A subsidiary of Pinnacle West Capital Corporation

Palo Verde Nuclear Generating Station

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102-06279-JHH/GAM
November 10, 2010

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

Dear Sirs:

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Units 1, 2, and 3
Docket Nos. STN 50-528, 50-529 and 50-530
Response to Draft Request for Additional Information for the Review of the PVNGS License Renewal Application (LRA), and LRA Amendment No. 26

In a conference call on October 28, 2010, the NRC staff discussed with APS a draft follow-up RAI B2.1.18-1 regarding buried piping inspections related to the PVNGS license renewal application (LRA). Enclosure 1 contains APS's responses to the draft RAIs.

Enclosure 2 contains LRA Amendment No. 26 to reflect the following changes:

- Revised LRA Section 3.1.2.1.4, Tables 3.1.1 and 3.1.2-4, and Sections A1.8 and B2.1.8, to correct the aging effect for Steam Generator tubes to be consistent with Generic Aging Lessons Learned (GALL) Report line IV.D1-19.

- Updated LRA Sections A1.10 and B2.1.10, and Commitment No. 12 in Table A4-1, to reflect the completion of the enhancement to the Closed-Cycle Cooling Water System aging management program.

- Revised LRA Sections A1.18 and B2.1 18, and Commitment No. 20 in Table A4-1, to specify that one of the cathodically-protected steel piping inspections will be performed on the diesel generator fuel oil piping. This is also discussed in the response to draft follow-up RAI B2.1.18-1 in Enclosure 1.

- Clarified Commitment No. 34 in Table A4-1 to provide examples of industry codes, standards, and guidelines to be consistent with the APS Response to Follow-up RAI B2.1.32-2 in letter no. 102-06194, dated May 21, 2010.

A138
NRR

- Updated Commitment No. 51 in Table A4-1 to reflect the completion of the reactor head replacement in all three PVNGS units.

- Updated Commitment No. 54 in Table A4-1 to reflect the completion of draining the abandoned spray chemical addition tanks in all three PVNGS units.

Enclosure 3 contains an updated listing of the LRA Table A4-1 commitments reflecting all LRA amendments to date.

Should you need further information regarding this submittal, please contact Glenn Michael, Licensing Engineer for License Renewal, at (623) 393-5750.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on 11/10/10
(date)

Sincerely,

JHH/RAS/GAM/gat

Enclosures:

1. Response to Draft Request for Additional Information for the Review of the PVNGS License Renewal Application

2. Palo Verde Nuclear Generating Station License Renewal Application Amendment No. 26

3. Updated Listing of the PVNGS License Renewal Application Table A4-1 Commitments

cc:

E. E. Collins Jr.	NRC Region IV Regional Administrator
J. R. Hall	NRC NRR Senior Project Manager
L. K. Gibson	NRC NRR Project Manager
J. H. Bashore	NRC Senior Resident Inspector (acting) for PVNGS
L. M. Regner	NRC License Renewal Project Manager
G. A. Pick	NRC Region IV (electronic)

ENCLOSURE 1

Response to Draft Request for Additional Information for the Review of the PVNGS License Renewal Application

NRC Draft Follow-up RAI B2.1.18-1

1. Justify why the inspections of in-scope diesel fuel oil piping, discussed in a letter from APS dated October 13, 2010, is not included in the Updated Final Safety Analysis Report Supplement, Appendix A of the LRA?

2. How many feet of in-scope buried fuel oil piping is located at each unit? How many feet of in-scope buried diesel fuel oil piping is not under concrete or asphalt?

3. Justify how aging of underground buried fuel oil piping will be managed in the 30 – 40 year, 40 – 50 year, and 50 – 60 year license renewal periods?

APS Response to Draft Follow-up RAI B2.1.18-1

Response (1)

Response (2) to Follow-up RAI B2.1.18-1 in letter no. 102-06263, dated October 13, 2010, stated that as part of APS's participation in the Nuclear Energy Institute (NEI) 09-14 buried piping integrity initiative, a 10-foot section of diesel generator fuel oil piping at one of the three PVNGS units will be excavated and inspected prior to 2015. LRA Sections A1.18 and B2.1.18, and Commitment No. 20 in Table A4-1 have been revised, as shown in Enclosure 2, to include this inspection to be performed between January 1, 2012 and December 31, 2015.

Response (2)

Subsequent to submitting letter no. 102-06263, dated October 13, 2010, a more detailed estimate of the buried diesel generator fuel oil piping length was performed based on a review of underground utility drawings and a plant walk down. The following buried diesel generator fuel oil piping lengths are estimated (all values are approximate):

- 1697 feet of in-scope buried diesel generator fuel oil system piping in all three units.
    - 633 feet in Unit 1.
    - 637 feet in Unit 2.
    - 427 feet in Unit 3.

- 95% of the in-scope buried diesel generator fuel oil system piping is under asphalt or concrete (65% [1112 feet] is under asphalt and the remaining 30% [503 feet] is under reinforced concrete)

- 5% (82 feet) of the in-scope buried diesel generator fuel oil system piping is not under concrete or asphalt.
    - 22 feet of 2½ inch pipe and 40 feet of 2 inch pipe in Unit 1.
    - None in Unit 2 (all piping under concrete or asphalt).
    - 9 feet of 2½ inch pipe and 11 feet of 2 inch pipe in Unit 3.

Response (3)

LRA Sections A1.18 and B2.1.18, and Commitment No. 20 in Table A4-1 have been revised, as shown in Enclosure 2, to specify that in one of the units, at least one of the two cathodically-protected steel piping inspections will be performed on diesel generator fuel oil piping. The initial diesel generator fuel oil piping inspection will be performed between January 1, 2012 and December 31, 2015, which is intended to accommodate aging management of the underground buried fuel oil piping for the 30 – 40 year period (e.g., 2015 – 2025 for Unit 1). Aging of underground buried fuel oil piping will be managed in the 40 – 50 year, and 50 – 60 year license renewal periods by the commitment to perform at least one of the two cathodically-protected steel piping inspections in one unit in each of these periods on diesel generator fuel oil piping.

ENCLOSURE 2

Palo Verde Nuclear Generating Station
License Renewal Application
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LRA Section	Page No.
3.1.2.1.4	3.1-6
Table 3.1.1	3.1-37
Table 3.1.2-4	3.1-92
A1.8	A-5
A1.10	A-6
A1.18	A-9, 10
Table A4-1, Item 12	A-44
Table A4-1, Item 20	A-47
Table A4-1, Item 34	A-54
Table A4-1, Item 51	A-58
Table A4-1, Item 54	A-58
B2.1.8	B-28, 29, 30
B2.1.10	B-34,35, 36, 37, 38
B2.1.18	B-52,53, 54

Palo Verde Nuclear Generating Station
License Renewal Application
Amendment 26

Revision to correct the aging effect for Steam Generator tubes to be consistent with GALL line IV.D1-19

Section 3.1.2.1.4, Steam Generators (page 3.1-6) is revised as follows (deleted text show with strikethrough)

Aging Effects Requiring Management

The following steam generator aging effects require management:

- Cracking
- ~~Denting~~
- Cumulative fatigue damage
- Loss of material
- Loss of preload
- Wall Thinning

Palo Verde Nuclear Generating Station
License Renewal Application
Amendment 26

Revision to correct the aging effect for Steam Generator tubes to be consistent with GALL line IV.D1-19

Table 3.1.1, Summary of Aging Management Evaluations in Chapter IV of NUREG-1801 for Reactor Vessel, Internals, and Reactor Coolant System, (page 3.1-37) is revised as follows (new text underlined and deleted text shown with strikethrough)

Table 3.1.1 Summary of Aging Management Evaluations in Chapter VII of NUREG-1801 for Auxiliary Systems (Continued)

Item Number	Component Type	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.1.1.79	Nickel alloy steam generator tubes exposed to secondary feedwater/steam	Denting due to corrosion of steel tube support plate	Steam Generator Tube Integrity (B2.1.8); Water Chemistry (B2.1.2) and, for plants that could experience denting at the upper supports, evaluate potential for rapidly propagating cracks and then develop and take corrective actions consistent with Bulletin 88-02	No	~~Consistent with NUREG-1801~~ Not applicable. Palo Verde does not have a carbon steel tube support system so denting is not an applicable aging effect. The Palo Verde steam generator tube support system is fabricated from 409 ferritic stainless steel.

Palo Verde Nuclear Generating Station
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Revision to correct the aging effect for Steam Generator tubes to be consistent with GALL line IV.D1-19

Table 3.1.2-4, Reactor Vessel, Internals, and Reactor Coolant System - Summary of Aging Management Evaluation – Steam Generators, (page 3.1-92) is revised as follows (deleted text shown strikethrough and new text underlined)

Table 3.1.2-4 Reactor Vessel, Internals, and Reactor Coolant System - Summary of Aging Management Evaluation – Steam Generators

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
~~SG Tubes~~	~~HT, PB~~	~~Nickel Alloys~~	~~Secondary Water (Ext)~~	~~Denting~~	~~Steam Generator Tube Integrity (B2.1.8) and Water Chemistry (B2.1.2)~~	~~IV.D1-19~~	~~3.1.1.79~~	~~A~~

A1.8 STEAM GENERATOR TUBE INTEGRITY

The Steam Generator Tube Integrity program includes the preventive measures, condition monitoring inspections, degradation assessment, repair and leakage monitoring activities necessary to manage cracking, ~~denting,~~ wall thinning, and loss of material. The aging management measures employed include: non-destructive examination, visual inspection, sludge removal, tube plugging, in-situ pressure testing, maintaining the chemistry environment by removal of impurities, and addition of chemicals to control pH and oxygen.

NDE inspection scope and frequency, and primary to secondary leak rate monitoring are conducted consistent with the requirements of the PVNGS Units 1, 2, and 3 Technical Specifications. PVNGS evaluates tube integrity in accordance with the structural integrity performance criteria specified in Technical Specifications which encompasses and exceeds the requirements of Regulatory Guide 1.121. In addition, Technical Specifications include accident induced leakage performance criterion and operational leakage performance criterion. The PVNGS steam generator management practices are consistent with NEI 97-06, "*Steam Generator Program Guidelines*".

A1.10 CLOSED CYCLE COOLING WATER SYSTEM

The Closed-Cycle Cooling Water System program manages loss of material, cracking, and reduction in heat transfer for components in closed cycle cooling water systems. The program includes maintenance of system corrosion inhibitor concentrations and chemistry parameters following the guidance of EPRI TR-107396 to minimize aging, and periodic testing and inspections to evaluate system and component performance. Inspection methods include visual, ultrasonic testing and eddy current testing.

~~Prior to the period of extended operation, procedures will be enhanced to incorporate the guidance of EPRI TR-107396 with respect to water chemistry control for frequency of sampling and analysis, normal operating limits, action level concentrations, and times for implementing corrective actions upon attainment of action levels.~~

A1.18 BURIED PIPING AND TANKS INSPECTION

The Buried Piping and Tanks Inspection program manages loss of material of buried components in the chemical and volume control, condensate storage and transfer, diesel fuel storage and transfer, domestic water, fire protection, SBOG fuel system, service gas and essential spray ponds systems. Visual inspections monitor the condition of protective coatings and wrappings found on carbon steel, gray cast iron or ductile iron components and assess the condition of stainless steel components with no protective coatings or wraps. The program includes opportunistic inspection of buried piping and tanks as they are excavated or on a planned basis if opportunistic inspections have not occurred.

The Buried Piping and Tanks Inspection program is a new program that will be implemented prior to the period of extended of operation. Industry and plant-specific operating experience will be evaluated in the development and implementation of this program.

Within the ten year period prior to entering the period of extended operation an opportunistic or planned inspection of buried tanks at the Palo Verde site will be performed.

The visual inspections noted below of piping in a soil environment within the scope of license renewal will be conducted within the ten-year period prior to entering the period of extended operation, and during each ten year period after entering the period of extended operation, except the initial diesel generator fuel oil piping inspection will be performed between January 1, 2012 and December 31, 2015. Each inspection will:

- select accessible locations where degradation is expected to be high;
- excavate and visually inspect the circumference of the pipe; and
- examine at least ten feet of pipe.

a. Metallic Piping not Cathodically-Protected

   At least two excavations and visual inspections of stainless steel piping will be conducted in each unit. Stainless steel piping within the scope of license renewal exists in the following systems:

   - Chemical and Volume Control (CH),
   - Condensate Transfer and Storage (CT), and
   - Fire Protection (FP).

b. Steel Piping Cathodically-Protected

   At least two excavations and visual inspections of cathodically-protected steel piping will be conducted in each unit. In one of the units, at least one of these inspections will be performed on diesel generator fuel oil piping.

c. Steel Piping with Potentially Degraded Cathodic Protection

   At least three excavations and visual inspections of fire protection steel piping with potentially degraded bonding straps will be conducted at the Palo Verde site.

Prior to the period of extended operation, the Buried Piping and Tanks Inspection program will include provisions to (1) ensure electrical power is maintained to the cathodic protection system for in-scope buried piping at least 90% of the time (e.g., monthly verification that the power supply circuit breakers are closed or other verification that power is being provided to the system), and (2) ensure that the National Association of Corrosion Engineers (NACE) cathodic protection system surveys are performed at least annually.

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LRA Table A4-1, License Renewal Commitment No. 12 is revised as follows (deleted text shown in strikethrough and new text underlined):

Item No.	Commitment	LRA Section	Implementation Schedule
12	Existing Closed-Cycle Cooling Water System program is credited for license renewal~~, AND~~ ~~Prior to the period of extended operation, procedures will be enhanced to incorporate the guidance of EPRI TR-107396 with respect to water chemistry control for frequency of sampling and analysis, normal operating limits, action level concentrations, and times for implementing corrective actions upon attainment of action levels~~. (RCTSAI 3246899)	A1.10 B2.1.10 Closed-Cycle Cooling Water System	~~Prior to the period of extended operation~~[1] Ongoing.

Palo Verde Nuclear Generating Station
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LRA Table A4-1, License Renewal Commitment No. 20 is revised as follows (new text underlined):

Item No.	Commitment	LRA Section	Implementation Schedule
20	The Buried Piping and Tanks Inspection program is a new program that will be implemented prior to the period of extended operation. Within the ten year period prior to entering the period of extended operation an opportunistic or planned inspection of buried tanks at the Palo Verde site will be performed. The visual inspections noted below of piping in a soil environment within the scope of license renewal will be conducted within the ten-year period prior to entering the period of extended operation, and during each ten year period after entering the period of extended operation, <u>except the initial diesel generator fuel oil piping inspection will be performed between January 1, 2012 and December 31, 2015</u>. Each inspection will: • select accessible locations where degradation is expected to be high; • excavate and visually inspect the circumference of the pipe; and • examine at least ten feet of pipe. a. Metallic Piping not Cathodically-Protected At least two excavations and visual inspections of stainless steel piping will be conducted in each unit. Stainless steel piping within the scope of license renewal exists in the following systems: o Chemical and Volume Control (CH),	A1.18 B2.1.18 Buried Piping And Tanks Inspection	Perform the buried piping and tanks inspections within the ten year period prior to the period of extended operation[1], <u>except the initial diesel generator fuel oil piping inspection will be performed between 1/1/12 and 12/31/15.</u> AND Perform the buried piping inspections during each ten year period after entering the period of extended operation. AND Implement the additional

Item No.	Commitment	LRA Section	Implementation Schedule
	o Condensate Transfer and Storage (CT), and o Fire Protection (FP). b. Steel Piping Cathodically-Protected At least two excavations and visual inspections of cathodically-protected steel piping will be conducted in each unit. In one of the units, at least one of these inspections will be performed on diesel generator fuel oil piping. c. Steel Piping with Potentially Degraded Cathodic Protection At least three excavations and visual inspections of fire protection steel piping with potentially degraded bonding straps will be conducted at the Palo Verde site. Prior to the period of extended operation, the Buried Piping and Tanks Inspection program will include provisions to (1) ensure electrical power is maintained to the cathodic protection system for in-scope buried piping at least 90% of the time (e.g., monthly verification that the power supply circuit breakers are closed or other verification that power is being provided to the system), and (2) ensure that the National Association of Corrosion Engineers (NACE) cathodic protection system surveys are performed at least annually. (RCTSAIs 3246909 [U1]; 3247263 [U2]; 3247264 [U3])		enhancements to the buried piping and tanks inspection program prior to the period of operation[1].

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LRA Table A4-1, License Renewal Commitment No. 34 is revised as follows (*new text underlined*):

Item No.	Commitment	LRA Section	Implementation Schedule

34	Existing Structures Monitoring Program is credited for license renewal, AND
	Prior to the period of extended operation:
	• The Structures Monitoring Program will be enhanced to specify ACI 349.3R-96 as the reference for qualification of personnel to inspect structures under the Structures Monitoring Program.
	• For structures within the scope of license renewal, the Structures Monitoring Program will be enhanced to establish the frequency of inspection for each unit at a 5 year interval, with the exception of exterior surfaces of the following nonsafety-related structures, below-grade structures, and structures within a controlled interior environment, which will be inspected at an interval of 10 years:
	  • Fire Pump House (Yard Structures)
	  • Radwaste Building
	  • Station Blackout Generator Structures
	  • Turbine Building
	  • Non-Safety Related Tank Foundations and Shells
	  • Non-Safety Related Transformer Foundations and Electrical Structures
	• The Structures Monitoring Program will be enhanced to quantify the acceptance criteria and critical parameters for monitoring degradation, and to provide guidance for identifying unacceptable conditions requiring further technical evaluation or corrective action. Procedures will also be enhanced to incorporate applicable industry codes, standards and guidelines <u>(e.g., ACI 349.3R-96, ANSI/ASCE 11-90, etc.)</u> for acceptance criteria.
	(RCTSAI 3246927)
		A1.32
		B2.1.32
		Structures Monitoring Program
			Prior to the period of extended operation[1].

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LRA Table A4-1, License Renewal Commitment No. 51 is revised as follows (deleted text shown in strikethrough and new text underlined):

Item No.	Commitment	LRA Section	Implementation Schedule
51	~~The original Unit 3 reactor pressure vessel (RPV) head is planned to be replaced during the fall refueling outage in 2010. All components penetrating the new heads and welds including the head vent will be replaced with Alloy 690. The Unit 2 RPV head was replaced during 2R15 outage in fall 2009, and the Unit 1 RPV head was replaced during 1R15 in spring 2010.~~ Completed (RCTSAI 3410460)	~~B2.1.34 Nickel Alloy Aging Management Program~~	~~12/31/10~~

LRA Table A4-1, License Renewal Commitment No. 54 is revised as follows (deleted text shown in strikethrough and new text underlined):

Item No.	**Commitment**	LRA Section	Implementation Schedule
54	~~By November 30, 2010, APS will ensure that the abandoned containment spray chemical addition tanks and associated piping components in PVNGS Units 1, 2, and 3 are drained to preclude any spatial interactions with safety related components.~~ Completed (RCTSAI 3443855)	~~APS letter no. 102-06243, dated 8/27/10~~	~~11/30/10~~

B2.1.8 STEAM GENERATOR TUBE INTEGRITY

Program Description

The scope of the Steam Generator Tube Integrity program includes the preventive measures, degradation assessment, steam generator inspection, integrity assessment, primary and secondary chemistry controls, leakage monitoring, and required maintenance and repair activities necessary to manage cracking, ~~denting,~~ wall thinning, and loss of material. The aging management measures employed include, non-destructive examination, visual inspection, sludge removal, tube plugging, in-situ pressure testing and maintaining the chemistry environment by removal of impurities and addition of chemicals to control pH and oxygen. Non-destructive Examination (NDE) inspection scope and frequency, and primary to secondary leak rate monitoring are conducted consistent with the requirements of PVNGS Technical Specifications. PVNGS evaluates tube integrity in accordance with the structural integrity performance criteria specified in Technical Specifications which encompasses and exceeds the requirements of Regulatory Guide 1.121. In addition, Technical Specifications include accident induced leakage performance criterion and operational leakage performance criterion. The steam generator management practices are consistent with NEI 97-06, "*Steam Generator Program Guidelines*".

Guidance for steam generator management is specified in station procedures. This guidance is consistent with the PVNGS Technical Specification requirements for steam generator tube integrity and primary to secondary leakage limits. The PVNGS steam generator inspection frequency is evaluated as part of the Degradation Assessment performed prior to each inservice inspection consistent with the Technical Specification requirements for the observed degradation mechanism. Plugging criteria for removing tubes from service are consistent with Technical Specifications.

Tube support degradation is monitored by the presence of normal support signals at expected tube locations and by visual inspection of the secondary side. The PVNGS steam generator management procedure specifies that steam generators will be visually inspected, as required, on the secondary side at the accessible portions of the following locations: tube sheet region, both hot and cold leg, tube supports, flow distribution plate, and upper steam drum internals.

Aging management activities for steam generator tubing integrity are controlled by station procedures. The steam generators are also monitored under the Maintenance Rule (10 CFR 50.65) as implemented by station procedures. The Steam Generator Tube Integrity program was developed from and is consistent with NEI 97-06, "*Steam Generator Program Guidelines*". PVNGS procedural guidance includes performance criteria for tube structural integrity, operational leakage and accident induced leakage that are consistent with NEI 97-06 and the PVNGS Technical Specifications. Procedural guidelines are also provided for monitoring and maintenance including plugging criteria, plug inspection requirements and inspection requirements for tube supports. The training and qualification standards for personnel engaged in the acquisition and/or evaluation of steam generator NDE activities are specified in a station administrative procedure, and inspection practices are consistent with EPRI 1013706, "*PWR Steam Generator Examination Guidelines*". PVNGS programmatic guidance also requires that each inspection be based on a degradation assessment that considers active, relevant and potential damage mechanisms.

NUREG-1801 Consistency

The Steam Generator Tube Integrity program is an existing program that is consistent with NUREG-1801, Section XI.M19, "Steam Generator Tube Integrity".

Exceptions to NUREG-1801

None

Enhancements

None

Operating Experience

The Steam Generator Tube Integrity program has been developed to be consistent with NEI 97-06, and it benefits from the industry operating experience available when the initiative was issued as well as the EPRI guidelines it endorses. Station procedural guidance requires that the Steam Generator Degradation Assessment for PVNGS be updated every operating cycle to incorporate the latest industry and plant-specific experience regarding steam generator degradation mechanisms.

NRC Information Notice 97-88 addressed the importance of recognizing the potential for degradation in areas that have not previously experienced tube degradation and the importance of licensees to assess the significance of indications with respect to the qualification of the inspection techniques and the manner in which the indications were detected. The PVNGS Steam Generator Degradation Assessment evaluates industry experience as well as PVNGS experience to identify active, relevant and potential tube damage mechanisms. The inspection sample size, location and method are developed to fully address active mechanisms and provide assurance that relevant and potential mechanisms will be identified if they become active at PVNGS. The inspection expansion criteria take into account both increasing the area inspected when degradation is found and changing the technology used to accurately examine ambiguous or unexpected degradation.

PVNGS Units 1, 2 and 3 are two loop Combustion Engineering (CE) plants with two identical replacement steam generators designed by ABB/CE which are considered a modified CE System 80 design. The original steam generators were replaced in Units 1, 2, and 3 during the fall of 2005, 2003, and 2007, respectively. Each steam generator has a total of 12,580 Alloy 690 thermally treated tubes. The tubes are hydraulically expanded into the tubesheet for the entire tubesheet thickness. The tube support system is similar to the original design, and like the original design is fabricated from 409 ferritic stainless steel. To minimize the potential for stress corrosion cracking, in addition to the tubing material change, the U-bend region in the first 17 rows were stress relieved after bending.

Industry experience has shown that tube damage in replacement steam generators typically occurs from loose parts and support wear.

Wear is the only active damage mechanism in the PVNGS Replacement Steam Generators (RSGs) and specifically wear as the result of interaction of tubing with the tube supports. Most

of the wear indications have been observed in a region around the stay cylinder and at either the Diagonal Supports or Vertical Supports (Primarily VS3).

As of the end of the U1R14, U2R15 and U3R14 outages no corrosion degradation has been detected in any of the PVNGS replacement steam generator tubes.

Due to certain historically observed wear phenomenon, PVNGS has employed conservative administrative plugging criteria related to support wear mechanisms. For example, support wear indications are removed for wear rate greater than or equal to 35% for a normal operating cycle if no previous wear is identified. This plugging criterion is designed to ensure that the structural and accident leakage performance criteria specified in the PVNGS Technical Specifications are not exceeded in the subsequent operating cycle. It was expected, based on RSG redesign, that the conditions necessary to generate high wear rates in the Batwing Stay Cylinder (BWSC) and Cold Leg Corner (CLC) regions were eliminated. While this was clearly the case for CLC wear, the RSG inspection results during the initial inspection in Unit 2 (U2R12) indicated that the RSG's continued to exhibit similar wear conditions within the BWSC region. As a result of these findings, a decision was made prior to Unit 1 and Unit 3 RSG installation to plug and stake all of the "frontline" BWSC tubes. The subsequent inspections during U2R13, U1R13, U2R14, U1R14, U3R14 and U2R15 have indicated that the BWSC wear issue exists in the RSG's of all 3 PVNGS units.

On February 19, 2004 Unit 2 was operating at full power when radiation monitors displayed indications of a low level primary to secondary leak. Shortly thereafter the leak rate was calculated to be 11.8 gallons per day, even though grab samples indicated 3 gallons per day, and the decision was made to shut the unit down to find and repair the leak.

After cooling the plant down and performing tests, one SG tube was found to be leaking and was plugged. Further analysis showed that the cause of the leak was from a puncture received from a wood screw that was used in the construction of the shipping crates for the tubes when the steam generators were being manufactured. The tubes were placed in the crate and the crate assembled around them. One screw that was used near the outer diameter of the top of the tube bend protruded through the wood and began to puncture the tube material. The screw did not completely penetrate the tube and the unit was operated from its post-outage startup to this date when the tube finally began leaking. Contamination to the secondary plant was minimal and the unit entered Mode 1 on March 9, 2004. Corrective actions put in place after the event prevented recurrence in the Unit 1 and 3 replacement steam generators.

Conclusion

The continued implementation of the Steam Generator Tube Integrity program provides reasonable assurance that aging effects will be managed such that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B2.1.10 Closed-Cycle Cooling Water System

Program Description

The Closed-Cycle Cooling Water (CCCW) System program manages loss of material, cracking, and reduction in heat transfer for components in the following closed cycle cooling water systems:

- Diesel Generator Jacket Water System
- Essential Chilled Water System
- Essential Cooling Water System
- Normal Chilled Water System
- Nuclear Cooling Water System

The CCCW systems serve heat exchangers and related components that are within the scope of license renewal in the following interfacing systems:

- Auxiliary Steam System
- Chemical and Volume Control System
- Spent Fuel Pool Cooling and Clean Up System
- Reactor Coolant System
- Secondary Chemical Control System
- Safety Injection and Shutdown Cooling System
- Nuclear Sampling System
- Auxiliary Building HVAC
- Containment Building HVAC
- Control Building HVAC

The program includes (a) maintenance of system corrosion inhibitor concentrations to minimize aging effects and (b) periodic testing and inspections to evaluate system and component performance. The water chemistry aspect of the program maintains an environment within CCCW systems that is consistent with the parameters specified in EPRI TR-107396 for CCCW system. Water chemistry is maintained through the addition of an iron corrosion inhibitor (nitrite), a copper corrosion inhibitor (tolyltriazole - TTA), pH control and biocide (glutaraldehyde). System corrosion inhibitor concentrations are maintained at levels described in EPRI TR-107396 to minimize aging effects. Testing and inspections are performed in accordance with guidance in EPRI TR 107396 for closed-cycle cooling water (CCCW) systems as appropriate for their license renewal intended functions; for example, components which do not have a license renewal heat transfer function, but which are evaluated as having a license renewal intended function of pressure boundary or leakage

barrier are not subject to internal inspection or performance testing. The effectiveness of water chemistry control measures of these heat exchangers is verified by visual inspection of the internal surfaces of selected components fabricated of similar materials and exposed to closed-cycle water using the same corrosion inhibitor program. Inspection processes include visual, eddy-current and ultrasonic methods. Testing methods include functional demonstrations and monitoring, thermal and hydraulic performance testing.

NUREG-1801 Consistency

The Closed-Cycle Cooling Water System program is an existing program that~~, following enhancement, will be~~ is consistent with exception to NUREG-1801, Section XI.M21, "Closed-Cycle Cooling Water."

Exceptions to NUREG-1801

Program Elements Affected

Preventive Actions - Element 2

NUREG-1801, Section XI.M21, Element 2, requires materials used in CCCW systems to be appropriate to the type of service. The essential cooling water system for each unit is provided with two radiation monitors (one per train) that employ an aluminum "window" as a pressure boundary between the CCCW and the ionization detector within the flow-through sample chambers. The chemical treatment program at PVNGS does not include controls described in EPRI TR-107396 as appropriate for aluminum. Exception is taken to employ the NUREG 1801 AMP XI.M38 Internal Surfaces Monitoring Program to manage the aging of the aluminum "windows" of the radiation monitors. A review of plant operating experience reveals no instances where aging effects have led to the loss of the intended function of the subject components.

Parameters Monitored or Inspected - Element 3 and Monitoring and Trending – Element 5

NUREG-1801, Section XI.M21, Element 3 requires testing and inspection as described in EPRI TR-107396 and further states "For pumps, the parameters monitored include flow, discharge pressures, and suction pressures and for heat exchangers, the parameters monitored include flow, inlet and outlet temperatures, and differential pressure" and Element 5 states "visual inspections and performance/functional tests are to be performed to confirm the effectiveness of the program." PVNGS monitors system parameters and performs a combination of visual inspections, non-destructive evaluations, performance and functional tests as well as thermal performance tests as described in EPRI TR-107396 Section 8.4 to confirm the effectiveness of the CCCW program in managing the aging of components and systems exposed to CCCW. Plant configuration constraints and consideration of components which do not have a license renewal heat transfer function, but which are evaluated as having a license renewal intended function of pressure boundary or leakage barrier have led to several exceptions with respect to some measures set forth in NUREG-1801 with respect to testing and inspection specifics that together do not compromise the ability to monitor program effectiveness to ensure the component intended functions are maintained. Specific exceptions taken include:

a.) The essential cooling water, spent fuel cooling and cleanup, and shutdown cooling heat exchangers are not monitored for differential pressure. The program of periodic sampling and maintenance of system chemistry together with thermal performance testing in conformance with

EPRI NR-7552, and, in the case of the essential cooling water heat exchanger, periodic ECT of the heat exchanger tubes and, in the case of the spent fuel cooling and cleanup heat exchanger, periodic NDE of the heat exchanger shell are adequate to ensure that component intended functions of pressure boundary and heat transfer are maintained.

b.) The essential chilled water and essential cooling water system circulating water pumps are not subject to periodic internal visual inspection or casing NDE. These pumps are monitored for flow, suction pressure and discharge pressure in accordance with the approved ASME Pump and Valve In-Service Testing Program. The performance monitoring of these pumps together with periodic sampling and control of water chemistry is adequate to ensure component intended function is maintained.

c.) The essential chilled water system chiller condenser, water cooler and lube oil cooler are not individually monitored for flow, inlet and outlet temperatures, and differential pressure. During periodic surveillance testing, the heat load on the essential chilled water system is not reproducible from test-to-test. Plant procedures require that these components are subject to visual inspection when their respective chiller is rebuilt. Visual inspection together with the periodic sampling and control of system water chemistry is adequate to ensure the component intended functions are maintained.

d.) The individual ventilation cooling coils served by the essential chilled water system are not monitored for differential pressure and, additionally are not subject to visual inspection of their internal surfaces or NDE because the internal diameter and geometry of the coils preclude effective internal inspection. The combination of chemistry control, preventive maintenance, air side inspection, and testing of a control room air filtration unit in each train provides reasonable assurance that essential auxiliary building HVAC and control building HVAC system cooling coil performance has not degraded. A review of plant operating experience reveals no instances where aging effects have led to the loss of the intended function of the subject components.

e.) The diesel generator jacket water engine-driven circulating water pump, the motor-driven circulating water pump, the jacket water heat exchanger, turbo air intercooler, turbocharger and governor lube oil cooler are not individually monitored for flow, inlet and outlet temperatures, and differential pressure and internal visual inspections are not performed on each component. At PVNGS, diesel generator performance parameters are monitored through periodic Technical Specification surveillance tests. Plant procedures require temperature and pressure parameters be compared to pre-established limiting values. From the comparison, overall heat exchanger and pump performance can be inferred collectively for the diesel generator under test. With respect to the motor-driven circulating water pump, the pump operates cyclically together with a heater to maintain jacket water temperature when the diesel generator is in standby; its functional performance is continuously monitored by measuring jacket water temperature. The diesel generator governor oil cooler, the engine-driven and motor-driven circulating water pumps and the turbocharger are not individually subject to periodic visual inspection. The jacket water heat exchanger and the turbo air intercooler are periodically inspected visually as an indication of interior surface conditions throughout the diesel generator jacket water system. The surveillance tests together with periodic visual inspections and the periodic sampling and control of system water chemistry are adequate to ensure the component intended functions are maintained within the diesel generator jacket water system.

f.) The RC hot leg sample cooler is within scope of license renewal for 10CFR54.4 criteria a(3) fire protection considerations that identify the capability to obtain a RC hot leg sample for boron

concentration as a means of reactivity control. Exception is taken for regular, periodic inspection and testing of this heat exchanger based on its variable heat load and on the fact that the design configuration of the RC hot leg sample cooler is a sealed unit not subject to opening for routine inspection or maintenance. The effectiveness of water chemistry control measures for this heat exchanger is verified by visual inspection of the internal surfaces of selected components fabricated of similar materials and exposed to closed-cycle cooling water using the same corrosion inhibitor program.

g.) Several heat exchangers are provided which do not have a license renewal heat transfer intended function and are not monitored for parameters pertaining to heat transfer nor subject to periodic performance monitoring and inspection to manage the aging effect of reduction in heat transfer. These heat exchangers include the letdown heat exchanger, which has the intended function of pressure boundary, and the following heat exchangers, which have the intended function of leakage barrier - spatial:

- auxiliary steam vent condenser
- cooler for auxiliary steam radiation monitor
- aftercooler for gas stripper
- cooling coils for normal HVAC Units (containment, auxiliary, and control building HVAC).
- steam generator hot leg, cold leg and downcomer blowdown sample coolers
- pressurizer steam space and surge line sample coolers
- safety injection sample coolers

The effectiveness of water chemistry control measures for these heat exchangers is verified by visual inspection of the internal surfaces of selected components fabricated of similar materials and exposed to closed-cycle cooling water using the same corrosion inhibitor program.

Enhancements

None ~~Prior to the period of extended operation, the following enhancements will be implemented in the following program elements:~~

~~*Preventive Actions - Element 2, Acceptance Criteria — Element 6, and Acceptance Criteria – Element 7*~~

~~Procedures will be enhanced to incorporate the guidance of EPRI TR-107396 with respect to water chemistry control for frequency of sampling and analysis, normal operating limits, action level concentrations, and times for implementing corrective actions upon attainment of action levels.~~

Operating Experience

A review of the PVNGS plant-specific operating experience indicates that there has been no evidence of significant fouling or loss of material that has resulted in a loss of intended function observed in the following closed cycle cooling systems:

- Diesel Generator Jacket Water System
- Essential Chilled Water System
- Essential Cooling Water System
- Normal Chilled Water System
- Nuclear Cooling Water System

During the second half of 2001, water chemistry monitoring identified an elevated levels of chlorides and sulfates characteristic of leakage from the essential spray pond system into the essential cooling water system of Unit 3. Diagnostic water chemistry testing further localized the source of the leak to the B-train essential cooling water heat exchanger. Visual inspection and Non-Destructive Evaluation (eddy current testing) were performed and localized the leak to a heat exchanger tube which was subsequently plugged. The cause was evaluated as a pit resulting from corrosion from the open-cycle cooling side of the heat exchanger into the closed-cycle side of the heat exchanger. An expanded testing program encompassing 100% of the essential cooling water heat exchanger tubes in all three units revealed no further degradation. This event demonstrates the effectiveness of managing the aging of the closed-cycle cooling water systems.

Conclusion

The continued implementation of the Closed-Cycle Cooling Water program provides reasonable assurance that aging effects will be managed such that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B2.1.18 Buried Piping and Tanks Inspection

Program Description

The Buried Piping and Tanks Inspection program manages loss of material on external surfaces of buried components in the following systems: chemical and volume control, condensate storage and transfer, diesel fuel storage and transfer, domestic water, fire protection, SBOG fuel system, service gas and essential spray ponds. Opportunistic visual inspections will monitor the condition of protective coatings and wrappings found on carbon steel, gray cast iron or ductile iron components and assess the condition of stainless steel components with no protective coatings or wraps. Any evidence of damaged wrapping or coating defects is an indicator of possible corrosion damage to the external surface of the components.

The Buried Piping and Tanks Inspection program is a new program that will be implemented prior to the period of extended operation.

Within the ten year period prior to entering the period of extended operation an opportunistic or planned inspection of buried tanks at the Palo Verde site will be performed.

The visual inspections noted below of piping in a soil environment within the scope of license renewal will be conducted within the ten-year period prior to entering the period of extended operation, and during each ten year period after entering the period of extended operation, except the initial diesel generator fuel oil piping inspection will be performed between January 1, 2012 and December 31, 2015. Each inspection will:

- select accessible locations where degradation is expected to be high;
- excavate and visually inspect the circumference of the pipe; and
- examine at least ten feet of pipe.

a. Metallic Piping not Cathodically-Protected

At least two excavations and visual inspections of stainless steel piping will be conducted in each unit. Stainless steel piping within the scope of license renewal exists in the following systems:

- Chemical and Volume Control (CH),
- Condensate Transfer and Storage (CT), and
- Fire Protection (FP).

b. Steel Piping Cathodically-Protected

At least two excavations and visual inspections of cathodically-protected steel piping will be conducted in each unit. In one of the units, at least one of these inspections will be performed on diesel generator fuel oil piping.

c. Steel Piping with Potentially Degraded Cathodic Protection

At least three excavations and visual inspections of fire protection steel piping with potentially degraded bonding straps will be conducted at the Palo Verde site.

Prior to the period of extended operation, the Buried Piping and Tanks Inspection program will include provisions to (1) ensure electrical power is maintained to the cathodic protection system for in-scope buried piping at least 90% of the time (e.g., monthly verification that the power supply circuit breakers are closed or other verification that power is being provided to the system), and (2) ensure that the National Association of Corrosion Engineers (NACE) cathodic protection system surveys are performed at least annually.

NUREG-1801 Consistency

The Buried Piping and Tanks Inspection program is a new program that, when implemented, will be consistent with exception to NUREG-1801, Section XI.M34, "Buried Piping and Tanks Inspection".

Exceptions to NUREG-1801

Program Elements Affected

Scope of Program – Element 1 and Acceptance Criteria- Element 6

NUREG-1801, Section XI.M34 scope only includes buried steel piping and components. However, PVNGS also includes stainless steel in their buried piping program that will be managed as part of this aging management program.

Scope of Program – Element 1, Preventive Actions – Element 2, and Acceptance Criteria- Element 6

NUREG-1801, Section XI.M34 relies on preventive measures such as coatings and wrappings. However, portions of buried stainless steel piping may not be coated or wrapped. Inspections of buried piping that is not wrapped will inspect for loss of material due to general, pitting, crevice, and microbiologically influenced corrosion.

Enhancements

None

Operating Experience

The Buried Piping and Tanks Inspection program is a new program. Degradation of buried components was addressed at PVNGS during an inspection program in September 2002. Observations of this inspection program include:

During the past several years, leaks developed in various buried piping segments, which potentially threaten the continuous operation of PVNGS. These leaks collectively indicated a negative trend in the overall integrity of the buried pipe.

Inspection and maintenance activities were implemented in order to address overall integrity of the buried pipe. Determination of system priorities and development of a draft inspection plan for each of the evaluated systems was developed.

The applicable systems with piping installed below grade were evaluated and assigned ranking based on priority. The majority of these evaluated buried piping systems have very little or no identified potential for degradation.

The majority of the systems evaluated in the inspection program are not within the scope of license renewal. The PVNGS corrective action documentation to date has shown that, for the systems within the scope of license renewal, degradation has been found primarily in the fire protection system. Fire protection system has had localized degradation in excess of the minimum wall requirement of 40% nominal wall thickness. The designated segments of the degraded ductile iron piping have been replaced by fiberglass reinforced plastic piping. The fire protection system has not experienced a failure that affected the ability of the plant to achieve and maintain safe shutdown in the event of a fire. To date, the actual pipe failures of the underground fire protection system have been isolated and repaired without adversely affecting any fire protection water suppression system.

Industry and plant-specific operating experience will be evaluated in the development and implementation of this program.

Conclusion

The implementation of the Buried Piping and Tanks Inspection program will provide reasonable assurance that aging effects will be managed such that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

ENCLOSURE 3

Updated Listing of the PVNGS License Renewal Application Table A4-1 Commitments

Table A4-1 License Renewal Commitments

Item No.	Commitment	LRA Section	Implementation Schedule
1	The summary descriptions of aging management programs, time-limited aging analyses, and license renewal commitments contained in LRA Appendix A, "Updated Final Safety Analysis Supplement," as required by 10 CFR 54.21(d), will be incorporated in the Updated Final Safety Analysis Report for PVNGS Units 1, 2, and 3 in the next update required by 10 CFR 50.71(e) following the issuance of the renewed operating licenses. (RCTSAI 3247244)	A0	The next 10 CFR 50.71(e) UFSAR update following issuance of the renewed operating licenses.
2	Existing Quality Assurance Program is credited for license renewal. (RCTSAI 3246887)	A1 B1.3 Summary Descriptions Of Aging Management	Ongoing
3	Existing ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program is credited for license renewal. (RCTSAI 3246890)	A1.1 B2.1.1 ASME Section XI Inservice Inspection, Subsections IWB, IWC, AND IWD	Ongoing
4	Existing Water Chemistry program is credited for license renewal. (RCTSAI 3246891).	A1.2 B2.1.2 Water Chemistry	Ongoing
5	Existing Reactor Head Closure Studs program is credited for license renewal. (RCTSAI 3246892)	A1.3 B2.1.3 Reactor Head Closure Studs	Ongoing
6	Existing Boric Acid Corrosion program is credited for license renewal. (RCTSAI 3246893)	A1.4 B2.1.4 Boric Acid Corrosion	Ongoing

Table A4-1 License Renewal Commitments

Item No.	Commitment	LRA Section	Implementation Schedule
7	Existing Nickel-Alloy Penetration Nozzles Welded to The Upper Reactor Vessel Closure Heads of Pressurized Water Reactors program is credited for license renewal. (RCTSAI 3246894)	A1.5 B2.1.5 Nickel-Alloy Penetration Nozzles Welded to The Upper Reactor Vessel Closure Heads of Pressurized Water Reactors	Ongoing
8	Existing Flow-Accelerated Corrosion program is credited for license renewal. (RCTSAI 3246895)	A1.6 B2.1.6 Flow-Accelerated Corrosion	Ongoing
9	Existing Bolting Integrity program is credited for license renewal. (RCTSAI 3246896)	A1.7 B2.1.7 Bolting Integrity	Ongoing
10	Existing Steam Generator Tube Integrity program is credited for license renewal. (RCTSAI 3246897)	A1.8 B2.1.8 Steam Generator Tube Integrity	Ongoing
11	Existing Open-Cycle Cooling Water System program is credited for license renewal, AND Prior to the period of extended operation, the program will be enhanced to clarify guidance in the conduct of piping inspections using NDE techniques and related acceptance criteria. (RCTSAI 3246898)	A1.9 B2.1.9 Open-Cycle Cooling Water System	Prior to the period of extended operation[1].
12	Existing Closed-Cycle Cooling Water System program is credited for license renewal. (RCTSAI 3246899)	A1.10 B2.1.10 Closed-Cycle Cooling Water System	Ongoing

Table A4-1 License Renewal Commitments

Item No.	Commitment	LRA Section	Implementation Schedule
13	Existing Inspection Of Overhead Heavy Load And Light Load (Related To Refueling) Handling Systems program is credited for license renewal, AND Prior to the period of extended operation, procedures will be enhanced to inspect for loss of material due to corrosion or rail wear. (RCTSAI 3246900)	A1.11 B2.1.11 Inspection Of Overhead Heavy Load And Light Load (Related To Refueling) Handling Systems	Prior to the period of extended operation[1].
14	Existing Fire Protection program is credited for license renewal, AND Prior to the period of extended operation procedures will be enhanced to perform the testing of the Electro-Thermal Links (ETLs) and functional testing of the halon and CO_2 dampers every 18 months or at the frequency specified in the current licensing basis in effect upon entry into the period of extended operation. (RCTSAIs 3246901 and 3554175)	A1.12 B2.1.12 Fire Protection	Prior to the period of extended operation[1].
15	Existing Fire Water System program is credited for license renewal, AND Prior to the period of extended operation, the following enhancements will be implemented: • Specific procedures will be enhanced to include review and approval requirements under the Nuclear Administrative Technical Manual (NATM). • Procedures will be enhanced to be consistent with the current code of record or NFPA 25 2002 Edition. • Procedures will be enhanced to field service test a representative sample or replace sprinklers prior to 50 years in service and test thereafter every 10 years to ensure that signs of degradation are detected in a timely manner. • Procedures will be enhanced to be consistent with NFPA 25 Section 7.3.2.1, 7.3.2.2, 7.3.2.3, and 7.3.2.4. (RCTSAI 3246902)	A1.13 B2.1.13 Fire Water System	Prior to the period of extended operation[1].

Table A4-1 License Renewal Commitments

Item No.	Commitment	LRA Section	Implementation Schedule
16	Existing Fuel Oil Chemistry program is credited for license renewal, AND Prior to the period of extended operation: • Procedures will be enhanced to extend the scope of the program to include the SBOG fuel oil storage tank and SBOG skid fuel tanks. • Procedures will be enhanced to include ten-year periodic draining, cleaning, and inspections on the diesel-driven fire pump day tanks, the SBOG fuel oil storage tank, and SBOG skid fuel tanks. • Ultrasonic testing (UT) or pulsed eddy current (PEC) thickness examination will be conducted to detect corrosion-related wall thinning if degradation is found during the visual inspections and once on the tank bottoms for the EDG fuel oil storage tanks, EDG fuel oil day tanks, diesel-driven fire pump day tanks, SBOG fuel oil storage tank, and SBOG skid fuel tanks. The onetime UT or PEC examination on the tank bottoms will be performed before the period of extended operation. (RCTSAI 3246903)	A1.14 B2.1.14 Fuel Oil Chemistry	Prior to the period of extended operation[1].

Table A4-1 License Renewal Commitments

Item No.	Commitment	LRA Section	Implementation Schedule
17	Existing Reactor Vessel Surveillance program is credited for license renewal, AND Prior to the period of extended operation: • The schedule will be revised to withdraw the next capsule at the equivalent clad-base metal exposure of approximately 54 EFPY expected for the 60-year period of operation, and to withdraw remaining standby capsules at equivalent clad-base metal exposures not exceeding the 72 EFPY expected for a possible 80-year second period of extended operation. This withdrawal schedule is in accordance with NUREG-1801, Section XI.M31, item 6, and with the ASTM E 185-82 criterion which states that capsules may be removed when the capsule neutron fluence is between one and two times the limiting fluence calculated for the vessel at the end of expected life. This schedule change must be approved by the NRC, as required by 10 CFR 50 Appendix H. • If left in the reactor beyond the presently-scheduled withdrawal, the next scheduled surveillance capsule in each unit will reach a clad-base metal 54 EFPY equivalent at about 40 actual operating EFPY (40, 39, and 42 actual EFPY in Units 1, 2, and 3, respectively). • Procedures will be enhanced to identify the withdrawal of the remaining standby capsules at 72 EFPY, at about 50 to 54 actual operating EFPY, near the end of the extended licensed operating period. The need to monitor vessel fluence following removal of the remaining standby capsules, and ex-vessel or in-vessel methods, will be addressed prior to removing the remaining capsules. (RCTSAI 3246904)	A1.15 B2.1.15 Reactor Vessel Surveillance	Prior to the period of extended operation[1].

Table A4-1 License Renewal Commitments

Item No.	Commitment	LRA Section	Implementation Schedule
18	The One-Time Inspection program conducts one-time inspections of plant system piping and components to verify the effectiveness of the Water Chemistry program (A1.2), Fuel Oil Chemistry program (A1.14), and Lubricating Oil Analysis program (A1.23). The aging effects to be evaluated by the One-Time Inspection program are loss of material, cracking, and reduction of heat transfer. (RCTSAIs 3246906 [U1]; 3247258 [U2]; 3247259 [U3])	A1.16 B2.1.16 One-Time Inspection	Within the ten year period prior to the period of extended operation[1].
19	The Selective Leaching of Materials program is a new program that will be implemented prior to the period of extended operation. Industry and plant-specific operating experience will be evaluated in the development and implementation of this program. (RCTSAIs 3246908 [U1]; 3247260 [U2]; 3247261 [U3])	A1.17 B2.1.17 Selective Leaching Of Materials	Within the ten year period prior to the period of extended operation[1].
20	The Buried Piping and Tanks Inspection program is a new program that will be implemented prior to the period of extended operation. Within the ten year period prior to entering the period of extended operation an opportunistic or planned inspection of buried tanks at the Palo Verde site will be performed. The visual inspections noted below of piping in a soil environment within the scope of license renewal will be conducted within the ten-year period prior to entering the period of extended operation, and during each ten year period after entering the period of extended operation, except the initial diesel generator fuel oil piping inspection will be performed between January 1, 2012 and December 31, 2015. Each inspection will: • select accessible locations where degradation is expected to be high; • excavate and visually inspect the circumference of the pipe; and • examine at least ten feet of pipe.	A1.18 B2.1.18 Buried Piping And Tanks Inspection	Perform the buried piping and tanks inspections within the ten year period prior to the period of extended operation[1], except the initial diesel generator fuel oil piping inspection will be performed between 1/1/12 and 12/31/15. AND Perform the buried piping inspections during each ten year period after entering

Table A4-1 License Renewal Commitments

Item No.	Commitment	LRA Section	Implementation Schedule
	a. Metallic Piping not Cathodically-Protected At least two excavations and visual inspections of stainless steel piping will be conducted in each unit. Stainless steel piping within the scope of license renewal exists in the following systems: o Chemical and Volume Control (CH), o Condensate Transfer and Storage (CT), and o Fire Protection (FP). b. Steel Piping Cathodically-Protected At least two excavations and visual inspections of cathodically-protected steel piping will be conducted in each unit. In one of the units, at least one of these inspections will be performed on diesel generator fuel oil piping. c. Steel Piping with Potentially Degraded Cathodic Protection At least three excavations and visual inspections of fire protection steel piping with potentially degraded bonding straps will be conducted at the Palo Verde site. Prior to the period of extended operation, the Buried Piping and Tanks Inspection program will include provisions to (1) ensure electrical power is maintained to the cathodic protection system for in-scope buried piping at least 90% of the time (e.g., monthly verification that the power supply circuit breakers are closed or other verification that power is being provided to the system), and (2) ensure that the National Association of Corrosion Engineers (NACE) cathodic protection system surveys are performed at least annually. (RCTSAIs 3246909 [U1]; 3247263 [U2]; 3247264 [U3])		the period of extended operation. AND Implement the additional enhancements to the buried piping and tanks inspection program prior to the period of operation[1].

Table A4-1 License Renewal Commitments

Item No.	Commitment	LRA Section	Implementation Schedule
21	The One-Time Inspection of ASME Code Class 1 Small-Bore Piping program is a new program that will be implemented prior to the period of extended operation. Industry and plant-specific operating experience will be evaluated in the development and implementation of this program. For ASME Code Class 1 small-bore piping, volumetric examinations on selected butt weld locations will be performed to detect cracking. Butt weld volumetric examinations will be conducted in accordance with ASME Section XI with acceptance criteria from Paragraph IWB-3000 and IWB-2430. Weld locations subject to volumetric examination will be selected based on the guidelines provided in EPRI TR-112657. Socket welds that fall within the weld examination sample will be examined following ASME Section XI Code requirements. At least 10% of the socket welds in ASME Code Class 1 piping that is less than four inches nominal pipe size and greater than or equal to one inch nominal pipe size will be selected per unit for ultrasonic testing examination. The sample will be selected based on risk insights and those welds with the potential for aging degradation. (RCTSAIs 3246910 [U1]; 3247265 [U2]; 3247266 [U3])	A1.19 B2.1.19 One-Time Inspection of ASME Code Class 1 Small-Bore Piping	Prior to the period of extended operation[1].
22	The External Surfaces Monitoring Program is a new program that will be implemented prior to the period of extended operation. Industry and plant-specific operating experience will be evaluated in the development and implementation of this program. (RCTSAIs 3246911 [U1]; 3247272 [U2]; 3247273 [U3])	A1.20 B2.1.20 External Surfaces Monitoring Program	Prior to the period of extended operation[1].

Table A4-1 License Renewal Commitments

Item No.	Commitment	LRA Section	Implementation Schedule
23	APS will: A. Reactor Coolant System Nickel Alloy Pressure Boundary Components Implement applicable (1) NRC Orders, Bulletins and Generic Letters associated with nickel alloys and (2) staff-accepted industry guidelines, (3) participate in the industry initiatives, such as owners group programs and the EPRI Materials Reliability Program, for managing aging effects associated with nickel alloys, (4) upon completion of these programs, but not less than 24 months before entering the period of extended operation, APS will submit an inspection plan for reactor coolant system nickel alloy pressure boundary components to the NRC for review and approval, and B. Reactor Vessel Internals (1) Participate in the industry programs for investigating and managing aging effects on reactor internals; (2) evaluate and implement the results of the industry programs as applicable to the reactor internals; and (3) upon completion of these programs, but not less than 24 months before entering the period of extended operation, APS will submit an inspection plan for reactor internals to the NRC for review and approval. C. Pressurizer Spray Heads Comply with applicable NRC Orders and implement applicable (1) Bulletins and Generic Letters, and (2) staff-accepted industry guidelines. (RCTSAIs 3246912 [U1]; 3247274 [U2]; 3247276 [U3])	A1.21 B2.1.21 Reactor Coolant System Supplement 3.1.2.2.16.2 Pressurizer spray head cracking	Not less than 24 months prior to the period of extended operation[1].
24	The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program is a new program that will be implemented prior to the period of extended operation. Industry and plant-specific operating experience will be evaluated in the development and implementation of this program. (RCTSAIs 3246914 [U1]; 3247277 [U2]; 3247278 [U3])	A1.22 B2.1.22 Inspection Of Internal Surfaces In Miscellaneous Piping And Ducting Components	Prior to the period of extended operation[1].

Table A4-1 License Renewal Commitments

Item No.	Commitment	LRA Section	Implementation Schedule
25	Existing Lubricating Oil Analysis program is credited for license renewal. (RCTSAI 3246915)	A1.23 B2.1.23 Lubricating Oil Analysis	Ongoing
26	The Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program is a new program that will be implemented prior to the period of extended operation. Industry and plant-specific operating experience will be evaluated in the development and implementation of this program. (RCTSAI 3246917)	A1.24 B2.1.24 Electrical Cables And Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Prior to the period of extended operation[1].
27	Existing Electrical Cables And Connections Not Subject To 10 CFR 50.49 Environmental Qualification Requirements Used In Instrumentation Circuits program is credited for license renewal , AND Prior to the period of extended operation: • Procedures will be enhanced to identify license renewal scope, require cable testing of ex-core neutron monitoring cables, require an evaluation of the calibration results for non-EQ area radiation monitors, and require acceptance criteria for cable testing be established based on the type of cable and type of test performed. (RCTSAI 3246919)	A1.25 B2.1.25 Electrical Cables And Connections Not Subject To 10 CFR 50.49 Environmental Qualification Requirements Used In Instrumentation Circuits	Prior to the period of extended operation[1].
28	The Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements program is credited for license renewal, AND Prior to the period of extended operation procedures will be enhanced to: • Extend the scope of the program to include low voltage (480V and above) non-EQ inaccessible power cables and associated manholes. • Perform the cable inspections on at least an annual frequency and perform the cable testing on a six year frequency. (RCTSAI 3246920)	A1.26 B2.1.26 Inaccessible Medium Voltage Cables Not Subject To 10 CFR 50.49 Environmental Qualification Requirements	Prior to the period of extended operation[1].

Table A4-1 License Renewal Commitments

Item No.	Commitment	LRA Section	Implementation Schedule
29	Existing ASME Section XI, Subsection IWE program is credited for license renewal. (RCTSAI 3246921)	A1.27 B2.1.27 ASME Section XI, Subsection IWE	Ongoing
30	Existing ASME Section XI, Subsection IWL program is credited for license renewal. (RCTSAI 3246922)	A1.28 B2.1.28 ASME Section XI, Subsection IWL	Ongoing
31	Existing ASME Section XI, Subsection IWF program is credited for license renewal. (RCTSAI 3246923)	A1.29 B2.1.29 ASME Section XI, Subsection IWF	Ongoing
32	Existing 10 CFR 50, Appendix J program is credited for license renewal. (RCTSAI 3246924)	A1.30 B2.1.30 10 CFR 50, Appendix J	Ongoing
33	Existing Masonry Wall Program is credited for license renewal, AND Prior to the period of extended operation, procedures will be enhanced to specify ACI 349.3R-96 as the reference for qualification of personnel to inspect structures under the Masonry Wall Program, which is part of the Structures Monitoring Program. (RCTSAI 3246926)	A1.31 B2.1.31 Masonry Wall Program	Prior to the period of extended operation[1].

Table A4-1 License Renewal Commitments

Item No.	Commitment	LRA Section	Implementation Schedule

34	Existing Structures Monitoring Program is credited for license renewal, AND
	Prior to the period of extended operation:
	• The Structures Monitoring Program will be enhanced to specify ACI 349.3R-96 as the reference for qualification of personnel to inspect structures under the Structures Monitoring Program.
	• For structures within the scope of license renewal, the Structures Monitoring Program will be enhanced to establish the frequency of inspection for each unit at a 5 year interval, with the exception of exterior surfaces of the following nonsafety-related structures, below-grade structures, and structures within a controlled interior environment, which will be inspected at an interval of 10 years:
	  • Fire Pump House (Yard Structures)
	  • Radwaste Building
	  • Station Blackout Generator Structures
	  • Turbine Building
	  • Non-Safety Related Tank Foundations and Shells
	  • Non-Safety Related Transformer Foundations and Electrical Structures
	• The Structures Monitoring Program will be enhanced to quantify the acceptance criteria and critical parameters for monitoring degradation, and to provide guidance for identifying unacceptable conditions requiring further technical evaluation or corrective action. Procedures will also be enhanced to incorporate applicable industry codes, standards and guidelines (e.g., ACI 349.3R-96, ANSI/ASCE 11-90, etc.) for acceptance criteria.
	(RCTSAI 3246927)
		A1.32
		B2.1.32
		Structures Monitoring Program
			Prior to the period of extended operation[1].

Table A4-1 License Renewal Commitments

Item No.	Commitment	LRA Section	Implementation Schedule
35	Existing RG 1.127, Inspection Of Water-Control Structures Associated With Nuclear Power Plants program is credited for license renewal, AND Prior to the period of extended operation, procedures will be enhanced to specify that the essential spray ponds inspections include concrete below the water level. (RCTSAI 3246928)	A1.33 B2.1.33 RG 1.127, Inspection Of Water-Control Structures Associated With Nuclear Power Plants	Prior to the period of extended operation[1].
36	Existing Nickel Alloy Aging Management Program is credited for license renewal. (RCTSAI 3260208)	A1.34 B2.1.34 Nickel Alloy Aging Management Program	Ongoing
37	The Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program is a new program that will be implemented prior to the period of extended operation. Industry and plant-specific operating experience will be evaluated in the development and implementation of this program. (RCTSAIs 3246930 [U1]; 3247228 [U2]; 3247231 [U3])	A1.35 B2.1.35 Electrical Cable Connections Not Subject To 10 CFR 50.49 environmental qualification requirements	Prior to the period of extended operation[1].
38	The Metal Enclosed Bus program is a new program and will be completed before the period of extended operation and once every 10 years thereafter. Industry and plant-specific operating experience will be evaluated in the development and implementation of this program. (RCTSAIs 3246932 [U1]; 3247220 [U2]; 3247221 [U3])	A1.36 B2.1.36 Metal Enclosed Bus	Prior to the period of extended operation and once every ten years thereafter.
39	No later than two years prior to the period of extended operation, the following enhancements will be implemented • Cumulative usage factor tracking will be implemented for NUREG/CR-6260 locations not monitored by cycle counting (the reactor vessel shell and lower head (juncture) location will be monitored by cycle counting). For PVNGS locations identified in NUREG/CR-6260 and monitored by CUF, fatigue usage factor	4.3.1 Fatigue Aging Management Program A2.1 B3.1 Metal Fatigue of Reactor Coolant	No later than two years prior to the period of extended operation[1].

Table A4-1 License Renewal Commitments

Item No.	Commitment	LRA Section	Implementation Schedule
	action limits will be required for including effects of the reactor coolant environment. • The Metal Fatigue of Reactor Coolant Pressure Boundary program will be enhanced to include a computerized program to track and manage both cycle counting and fatigue usage factor. FatiguePro® will be used for cycle counting and cycle-based fatigue (CBF) monitoring methods. FatiguePro® is an EPRI licensed product. • The enhanced Metal Fatigue of Reactor Coolant Pressure Boundary program will monitor plant transients as required by PVNGS Technical Specification 5.5.5. Cumulative usage factors (CUFs) will be calculated for a subset of ASME III Class 1 reactor coolant pressure boundary vessel and piping locations, and component locations with Class 1 analyses. The following methods will be used: 1) The Metal Fatigue of Reactor Coolant Pressure Boundary program will be enhanced to use cycle based fatigue (CBF) and stress based fatigue (SBF) CUF calculations to monitor fatigue. FatiguePro® will be used for cycle counting and cycle-based fatigue (CBF) monitoring methods. FatiguePro® is an EPRI licensed product. 2) The SBF method will use a fatigue monitoring software program that incorporates a three-dimensional, six-component stress tensor method meeting ASME III NB-3200 requirements. • The enhanced Metal Fatigue of Reactor Coolant Pressure Boundary program will provide action limits on cycles and on CUF that will initiate corrective actions before the licensing basis limits on fatigue effects at any location are exceeded. o In order to ensure sufficient cycle count margin to accommodate occurrence of a low-probability transient,	Pressure Boundary	

Table A4-1 License Renewal Commitments

Item No.	Commitment	LRA Section	Implementation Schedule
	corrective actions must be taken before the remaining number of allowable occurrences for any specified transient becomes less than 1. o CUF action limits will be established to require corrective action when the calculated CUF (from cycle-based or stress-based monitoring) for any monitored location is projected to reach 1.0 within the next 2 or 3 operating cycles. In order to ensure sufficient margin to accommodate occurrence of a low-probability transient, corrective actions will be taken while there is still sufficient margin to accommodate at least one occurrence of the worst-case design transient event (i.e., with the highest fatigue usage per event cycle). (RCTSAI 3246934)		
40	Existing Environmental Qualification program is credited for license renewal, AND maintaining qualification through the extended license renewal period requires that existing EQ evaluations (EEQDFs) be re-evaluated. (RCTSAI 3246935)	A2.2 B3.2 Environmental Qualification (EQ) Of Electrical Components	Prior to the period of extended operation[1].

Table A4-1 License Renewal Commitments

Item No.	Commitment	LRA Section	Implementation Schedule
41	Existing Concrete Containment Tendon Prestress program is credited for license renewal, AND • The program will be enhanced to continue to compare regression analysis trend lines of the individual lift-off values of tendons surveyed to date, in each of the vertical and hoop tendon groups, with the MRV and PLL for each tendon group, to the end of the licensed operating period, and to take appropriate corrective actions if future values indicated by the regression analysis trend line drop below the PLL or MRV. The regression analyses will be updated for tendons of the affected unit and for a combined data set of all three units following each inspection of an individual unit. • Prior to the period of extended operation, procedures will be enhanced to require an update of the regression analysis for each tendon group of each unit, and of the joint regression of data from all three units, after every tendon surveillance. The documents will invoke and describe regression analysis methods used to construct the lift-off trend lines, including the use of individual tendon data in accordance with Information Notice (IN) 99-10, "Degradation of Prestressing Tendon Systems in Prestressed Concrete Containments." • The Tendon Integrity test procedure will be revised to extend the list of surveillance tendons to include random samples for the year 45 and 55 surveillances. (RCTSAI 3246937)	A2.3 B3.3 Concrete Containment Tendon Prestress 4.5 Concrete Containment Tendon Prestress	Prior to the period of extended operation[1].
42	APS will confirm the RCS Pressure-Temperature limits basis for 54 EFPY prior to operation beyond 32 EFPY and will update documents in accordance with the provisions of 10 CFR 50.59. (RCTSAI 3246939)	A3.1.3 Pressure-Temperature Limits	Prior to operation beyond 32 EFPY[1].
43	Completed (RCTSAI 3246941)		
44	Completed (RCTSAI 3253459)		
45	See Item No. 46 (RCTSAI 3246943)		

Table A4-1 License Renewal Commitments

Item No.	Commitment	LRA Section	Implementation Schedule
46	An extension of ISI Relief Request 31, Revision 1 authorization will be requested for the period of extended operation, supported by a continuation of the cold shutdown time monitoring program. (RCTSAI 3246945)	4.7.4 Fatigue Crack Growth and Fracture Mechanics Stability Analyses of Half-Nozzle Repairs to Alloy 600 Material in Reactor Coolant Hot Legs; Absence of a TLAA for Supporting Corrosion Analyses	Prior to the period of extended operation[1].
47	Deleted (Note: this was in the PVNGS Environmental Report)		
48	Deleted (Note: this was in the PVNGS Environmental Report)		
49	Deleted (Note: this was in the PVNGS Environmental Report)		
50	The Fuse Holder program is a new program that will be implemented prior to the period of extended operation and once every 10 years thereafter. Industry and plant-specific operating experience will be evaluated in the development and implementation of this program (RCTSAI 3409443)	A1.37 B2.1.37 Fuse Holder	Prior to the period of extended operation and once every 10 years thereafter.
51	Completed (RCTSAI 3410460)		
52	Deleted (Note: this was in the PVNGS Environmental Report)		
53	Completed (RCTSAI 3429933)		
54	Completed (RCTSAI 3443855)		
55	Completed (RCTSAI 3469024)		
56	The spray pond wall rework/repair methods are currently being determined, and the rework/repair is planned to begin in 2011. As Unit 1 spray ponds have the most degradation, work is planned to start there followed by Units 2 and 3. It is expected that the work will be completed in all three units in 2015. (RCTSAI 3484623)	Follow-up Response to RAI B2.1.33-2 (letter no. 102-06205, dated June 21, 2010)	12/31/15

Table A4-1 License Renewal Commitments

Item No.	Commitment	LRA Section	Implementation Schedule
57	No later than two years prior to the period of extended operation, APS will confirm the conservatism of the F_{en} value of 1.49 using the methods specified in NUREG/CR-6909, and will use the F_{en} calculated using the NUREG/CR-6909 methods if it is more conservative than the 1.49 value. (RCTSAI 3488220)	Response to RAI 4.3-6 (letter no. 102-06210, dated June 29, 2010)	No later than two years prior to the period of extended operation[1].
58	No later than two years prior to the period of extended operation, APS will perform a reanalysis of the pressurizer heater penetrations to consider EAF effects using the formulas and methodology given in NUREG/CR-6909. (RCTSAI 3488223)	Response to RAI RAI 4.3-6 (letter no. 102-06210, dated June 29, 2010)	No later than two years prior to the period of extended operation[1].
59	As documented in CRAI 3337611, Engineering Study 13-MS-B089, "Cavitation in Safety Injection System," APS identified 26 components and associated piping in each PVNGS unit potentially susceptible to cavitation under design basis maximum flow conditions. One location in each unit, the HPSI recirculation piping downstream of throttle valve JSIBUV0667, has been confirmed to be susceptible to cavitation erosion, and a 7.5-year time-based replacement schedule described below has been established. All of the remaining 25 locations identified as potentially susceptible to cavitation in Unit 2, 20 of the locations in Unit 1, and 15 of the locations in Unit 3 have been inspected by ultrasonic testing (UT) and demonstrated no degradation. The remaining five locations in Unit 1 are scheduled to be inspected in the Unit 1 fall 2011 refueling outage. Of the remaining ten locations in Unit 3, five will be inspected in the Unit 3 fall 2010 outage and five will be inspected in the Unit 3 spring 2012 outage. Therefore, the inspections in all three units will be completed no later than June 30, 2012. If any of the remaining components and associated piping is found to be susceptible to cavitation or a form of flow-related degradation, it will be incorporated into a replacement plan similar to that for the HPSI recirculation piping downstream of throttle valve JSIBUV0667. (RCTSAI 3497597)	Supplemental Response to RAI B2.1.19-3 (letter no. 102-06233, dated 07/30/2010)	06/30/12

Table A4-1 License Renewal Commitments

Item No.	Commitment	LRA Section	Implementation Schedule
60	The reactor coolant system transient and cycle tracking procedure 73ST-9RC02 and UFSAR Section 3.9.1 will be enhanced to discuss corrective actions that need to be taken prior to ASME Section III fatigue design limits being exceeded and to state that corrective actions may be required for other fatigue-related analyses, such as certain ASME Section XI supplemental fatigue flaw growth or cycle-dependent fracture mechanics evaluations that are dependent on the number of occurrences of design transients. (RCTSAI 3531679)	Response to Draft RAI 4.3-19 in APS letter no. 102-06263, dated October 13, 2010	11/30/10

(1) "Prior to period of extended operation," "prior to operation beyond 32 EFPY," and "prior to the end of the current licensed operating period," is prior to the following PVNGS Operating License expiration dates: Unit 1: June 1, 2025; Unit 2: April 24, 2026; Unit 3: November 25, 2027.