APS

10 CFR 50.54(f)

Palo Verde Nuclear Generating Station

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102-05130-CDMSAB/RJR
July 22, 2004

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
11555 Rockville Pike
Rockville, Maryland 20852

Dear Sirs:

Subject: **Palo Verde Nuclear Generating Station (PVNGS)**
Units 1, 2, and 3
Docket Nos. STN 50-528/529/530
APS' 60-Day Response to the Information Requested by NRC Bulletin 2004-01

In accordance with 10 CFR 50.54(f), the attached enclosure contains the Arizona Public Service Company (APS) 60-day response to U.S. Nuclear Regulatory Commission (NRC) Bulletin 2004-01, "Inspection of Alloy 82/182/600 Materials Used in the Fabrication of Pressurizer Penetrations and Steam Space Piping Connections at Pressurized-Water Reactors," dated May 28, 2004. Although APS has included information about the pressurizer surge line welds in previous communications to the NRC, APS understands that pressurizer surge line welds are not intended to be within the scope of this bulletin.

Pursuant to 10 CFR 50.73, APS has reported three instances of reactor coolant pressure boundary leakage caused by a degraded Alloy 600 pressurizer heater sleeve. These instances were reported in Licensee Event Reports 2000-004-00, 2003-002-00, and 2004-001-00, dated November 1, 2000, May 27 2003, and April 29. 2004, respectively.

This letter contains the following commitments to the NRC:

1. APS will adopt the three elements of the proposed Westinghouse Owners Group (WOG) inspection program, as discussed in WOG letter WOG-04-057 to NRC, "WOG CE Fleet Pressurizer Heater Sleeve Inspection Program", dated January 30, 2004, during the next and subsequent planned refueling outages.

2. APS will provide the information requested in NRC Bulletin 2004-01, Item 2, within 60 days of plant restart following the next inspection of alloy 82/182/600 pressurizer penetrations and steam space connections. A separate response will be provided for each unit.

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3. APS will perform Non-Destructive Examination (NDE) capable of characterizing crack orientation on Unit 3 pressurizer heater sleeve A-3 during the Unit 3 fall 2004 refueling outage. This heater sleeve was repaired using a mechanical nozzle seal assembly (MNSA) during a previous forced outage in the first quarter of 2004 (refer to APS letter 102-05065-CDM/SAB/RJR to NRC, "Pressurizer Heater Sleeve Leak Discussion Documentation", dated March 9, 2004).

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

Sincerely,

David Mauldin

CDM/SAB/RJR/

Enclosures:

1. Affidavit
2. APS' 60-Day Response to the Information Requested by NRC Bulletin 2004-01

Attachments:
1. List of Regulatory Commitments
2. Typical Nozzle Arrangement
3. Pressurizer Nozzle Configuration
4. Pressurizer Heater Sleeve NDE Summary

cc:	B. S. Mallett, NRC Region IV Regional Administrator	(w/Enclosure)
	M. B. Fields, NRC NRR Project Manager	(w/Enclosure)
	N. L. Salgado, NRC Senior Resident Inspector for PVNGS	(w/Enclosure)

Enclosure 1
Affidavit

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

David Mauldin

Sworn To Before Me This 22nd Day Of July, 2004.

OFFICIAL SEAL
Susie Lynn Ergish
NOTARY PUBLIC - STATE of ARIZONA
MARICOPA COUNTY
MY COMM. EXPIRES July 14, 2007

Susie Lynn Ergish

Notary Public

Notary Commission Stamp

Enclosure 2

APS' 60-Day Response to the Information Requested by NRC Bulletin 2004-01

This is the Arizona Public Service Company (APS) response to information requested by Nuclear Regulatory Commission (NRC) Bulletin 2004-01.

Since the issuance of NRC Bulletin 2004-01 on May 28, 2004, the following significant operating events have occurred at the Palo Verde Nuclear Generating Station (PVNGS). On June 7, 2004, PVNGS Unit 3 experienced an un-planned shutdown due to main turbine electro-hydraulic control oil system problems. After reaching a stable condition, APS personnel performed a bare metal, 360 degree, visual inspection of 100 percent of all pressurizer heater sleeves. The inspection did not identify any leakage. On June 14, 2004, all three PVNGS units tripped due to a grid disturbance. After each plant reached a stable condition, APS personnel performed a bare metal, 360 degree, visual inspection of 100 percent of all pressurizer heater sleeves in all three units. The inspection did not identify any leakage. On July 13, 2004, Unit 2 tripped due to a grid disturbance. After the plant reached a stable condition, APS personnel performed a bare metal, 360 degree, visual inspection of 100 percent of all pressurizer heater sleeves. The inspection did not identify any leakage.

Background Information

As described in PVNGS UFSAR Section 5.4.10.2 "[Pressurizer] Description", the pressurizer is a vertically mounted, bottom supported, cylindrical pressure vessel. Replaceable direct immersion electric heaters are vertically mounted in the bottom head. The pressurizer is also furnished with nozzles for spray and surge lines, safety valves, and pressure and level instrumentation. A manway is provided in the top head for access for inspection of the pressurizer internals. The pressurizer surge line is connected to one of the reactor coolant hot legs and the spray lines are connected to two of the cold legs at the reactor coolant pump discharge. The pressurizer spray and surge nozzles are furnished with a thermal sleeve to withstand specified plant transients during the design life. There are 36 pressurizer heaters. Each is a single unit, direct immersion heater that protrudes vertically into the pressurizer through sleeves welded in the lower head [see Attachment 2].

The pressurizer is designed and fabricated in accordance with the ASME Code listed in UFSAR Table 5.2-1 (duplicated, in part, below). The interior surface is clad with weld deposited stainless steel. However, as shown on APS/Combustion Engineering drawing D78373-650-001, the interior surface in the area of the heater sleeve penetrations is clad with weld deposited Alloy 82/182.

PVNGS UFSAR Table 5.2-1 (Abbreviated)

ASME Boiler & Pressure Vessel Code, Section III, Nuclear Power Plant Components				
Component	Suppler	Class	Edition	Addenda
Pressurizer	CE-CNO	1	1971	W-73

As stated in PVNGS UFSAR Section 5.4.10.3 "[Pressurizer] Evaluation", the pressurizer was subjected to the required ASME Code, Section III hydrostatic test and post-hydrostatic test non-destructive testing following completion of fabrication. Further assurance of the structural integrity of the pressurizer during plant life is obtained from the in-service inspections performed in accordance with ASME Code, Section XI.

Instrument Nozzles

The pressurizer instrument nozzles in each unit have been replaced with Alloy 690 nozzles.

Pressurizer Heater Sleeve Replacement Project

During the 11th refueling outage in Unit 2, 34 of 36 pressurizer heater sleeves (Alloy 600) were replaced with thermally treated SB-167, Alloy 690 sleeves using the ½ nozzle repair technique. The two sleeves that were not replaced were plugged during a previous outage using Alloy 690 material. The new sleeves were attached to the outside surface of the pressurizer by an Inconel 52 temper bead weld pad that was deposited over the pressurizer SA-508 Class 1 (P3) material. Installation of the new heater sleeves used the following major steps:

1. Remove the existing heater.
2. Remove the existing Alloy 600 sleeve to a predetermined length in the heater sleeve borehole by machining.
3. Build-up an approximately 1/2" thick Alloy 52 weld pad (using the ambient temperature temper bead method) around the heater sleeve bore hole.
4. Perform required ultrasonic testing (UT) & liquid penetrant testing (PT) of the pad after 48-hour wait at ambient temperature.
5. Cut a partial penetration weld prep in the pad.
6. Insert the Alloy 690 sleeve in the heater sleeve borehole and weld it to the pad.
7. Perform progressive PT during welding.
8. Install heater.

APS intends to replace all of the heater sleeves in Units 1 and 3 during future refueling outages for these units.

NRC Required Information: 1(a)

A description of the pressurizer penetrations and steam space piping connections at your plant. At a minimum, this description should include materials of construction (e.g., stainless steel piping and/or weld metal, Alloy 600 piping/sleeves, Alloy 82/182 weld metal or buttering, etc.), joint design (e.g., partial penetration welds, full penetration welds, bolted connections, etc.), and, in the case of welded joints, whether or not the weld was stress-relieved prior to being put into service. Additional information relevant with respect to determining the susceptibility of your plant's pressurizer penetrations and steam space piping connections to PWSCC should also be included.

APS Response

The PVNGS pressurizer vessels are SA-508 Class 1 (P3) material with a stainless steel weld deposited cladding on the inside surface and a weld cladding of Alloy 82/182 in the heater area. The vessel was stress relieved prior to the attachment of any nozzles. Attachment 2 provides a cut away view of a typical PVNGS pressurizer.

Tables 2, 2A, 2B, and 2C of Attachment 3 provide the original and current configuration of the non-heater sleeve nozzles, including the number of nozzles, nozzle size, weld type, post weld heat treatment (PWHT), and the nozzle and weld material.

The pressurizer instrument nozzles in all three units were replaced during the third refueling outage for each unit after discovering a crack in one Unit 1 instrument nozzle. The crack was identified as having been caused by primary water stress corrosion cracking (PWSCC).

The pressurizer also has one manway opening. It is a sixteen-inch (nominal inside diameter) opening located in the pressurizer top head to provide access to the spray nozzle and other internals as required. The manway is sealed with a spiral wound metallic gasket and retainer plate held in place by a cover plate and twenty (20) 1-1/2 inch stud and nut assemblies. The manway opening is designed with a recessed seat so that a welded diaphragm plate may be substituted for the gasket if required.

Each pressurizer has 36 heater sleeves. The original configuration of the pressurizer heater sleeves consisted of an Alloy 600 heater sleeve that was attached to the pressurizer shell with an Alloy 82/182 partial penetration J-groove weld. APS is currently replacing the Alloy 600 heater sleeves in each unit. The status of the pressurizer heater sleeve repairs for each unit is as follows:

Unit 1 – All heater sleeves are in the original configuration of Alloy 600 sleeves with an Alloy 82/182 partial penetration J-groove weld. APS is preparing to replace these heater sleeves with Alloy 690 sleeves during the fall 2005 refueling outage.

Unit 2 - Pressurizer heater sleeves A-6 and B-18 were plugged during a previous refueling outage. Heater sleeves A-6 and B-18 have had the pressure boundary weld moved to the outside surface of the pressurizer shell by cutting the degraded pressurizer heater sleeve as close as possible to the bottom head of the pressurizer. The degraded sleeves and heaters were then counter bored and a reinforcing pad and plug were welded to seal the sleeve location. This repair resulted in the relocation of the ASME Pressure boundary weld from the inside surface to the outside surface of the pressurizer shell. The repairs were made using Alloy 690 material.

The remaining 34 heater sleeves were repaired using the ½ nozzle repair technique. This repair technique moved the pressure boundary weld to the outside surface of the pressurizer shell by cutting the heater sleeve inside the pressurizer shell. A weld pad of Alloy 690 was overlaid on the shell. New Alloy 690 ½ sleeves were inserted and attached to the weld pad on the outside surface of the pressurizer shell. This repair resulted in the relocation of the ASME Pressure boundary weld from the inside surface to the outside surface of the pressurizer shell. The repairs were made using Alloy 690 material. These sleeves were installed using an ambient temperature gas-tungsten arc welding (GTAW) technique that is described in APS Relief Request 23. APS Relief Request 23 was approved by the NRC on July 30, 2003 as referenced in NRC letter to APS, "Palo Verde Nuclear Generating Station, Units 1, 2, and 3 – Relief Request No. 23 RE: Alternative to Temper Bead Welding Requirements for Inservice Inspection Program (TAC NOS. MB8973, MB8974, and MB8975)".

Unit 3 - Heaters A-1, A-3 and A-15 have degraded sleeves that were repaired using a mechanical nozzle seal assembly (MNSA) that has been approved by the NRC for this application (NRC letter to APS, "Palo Verde Nuclear Generating Station, Units 1, 2, and 3 – Request for Code Alternative for the Use of Mechanical Nozzle Seal Assemblies – Relief Request No. 17 (TAC NOS. MB1618, MB1619, and MB1620)", dated October 10, 2001). The MNSA is a mechanical device consisting of a split gasket/flange assembly that is placed around the leaking penetration. The gasket is made of Grafoil packing, a graphite compound that is compressed within the assembly to prevent RCS leakage past the penetration. The assembly is bolted into holes drilled and threaded on the outer surface of the pressurizer. Another piece of the assembly is bolted to the flanges, which serves as the structural attachment of the sleeve to the wall. This part of the assembly serves to carry the loads in lieu of the J-groove weld on the Alloy 600 penetration. Post-installation inspection of the MNSA at normal operating pressure and temperature verified the acceptability of the installation.

The remaining 33 heater sleeves are in the original configuration of Alloy 600 sleeves with an 82/182 partial penetration J-groove weld. APS intends to replace all the U3 heater sleeves (36) with Alloy 690 sleeves during the Unit 3 fall 2004 refueling outage.

NRC Required Information: 1(b)

A description of the inspection program for Alloy 82/182/600 pressurizer penetrations and steam space piping connections that has been implemented at your plant. The description should include when the inspections were performed; the areas, penetrations and steam space piping connections inspected; the extent (percentage) of coverage achieved for each location which was inspected; the inspection methods used; the process used to resolve any inspection findings; 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 pressurizer penetrations and steam space piping connections. If leaking pressurizer penetrations or steam space piping connections were found, indicate what follow-up NDE was performed to characterize flaws in the leaking penetrations.

APS Response

APS In-Service Inspection (ISI) Program

The APS ISI program requires all ASME Class 1 components, which includes the pressurizer, to receive a VT-2 visual examination once every refueling outage. This inspection is documented on the ASME required VT-2 examination record. APS performs a visual examination of the Class 1 pressure boundary piping and the connections coming from the pressurizer at the end of each refueling outage at normal operating pressure. The scope of the examination includes all Alloy 600 nozzles, all 82/182 dissimilar metal welds, and all Class 1 bolted connections (pressurizer manway). Additionally, APS performs a visual examination of the pressurizer heater sleeves for leakage during cold shutdown. This additional examination was implemented based on plant operating experience with Alloy 600 nozzles.

The ASME Section XI Code allows performance of visual examinations with the insulation installed. These ISI visual examinations require certified VT-2 examiners. However, when there are specific areas of interest due to operating plant experience, (e.g., pressurizer heater sleeves, Alloy 600 nozzles in the hot leg piping) insulation modifications have been made to allow for bare-metal examinations. If the examiners find boric acid residue, the APS ISI Program requires the source of the leakage to be determined and an engineering evaluation to be performed to determine the impact of the leakage.

APS procedure 73TI-9ZZ78, Visual Examination for Leakage, requires the initiation of a work order (WO) or condition request/disposition request (CRDR) for rejected pressure tests. In accordance with the APS corrective action program, a WO or CRDR is used to identify the condition and to document the ISI Program engineering evaluation that may be performed to assess the impact of the leakage. Procedure 73TI-9ZZ78 contains the following examples of rejectable indications:

- pressure boundary leakage,
- evidence of leakage at pressure retaining bolted connections, or
- components with general corrosion (from boric acid residue) that reduces the wall thickness by more than 10%.

All piping welds that have Alloy 82/182 welds are surface and volumetrically examined at different periods during the 10-year ISI Program interval. When the Alloy 82/182 welds are surface or volumetrically examined, the insulation is removed to allow access to the surface of the weld. Any rejectable condition of these welds requires an engineering evaluation at a minimum. APS' ISI Program requires certified examiners in the respective process to perform the surface or volumetric examinations. The results of Alloy 82/182 dissimilar metal butt weld surface and volumetric examinations associated with the pressurizer that were performed in accordance with the ISI Program are shown in Table 1 of this enclosure.

In addition, a bare metal visual examination of each of the Alloy 82/182 dissimilar metal butt welds on the pressurizer connections has been performed in Units 1 and 2. A similar inspection will be performed in Unit 3 during the next Unit 3 refueling outage. These examinations are consistent with the recommendations contained in Dominion Energy – Domination Generation letter MRP 2004-05, "Needed Action for Visual Inspection of Alloy 82/182 Butt Welds and Good Practice Recommendations for Weld Joint Configurations", dated April 2, 2004. This letter was issued under the purview of the NEI 03-08, "Guideline for the Management of Materials Issues". These bare metal visual examinations are categorized as "NEEDED", as defined in NEI 03-08.

<u>Boric Acid Corrosion Prevention Program</u>

Procedure 70TI-9ZC01, Boric Acid Corrosion Prevention Program, requires a complete Boric Acid Walkdown (BAW) inspection during each refueling outage. The results of this inspection are documented within the work order package and are maintained as a permanent plant record.

The Boric Acid Corrosion Prevention Program requires additional BAW inspections when certain criteria are met. A complete BAW inspection is required to be performed any time the unit at the time of shutdown has been in power operation for more than three months or 90 Effective Full Power Days (EFPD) since the last inspection. Additionally, a determination to perform a limited BAW inspection is required after each reactor trip or controlled shutdown if less than three months or 90 EFPD have elapsed since the last inspection. However, if the unit will be in Mode 3 or below for more than approximately 14 days, a complete BAW is required. Although the Boric Acid Corrosion Prevention Program defines the minimum requirements for when boric acid walkdowns will be performed, it is a management expectation that the walkdowns will be performed every time a unit is shutdown (enters Mode 3), regardless of whether the shutdown was planned or unplanned.

The technical basis for the BAW inspection frequency is based on PVNGS and industry operating experience. A complete BAW inspection every refueling outage is the most frequent interval for inspection without a mid-cycle shutdown. Industry experience has demonstrated that a complete and effective inspection every refueling outage, combined with an effective corrective action program, is sufficient to prevent significant degradation of the RCPB due to boric acid leakage and corrosion. Based on PVNGS operating experience, the three-month/90 day inspection requirement applied to other types of plant shutdowns is a reasonable, conservative compromise between the risk and consequences of boric acid leaks and ALARA considerations.

BAW inspections are usually completed in Mode 1 or Mode 3 just prior to the start of the refueling outage when the unit is at normal operating pressure and temperature. The inspection includes observation of the components identified in procedure 70TI-9ZC01 as principle potential leak locations. The inspections routinely include the accessible portions of all piping attached to the pressurizer.

There are 49 attachments to each of the PVNGS pressurizers - surge line, spray line, 4 pressurizer safety valves (PSV) inlets, 7 instrument nozzles, and 36 heater sleeves. All attachments are insulated with the exception of the inlet flanges of the PSVs and the heater sleeves. Since bare metal inspection of the rest of the penetrations are not possible without insulation removal, APS personnel look for signs of leakage at the insulation joints, and at the support skirt at the base of the vessel, which is not insulated.

The specific inspection techniques and coverage for the pressurizer are discussed below:

Pressurizer Instrument Nozzles

The design of each pressurizer originally consisted of seven Alloy 600 instrument nozzles. These nozzles include pressure/level taps and a temperature element tap. All of the instrument nozzles that were originally fabricated of Alloy 600 material have been replaced with nozzles made of Alloy 690 in all three Units. Accordingly, procedure 70TI-9ZC01 requires only a general area visual inspection of each nozzle location (i.e., a bare-metal inspection is not required). Such an inspection consists of an observation of the component location, looking for abnormal conditions that might indicate a boric acid leak. Such conditions would include boric acid residue on or at the base of the nozzle where it protrudes from the base metal, or residue at seams in the insulation. The technical basis for not requiring a bare-metal inspection of these nozzles is that Alloy 690 material is resistant to PWSCC. Weld material used in the replacements was E82 for Unit 1 and E52 for Units 2 and 3.

Pressurizer Heater Sleeves

The bottom head of each PVNGS pressurizer includes 36 Alloy 600 heater sleeve penetrations. Due to the heater sleeve's susceptibility to PWSCC - the sleeves are exposed to pressurizer operating temperature - APS completed a modification of the pressurizer insulation in all three units that allows for a complete visual inspection of each heater sleeve.

When potential pressurizer heater sleeve leaks were found, APS performed follow-up NDE to characterize the flaws in the leaking pressurizer heater sleeves. Attachment 4 contains the results of these pressurizer heater sleeve examinations. Note that pressurizer heater sleeve A-3 in Unit 3 is scheduled to be non-destructively examined to characterize the suspected flaw during the Unit 3 fall 2004 refueling outage.

The response to Item 1(d) provides the basis for concluding that PVNGS satisfies applicable regulatory requirements related to the integrity of pressurizer penetrations and steam space piping connections.

Table 1 – PVNGS Pressurizer Butt Weld NDE

Component	Total Nozzles	Weld ID	Examination Type/Report Number	Coverage Obtained
PRESSURIZER Unit 1				
Pressurizer Spray Line	1	005-33	UT-93-1202, UT-93-1203 RT-93-1368, RT-02-003 PT-89-1073, PT-02-147	100%, 100% N/A*, 100% 100%, 100%
Pressurizer Safety Valve Lines	4	5-29	UT-87-1584, UT-01-1238 UT-01-1239, UT-01-1240 UT-01-1278, PT-87-1526 PT-01-1010	100%, 100% 100%, 100% 100%, 100% 100%
		5-30	UT-98-1056, PT-96-1036	100%, 100%
		5-31	UT-93-1197, UT-02-257 PT-93-1104, PT-02-155	100%, 100% 100%, 100%
		5-32	UT-98-1055, PT-96-1036	100%, 100%

* This exam was not required by ASME Code.
Non-heater nozzles are discussed separately and are described in Tables 2A, 2B, and 2C of Attachment 3.
Report number legend is: RT (radiographic testing), UT (ultrasonic testing), PT (penetrant testing), XX (year), XXXX (report number).

Table 1 – PVNGS Pressurizer Butt Weld NDE (continued)

Component	Total Nozzles	Weld ID	Examination Type/Report Number	Coverage Obtained
PRESSURIZER Unit 2				
Pressurizer Spray Line	1	005-33	UT-93-2403, UT-93-2405 RT-93-2632, RT-02-001 PT-93-2400, PT-02-030	100%, 100% N/A*, 100% 100%, 100%
Pressurizer Safety Valve Lines	4	5-29	UT-88-2316, UT-00-2383 UT-00-2384, UT-00-2385 UT-00-2429, RT-00-2099 PT-88-2309, PT-00-2089	100%, 100% 100%, 100% 100%, 100% 100%, 100%
		5-30	UT-96-2066, UT-96-2068 UT-96-2331, PT-96-2059	100%, 100% 100%, 100%
		5-31	UT-93-2223, UT-93-2438 UT-02-061, UT-02-062 UT-02-063, UT-02-064 PT-93-2199, PT-02-028	100%, 100% 93%, 100% 100%, 93% 100%, 100%
		5-32	UT-96-2067, UT-96-2069 PT-96-2059	100%, 100% 100%

* This exam was not required by ASME Code.
Non-heater nozzles are discussed separately and are described in Tables 2A, 2B, and 2C of Attachment 3.
Report number legend is: RT (radiographic testing), UT (ultrasonic testing), PT (penetrant testing), XX (year), XXXX (report number).

Table 1 – PVNGS Pressurizer Butt Weld NDE (continued)

Component	Total Nozzles	Weld ID	Examination Type/Report Number	Coverage Obtained
PRESSURIZER Unit 3				
Pressurizer Spray Line	1	005-33	UT-94-3194, RT-94-3076	100%, N/A*
Pressurizer Safety Valve Lines	4	5-29	UT-89-3463, UT-01-2375 PT-89-3442, PT-89-3608 PT-01-3272,	100%, 100% 100%, 100% 100%
		5-30	UT-97-3315, UT-97-3316 PT-97-3319	100%, 100% 100%
		5-31	UT-94-3081, UT-94-3082 PT-94-3019	100%, 100% 100%
		5-32	UT-97-3318, UT-97-3318	100%, 100%

* This exam was not required by ASME Code.
Non-heater nozzles are discussed separately and are described in Tables 2A, 2B, and 2C of Attachment 3
Report number legend is: RT (radiographic testing), UT (ultrasonic testing), PT (penetrant testing), XX (year), XXXX (report number)

NRC Required Information: 1(c)

A description of the Alloy 82/182/600 pressurizer penetration and steam space piping connection inspection program that will be implemented at your plant during the next and subsequent refueling outages. The description should include the areas, penetrations and steam space piping connections to be inspected; the extent (percentage) of coverage to be achieved for each location; inspection methods to be used; qualification standards for the inspection methods and personnel; the process used to resolve any inspection indications; 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 pressurizer penetrations and steam space piping connections. If leaking pressurizer penetrations or steam space piping connections are found, indicate what follow-up NDE will be performed to characterize flaws in the leaking penetrations. Provide your plans for expansion of the scope of NDE to be performed if circumferential flaws are found in any portion of the leaking pressurizer penetrations or steam space piping connections.

APS Response

In accordance with the ISI Program and the Boric Acid Corrosion Program described in the response to item 1(b), APS will be performing visual bare metal examinations of 100 percent of the circumference of each remaining Alloy 82/182/600 pressurizer penetration and steam space piping connection to detect evidence of possible through-wall leakage during refueling outages. The implementation of the Westinghouse Owners Group (WOG) recommendations into the APS program will include performing NDE capable of characterizing a flaw when NDE defines the flaw as a potential circumferential crack below the sleeve attachment weld. In addition, APS will inform the NRC staff if such an indication is found. Additionally, any scope expansion will be discussed with the NRC staff if circumferential PWSCC is observed in either the pressure boundary or non-pressure boundary portions of locations covered under the scope of NRC Bulletin 2004-01.

APS will continue performing NDE pipe weld examinations as required by the APS Section XI ISI Program. APS is also participating in the EPRI MRP A600 Program. The EPRI MRP A600 Program, in addition to performing butt weld examination assessments, is also reviewing the current Code required examination frequencies and is looking at possibly increasing the examination frequency for dissimilar metal butt welds containing Inconel 600 weld filler material. This work is presently ongoing and APS intends to follow the industry developed guidelines as a minimum for examining Alloy 600 butt welds.

Additionally, as stated in APS letter 102-05065 to NRC, dated March 9, 2004, APS will perform the required NDE on Unit 3 pressurizer heater sleeve A-3 during the Unit 3 fall 2004 refueling outage.

NRC Required Information: 1(d)

In light of the information discussed in this bulletin and your understanding of the relevance of recent industry operating experience to your facility, explain why the inspection program identified in your response to item (1)(c) above is adequate for the purpose of maintaining the integrity of your facility's RCPB and for meeting all applicable regulatory requirements which pertain to your facility.

APS Response

As described in the Applicable Regulatory Requirements section of Bulletin 2004-01, several provisions of the NRC regulations and facility operating licenses (Technical Specifications (TS)) pertain to reactor coolant pressure boundary (RCPB) integrity and the issues addressed by this Bulletin. The regulatory requirements include the general design criteria (GDC) for nuclear power plants (Appendix A to 10 CFR Part 50), the requirements of 10 CFR 50.55a, and the quality assurance criteria of Appendix B to 10 CFR Part 50. APS has effectively implemented comprehensive and aggressive inspection programs that contain all inspections required by these regulations as well as those required by the ASME Code and APS' regulatory commitments. APS' approach provides reasonable assurance that Palo Verde will continue to meet regulatory requirements for RCPB integrity.

The applicable GDCs include GDC 14 (Reactor coolant pressure boundary), GDC 31 (Fracture prevention of reactor coolant pressure boundary), and GDC 32 (Inspection of reactor coolant pressure boundary). GDC 14 specifies that the RCPB be designed, fabricated, erected, and tested 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 which are part of the RCPB have the capability of being periodically inspected to assess their structural and leak-tight integrity.

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"

- Technical Specifications

- 10 CFR 50.55a, Codes and Standards, which incorporates by reference Section XI, "Rules for In-Service 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 following information provides the basis for concluding that APS is meeting all regulatory requirements at the Palo Verde Nuclear Generating Station.

General Design Criteria (GDC):

GDC 14 specifies that the reactor coolant pressure boundary (RCPB) 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.

As part of the original design and licensing of PVNGS, APS demonstrated to the NRC that the design of the RCPB met these requirements. APS complied with these criteria in part by: 1) selecting Alloy 600 and other austenitic materials with excellent corrosion resistance and extremely high fracture toughness for reactor coolant pressure boundary materials; and 2) following ASME Codes and Standards and other applicable requirements for fabrication, erection, and testing of the pressure boundary components and piping. The requirements established for the design, fracture toughness, and inspectability in GDC 14, 31, and 32, respectively, were satisfied during the initial design and licensing phase, and continue to be satisfied during the operational phase. However, the industry, as well as APS, has recognized the susceptibility of Alloy 600 to Primary Water Stress Corrosion Cracking (PWSCC). As a result, APS has implemented additional inspection activities and long-term corrective actions. Therefore, in view of the inspection programs and long-term corrective action activities described throughout this response, there is reasonable assurance that the PVNGS units continue to meet regulatory requirements.

Technical Specifications:

The limits for 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 (gpm) 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 affected unit 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. In addition, inspections beyond those required by Section XI have been implemented to address the potential cracking associated with Alloy 600 PWSCC and boric acid corrosion. Therefore, the ASME Code Section XI requirements continue to be met.

Quality Assurance Requirements (10 CFR 50, Appendix B):

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. Criterion V states that activities affecting quality shall be prescribed by documented instructions, procedures, or drawings, of a type appropriate to the circumstances and shall be accomplished in accordance with these instructions, procedures, or drawings. APS complies with these standards on a programmatic basis.

Criterion XVI of Appendix B states that measures shall be established to assure that conditions adverse to quality are promptly identified and corrected. For significant conditions adverse to quality, the measures taken shall include a root cause of failure determination and appropriate corrective action to preclude repetition of the adverse conditions.

If any indication of leakage is detected during the inspections described in the response to Bulletin Item 1.A, corrective actions are required to be taken in accordance with the APS corrective action program and applicable 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 of failure analysis, will be taken.

In consideration of potential conditions adverse to quality, APS has been actively participating in industry organizations, such as the Westinghouse Owners Group and EPRI Material Reliability Program, and continues to monitor and evaluate industry operating experience. Therefore, 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.

Conclusion:

The inspection programs discussed in the responses to items 1(b) and 1(c) meet not only the applicable regulatory requirements, but are also responsive to new or developing industry issues involving PWSCC. The inspections performed by APS, as described in the responses to Bulletin Items 1(b) and 1(c), are capable of detecting through-wall leakage from any pressurizer penetration or steam space piping connection. Beginning at the next refueling outage, the APS programs discussed in the response to Bulletin Items 1(b) and 1(c) will include a visual bare metal examination of 100 percent of the circumference of each remaining Alloy 82/182/600 pressurizer penetration and steam space piping connection.

The APS programs and inspections discussed in the responses to this Bulletin are aggressive and comprehensive and as a result, provide reasonable assurance that the applicable regulatory requirements continue to be met.

NRC Required Information: 2

Within 60 days of plant restart following the next inspection of the Alloy 82/182/600 pressurizer penetrations and steam space piping connections, the subject PWR licensees should either:

a. submit to the NRC a statement indicating that the inspections described in the licensee's response to item (1)(c) of this bulletin were completed and a description of the as-found condition of the pressurizer shell, any findings of relevant indications of through-wall leakage, follow-up NDE performed to characterize flaws in leaking penetrations or steam space piping connections, a summary of all relevant indications found by NDE, a summary of the disposition of any findings of boric acid, and any corrective actions taken and/or repairs made as a result of the indications found,

   or

b. if the licensee was unable to complete the inspections described in response to item (1)(c) of this bulletin, 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 pressurizer shell, any findings of relevant indications of through-wall leakage, follow-up NDE performed to characterize flaws in leaking penetrations or steam space piping connections, a summary of all relevant indications found by NDE, a summary of the disposition of any findings of boric acid, and any corrective actions taken and/or repairs made as a result of the indications found. In addition, supplement the answer which you provided to item (1)(d) above to explain why the inspections that you completed were adequate for the purpose of maintaining the integrity of your facility's RCPB and for meeting all applicable regulatory requirements which pertain to your facility.

APS Response

APS will provide the information requested in NRC Bulletin 2004-01, Item 2, within 60 days of plant restart following the next inspection of alloy 82/182/600 pressurizer penetrations and steam space connections. A separate response will be provided for each unit.

Commitments

This Bulletin response contains the commitments listed in Attachment 1.

References:

1. NRC Bulletin 2004-01, "Inspection of Alloy 82/182/600 Materials Used in the Fabrication of Pressurizer Penetrations and Steam Space Piping Connections at Pressurized-Water Reactors", dated May 28, 2004.

2. APS letter 102-04551-CDM/SAB/RKB to NRC, "Request for Code Alternative for the use of Mechanical Nozzle Seal Assemblies – Relief Request No. 17", dated April 1, 2001.

3. NRC letter to APS, "Palo Verde Nuclear Generating Station Units 1, 2, and 3 - Request for Code Alternative for the use of Mechanical Nozzle Seal Assemblies – Relief Request No. 17 (TAC NOS. MB1618, MB 1619, and MB1620)", dated October 10, 2001.

4. APS letter 102-05065-CDM/SAB/RJR to NRC, "Pressurizer Heater Sleeve Leak Discussion Documentation", dated March 9, 2004.

5. NRC letter to APS, "Palo Verde Nuclear Generating Station, Units 1, 2, and 3 – Relief Request No. 23 RE: Alternative to Temper Bead Welding Requirements for Inservice Inspection Program (TAC NOS. MB8973, MB8974, and MB8975)", dated July 30, 2003.

6. Dominion Energy – Domination Generation letter MRP 2004-05, "Needed Action for Visual Inspection of Alloy 82/182 Butt Welds and Good Practice Recommendations for Weld Joint Configurations", dated April 2, 2004.

7. Nuclear Energy Institute (NEI) 03-08, "Guideline for the Management of Materials Issues", effective January 2, 2004.

8. Palo Verde Nuclear Generating Station Updated Final Safety Analysis Report, Revision 12.

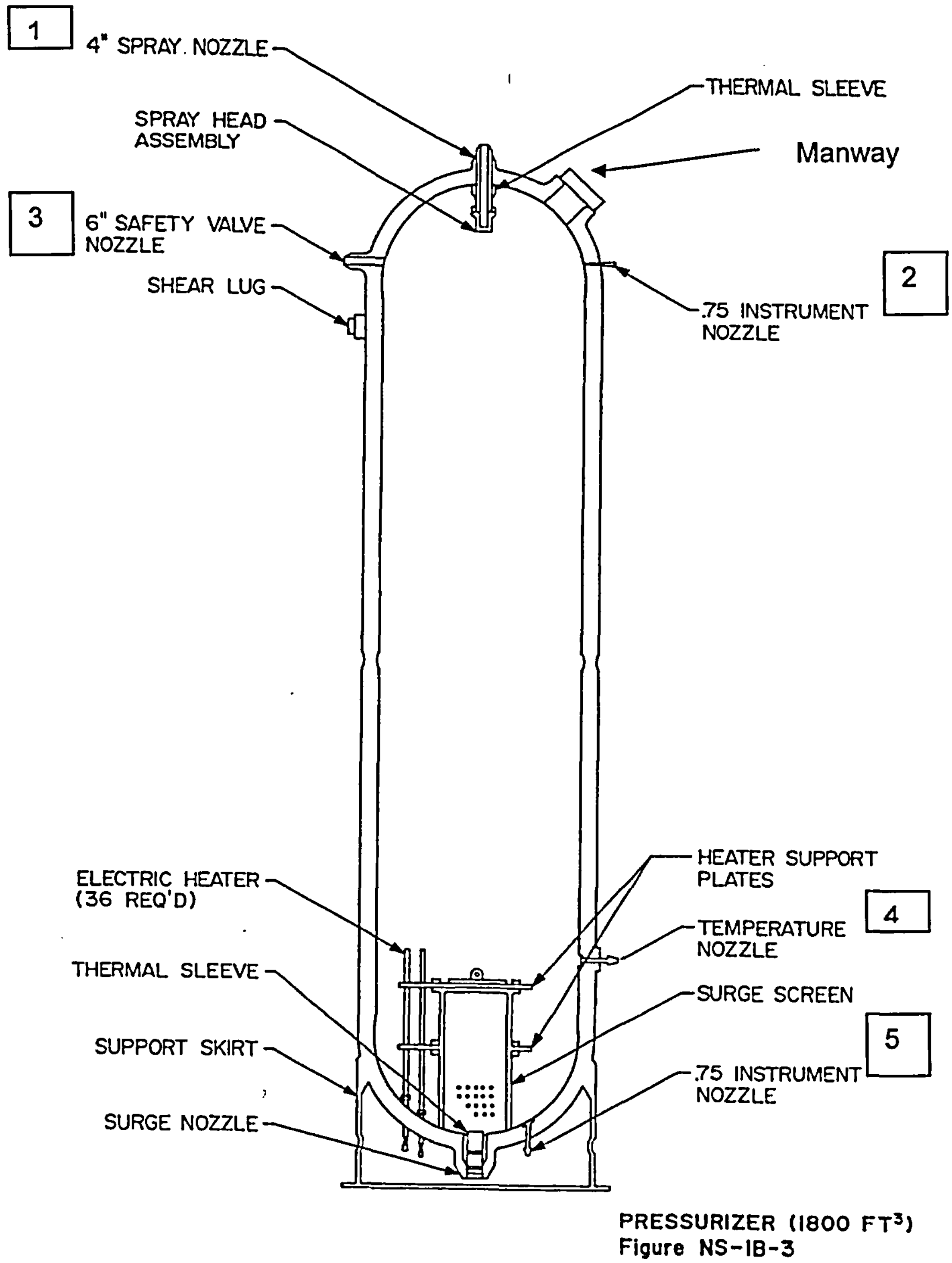
Attachment 1
List of Regulatory Commitments

Attachment 1
List of Regulatory Commitments

Regulatory Commitments	Due Date
APS will adopt the three elements of the proposed Westinghouse Owners Group (WOG) inspection program, as discussed in WOG letter WOG-04-057 to NRC, "WOG CE Fleet Pressurizer Heater Sleeve Inspection Program", dated January 30, 2004, during the next and subsequent planned refueling outages.	Completed - APS has been performing examinations which meet these expectations.
APS will provide the information requested in NRC Bulletin 2004-01, Item 2, within 60 days of plant restart following the next inspection of alloy 82/182/600 pressurizer penetrations and steam space connections. A separate response will be provided for each unit.	60 days following unit restart: Fall 2004 for Unit 3 Spring 2005 for Unit 2 Fall 2005 for Unit 1
APS will perform Non-Destructive Examination (NDE) capable of characterizing crack orientation on Unit 3 pressurizer heater sleeve A-3 during the Unit 3 fall 2004 refueling outage. This heater sleeve was repaired using a mechanical nozzle seal assembly (MNSA) during a previous forced outage in the first quarter of 2004 (refer to APS letter 102-05065-CDM/SAB/RJR to NRC, "Pressurizer Heater Sleeve Leak Discussion Documentation", dated March 9, 2004).	Fall 2004

Attachment 2
Typical Nozzle Arrangement

Attachment 2



Typical Nozzle Arrangement
Non-Heater Sleeve Nozzles are Numbered 1-5
(Refer to Attachment 3)

Attachment 3
Pressurizer Nozzle Configuration

Attachment 3
Pressurizer Nozzle Configuration

Table 2 - Original Pressurizer Nozzle Configuration

Nozzle #1	Nozzle #2	Nozzle #3	Nozzle #4	Nozzle #5
1 – 4" Carbon Steel Spray Nozzle, buttered with 182, PWHT, full penetration weld to SA-182, F316 safe-end using 182 filler, no final PWHT	4 - .75" Alloy 600 Instrument Nozzles, J-groove buttered with 182, PWHT, J-groove weld made with 82 filler, no final PWHT	4- 6" Carbon Steel Safety Valve Nozzles, buttered with 182, PWHT, full penetration weld to SA-182, F316 safe-end using 182 filler, no final PWHT	1 – 1.0" Alloy 600 Instrument Nozzle, J-groove buttered with 182, PWHT, J-groove weld made with 82 filler, no final PWHT	2 - .75" Alloy 600 Instrument Nozzles, J-groove buttered with 182, PWHT, J-groove weld made with 182 filler, no final PWHT

Table 2A – Current Unit 1 Pressurizer Nozzle Status

Nozzle #1	Nozzle #2	Nozzle #3	Nozzle #4	Nozzle #5
No changes	Nozzle changed to Alloy 690/Alloy 82 J-groove weld	No changes	Nozzle changed to Alloy 690/Alloy 82 J-groove weld	Nozzle changed to Alloy 690/Alloy 82 J-groove weld

Table 2B – Current Unit 2 Pressurizer Nozzle Status

Nozzle #1	Nozzle #2	Nozzle #3	Nozzle #4	Nozzle #5
No changes	Nozzle changed to Alloy 690/Alloy 52 J-groove weld	No changes	Nozzle changed to Alloy 690/Alloy 52 J-groove weld	Nozzle changed to Alloy 690/Alloy 52 J-groove weld

Table 2C – Current Unit 3 Pressurizer Nozzle Status

Nozzle #1	Nozzle #2	Nozzle #3	Nozzle #4	Nozzle #5
No changes	Nozzle changed to Alloy 690/Alloy 52 J-groove weld	No changes	Nozzle changed to Alloy 690/Alloy 52 J-groove weld	Nozzle changed to Alloy 690/Alloy 52 J-groove weld

Attachment 4
Pressurizer Heater Sleeve NDE Summary

Attachment 4

Pressurizer Heater Sleeve NDE Summary

U2 A6 Failed heater, leak discovered, eddy current testing identified a linear indication in the heater sleeve, plugged.

U2 A9 No leakage, eddy current testing prior to modification identified circumferential indication, repaired with ½ sleeve – pad.

U2 A12 No leakage, eddy current testing prior to modification identified circumferential indication, repaired with ½ sleeve – pad.

U2 A15 No leakage, eddy current testing prior to modification identified circumferential indication, repaired with ½ sleeve – pad.

U2 A18 No leakage, eddy current testing prior to modification identified axial indication, repaired with ½ sleeve – pad.

U2 B2 No leakage, eddy current testing prior to modification identified circumferential indication, repaired with ½ sleeve – pad.

U2 B3 No leakage, eddy current testing prior to modification identified circumferential and axial indications, repaired with ½ sleeve – pad.

U2 B5 No leakage, eddy current testing prior to modification identified circumferential indication, repaired with ½ sleeve – pad.

U2 B6 No leakage, eddy current testing prior to modification identified circumferential indication, repaired with ½ sleeve – pad.

U2 B7 No leakage, eddy current testing prior to modification identified axial indication, repaired with ½ sleeve – pad.

U2 B11 No leakage, eddy current testing prior to modification identified axial indication, repaired with ½ sleeve – pad.

U2 B13 No leakage, eddy current testing prior to modification identified axial indications (2), repaired with ½ sleeve – pad.

U2 B14 No leakage, eddy current testing prior to modification identified axial indication, repaired with ½ sleeve – pad.

U2 B18 Failed heater, no leak, eddy current testing identified a linear indication in the heater sleeve, plugged.

Attachment 4 (continued)

U3 A1 Leak discovered, NDE found axial orientated PWSCC, repaired with MNSA.

U3 A3 Leak discovered, no NDE performed, repaired with MNSA. APS will perform NDE to characterize the suspected flaw during the Unit 3 fall 2004 refueling outage.