Administrator, NRC Region IV
M. B. Fields
N. L. Salgado

STATE OF ARIZONA)
) ss.
COUNTY OF MARICOPA)

I, David Mauldin, represent that I am Vice President Nuclear Engineering and Support, Arizona Public Service Company (APS), that the foregoing document has been signed by me on behalf of APS with full authority to do so, and that to the best of my knowledge and belief, the statements made therein are true and correct.

David Mauldin

Sworn To Before Me This 19th Day Of September, 2003.



Karen D. Greiner

Notary Public

Notary Commission Stamp

ENCLOSURE

APS' 30-Day Response to the Information Requested by NRC Bulletin 2003-02

This is the Arizona Public Service Company (APS) response to information requested by Nuclear Regulatory Commission (NRC) Bulletin 2003-02 (Ref. 1). APS has been requested to provide the following information within 30 days of the date of this bulletin since PVNGS Unit 2 will be entering a refueling outage before December 31, 2003.

NRC Required Information: 1(a)

Provide a description of the RPV lower head penetration inspection program that has been implemented at your plant. The description should include

- when the inspections were performed,
- the extent of the inspections with respect to the areas and penetrations inspected,
- inspection methods used,
- the process used to resolve the source of findings of any boric acid deposits,
- the quality of the documentation of the inspections (e.g., written report, video record, photographs), and
- the basis for concluding that your plant satisfies applicable regulatory requirements related to the integrity of the RPV lower head penetrations.

APS Response

The design of each PVNGS Unit includes 61 Alloy 600 penetrations of the reactor lower head for In-core instrumentation (ICI). The following is a description of the RPV lower head penetration inspection program that has been implemented at PVNGS Units 1, 2, and 3.

When Inspections Were Performed

For the first 10-year ISI program interval, a relief request was granted to monitor sump levels to determine if there was RCS leakage under the reactor vessel in lieu of visual examinations. As a result, no bare-metal visual examinations of the RPV lower head penetrations were conducted during the 1st 10-year ISI program interval for Units 1, 2, or 3.

During the second 10-year ISI program interval, which started in August of 1998 for Unit 1, May of 1997 for Unit 2, and January of 1998 for Unit 3, a visual examination of the bottom of the reactor head (with insulation installed), ICI penetrations, and ICI tubing was performed following each refueling outage (18 month frequency) during the Mode 3 RCS pressure test.

Prior to the fall 2003 refueling outage, the PVNGS Boric Acid Corrosion Prevention Program did not include the Alloy 600 ICI penetrations on the bottom of the reactor vessel as principle potential leak sites. The technical basis for not including ICI penetrations in the inspection program is the lack of industry and PVNGS experience

of leaks at these locations. Additionally, Alloy 600 nozzles exposed to at or near cold leg temperatures (including reactor lower head penetrations) have been considered (e.g., by the EPRI Materials Reliability Program (MRP)) to be of low susceptibility to PWSCC. In order to be consistent with the inspection of other leak sites subject to cold leg (or near cold leg) temperatures, the PVNGS Boric Acid Corrosion Prevention Program is being revised to include the bottom of the reactor vessel as a potential leak site.

Although not a formal inspection, APS did access the area between the vessel bottom and the insulation package during the recent Unit 3 spring outage to support planning and preparation for future examinations of the bottom instrumentation nozzles. During this data gathering, some light staining and boric acid residue was evident on the bottom of the vessel. The probable cause of the staining and residue was from refueling pool seal leaks before the installation of a permanent reactor cavity pool seal during the 4th refueling outage. APS has determined that the observed staining produced only slight surface oxidation. No measurable degradation was observed. On April 29, 2003, APS discussed this condition with members of the NRC staff as documented in an NRC letter dated May 30, 2003 (Ref. 2) and reported to the NRC by APS in a letter dated July 16, 2003 (Ref. 3).

Extent of Inspections and Inspection Methods Used

ISI performs visual examinations of the ICI tubing and penetrations on the outside of the insulation package while the refueling pool is flooded during the refueling outage. This visual examination documents the ICI seal table leakage and gives a reference for the required ASME Section XI examination. Subsequently, during Mode 3 at normal operating pressure (NOP), the ASME Section XI visual examination is performed from outside the insulation package after a 4 hour holding time to meet the ASME Section XI requirements.

Due to the high dose rates normally found under the reactor lower head (very high radiation area (VHRA)), the inspection is performed using a remote, robotic video camera from outside of the lower head insulation package. This is a visual inspection for leakage. Removal of insulation is not currently required per ASME Section XI.

Process Used to Resolve Source of Findings of Boric Acid Deposits

The PVNGS test procedure which performs ASME Section XI visual examinations for leakage requires that all abnormal indications be evaluated in accordance with ASME Section XI. If boric acid residue is found during a visual examination, the ASME Code requires that the source of leakage be determined and an engineering evaluation performed on the impact of the leakage. The source of leakage determination would include insulation removal, as appropriate. The test procedure also requires that rejected pressure tests be formally evaluated using the PVNGS

Corrective Action Program and/or Engineering Deficiency Work Order Process to document, evaluate, and resolve the finding.

The PVNGS Boric Acid Corrosion Prevention Program requires that boric acid leakage on carbon and low alloy steel components be carefully cleaned to evaluate the extent of affected area. This process includes an evaluation of any wastage and the potential impact on the affected component's operability and structural integrity.

Quality of Inspection Documentation

Results of the ASME Section XI visual examinations are videotaped. However, the document of record is the pressure test report that documents the results of the visual examination performed in accordance with the PVNGS ASME Section XI program. The test report is maintained in accordance with the PVNGS Quality Assurance Program. There are currently no requirements to maintain the videotape as a quality record.

Basis for Concluding that PVNGS Satisfies Applicable Regulatory Requirements

As described in the Applicable Regulatory Requirements section of Bulletin 2003-02, several provisions of the NRC regulations pertain to the issue of reactor head degradation and reactor pressure vessel head (RPVH) bottom mounted instrumentation (BMI) cracking. These include the general design criteria, 10 CFR 50.55a, quality assurance criteria, and the plant Technical Specifications. APS has effectively implemented comprehensive inspection programs which contain all inspections required by these regulations as well as those required by the ASME Code and APS' regulatory commitments.

The applicable regulatory requirements are as follows:

- Appendix A to 10 CFR Part 50, "General Design Criteria for Nuclear Power Plants"
  GDC 14 – "Reactor Coolant Pressure Boundary"
  GDC 31 – "Fracture Prevention of Reactor Coolant Pressure Boundary"
  GDC 32 – "Inspection of Reactor Coolant Pressure Boundary"

- Plant Technical Specifications

- 10 CFR 50.55a, Codes and Standards, which incorporates by reference Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components, of the ASME Boiler and Pressure Vessel Code"

- Appendix B of 10 CFR Part 50, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," Criteria V, IX, and XVI

- NRC Generic Letter 88-05

The basis for concluding that all regulatory requirements are being met at PVNGS is provided below:

General Design Criteria (GDC)
GDC 14 specifies that the RCPB be designed, fabricated, erected, and tested so as to have an extremely low probability of abnormal leakage, of rapidly propagating failure, and of gross rupture. GDC 31 specifies that the probability of rapidly propagating fracture of the RCPB be minimized. GDC 32 specifies that components that are part of the RCPB have the capability of being periodically inspected to assess their structural and leak-tight integrity; inspection practices that do not permit reliable detection of degradation are not consistent with this GDC.

These requirements established for design, fracture toughness, and inspectability in GDC 14, 31, and 32, respectively, were satisfied during the initial design and licensing of PVNGS (Ref. 4) and continue to be satisfied during operation.

In addition, Alloy 600 susceptibility to Primary Water Stress Corrosion Cracking (PWSCC) is an industry recognized issue and is common to both the top and lower head penetrations at PVNGS. However, the top head is exposed to higher temperatures which increases the probability of experiencing PWSCC over that of the lower head. Recent examinations on the top head nozzles of all three PVNGS units have resulted in no detectable defects providing additional assurances that the applicable General Design Criteria are being met.

Plant Technical Specifications
The limits for PVNGS RCPB leakage are provided in Technical Specification 3.4.14, "RCS Operational Leakage," and are stated in terms of the amount of leakage (i.e., 1 gallon per minute for unidentified leakage; 10 gpm for identified leakage; and no leakage in the reactor coolant system pressure boundary). Routine surveillance testing is required to ensure these requirements are met.

Based on industry experience, most leaks from reactor coolant system Alloy 600 penetrations have been well below the sensitivity of on-line leakage detection systems. However, if leakage or unacceptable indications are identified, defects will be identified and repaired before startup. If measurable leakage is detected by the on-line leak detection systems, the leak will be evaluated per the Technical Specifications, and the plant will be shut down if required. Upon detection and identification of a leak, corrective actions will be taken to restore RCPB integrity. APS continues to meet the requirements of this Technical Specification.

Inspection Requirements (10 CFR 50.55a and ASME Section XI)
NRC regulations in 10 CFR 50.55a require that the RCPB meet the requirements of Section XI of the ASME Boiler and Pressure Vessel Code. Section XI requires inspection and corrective actions for RCPB degradation. APS complies with these

requirements through the implementation of the PVNGS Inservice Inspection Program. Therefore, the Section XI requirements continue to be met.

Quality Assurance Requirements (10 CFR 50, Appendix B)
Criterion V states in part that activities affecting quality shall be prescribed by and accomplished in accordance with documented instructions that provide appropriate acceptance criteria. APS uses procedure 73TI-9ZZ78, Visual Examination for Leakage which contains acceptance criteria based on the ASME Code. It also contains personal qualification and record keeping requirements.

Criterion IX states that special processes, including nondestructive testing, shall be controlled and accomplished by qualified personnel using qualified procedures in accordance with applicable codes, standards, specifications, criteria, and other special requirements. Procedure 73TI-9ZZ78 requires personnel to be qualified and certified to at least Level II in the VT-2 method to perform examinations and to interpret test results.

Criterion XVI of Appendix B states that measures shall be established to assure those conditions adverse to quality are promptly identified and corrected. For significant conditions adverse to quality, the measures taken shall include root cause determination and corrective action to preclude repetition of the adverse conditions. At PVNGS, if any indication of leakage is detected during the inspections described in this response, corrective actions are required to be taken in accordance with the corrective action program and plant procedures. Any detectable degradation of the RCPB could be considered a significant condition adverse to quality and, if so, appropriate actions, including a root cause analysis, will be taken.

In consideration of potential conditions adverse to quality, APS has been actively participating in industry organizations (Westinghouse Owners Group and Material Reliability Program) and continues to be aware of industry experience. APS continues to meet the requirements of 10 CFR 50, Appendix B.

NRC Generic Letter 88-05
APS has implemented the inspection and walkdown requirements of Generic Letter 88-05 (Ref. 5). To be consistent with the inspection of other leak sites subject to cold leg (or near cold leg) temperatures, the PVNGS Boric Acid Corrosion Prevention Program is being revised to include the bottom of the reactor vessel as a potential leak site.

NRC Required Information: 1(b)

Provide a description of the RPV lower head penetration inspection program that will be implemented at your plant during the next and subsequent refueling outages. The description should include:

- the extent of the inspections which will be conducted with respect to the areas and penetrations to be inspected,
- inspection methods to be used, qualification standards for the inspection methods,
- the process used to resolve the source of findings of boric acid deposits or corrosion,
- the inspection documentation to be generated, and
- the basis for concluding that your plant will satisfy applicable regulatory requirements related to the structural and leakage integrity of the RPV lower head penetrations.

APS Response

The following is a description of the RPV lower head penetration inspection program that is being developed and will be initially implemented in the upcoming fall outage in Unit 2.

Extent of Inspections to be Conducted

APS plans to conduct 100% bare-metal visual examinations of the 61 reactor vessel bottom mounted instrument (BMI) nozzles, including 100% of the circumference of each penetration as it enters the RV lower head to the maximum extent practical. Some nozzle visual examinations may have remaining remnants of spraylat protective coating covering these areas left from construction as noted during recent U3R10 observations. If this is the case, then a best effort detailed visual examination for leakage will be completed. The spraylat material interfering with the examination of the nozzles will then be removed from the area of the nozzle-vessel interface by a qualified process and re-baselined for visual examinations for subsequent outages.

APS will perform bare-metal visual examinations of the Reactor Pressure Vessel (RPV) lower head penetrations at PVNGS Units 1, 2, and 3 during the next refueling outage in each unit (Unit 2 Fall 2003, Unit 1 Spring 2004, Unit 3 Fall 2004) and subsequent outages until a complete as found bare-metal examination of all BMI penetrations has been performed in all three units.

If APS is unable to perform a bare-metal visual examination of each penetration, APS will provide the information requested in Bulletin 2003-02, Item 1(c), within 60 days of determining that the examination could not be performed.

Inspection Methods to be Used, Qualification Standards for Inspection Methods

The examination method for the BMI at PVNGS will be direct visual examination (VT-2) aided by remote robotic cameras. The visual examination personnel and procedures will be qualified in accordance with APS' written visual examination for

leakage procedure, ASME Section XI, and supplemented by EPRI Report 1007842, (Ref. 6), as applicable for the lower head penetrations.

Process Used to Resolve Source of Findings of Boric Acid Deposits or Corrosion

APS will utilize the PVNGS corrective action program to evaluate all findings of leakage during the BMI penetration examination. The process will include evaluations to determine if the findings of leakage are relevant as an RCS leak as well as determining the source of the leakage. Examples used to determine characteristics of relevant leakage are identified in the March 2003 EPRI report 1007482, Visual Examination for Leakage of PWR Reactor Head Penetrations, supplemented by the as found pictures of the boric acid accumulation at South Texas Project Unit 1 (STP-1) at BMI locations #1 and #46 available on the NRC web site.

Unlike the reactor vessel head upper penetrations, the lower head location has no potential leak source above the BMI that could result in boron accumulation on the BMI during normal plant operation. Reactor cavity seal ring leakage that occurs during a refueling outage only occurs at low temperature and results in staining without the "popcorn like" accumulation features of an RCS leak at normal operating temperature. The lower head location of the BMI penetrations is also not likely to be affected by settled debris that could mask a VT-2 examination.

Examples of non-relevant leakage may include thin films or stains of boron or light surface rust having a characteristic of no discernable thickness with no accumulation around the penetration. Non-relevant indications would typically have a trail leading to the source. Each case of leakage will be documented using the condition report process identifying the determination on whether the finding is relevant to leakage from a BMI nozzle.

Inspection Documentation to be Generated

The examinations will be documented by a report signed by the qualified VT-2 examiner that performed the examination. Video and photographic images to support the examination findings will supplement the report. The test report will be maintained in accordance with the PVNGS Quality Assurance Program.

Basis for Concluding that PVNGS will Satisfy Applicable Regulatory Requirements

As stated in response to Item 1(a), APS has been performing inspections of the RPV lower head in accordance with ASME Section XI requirements. Performance of bare-metal examinations of the reactor vessel BMI nozzles as described above will provide increased assurance of identifying and addressing early indications of leakage on the RPV lower head. These additional inspections strengthen APS' compliance with the applicable regulatory requirements. For further information

regarding APS compliance with applicable regulatory requirements, reference APS response to Item 1(a) of this letter.

NRC Required Information: 1(c)

If you are unable to perform a bare-metal visual inspection of each penetration during the next refueling outage because of the inability to perform the necessary planning, engineering, procurement of materials, and implementation, are you planning to perform bare-metal visual inspections during subsequent refueling outages? If so, provide a description of the actions that are planned to enable a bare-metal visual inspection of each penetration during subsequent refueling outages. Also, provide a description of any penetration inspections you plan to perform during the next refueling outage. The description should address the applicable items in paragraph (b).

APS Response

APS is currently planning to perform the required bare-metal visual examination of the RPV lower head penetrations during the upcoming fall refueling outage for Unit 2. The examination that will be conducted is described in the response to 1(b) above. The examinations being planned for Unit 1 (Spring 2004) and Unit 3 (Fall 2004) will be similar to those describes in the response to 1(b) above. If APS is unable to perform a bare-metal visual examination of each penetration, APS will provide the information requested in Bulletin 2003-02, Item 1(c), within 60 days of determining that the examination could not be performed.

NRC Required Information: 1(d)

If you do not plan to perform either a bare-metal visual inspection or non-visual (e.g., volumetric or surface) examination of the RPV lower head penetrations at the next or subsequent refueling outages, provide the basis for concluding that the inspections performed will assure applicable regulatory requirements are and will continue to be met.

APS Response

APS plans to perform bare-metal visual examinations during the next refueling outage in each unit (Unit 2 Fall 2003, Unit 1 Spring 2004, Unit 3 Fall 2004) and subsequent outages until a complete as found bare-metal examination of all Bottom Mounted Instrument (BMI) penetrations has been performed in all three units. APS will then evaluate the results of the RPV lower head examinations from the three PVNGS units as well as those performed by other utilities and take into consideration any additional regulatory guidance for determining if additional examinations are required to continue to meet ASME Code/Regulatory requirements.

NRC Required Information: 2

Within 60 days of plant restart following the next inspection of the RPV lower head penetrations, the subject PWR addressees should submit to the NRC a summary of the inspections performed, the extent of the inspections, the methods used, a description of the as-found condition of the lower head, any findings of relevant indications of through-wall leakage, and a summary of the disposition of any findings of boric acid deposits and any corrective actions taken as a result of indications found.

APS Response

APS will provide the requested information within 60-days of a plant restart following the next inspection of the RPV lower head penetrations.

Commitments:

This response contains the following commitments:

1. APS will perform bare-metal visual examinations of the Reactor Pressure Vessel (RPV) lower head penetrations at PVNGS Units 1, 2, and 3 during the next refueling outage in each unit (Unit 2 Fall 2003, Unit 1 Spring 2004, Unit 3 Fall 2004) and subsequent outages until a complete as found bare-metal examination of all Bottom Mounted Instrument (BMI) penetrations has been performed in all three units. APS will then evaluate the results of the RPV lower head examinations from the three PVNGS units as well as those performed by other utilities and take into consideration any additional regulatory guidance for determining if additional examinations are required to continue to meet ASME Code/Regulatory requirements.

2. If APS is unable to perform a bare-metal visual examination of each penetration, APS will provide the information requested in Bulletin 2003-02, Item 1(c), within 60 days of determining that the examination could not be performed.

3. APS will provide the information requested in Bulletin 2003-02, Item 2, within 60 days of a plant restart in which a RPV lower head penetration examination was performed in response to Bulletin 2003-02.

References:

1. NRC Bulletin 2003-02, "Leakage from Reactor Pressure Vessel Lower Head Penetrations and Reactor Coolant Pressure Boundary Integrity," dated August 21, 2003.

2. NRC Letter, Conference Call on April 29, 2003, With Region IV and Arizona Public Service Company for Restart of Palo Verde Nuclear Generating Station, Unit 3, From its refueling Outage (TAC No. MA2264), dated May 30, 2003

3. APS letter 102-04967-CDM/SAB/RJR, "Bulletin 2002-01 Additional Information (TAC Nos. MB4563, MB4564, MB4565)," dated July 16, 2003.

4. NUREG-0857, Safety Evaluation Report Related to the Operation of PVNGS Units 1, 2, and 3

5. APS Letter 161-01058-EEVB/ACR/JMQ, Palo Verde Nuclear Generating Station Units 1, 2, and 3, Generic Letter 88-05 Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants, dated May 27, 1988

6. EPRI Report 1007842, "Visual Examination for Leakage of PWR Reactor Head Penetrations: Revision 2 of 1006296, Includes 2002 Inspection Results and MRP Guidance," dated March 2003

7. EPRI Report 1006284, "PWR Materials Reliability Program Response to NRC Bulletin 2001-01 (MRP-48)," dated August 2001

8. APS Letter 102-04603-CDM/SAB/RJR, Response to NRC Bulletin 2001-01: Circumferential Cracking of Reactor Pressure Vessel Head Penetration Nozzles, dated September 4, 2001