APS

A subsidiary of Pinnacle West Capital Corporation

Palo Verde Nuclear
Generating Station

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102-06263-JHH/GAM
October 13, 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
Responses to Requests for Additional Information for the Review of the PVNGS License Renewal Application (LRA), and LRA Amendment No. 25

By letter dated September 27, 2010, the Nuclear Regulatory Commission (NRC) staff issued request for additional information (RAI) B2.1.26-3 and Follow-up RAI B2.1.18-1 related to the PVNGS license renewal application (LRA). Enclosure 1 contains Arizona Public Service Company's (APS's) responses to the RAIs. Enclosure 2 contains LRA Amendment No. 25 to reflect changes made as a result of the RAI responses.

In addition, Enclosure 1 contains responses to Draft RAI 4.3-19 and Draft Follow-up RAI 4.3-2. These draft RAIs were discussed and clarified during a telephone conference call between APS and the NRC staff on September 22, 2010.

A revision to LRA Table 3.5.2-14 has been made in LRA Amendment No. 25 in Enclosure 2 to correct the aging effect shown for Containments, Structures, and Component Supports. This error was identified recently during the preparation of another license renewal application by the STARS Center of Business.

Regarding commitment changes, Commitment Nos. 47, 48, 49, and 52 have been deleted from the list of commitments in Table A4-1 in LRA Amendment No. 25 because they are associated with the Environmental Report. These items will continue to be tracked in Palo Verde's Regulatory Commitment Tracking System, but the NRC staff has informed APS that these are not considered to be commitments for the license renewal application. Commitment No. 55 has been deleted from the list of commitments because it has been completed.

A138
NRR

Commitment No. 28 in LRA Table A4-1 is being revised as discussed in the APS response to RAI B2.1.26-3. A new Commitment No. 60 to enhance the UFSAR and the plant design transient tracking procedure is provided in Table A4-1, as discussed in the APS response to Draft RAI 4.3-19.

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 10-13-2010
(date)

Sincerely,

JHH/RAS/GAM/

Enclosures:

1. Responses to License Renewal Requests for Additional Information

2. Palo Verde Nuclear Generating Station License Renewal Application Amendment No. 25

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

Responses to License Renewal Requests for Additional Information

RAI B2.1.26-3
Follow-up RAI B2.1.18-1
Draft RAI 4.3-19
DRAFT Follow-up RAI 4.3-2

NRC RAI B2.1.26-3

Background:

NUREG-1801, Revision 1, "Generic Aging Lessons Learned," (the GALL Report) addresses inaccessible medium voltage cables in aging management program (AMP) XI.E3, "Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements." The purpose of this program is to provide reasonable assurance that the intended functions of inaccessible medium voltage cables (2 kV to 35 kV), that are not subject to environmental qualification requirements of 10 CFR 50.49 and are exposed to adverse localized environments caused by moisture while energized, will be maintained consistent with the current licensing basis. The scope of the program applies to inaccessible (in conduits, cable trenches, cable troughs, duct banks, underground vaults or direct buried installations) medium voltage cables within the scope of license renewal that are subject to significant moisture simultaneously with significant voltage.

The application of the GALL Report AMP to medium voltage cables was based on the operating experience available at the time Revision 1 of the GALL Report was developed; however, recently identified industry operating experience indicates that the presence of water or moisture can be a contributing factor to inaccessible power cable failures at lower service voltages (480 V to 2 kV). Applicable operating experience was identified in licensee responses to Generic Letter (GL) 2007-01, "Inaccessible or Underground Power Cable Failures that Disable Accident Mitigation Systems or Cause Plant Transients," which included failures of power cables operating at service voltages of less than 2 kV where water was considered a contributing factor.

The industry operating experience provided by licensees in response to GL 2007-01, has shown that there is an increasing trend of cable failures with length in service beginning in the 6th through 10th years of operation and also that moisture intrusion is the predominant factor contributing to cable failure. The staff has determined, based on the review of the cable failure distribution, that annual inspection of manholes and cable testing frequency of at least every six years is a conservative approach to ensuring the operability of power cables and, therefore, should be considered.

In addition, the recent operating experience has shown that some licensees may experience events, such as flooding or heavy rain, that subject cables within the scope of the GALL Report AMP to significant moisture. The staff has determined that event driven inspections of manholes, in addition to a 1-year periodic inspection frequency, is a conservative approach and, therefore, should be considered.

PVNGS has experienced cases where medium voltage cable splices have been subjected to water intrusion resulting in low megger readings. The applicant stated that during manhole walkdowns in 2009, one was found to contain water with submerged cables. Subsequent inspections of connected manholes found additional water. The

applicant also stated that a review of these manholes and the connected manholes found recurring instances of water intrusion.

Issue:

Based on recently identified industry operating experience concerning the failure of inaccessible low voltage power cables in the presence of significant moisture, the staff concludes that these cables can potentially experience age related degradation. The staff noted that the applicant's Inaccessible Medium-Voltage Cables Program does not address inaccessible low voltage power cables [400 V (nominally 480 V) to 2 kV inclusive]. In addition, increased cable testing and manhole inspection frequencies should be evaluated to ensure that the Inaccessible Medium Voltage Program test and inspection frequencies reflect industry and plant-specific operating experience.

Request:

1. Provide a summary of your evaluation of recently identified industry operating experience and any plant-specific operating experience concerning inaccessible low voltage power cable failures within the scope of license renewal (not subject to 10 CFR 50.49 environmental qualification requirements), and how this operating experience applies to the need for additional aging management activities at PVNGS.

2. Discuss how PVNGS will manage the effects of aging on inaccessible low voltage power cables within the scope of license renewal and subject to an aging management review with consideration of recently identified industry operating experience and any plant-specific operating experience. The discussion should include assessment of your AMP description, program elements (i.e., scope of program, parameters monitored or inspected, detection of aging effects, and corrective actions), and Updated Final Safety Analysis Report (UFSAR) summary description to demonstrate reasonable assurance that the intended functions of inaccessible low voltage power cables subject to adverse localized environments will be maintained consistent with the current licensing basis through the period of extended operation.

3. Evaluate whether the Inaccessible Medium Voltage Program test and inspection frequencies, including event driven inspections, incorporate recent industry and plant-specific operating experience for both inaccessible low-and medium-voltage cables. Discuss how the Inaccessible Medium Voltage Cable Program will ensure that future industry and plant-specific operating experience will be incorporated into the program.

APS Response to RAI B2.1.26-3

Response (1)

APS has been involved with the NEI Power Cable Issue Team in evaluating recent industry concerns relative to inaccessible low and medium voltage power cable. A review of Palo Verde site specific operating experience identified two low voltage power cable testing failures reported in response to NRC Generic Letter (GL) 2007-01 (APS letter no. 102-05697, dated May 3, 2007, ADAMS Accession No. ML071360090). The two low voltage cables did not meet the acceptance criteria for the insulation resistance tests and the failures were attributed to moisture intrusion. The two low voltage cables have been abandoned. No subsequent low voltage power cable failures have been identified.

The Palo Verde Aging Management Program requires event driven inspections of site manholes containing medium voltage cables in addition to a two-year periodic inspection frequency. Based on Palo Verde and industry operation experience, LRA Sections A1.26, and B2.1.26, and Commitment No. 28 in Table A4-1, have been revised, as shown in LRA Amendment No. 25 in Enclosure 2, to increase the periodic inspection frequency to one year.

The Palo Verde Aging Management Program requires that medium voltage cables be tested on a periodicity based on the safety significance of the cable and the testing history, with initial testing prior to the period of extended operation and once every ten years thereafter. Based on Palo Verde and industry operation experience, LRA Sections A1.26, and B2.1.26, and Commitment No. 28 in Table A4-1, have been revised, as shown in LRA Amendment No. 25 in Enclosure 2, to increase the periodic testing frequency to six years.

Based on Palo Verde and industry operating experience, LRA Sections 3.6.2.1.4.3, A1.26, and B2.1.26, and Commitment No. 28 in Table A4-1, have been revised, as shown in LRA Amendment No. 25 in Enclosure 2, to add low voltage (480V and above) non-EQ inaccessible power cables and associated manholes within the scope of license renewal to the Palo Verde Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements AMP.

Response (2)

Aging management requirements of the recently implemented Palo Verde Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements AMP will apply to all non-EQ inaccessible power cables (480V and above) within the scope of license renewal. This includes the inspection and testing aging management requirements noted in Response (3). Element 1, Scope of Program, will require enhancement to add low voltage non-EQ inaccessible power cables (480 volt and above) and associated manholes within the scope of license

renewal to the scope of the program. LRA Sections 3.6.2.1.4.3, A1.26, and B2.1.26, and Commitment No. 28 in Table A4-1, have been revised, as shown in LRA Amendment No. 25 in Enclosure 2, to add low voltage non-EQ inaccessible power cables (480 volt and above) and associated manholes within the scope of license renewal to the Palo Verde Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements AMP.

Response (3)

The cable manholes that contain in-scope non-EQ inaccessible cables (480 volt and above) are inspected for water collection. Any collected water is removed to ensure the cables are not submerged. This inspection and water removal is performed based on actual plant experience but at least every two years. The preventive maintenance (PM) program groups the manholes into three frequencies of inspections based on their history of water intrusion: two weeks, six months, and two years. The two-week PM task requires inspection of manholes if it has rained 0.3 inches or more within a 24-hour period since the last time the PM was performed. The manholes grouped into this PM task are also inspected on a six-month frequency to ensure they are always inspected, including during dry periods. Under the PM program, a manhole will not be moved to the two-year reduced frequency inspection interval until it has been found dry for two years. Based on Palo Verde and industry operation experience, LRA Sections A1.26, and B2.1.26, and Commitment No. 28 in Table A4-1, have been revised, as shown in LRA Amendment No. 25 in Enclosure 2, to increase the periodic inspection frequency from two years to one year.

At least once every six years, a polarization index test as described in EPRI TR-103834-P1-2 or other testing that is state-of the-art at the time of the testing will be performed.

Palo Verde participates in ongoing industry development of guidelines for the management of inaccessible cable required for the maintenance rule to remain abreast of emerging issues. The review of industry operating experience as part of the Palo Verde Corrective Action Program is an ongoing program and will identify applicable changes to inspection and test frequencies.

Recent Operating Experience

The following recent PVNGS electrical cable operating experience is provided for information, but is not being added to the LRA at this time because the root cause investigation is currently being performed.

On September 15, 2010, at 05:46, during performance of an emergency diesel generator surveillance test, the Unit 2 Train-A Diesel Fuel Oil Transfer Pump (DFOTP) tripped. During troubleshooting activities it was observed in a pull box that the control cable from the DFOTP (120 VAC) had a degraded jacket and indications of moisture. It

was also observed that the fault apparently occurred at the motor terminal box. The preliminary cause appears to be a degraded cable jacket that allowed moisture to be wicked into the motor terminal box causing an electrical fault.

As a part of the extent of condition review, the DFOTP control cable pull boxes for the other five PVNGS emergency diesel generators were inspected. Evidence of a similar failure mechanism was also found for the DFOTP control cables for Unit 2 Train B and Unit 3 Train A emergency diesel generators. As interim corrective actions, splices were placed in the affected pull boxes and a portion of the affected cables were replaced. This corrective action will eliminate the wicking effect and the transport of moisture to the motor terminal box. A root cause investigation is being performed under Significant Condition Report/Disposition Request (CRDR) 3529151 that will determine final corrective actions.

NRC Follow-up RAI B2.1.18-1

Background:

In supplemental responses to RAI B2.1.18-1 dated June 21, 2010, and July 21, 2010, the applicant stated that, in addition to risk ranking of piping required by their commitment to the Nuclear Energy Institute initiative on buried piping, they will excavate and visually inspect at least ten feet of piping at the following locations: a) two inspections of stainless steel piping per unit, b) two inspections of cathodically protected steel piping per unit, and c) three inspections of fire protection piping with potentially degraded cathodic bonding straps during the period prior to extended operation and again during each ten year period in the period of extended operation.

Issue:

The staff notes that buried steel piping is present in the essential spray pond, diesel fuel oil, domestic water, and fire protection systems. The staff also notes that buried fuel oil piping contains hazardous material (i.e., material that if released could be detrimental to the environment, including concentration of radioisotopes within the piping during normal operation which exceeds the Environmental Protection Agency drinking water standard) whereas the other systems typically contain non-hazardous water.

The quality of backfill is a significant contributor to damage to coatings and piping without coatings. The staff also notes that the applicant found coating damage on the external surfaces of underground fire protection piping caused by abrasion from the bedding rock material which exposed the piping to corrosive attack. The staff further notes that there is no docketed information on the quality of the backfill used during installation of the buried essential spray pond, diesel fuel oil, domestic water, and fire protection systems piping.

Request:

1. State whether the essential spray pond contains hazardous material.

2. State whether inspections of in-scope buried piping containing diesel fuel oil will be conducted within the six inspections of carbon steel piping being conducted on site. Also, if the essential spray pond contains hazardous material, state whether inspections of piping will be conducted.

3. Justify why backfill quality is adequate such that piping and piping coatings will not be damaged for the following systems: essential spray pond, diesel fuel oil and fire protection.

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

Response (1)

The essential spray pond system water does not contain hazardous material. The essential spray pond system water does not contain material that if released could be detrimental to the environment, including concentration of radioisotopes within the piping during normal operation which exceeds the Environmental Protection Agency drinking water standard.

Response (2)

The in-scope buried diesel generator fuel oil piping in each unit consists of approximately 50 feet of 2 inch diameter carbon steel feed piping and 2½ inch carbon steel return piping running between each of the two buried diesel generator fuel oil storage tanks and the emergency diesel generator building (a total of approximately 200 feet for four pipes in each unit). The tanks are located underground about 35 feet from the diesel generator building. There is concrete on the surface above the buried tanks and piping, and the tanks and piping are partially under areas within the radiologically controlled area.

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. If degradation is found, the condition would be entered into the PVNGS Corrective Action Program and corrective actions would be determined. Corrective actions would include the consideration of expanding the scope of inspections.

Preventive measures that have been required in the Palo Verde licensing basis since initial licensing in June 1985 are requirements to routinely verify that the cathodic protection system associated with the diesel generator fuel oil storage tanks is operable. The requirements currently in Technical Requirements Manual (TRM) Surveillance

Requirements 3.8.100.1 and 3.8.100.2 are to (1) verify that the diesel generator fuel oil storage tank cathodic protection rectifiers are operable and have been inspected in accordance with Regulatory Guide 1.137 every 61 days, and (2) verify that the cathodic protection is operable and providing adequate protection against corrosion in accordance with Regulatory Guide 1.137 every 12 months. The diesel generator fuel oil storage tank cathodic protection system also provides cathodic protection to the associated buried diesel fuel oil piping.

As described in UFSAR Table 3.2-1, the diesel generator fuel oil piping is quality class Q. Therefore, the bedding and backfill used for the buried diesel fuel oil piping was required to meet standards for Q class piping that would prevent damage to the piping during the backfill process. The grading required material with 100% passing a ¾ inch sieve, greater than 95% passing a ⅜ inch sieve, and greater than 90% passing a number 4 sieve to be used as the bedding material for "Q" class buried piping. Although the fuel oil piping at Palo Verde has not had a need to be excavated since original construction, excavation of another Q class piping section verified that the protective pipe wrapping was intact and not degraded, and that the bedding and backfill were the proper materials. Restoration of the bedding and backfill was performed in accordance with the specification for Q class piping.

APS does not plan to conduct inspections of in-scope buried piping containing diesel generator fuel oil within the six inspections of carbon steel piping being conducted on site because of the following considerations:

- 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.

- If degradation is found during the NEI 09-14 inspection, the condition would be entered into the PVNGS Corrective Action Program and corrective actions would be determined. Corrective actions would include the consideration of expanding the scope of inspections.

- The in-scope buried diesel generator fuel oil piping in each unit has concrete covering the surface above the piping that will need to be cut out and replaced in order to excavate the piping. In addition, the piping is partially under areas within the radiologically controlled area.

- The cathodic protection system rectifiers associated with the diesel generator fuel oil storage tanks and piping is required to be verified operable every 61 days and verified to be providing adequate protection every 12 months in accordance with Technical Requirements Manual surveillance requirements.

- The bedding and backfill used for the buried diesel generator fuel oil piping was required to meet standards for Q class piping that would prevent damage to the

piping during the backfill process, and excavations at Palo Verde have verified proper bedding and backfill materials were used for other Q class piping.

With respect to the essential spray pond system piping, the essential spray pond system water does not contain hazardous material.

Response (3)

The bedding and backfill requirements for the essential spray pond piping and diesel generator fuel oil piping meet the requirements of plant specifications. The grading requires material with 100% passing a ¾ inch sieve, greater than 95% passing a ⅜ inch sieve, and greater than 90% passing a number 4 sieve to be used as the bedding material for "Q" class buried piping. Placement and compaction of this material in accordance with the specification would prevent damage to the pipe and pipe coatings during backfill. Although the fuel oil piping at Palo Verde has not had a need to be excavated since original construction, excavation of essential spray pond piping has verified that the bedding and backfill were installed correctly and that the protective pipe wrapping was intact and not degraded.

Palo Verde has had operating experience indicating that coarse angular material backfill was used during construction of the fire protection (FP) buried piping that caused abrasion related degradation of the protective coating on the pipe and resulted in pipe wall corrosion. Sections of the affected FP buried piping have been replaced with fiberglass reinforced plastic material using engineered bedding and backfill (⅜ inch or smaller pea gravel) that prevent damage to the piping. Palo Verde has continuing long-range plans for fire protection system piping upgrades.

DRAFT RAI 4.3-19

Background:

In LRA Section 4.7.4, the applicant dispositioned ASME Code Section XI supplemental fatigue flaw growth or cycle-dependent fracture mechanics evaluations in accordance with 10 CFR 54.21(c)(1)(iii). The applicant proposed to use the cycle counting activities from its Metal Fatigue of Reactor Coolant Pressure Boundary Program to manage the effects of aging and verify the continued validity of these ASME Code Section XI analyses during the period of extended operation.

Issue:

The staff noted that the applicant's proposal to use cycle counting activities to verify the continued validity of these ASME Code Section XI analyses may be beyond the applicant's current licensing basis.

The staff noted that Technical Specifications 5.5.5 and UFSAR Section 3.9.1.1 discuss cycle tracking/counting against design limits/design calculations, but does not appear to discuss design transient tracking/counting for ASME Code Section XI supplement fatigue flaw growth or cycle dependent fracture mechanics evaluations

Per TS 5.5.5 and UFSAR Section 3.9.1.1 cyclic and transient occurrences are tracked to ensure that components are maintained within the design limits. However, the applicant's cycle counting procedure does not discuss the types of analyses this requirement is applicable to or the action limits and corrective actions that may be taken for these fatigue related or fracture mechanics evaluations. The staff noted that these corrective actions should be specified in the applicant's procedures and the action limits and corrective actions should be associated with the specific type of analysis.

Request:

Clarify how design basis transient cycle tracking/counting activities are accounted for in the CLB for these types ASME Section XI supplemental fatigue flaw growth or cycle-dependent fracture mechanics evaluations.

Justify the use of design basis transient cycle tracking/counting activities as the basis to disposition the ASME Code Section XI analyses in LRA Section 4.7.4 in accordance with 10 CFR 54.21(c)(1)(iii), if the scope of the applicant's current licensing basis does not include this activity.

APS Response to DRAFT RAI 4.3-19

Although the accounting for design basis transient cycle tracking/counting activities for ASME Section XI supplemental fatigue flaw growth or cycle-dependent fracture mechanics evaluations is not explicitly described in the CLB today, APS recognizes the benefit of enhancing the UFSAR and the plant design transient tracking procedure to provide this explicit guidance to assist an analyst if a design transient assumption or CUF limit is approached. Therefore, as shown in Commitment No. 60 in LRA Amendment 25 in Enclosure 2, APS will complete the following by November 30, 2010:

> 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.

DRAFT Follow-up RAI 4.3-2

Background:

In its response to RAI 4.3-2, dated June 29, 2010, the applicant stated that there is a factor of five difference between the CUFs reported for the instrument nozzles at Unit 1 from those that are reported for the corresponding nozzles at Units 2 and 3 because of modeling and analysis methods and assumptions. The applicant stated that the differences include:

- The Unit 1 analysis used a more-conservative treatment of vortex shedding
- Some model differences resulting in a slightly-different limiting location
- Arithmetic instead of vector load addition at the limiting Unit 1 location

The applicant also stated the vortex shedding difference produced a larger number of assumed vortex shedding load cycles for Unit 1, which was a significant factor in the difference. Furthermore, the stress ranges in some cases were slightly lower in the analyses for Units 2 and 3 as compared to Unit 1, and a small reduction in stress range yields a significant reduction in CUF.

Issue:

The details associated with the differences that were described by the applicant in its response are unclear. Specifically it is unclear if vortex shedding is accounted for in the fatigue analysis for Units 2 and 3 and why the Unit 1 analysis treat vortex shedding so conservatively. It is also not clear to the staff why the stress ranges were slightly lower for the analyses for Units 2 and 3 as compared to Unit 1.

Request:

a) Clarify which transients are affected by the vortex shedding effect.

b) Clarify if the Unit 2 and 3 analyses account for vortex shedding:

   - If yes, justify why it was treated less conservatively when compared to the Unit 1 fatigue analysis.
   - If not, justify why it does not need to be accounted for in the fatigue analyses.

c) Clarify and justify why the stress ranges were slightly lower for the analyses for Units 2 and 3 as compared to Unit 1.

APS Response to DRAFT Follow-up RAI 4.3-2

Response (a)

Vortex shedding is a flow induced vibration at the instrument nozzle and it is present at all times while the unit is in operation or the reactor coolant pumps are running. Therefore, it is applicable to all transients associated with the reactor vessel instrument nozzle analysis. Combustion Engineering designed the instrument nozzle such that the natural frequency of the nozzle (approximately 347 cps) was away from the vortex shedding frequency (254 cps) so as to avoid a resonance condition, and accounted for the hydraulic loads imposed on the nozzle and J weld attachment to the vessel wall. This hydraulic load acts normal to the direction of flow oscillating at the vortex shedding frequency.

Response (b)

The reports for all three units considered vortex shedding in the analyses. The same analyst prepared all three of the reports: Unit 1 in 1978, Unit 2 in 1979, and Unit 3 in 1981.

The main differences between the analyses are as follows:

1. The reports for Units 2 and 3 utilized a more thorough evaluation in that more cuts were used in the determination of stresses in the critical areas of the instrument nozzle.

2. All three reports account for the operating loads, external loads as well as hydraulic loads from vortex shedding, but the reports for Units 2 and 3 implicitly demonstrate that the vortex shedding hydraulic loads and their corresponding alternating stresses are below the endurance limit and as such it is not required to be superimposed as a separate transient with all the other design transients. Nevertheless this external load was included with the other loads in the fatigue analysis and shown that the CUF was below 1.0.

   This is consistent with The ASME NB-3200 fatigue analysis where vibration is not combined with other service loads in the fatigue evaluation. The Unit 1 report performed a more simplified conservative analysis and normalized all of the plant transients to 254 cps so that the vortex shedding load transient (with equivalent 10^9 cycles) could be superimposed as a separate transient and paired up with other plant design transients. In addition, the Unit 1 report utilized a commercial fatigue curve in lieu of the ASME Figure 1-9.2 to calculate a usage factor beyond 10^6 cycles resulting in the higher CUF factor.

Response (c)

The un-concentrated maximum stress ranges for the nozzle at the base junction for all three analyses are similar (range from 23 to 40 ksi < $3S_m$) except for minor differences due to additional cuts made in the Units 2 and 3 reports, with these later reports having the higher stress range values. This is a clarification to the APS Response (3) to RAI 4.3-2, in letter no. 102-06210, dated June 29, 2010, that stated that the stress ranges in some cases were slightly lower for Units 2 and 3 as compared to Unit 1.

ENCLOSURE 2

Palo Verde Nuclear Generating Station
License Renewal Application
Amendment No. 25

LRA Section	Page No.
Table 3.5.2-14	3.5-131
3.6.2.1.4.3	3.6-6
A1.26	A-15
Table A4-1, Item No. 28	A-51
Table A4-1, Item Nos. 47, 48, 49, and 52	A-58, A-59
Table A4-1, Item 60	A-59
B2	B2-10
B2.1.26	B-76, B-77

Revision to correct the aging effect for ASME Class 2 and 3 Supports to be consistent with GALL line III.B1.2-3

Table 3.5.2-14, Containments, Structures, and Component Supports - Summary of Aging Management Evaluation - Supports, (page 3.5-131) is revised as follows (deleted text shown in strikethrough and new text underlined):

Table 3.5.2-14 Containments, Structures, and Component Supports - Summary of Aging Management Evaluation - Supports

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Supports	ES, SS	Lubrite	Plant Indoor Air (Structural) (Ext)	~~Loss of material, cracking~~ Loss of Mechanical Function	ASME Section XI, Subsection IWF (B2.1.29)	III.B1.2.3	3.5.1.56	A

Palo Verde Nuclear Generating Station
License Renewal Application
Amendment 25

Source: Response to RAI B2.1.26-3

Section 3.6.2.1.4.3, Inaccessible Medium Voltage Electrical Cables not subject to 10 CFR 50.49 EQ requirements (page 3.6-6) is revised as follows (deleted text shown in strikethrough and new text underlined):

3.6.2.1.4.3 Inaccessible ~~Medium Voltage~~ Electrical Cables (480V and above) not subject to 10 CFR 50.49 EQ requirements

Materials

The materials of construction for the inaccessible ~~medium voltage~~ electrical cables (480V and above) not subject to 10 CFR 50.49 EQ requirements are:

- Various Organic Polymers

Environment

The inaccessible ~~medium voltage~~ electrical cables (480V and above) not subject to 10 CFR 50.49 EQ requirements are exposed to the following environment:

- Adverse Localized Environment

Aging Effects Requiring Management

The following inaccessible ~~medium voltage~~ electrical cables (480V and above) not subject to 10 CFR 50.49 EQ requirements aging effects require management:

- Localized damage and breakdown of insulation leading to electrical failure

Aging Management Programs

The following aging management program manages the inaccessible ~~medium voltage~~ electrical cables (480V and above) not subject to 10 CFR 50.49 EQ requirements:

- Inaccessible Medium Voltage Electrical Cables Not Subject to 10 CFR 50.49 EQ Requirements (B2.1.26)

A1.26 INACCESSIBLE MEDIUM VOLTAGE CABLES NOT SUBJECT TO 10 CFR 50.49 ENVIRONMENTAL QUALIFICATION REQUIREMENTS

The Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements program manages localized damage and breakdown of insulation leading to electrical failure in inaccessible ~~medium voltage~~ cables (480V and above) exposed to adverse localized environments caused by significant moisture (moisture that lasts more than a few days) ~~simultaneously with significant voltage (energized greater than 25% of the time)~~ to ensure that inaccessible ~~medium voltage~~ cables (480V and above) not subject to the environmental qualification (EQ) requirements of 10 CFR 50.49 and within the scope of license renewal are capable of performing their intended function.

All cable manholes that contain in-scope non-EQ inaccessible ~~medium voltage~~ cables (480V and above) will be inspected for water collection. Collected water will be removed as required. This inspection and water removal will be performed based on actual plant experience with water accumulation in the manhole and site rain events. ~~with an~~ The inspection frequency is event driven and ~~of~~ at least annually ~~every two years~~.

The program provides for testing of in-scope non-EQ inaccessible ~~medium voltage~~ cables (480V and above) to provide an indication of the conductor insulation condition. At least once every six ~~ten~~ years, a polarization index test as described in EPRI TR-103834-P1-2 or other testing that is state-of the- art at the time of the testing is performed.

~~The Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 EQ 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.~~

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.

LRA Table A4-1, License Renewal Commitments (page A-51), is revised as follows (deleted text shown in strikethrough and new text underlined):

Table A4-1 License Renewal Commitments

Item No.	Commitment	LRA Section	Implementation Schedule
28	The Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 EQ 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.~~ 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].

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LRA Table A4-1, License Renewal Commitments (page A-58 and A-59), are revised as follows (deleted text shown in strikethrough and new text underlined):

Item No.	Commitment	LRA Section	Implementation Schedule
47	**Deleted (Note: this was in the PVNGS Environmental Report)** ~~Once the ground surface is made less permeable and ambient monitoring is sufficient to characterize subsurface water quality, a [tritiated water] remediation plan will be implemented.~~ ~~(RCTSAI 3246946)~~	~~Environmental Report 2.3~~	~~12/31/10~~
48	Deleted (Note: this was in the PVNGS Environmental Report) ~~New Evaporation Pond No. 3 is currently under construction and is being built using a Best Available Demonstrated Control Technology (BADCT), a geosynthetic clay liner, with two overlaying HDPE liners, including a leachate collection and recovery system, plus soil cement side armoring, including a leak detection system. Following that, the existing liner in Evaporation Pond No. 2 will be replaced with the same BADCT liner system. This liner is approaching the end of its useful life. Following that, the existing liner in Evaporation Pond Number 1 will be replaced with the same BADCT liner system.~~ ~~(RCTSAI: 3246947)~~	~~Environmental Report 3.1.2~~	~~12/31/15~~
49	Deleted (Note: this was in the PVNGS Environmental Report) ~~APS commits to implement SAMAs 6, 17 and 23 prior to the period of extended operation.~~ ~~(RCTSAI 3246952)~~	~~Environmental Report D.8~~	~~Prior to the period of extended operation[1].~~
52	Deleted (Note: this was in the PVNGS Environmental Report) ~~APS will consider SAMA 8 for potential implementation.~~ ~~(RCTSAI 3420542)~~	~~Follow-up Response to SAMA RAI (letter no. 102-06121, dated January 13, 2010)~~	~~Prior to the period of extended operation[1].~~

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LRA Table A4-1, License Renewal Commitments (page A-59), is revised as follows (deleted text shown in strikethrough and new text underlined):

Item No.	Commitment	LRA Section	Implementation Schedule
55	Completed (RCTSAI 3469024) ~~The transient in UFSAR Table 3.9-1 Sheet No. 9 Item No. I.E.1.b, and Sheet No. 18, Item No. III.A.1.f, "Standby to SI hot leg injection check valve stroke test to standby (using the HPSI pump)," will be added to the cycle counting surveillance procedure 73ST-9RC02 by August 25, 2010.~~ ~~(RCTSAI 3469024)~~	~~4.3.1~~ ~~Fatigue Aging Management Program (Table 4.3-2, Row No. 25)~~	~~8/25/10~~
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

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Source: Response to RAI B2.1.26-3

Section B2, Aging Management Program Table (page B2-10) is revised as follows (deleted text shown in strikethrough and new text underlined)

NUREG-1801 NUMBER	NUREG-1801 PROGRAM	PLANT PROGRAM	EXISTING OR NEW	APPENDIX B REFERENCE
XI.E3	Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	~~New~~ Existing	B2.1.26

B2.1.26 Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

Program Description

The Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements program manages localized damage and breakdown of insulation leading to electrical failure in inaccessible ~~medium voltage~~ cables (480V and above) exposed to adverse localized environments caused by significant moisture (moisture that lasts more than a few days) ~~simultaneously with significant voltage (energized greater than 25% of the time)~~ to ensure that inaccessible ~~medium voltage~~ cables (480V and above) not subject to the environmental qualification (EQ) requirements of 10 CFR 50.49 and within the scope of license renewal are capable of performing their intended function.

All cable manholes that contain in-scope non-EQ inaccessible ~~medium voltage~~ cables (480V and above) will be inspected for water collection. The collected water will be removed as required. This inspection and water removal will be performed based on actual plant experience with water accumulation in the manholes and site rain events. The inspection frequency is event driven and at least annually ~~but at least every two years~~.

All in-scope non-EQ inaccessible ~~medium voltage~~ cables (480V and above) routed through manholes will be tested to provide an indication of the conductor insulation condition. A polarization index test as described in EPRI TR-103834-P1-2 or other testing that is state-of-the-art at the time of the testing will be performed at least once every six ~~ten~~ years. The first test will be completed before the period of extended operation.

The acceptance criteria for each test will be defined for the specific type of test performed and the specific cable tested. Periodic inspections of cable manholes, for the accumulation of water will minimize cable exposure to water. Corrective actions for conditions that are adverse to quality are performed in accordance with the corrective action program as part of the QA program. The corrective action program provides reasonable assurance that deficiencies adverse to quality are either promptly corrected or are evaluated to be acceptable.

Procedures will implement the aging management program for testing of the ~~medium voltage~~ inaccessible cables (480V and above) not subject to 10 CFR 50.49 EQ requirements and the periodic inspections and removal of water from the cable manholes containing in-scope ~~medium voltage~~ inaccessible cables (480V and above) not subject to 10 CFR 50.49 EQ requirements.

NUREG-1801 Consistency

The Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements program is ~~a new~~ an existing program that, ~~when implemented~~, following enhancement, will be consistent with NUREG-1801, Section XI.E3, "Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements".

Exceptions to NUREG-1801

None

Enhancements

~~None~~

Prior to the period of extended operation, the following enhancements will be implemented in the following program elements.

Scope of Program - Element 1,

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.

Detection of Aging Effects – Element 4

Perform the cable inspections on at least an annual frequency and perform the cable testing on a six year frequency.

Operating Experience

Industry operating experience has shown that cross linked polyethylene or high molecular weight polyethylene insulation materials, exposed to significant moisture and voltage, are most susceptible to water tree formation. Formation and growth of water trees varies directly with operating voltage.

PVNGS has not experienced a failure of any inaccessible medium voltage cables. PVNGS has experienced cases where medium voltage cable splices have been subjected to water intrusion resulting in low megger readings. In all cases the splices were reworked. In addition, in one case the splice was moved to a manhole less subject to water intrusion.

During manhole walkdowns in 2009, one station blackout cable manhole was found to contain water submerging the cables. Subsequent inspection of a connected manhole found additional water, but no additional submerged cables. A review of the history of these manholes found recurring instances of water intrusion. The manhole found to contain water with submerged cables has had a seal replaced, lid raised above grade, and the ground surface reworked to route water away from the manhole. As a result of this operating experience, APS moved these manholes to the most frequent inspection interval. The preventive maintenance (PM) program groups the manholes into three frequencies of inspections based on their history of water intrusion: two weeks, six months, and two years. The two-week PM task requires inspection of manholes if it has rained 0.3 inches or more within a 24-hour period since the last time the PM was performed. The manholes grouped into this PM task are also inspected on a six-month frequency to ensure they are always inspected even during dry periods. Under the PM program, a manhole will not be moved to the two-year reduced frequency inspection interval until it has been found dry for two years.

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

Conclusion

The continued implementation of the Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 EQ Requirements program ~~will provide~~ provides reasonable assurance that aging effects will be managed ~~so that the intended functions of the inaccessible medium voltage~~

~~cables within the scope of license renewal are maintained during~~ 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.