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Palo Verde Nuclear Generating Station

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102-06156-DCM/GAM
March 24, 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 February 19, 2010, Request for Additional Information Regarding Closure Bolting, Elastomer, Structures, and Electrical, for the Review of the PVNGS License Renewal Application, and License Renewal Application Amendment No. 12

By letter dated February 19, 2010, the Nuclear Regulatory Commission staff issued a request for additional information (RAI) related to the PVNGS license renewal application (LRA). Enclosure 1 contains Arizona Public Service Company's response to the February 19, 2010 RAI. Enclosure 2 contains LRA Amendment No. 12 to reflect changes made as a result of the RAI responses.

In addition, LRA Amendment No. 12 in Enclosure 2 contains the following changes:

- Sections A1.12 and B2.1.12, and Table A4-1 Item 14, have been revised to reflect the completion of the commitment to enhance procedures to state trending requirements for the diesel-driven fire pump.

- Sections A1.12 and B2.1.12 have also been revised to clarify the discussion regarding the testing of the Electro-Thermal links and functional testing of the dampers every 54 months. This clarification supplements the changes to A1.12 and B2.1.12 in LRA Amendment No. 3 in APS letter no. 102-06100, dated December 7, 2009, and the APS response to RAI B2.1.12-2 in letter no. 102-06134, dated February 19, 2010.

- Table A4-1, Item 19, has been updated to clarify the commitment to implement the Selective Leaching Program. This clarification addresses a question asked during the NRC license renewal inspection the week of February 22, 2010, and documented in Palo Verde Action Request (PVAR) 3446894.

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- Section B2.1.19 has been updated to revise the operating experience for ASME Class 1 piping socket welds. This update addresses a question asked during the NRC license renewal inspection the week of February 22, 2010, and documented in PVAR 3440002.

- Minor editorial enhancements to Sections B2.1.12 and B2.1.19.

Enclosure 3 contains the response to RAI B2.1.7-03 for the portion of the request regarding management of aging effects for GALL AMP XI.M3, Reactor Head Closure Studs. This portion of the response to RAI B2.1.7-03 was not included in APS letter no. 102-06134, dated February 19, 2010, responding to the December 29, 2009, AMP audit RAI.

Commitments being revised by this letter are shown on the LRA Table A4-1 mark-ups in Enclosure 2. Should you need further information regarding this submittal, please contact Russell A. Stroud, Licensing Section Leader, at (623) 393-5111.

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

Executed on 3/24/10
(date)

Sincerely,

DCM/RAS/GAM

Enclosures:

1. Response to February 19, 2010, Request for Additional Information Regarding Closure Bolting, Elastomer, Structures, and Electrical, for the Review of the PVNGS License Renewal Application
2. Palo Verde Nuclear Generating Station License Renewal Application Amendment No. 12
3. Response to RAI B2.1.7-03 for GALL AMP XI.M3, Reactor Head Closure Studs

cc:	E. E. Collins Jr.	NRC Region IV Regional Administrator
	J. R. Hall	NRC NRR Project Manager
	R. I. Treadway	NRC Senior Resident Inspector for PVNGS
	L. M. Regner	NRC License Renewal Project Manager
	G. A. Pick	NRC Region IV (electronic)

ENCLOSURE 1

Response to February 19, 2010, Request for Additional Information Regarding Closure Bolting, Elastomer, Structures, and Electrical, for the Review of the PVNGS License Renewal Application

NRC RAI 3.3-1

Background:

Table 3.2.1 of the LRA, item 3.2.1.21 states, "Not applicable. PVNGS has no in-scope high-strength steel closure bolting exposed to air with steam or water leakage in the engineered safety features system."

The discussion in item 3.2.1.22 states, "Not applicable. PVNGS has no closure bolting in Engineered Safety Features systems that is exposed to an environment of water [*sic*] with steam or water leakage, so the applicable NUREG-1801 line was not used."

In LRA Table 3.3.1, item 3.3.1.42, the discussion states, "Not applicable. PVNGS has no in-scope steel closure bolting exposed to air with steam or water leakage in the auxiliary systems, so the applicable NUREG-1801 line was not used."

The discussion in item 3.3.1.44 states, "Not applicable. PVNGS has no in-scope steel closure bolting exposed to condensation in the compressed air system, so the applicable NUREG-1801 line was not used."

Issue:

The discussion in the LRA, item 3.2.1.21, is not sufficient for the staff to determine whether there is no in-scope high-strength closure bolting used in the Engineered Safety Features (ESF) systems or whether high-strength closure bolting is used but these bolts are not exposed to an environment of air with steam or water leakage.

The discussion in LRA items 3.2.1.22, 3.3.1.42 and 3.3.1.44 is not sufficient for the staff to determine why the environments identified in the Generic Aging Lessons Learned (GALL) Report are not applicable for steel closure bolting in the ESF and auxiliary systems.

Request:

a) For Table 3.2.1, item 3.2.1.21, clarify whether high strength closure bolting is used in ESF systems.

b) For Table 3.2.1, item 3.2.1.22 and for Table 3.3.1, items 3.3.1.42 and 3.3.1.44, clarify the basis for your claim that the environments listed in the GALL Report are not applicable for steel closure bolting in ESF or auxiliary systems.

APS Response to RAI 3.3-1

Response (a)

For LRA Table 3.2.1, item 3.2.1.21, the associated GALL line item is V.E-3 for high-strength steel closure bolting exposed to air with steam or water leakage. Palo Verde does not use high strength (>150 ksi) steel closure bolting in the Containment Leak Test, Containment Purge, or the Containment Hydrogen Control ESF Systems per plant specifications. In addition, an environment of air with steam or water leakage would be an event driven environment and is not expected for the steel closure bolting in the Containment Leak Test, Containment Purge, or the Containment Hydrogen Control ESF Systems that are evaluated with GALL lines V.E-4 and V.E-1. The Safety Injection and Shutdown Cooling System uses stainless steel bolting that is evaluated in a borated water leakage environment. Therefore, GALL line V.E-3 was not used for evaluation of high-strength steel closure bolting exposed to air with steam or water leakage in ESF systems.

Response (b)

ESF and auxiliary system steel closure bolting and steel ducting closure bolting were not evaluated in an environment of air with steam or water leakage or an environment of condensation (compressed air system).

LRA Table 3.2.1, item 3.2.1.22 (GALL line V.E-6)

For LRA Table 3.2.1, item 3.2.1.22, the associated GALL line item is V.E-6 which identifies the Bolting Integrity aging management program (AMP) for aging management of steel closure bolting with loss of material due to general corrosion in an environment of air with steam or water leakage. The Bolting Integrity AMP is also identified for aging management of ESF System steel closure bolting with loss of material due to general, pitting, and crevice corrosion in an environment of plant indoor air (GALL line V.E-4 with an air – indoor uncontrolled environment) or air-outdoor (GALL V.E-1 with an atmosphere/weather environment). Although different environments were selected for the ESF system steel closure bolting, the Bolting Integrity AMP will manage loss of material due to general corrosion. In addition, an air environment with steam or water leakage would be an event driven environment and is not expected for the steel closure bolting in the Containment Leak Test, Containment Purge, or the Containment Hydrogen Control ESF Systems that are evaluated with GALL lines V.E-4 and V.E-1.

LRA Table 3.3.1, item 3.3.1.42 (GALL line VII.I-6)

For LRA Table 3.3.1, item 3.3.1.42, the associated GALL line item is VII.I-6 which identifies the Bolting Integrity AMP for aging management of steel closure bolting with loss of material due to general corrosion in an environment of air with steam or water leakage. The Bolting Integrity AMP is also identified for aging management of auxiliary system steel closure bolting with loss of material due to general, pitting, and crevice corrosion in an environment of plant indoor air (GALL line VII.I-4 with an air – indoor uncontrolled environment) or air-outdoor (GALL VII.I-1 with an atmosphere/weather environment). Although different environments were selected for the auxiliary system steel closure bolting, the Bolting Integrity AMP will manage loss of material due to general corrosion. The External Surfaces Monitoring AMP is identified for aging management of steel ducting closure bolting in Auxiliary HVAC systems with loss of material due to general corrosion in an environment of plant indoor air consistent with GALL lines VII.I-7, VII.F1-4, VII.F2-4, VII.F3-4 and VII.F4-3. In addition, an air with steam or water leakage would be an event driven environment and is not expected for the steel closure bolting or steel ducting closure bolting in the auxiliary systems that are evaluated with GALL lines VII.I-1, VII.I-4, VII.I-7, VII.F1-4, VII.F2-4, VII.F3-4 and VII.F4-3.

LRA Table 3.3.1, item 3.3.1.44 (GALL VII.D-1)

For LRA Table 3.3.1, item 3.3.1.44, the associated GALL line item is VII.D-1 which identifies the Bolting Integrity AMP for aging management of compressed air system steel closure bolting with loss of material due to general, pitting, and crevice corrosion in an environment of condensation. The Bolting Integrity AMP is identified for aging management of Compressed Air System steel closure bolting with loss of material due to general, pitting, and crevice corrosion in an environment of plant indoor air (GALL line VII.I-4 with an air – indoor uncontrolled environment). The temperature of the Compressed Air System components within the scope of license renewal is typically higher than the dew point of the plant indoor air environment; therefore, condensation is considered to be insignificant. Plant indoor air is considered to have enough moisture to facilitate loss of material in steel due to general, pitting, and crevice corrosion. Therefore a plant indoor air environment (GALL line VII-4) was used rather than a condensation environment and GALL line VII.D-1 with an environment of condensation was not used for evaluation of steel closure bolting of the Compressed Air System.

Note: The discussion in item 3.2.1.22 in Table 3.2.1 has been revised, as shown in LRA Amendment 12 in Enclosure 2, to correct "water" to "air."

NRC RAI 3.3-2

Background:

Table 3.3.2-2 of the LRA, page 3.3-76, includes two AMR line items for closure bolting made of stainless steel in an environment of borated water leakage. For one of these line items the aging effect requiring management (AERM) is identified as loss of preload which is managed by the Bolting Integrity AMP (B2.1.7); for the other of these line items the AERM is identified as "none," and no AMP is recommended. There also are similar pairs of AMR line items for closure bolting in other LRA tables where for identical materials and environments one AMR line item identifies the AERM as loss of preload managed by the Bolting Integrity AMP and the other line identifies the AERM as "none," with no AMP recommended. These occur in Table 3.3.2-4, page 3.3-89 (stainless steel, plant indoor air); Table 3.3.2-5, page 3.3-101 (stainless steel, plant indoor air); Table 3.3.2-7, page 3.3-107 (copper alloy, plant indoor air); Table 3.3.2-8, page 3.3-114 (stainless steel, borated water leakage); and Table 3.3.2-9, page 3.3-122 (copper alloy, plant indoor air).

Issue:

Because one of the AMR line items identifies the aging effect of loss of preload to be managed by the Bolting Integrity program and the other AMR line item, with the same component, material and environment combination, states that there is no aging effect, the two AMR result lines appear to contradict each other.

Request:

Explain why the AMR line items discussed above specify differing results for closure bolting for the same material and environment.

APS Response to RAI 3.3-2

Based on available GALL lines, the aging management review for auxiliary system stainless steel and copper alloy closure bolting were evaluated for loss of preload and loss of material aging effects. When the aging management review identified loss of preload as an aging effect, the Bolting Integrity AMP was used to manage the aging effect. When the aging management review identified loss of material was not a relevant aging effect for the component material and environment combination, the result was documented as no aging effect and no aging management program was credited. The Auxiliary System stainless steel and copper alloy closure bolting aging management reviews in LRA Tables 3.3.2-2, -4, -5, -7, -8, and -9 have been revised, as shown in LRA Amendment 12 in Enclosure 2, to delete the "no aging effect" aging management reviews when an aging effect such as loss of preload has been identified for the same component material environment combination.

NRC RAI 3.3.2.2.5-1

Background:

Section 3.3.2.2.5.1 of the LRA states that the External Surfaces Monitoring Program will manage hardening and loss of strength from elastomer degradation for elastomer external surfaces exposed to plant indoor air (uncontrolled) in locations where the ambient temperature cannot be shown to be less than 95 degrees Fahrenheit. It also states that the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will manage hardening and loss of strength from elastomer degradation for elastomer internal surfaces exposed to plant indoor air (uncontrolled) in locations where the ambient temperature cannot be shown to be less than 95 degrees Fahrenheit.

Issue:

In Table XI.D of the GALL report, the temperature of 95 degrees Fahrenheit is identified as a temperature limit below which any thermal aging of organic materials can be considered to be insignificant over the period of extended operation. However, being below this temperature limit does not preclude hardening and loss of strength of due to other aging mechanisms such as exposure to ozone, oxidation, and radiation.

Request:

Identify which plant systems contain in-scope elastomer components that will be inspected using this criteria and which plant systems will use this criteria to eliminate inspection of all in-scope elastomer components.

APS Response to RAI 3.3.2.2.5-1

LRA section 3.3.2.2.5.1 includes evaluations of the following mechanical systems that contain elastomer components within the scope of license renewal, exposed to a plant indoor air (uncontrolled) environment or ventilation atmosphere environment:

System	Component Type
Containment Purge	Flexible Connectors
Fuel Building HVAC	Flexible Connectors
Auxiliary Building HVAC	Flexible Connectors
Containment Building HVAC	Flexible Connectors
Diesel Building HVAC	Flexible Connectors
Control Building HVAC	Flexible Connectors
Miscellaneous Buildings HVAC	Flexible Connectors

All of the elastomer flexible connectors listed above are subject to the aging effect of hardening and loss of strength and will be managed by AMP B2.1.20, the External Surfaces Monitoring Program, for the exterior surfaces and AMP B2.1.22, Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components for interior surfaces. None of the elastomer flexible connectors were excluded from aging management due to the 95 degrees Fahrenheit criterion.

NRC RAI 3.5.2.2.1-1

Background:

The GALL Report states that aging management is not necessary for certain aging effects (increase in porosity, leaching of calcium hydroxide, and loss of strength) of inaccessible concrete if the concrete was constructed in accordance with the recommendations in ACI 201.2R-77 "Guide to Durable Concrete." However, further evaluation is necessary if the concrete is not constructed in accordance with these recommendations. The intent of the GALL Report recommendation is to ensure the durability of the as-placed concrete during the period of extended operation.

Issue:

Sections 3.5.2.2.1.4 and 3.5.2.2.1.10 of the LRA state that concrete mixes were designed in accordance with ACI 211.1-74, "Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete," which does not provide recommendations for ensuring durable concrete. The LRA provides no additional information as to how this code compares to ACI 201.2R-77.

Request:

Explain how ACI 211.1-74 meets the intent of ACI 201.2R-77. Include important concrete design parameters (e.g. water-cement ratio, air entrainment, etc.) which demonstrate that PVNGS concrete meets the recommendations in ACI 201.2R-77.

APS Response to RAI 3.5.2.2.1-1

The GALL Report cites ACI 201.2R-77 as an acceptable reference for design and construction of concrete to ensure the durability of the as-placed concrete during the period of extended operation. UFSAR Section 3.8 references ACI 211.1-74, which incorporates ACI 201 by reference. ACI 211.1-74, Section 3.5, Durability, provides general guidance for design of durable concrete mixes. It states that concrete must be able to endure those exposures that may deprive it of its serviceability. It discusses the use of a low water-cement ratio to prolong the life of concrete, and the incorporation of a proper distribution of entrained air to improve resistance to severe weathering. ACI 211.1-74 provides procedures for designing concrete mixes that take into consideration the requirements for placeability, consistency, strength, and durability. The requirements of ACI 201 are incorporated throughout these procedures. Specifically, ACI 201 is referenced in ACI 211.1-74 discussions of durability, air entrainment, and water-cement ratios. Therefore, the applicable requirements in ACI 201 were addressed in the concrete designs at Palo Verde.

Two critical environmental conditions to consider when designing durable concrete are the presence of groundwater and exposure to freeze-thaw cycles. The groundwater below the Palo Verde plant site is a perched aquifer that resulted from irrigation of the property for farming, prior to construction of the plant. Since cessation of the irrigation, the water level has dropped significantly. It is currently about 20 feet below the lowest structure on the site and continues to decline. An engineering study completed in 2007 concluded that there is little likelihood of local rising groundwater levels beneath the units in the future. Therefore, site structures are not exposed to groundwater from the perched aquifer. The weathering index for Palo Verde is Negligible according to ASTM C33, Figure 1, therefore, freeze-thaw cycles are not a concern.

NRC RAI 3.5.2.2.2-1

Background:

The GALL Report recommends periodic monitoring of below-grade water chemistry to ensure the below-grade environment is non-aggressive. Additionally, it recommends examination of representative samples of below-grade concrete when excavated for any reason.

Issue:

The LRA states that concrete structures are not subject to groundwater for any sustained periods; however, it does not discuss groundwater sampling or opportunistic examinations of exposed below-grade concrete. In addition, the LRA does not clearly explain how the current AMP demonstrates that the below-grade environment is non-aggressive.

Request:

a) Explain how the current AMP demonstrates that the environment (groundwater or soil) adjacent to inaccessible concrete structures is not aggressive. Include in this discussion an explanation of why periodic monitoring of groundwater is unnecessary.

Question:

b) Explain why there is no provision for opportunistic inspections of excavated portions of below-grade concrete.

APS Response to RAI 3.5.2.2.2-1

Response (a)

Plant operating experience, including opportunistic inspections of buried structures, has not identified any degradation of structures due to aggressive groundwater or soil. The Structures Monitoring Program, AMP B2.1.32, will continue to monitor the structures, including opportunistic inspections of buried structures, to confirm the absence of aging effects due to aggressive groundwater or soil.

The groundwater below the PVNGS plant site is a perched aquifer that resulted from irrigation of the property for farming, prior to construction of the plant. Since cessation of the irrigation, the water level has dropped significantly. It is currently about 20 feet below the lowest structure on the site and continues to drop. An engineering study completed in 2007 concluded that there is little likelihood of local rising groundwater levels beneath the units in the future. Therefore, site structures are not exposed to groundwater from the perched aquifer, and monitoring of the chemistry of this water is not required.

Response (b)

AMP B2.1.32, Structures Monitoring Program, provides for opportunistic inspections of inaccessible areas (includes below grade concrete) when they are made accessible by maintenance or other activities. Inaccessible areas would also be opened for inspection if conditions observed in adjoining areas or in other similar structures indicate that it is necessary.

NRC RAI 3.5.2.3-1

Background:

For the component type 'structural steel,' Table 3.5.2-9 of the LRA credits the Structures Monitoring Program to manage loss of material for carbon steel in a buried environment. The LRA states that neither the component nor the material and environment combination is evaluated in the GALL Report.

Issue:

It is not clear to the staff how the Structures Monitoring Program will be used to inspect a buried component since the program is, primarily, a visual inspection program.

Request:

Explain how the Structures Monitoring Program will manage the effect of aging on carbon steel in a buried environment.

APS Response to RAI 3.5.2.3-1

This component is a steel plate installed at the edge of the seismic gap between the Fuel Building and adjacent buildings that prevents dirt from obstructing the seismic gap. The side of the plate that is in a "buried" environment is normally inaccessible. AMP B2.1.32, Structures Monitoring Program, will inspect inaccessible areas when they are made accessible by maintenance or other activities. Inaccessible areas would be opened for inspection if conditions observed in adjoining areas or in other similar structures indicate that it is necessary.

NRC RAI 3.5.2.3-2

Background:

For the component type 'screen,' Table 3.5.2-10 of the LRA credits the Structures Monitoring Program to manage loss of material for copper alloy in a raw water environment. The LRA states that neither the component nor the material and environment combination is evaluated in the GALL Report.

Issue:

The 'screen' component is used as a filter in a raw water environment and may have limited accessibility. It is not clear to the staff how the Structures Monitoring Program will inspect the component to ensure the aging effect is being managed.

Request:

Explain how the Structures Monitoring Program will manage the effect of aging on copper alloy screens in a raw water environment.

APS Response to RAI 3.5.2.3-2

The screens in question are the Essential Spray Pond screens, and they are accessible through the exterior deck of the Spray Pond Pump House. The screens are raised above the water level for visual inspection for loss of material. The inspection attributes to be monitored are listed in the Structures Monitoring Program under the category of Steel Structures and Connections Categorization Guidelines Including Non-ASME Code Supports, Electrical Panel, Cable Tray, Conduits, and Electrical Supports.

NRC RAI 3.5.2.3-3

Background:

For the component type 'supports, non-ASME,' Table 3.5.2-14 of the LRA credits the Structures Monitoring Program to manage loss of material for carbon and stainless steel in a raw water environment. The LRA states that the environment is not in the GALL Report for this component and material.

Issue:

The 'support' component is in a raw water environment and may potentially have limited accessibility. It is not clear to the staff how the Structures Monitoring Program will inspect the component to ensure the aging effect is being managed.

Request:

Explain how the Structures Monitoring Program will manage the effect of aging on carbon and stainless steel components in a raw water environment.

APS Response to RAI 3.5.2.3-3

The carbon steel and stainless steel supports in a raw water environment were included to evaluate the non-code supports for drain pipes located inside Radioactive Waste Drain sumps. The Radioactive Waste Drain non-code supports were included within the scope of license renewal in error. The Radioactive Waste Drain non-code supports in a raw water environment have been deleted from LRA Table 3.5.2-14, as shown in LRA Amendment 12 in Enclosure 2. In addition, LRA Section 3.3.2.1.2 and Table 3.3.2-2 have been revised, as shown in LRA Amendment 12 in Enclosure 2, to indicate that the Spent Fuel Cooling and Cleanup system cask pit drain line and valve in the Fuel Building sump are submerged in the sump water (evaluated as a raw water environment). There are no supports on the portion of the Spent Fuel Cooling and Cleanup system cask pit drain line and valve in the Fuel Building sump.

NRC RAI 3.6.2.2.2-1

Background:

Section 3.6.2.2.2 of the LRA states that PVNGS is located in an area where the outdoor environment is not subject to industry air pollution or salt spray. It further states that contamination buildup on high-voltage insulators is not a problem due to sufficient rainfall in the spring and summer washing the insulators. Additionally, there is no salt spray at the plant since the plant is not located near the ocean. The applicant also stated that degradation of insulator quality in the absence of salt deposits and surface contamination is not an aging effect requiring management.

Issue:

Section 3.6.2.2.2 of the Standard Review Plan for License Renewal states that degradation of insulator quality due to presence of any salt deposit and surface contamination could occur in high voltage insulators. The applicant did not address plant-specific operating experience with high-voltage insulator failures relating to surface contamination.

Request:

Confirm that there is no plant-specific operating experience with failures of high voltage insulators due to surface contamination.

APS Response to RAI 3.6.2.2.2-1

Palo Verde and the transmission system owner (Salt River Project) have not identified any documented operating experience failures of high-voltage insulators within the scope of license renewal due to surface contamination.

A search of documented Palo Verde operating experience identified the following three high voltage bushing flashovers that resulted in unit trips:

- July 31, 1988 - B Phase in Palo Verde Unit 3
- November 14, 1991 - A Phase in Palo Verde Unit 3
- March 1, 1996 - C Phase in Palo Verde Unit 1

During the initial Palo Verde evaluation of the flashovers, contamination levels were reviewed and it was concluded that contaminate deposits on the bushings were minimal such that there was little risk of contamination induced flashover. Subsequent additional evaluation of the flashovers concluded that the flashovers were due to the tilt angle of the bushings. Booster sheds were added to channel water away from the bushings during heavy rain with no repeat flashovers.

NRC RAI 3.6.2.2.2-2

Background:

Section 3.6.2.2.2 of the LRA states that industry experience has shown that transmission conductors are designed and installed not to swing significantly and cause wear due to wind induced abrasion and fatigue. The applicant further stated that the transmission conductors are designed and installed not to swing significantly and cause wear due to wind induced abrasion and fatigue. The applicant then concluded that loss of material due to wind induced abrasion and fatigue is not an applicable aging effect requiring management.

Issue:

Section 3.6.2.2.2 of the Standard Review Plan for License Renewal states that the loss of material due to mechanical wear caused by wind blowing on transmission conductors could occur in high voltage insulators. The applicant did not address plant-specific operating experience with high-voltage insulator and transmission conductor loss of material due to wear.

Request:

Confirm that there is no plant-specific operating experience concerning wear of high-voltage insulators and transmission conductors.

APS Response to RAI 3.6.2.2.2-2

Palo Verde and the transmission system owner (Salt River Project) have not identified any documented operating experience of high-voltage insulators and transmission conductors within the scope of license renewal associated with loss of material due to wear that has resulted in a loss of intended function.

NRC RAI 3.6.2.2.3-1

Background:

Section 3.6.2.2.3 of the LRA states that transmission conductor and switchyard bus connections are torqued to avoid loss of pre-load. Based on temperature data in the Updated Final Safety Analysis Report, Chapter 2.3, the transmission connections and switchyard bus does not experience thermal cycling. The applicant further stated that transmission connections and switchyard bus are subject to average monthly temperatures ranging from 105 degrees Fahrenheit in July and August to 38 degrees Fahrenheit in January with minimal ohmic heating. The applicant concluded that increased resistance of connections due to loss of pre-load is not an aging effect requiring management for the period of extended operation. Electric Power Research Institute Technical Report 104213, "Bolted Joint Maintenance & Applications Guide," states that an electrical connection must be designed to remain tight and maintain good conductivity through a large temperature range. Meeting this design requirement is difficult if the materials specified for the bolt and the conductor are different and have different rates of thermal expansion. For example, copper and aluminum bus materials expand faster than most bolting materials. If thermal stress is added to stresses inherent at assembly, the joint members or fasteners can yield. If deformation occurs during thermal loading (i.e., heatup), when the connection cools, the joint will become loose.

Issue:

Section 3.6.2.2.3 of the Standard Review Plan for License Renewal states that increased resistance of connections due to loss of pre-load could occur in transmission connections and in switchyard bus connections. Torqueing transmission conductor and switchyard bus connections alone may not avoid loss of pre-load due to different thermal expansion between bolted connection and conductor materials.

Request:

Provide additional technical justification for why loss of pre-load of switchyard bus and transmission connections is not an applicable aging effect requiring management. Also, confirm that there is no plant-specific operating experience concerning failures of transmission connections and switchyard bus connections due to loss of pre-load.

APS Response to RAI 3.6.2.2.3-1

Loss of pre-load of switchyard bus and connections is not an applicable aging effect requiring management because procedures require that switchyard connections are assembled using a corrosion inhibitor and torqued to avoid loss of pre-load. Additionally, switchyard conductor and bus connections are assembled with stainless steel Belleville washers to prevent loss of preload. The transmission system owner, Salt River Project (SRP), periodically performs infrared scans of switchyard equipment and connections, including before and after scans, for equipment involved in a maintenance procedure to verify connector integrity.

A search of operating experience by PVNGS and the transmissions system owner, SRP, identified no evidence of switchyard bus connection or transmission conductor connection loss of pre-load.

ENCLOSURE 2

Palo Verde Nuclear Generating Station
License Renewal Application Amendment No. 12

LRA Section	Page Nos.	RAI
Table 3.2.1	3.2-15	RAI 3.3-1
3.3.2.1.2	3.3-5	RAI 3.5.2.3-3
Table 3.3.1	3.3-67	RAI 3.5.2.3-3
Table 3.3.2-2	3.3-76	RAI 3.3-2
Table 3.3.2-2	3.3-79, 80, 82	RAI 3.5.2.3-3
Table 3.3.2-4	3.3-89	RAI 3.3-2
Table 3.3.2-5	3.3-101	RAI 3.3-2
Table 3.3.2-7	3.3-107	RAI 3.3-2
Table 3.3.2-8	3.3-114	RAI 3.3-2
Table 3.3.2-9	3.3-122	RAI 3.3-2
Table 3.5.2-14	3.5-136, 137	RAI 3.5.2.3-3
A1.12*	A6, 7	Clarification
A4, Table A4-1, No. 14	A-44	Clarification
A4, Table A4-1, No. 19	A-48	Clarification
B2.1.12*	B-45, 46, 47	Clarification
B2.1.19*	B-62,63,63A	Update

* The complete Appendix A and B aging management program sections are provided for reviewer convenience when there is any change to the sections.

Source: RAI 3.3-1 Response

Table 3.2.1, Summary of Aging Management Evaluations in Chapter V of NUREG-1801 for Engineered Safety Features (page 3.2-15) is revised as follows (deleted text shown with strike through, new text underlined):

Table 3.2.1 Summary of Aging Management Evaluations in Chapter V of NUREG-1801 for Engineered Safety Features

Item Number	Component Type	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.2.1.22	Steel closure bolting exposed to air with steam or water leakage	Loss of material due to general corrosion	Bolting Integrity (B2.1.7)	No	Not applicable. PVNGS has no closure bolting in Engineered Safety Features Systems that is exposed to an environment of ~~water~~ <u>air</u> with steam or water leakage, so the applicable NUREG-1801 line was not used.

Source: RAI 3.5.2.3-3

LRA Section 3.3.2.1.2 Spent Fuel Pool Cooling and Cleanup System (page 3.3-5) is revised as follows (new text underlined):

Environment

The spent fuel pool cooling and cleanup system component types are exposed to the following environments:

- Borated Water Leakage
- Closed-Cycle Cooling Water
- Encased in Concrete
- Plant Indoor Air
- Treated Borated Water
- <u>Raw Water</u>

Source: RAI 3.5.2.3-3

LRA Table 3.3.1, Summary of Aging Management Evaluations in Chapter VII of NUREG-1801 for Auxiliary Systems (page 3.3-67), is revised as follows (new text underlined, deleted text strike through):

Table 3.3.1 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
3.3.1.78	Stainless steel, nickel alloy, and copper alloy piping, piping components, and piping elements exposed to raw water	Loss of material due to pitting and crevice corrosion	Open-Cycle Cooling Water System (B.2.1.9)	No	Consistent with NUREG-1801.
3.3.1.79	Stainless steel piping, piping components, and piping elements exposed to raw water	Loss of material due to pitting and crevice corrosion, and fouling	Open-Cycle Cooling Water System (B.2.1.9)	No	<u>Consistent with NUREG-1801 for material, environment, and aging effect, but different aging management programs, Inspection Of Internal Surfaces In Miscellaneous Piping And Ducting Components (B2.1.22) and External Surfaces Monitoring Program (B2.1.20), are credited for internal and external environment, respectively.</u> ~~Consistent with NUREG-1801 for material, environment, and aging effect, but a different aging management program Inspection Of Internal Surfaces In Miscellaneous Piping And Ducting Components (B2.1.22) is credited.~~

Source: RAI 3.5.2.3-3 Response

LRA Table 3.3.2-2, Auxiliary Systems – Summary of Aging Management Evaluation – Spent Fuel Pool Cooling and Cleanup System (page 3.3-79), is revised as follows (new text underlined):

Table 3.3.2-2 Auxiliary Systems – Summary of Aging Management Evaluation – Spent Fuel Pool Cooling and Cleanup System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping	SIA	Stainless Steel	Raw Water (Ext)	Loss of material	External Surfaces Monitoring Program (B2.1.20)	VII.C1-15	3.3.1.79	E, 4
Piping	SIA	Stainless Steel	Raw Water (Int)	Loss of material	Inspection Of Internal Surfaces In Miscellaneous Piping And Ducting Components (B2.1.22)	VII.C1-15	3.3.1.79	E, 3

LRA Table 3.3.2-2, Auxiliary Systems – Summary of Aging Management Evaluation – Spent Fuel Pool Cooling and Cleanup System (page 3.3-80), is revised as follows (new text underlined):

Table 3.3.2-2 Auxiliary Systems – Summary of Aging Management Evaluation – Spent Fuel Pool Cooling and Cleanup System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve	PB	Stainless Steel	Raw Water (Ext)	Loss of material	External Surfaces Monitoring Program (B2.1.20)	VII.C1-15	3.3.1.79	E, 4

LRA Table 3.3.2-2, Auxiliary Systems – Summary of Aging Management Evaluation – Spent Fuel Pool Cooling and Cleanup System (page 3.3-82), is revised as follows (new text underlined):

Plant Specific Notes:

3 Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program (B2.1.22) is credited instead of Open-Cycle Cooling Water program (B2.1.9) for aging management of the components exposed to uncontrolled water streams such as drains, sumps and waste water/slurry flows.

4 External Surfaces Monitoring Program (B2.1.20) is credited instead of Open-Cycle Cooling Water program (B2.1.9) for aging management of the components exposed to uncontrolled water streams such as drains, sumps and waste water/slurry flows.

Source: RAI 3.3-2 Response

Table 3.3.2-2, Auxiliary Systems – Summary of Aging Management Evaluation – Spent Fuel Pool Cooling and Cleanup System (page 3.3-76), is revised as follows (deleted text shown with strike through):

Table 3.3.2-2 Auxiliary Systems – Summary of Aging Management Evaluation – Spent Fuel Pool Cooling and Cleanup System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
~~Closure Bolting~~	~~LBS, PB, SIA~~	~~Stainless Steel~~	~~Borated Water Leakage (Ext)~~	~~None~~	~~None~~	~~VII.J-16~~	~~3.3.1.99~~	~~C~~

Table 3.3.2-4, Auxiliary Systems – Summary of Aging Management Evaluation – Essential Chilled Water System (page 3.3-89), is revised as follows (deleted text shown with strike through):

Table 3.3.2-4 Auxiliary Systems – Summary of Aging Management Evaluation – Essential Chilled Water System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
~~Closure Bolting~~	~~LBS, PB, SIA~~	~~Stainless Steel~~	~~Plant Indoor Air (Ext)~~	~~None~~	~~None~~	~~VII.J-15~~	~~3.3.1.94~~	~~C~~

Table 3.3.2-5, Auxiliary Systems – Summary of Aging Management Evaluation – Normal Chilled Water System (page 3.3-101), is revised as follows (deleted text shown with strike through):

Table 3.3.2-5 Auxiliary Systems – Summary of Aging Management Evaluation – Normal Chilled Water System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
~~Closure Bolting~~	~~LBS, SIA~~	~~Stainless Steel~~	~~Plant Indoor Air (Ext)~~	~~None~~	~~None~~	~~VII.J-15~~	~~3.3.1.94~~	~~C~~

Source: RAI 3.3-2 Response (Continued)

Table 3.3.2-7, Auxiliary Systems – Summary of Aging Management Evaluation – Essential Spray Pond System (page 3.3-107), is revised as follows (deleted text shown with strike through):

Table 3.3.2-7 Auxiliary Systems – Summary of Aging Management Evaluation – Essential Spray Pond System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
~~Closure Bolting~~	~~PB~~	~~Copper Alloy (Aluminum > 8%)~~	~~Plant Indoor Air (Ext)~~	~~None~~	~~None~~	~~VIII.I-2~~	~~3.4.1.41~~	~~C~~

Table 3.3.2-8, Auxiliary Systems – Summary of Aging Management Evaluation – Nuclear Sampling System (page 3.3-114), is revised as follows (deleted text shown with strike through):

Table 3.3.2-8 Auxiliary Systems – Summary of Aging Management Evaluation – Nuclear Sampling System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
~~Closure Bolting~~	~~LBS, PB, SIA~~	~~Stainless Steel~~	~~Borated Water Leakage (Ext)~~	~~None~~	~~None~~	~~VII.J-16~~	~~3.3.1.99~~	~~C~~

Table 3.3.2-9, Auxiliary Systems – Summary of Aging Management Evaluation – Compressed Air System (page 3.3-122), is revised as follows (deleted text shown with strike through):

Table 3.3.2-9 Auxiliary Systems – Summary of Aging Management Evaluation – Compressed Air System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
~~Closure Bolting~~	~~SIA~~	~~Copper Alloy~~	~~Plant Indoor Air (Ext)~~	~~None~~	~~None~~	~~V.F-3~~	~~3.2.1.53~~	~~C~~

Source: RAI 3.5.2.3-3 Response

Table 3.5.2-14, Containments, Structures, and Component Supports – Summary of Aging Management Evaluation – Supports (Page 3.5-136), is revised as follows (deleted text shown with strike-through):

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 Non ASME~~	~~NSRS~~	~~Carbon Steel~~	~~Raw Water (Ext)~~	~~Loss of material~~	~~Structures Monitoring Program (B2.1.32)~~	~~None~~	~~None~~	~~G~~

Table 3.5.2-14, Containments, Structures, and Component Supports – Summary of Aging Management Evaluation – Supports (Page 3.5-137), is revised as follows (deleted text shown with strike-through):

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 Non ASME~~	~~NSRS~~	~~Stainless Steel~~	~~Raw Water (Ext)~~	~~Loss of material~~	~~Structures Monitoring Program (B2.1.32)~~	~~None~~	~~None~~	~~G~~

open-cycle cooling water system and components. The various aspects of the PVNGS program (control, monitoring, maintenance and inspection) are implemented in plant procedures.

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.

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.

A1.11 INSPECTION OF OVERHEAD HEAVY LOAD AND LIGHT LOAD (RELATED TO REFUELING) HANDLING SYSTEMS

The Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program manages loss of material for all cranes, trolley and hoist structural components, fuel handling equipment and applicable rails within the scope of license renewal. Program inspection activities verify the structural integrity of the components required to maintain their intended function. The inspection requirements are consistent with the guidance provided by NUREG-0612, "*Control of Heavy Loads at Nuclear Power Plants*" for load handling systems that handle heavy loads which can directly or indirectly cause a release of radioactive material, applicable industry standards (such as CMAA Spec 70) for other components within the scope of license renewal in this program, and applicable OSHA regulations (such as 29 CFR Volume XVII, Part 1910 and Section 1910.179).

Prior to the period of extended operation, procedures will be enhanced to inspect for loss of material due to corrosion or rail wear.

A1.12 FIRE PROTECTION

The Fire Protection program manages loss of material for fire rated doors, fire dampers, diesel-driven fire pumps, and the halon/CO_2 fire suppression systems, cracking, spalling, and loss of material for fire barrier walls, ceilings, and floors, and hardness and shrinkage due to weathering of fire barrier penetration seals. Periodic visual inspections of fire barrier penetration seals, fire dampers, fire barrier walls, ceilings and floors, and periodic visual inspections and functional tests of fire-rated doors manage aging. Periodic testing of the diesel-driven fire pumps ensures that there is no loss of function due to aging of diesel fuel supply lines. Drop tests are performed on 10 percent of fire dampers on an 18 month basis to manage aging. Visual inspections manage aging of fire-rated doors every 18 months to verify the integrity of door surfaces and for clearances to detect aging of the fire doors. A visual inspection and function test of the halon and CO_2 fire suppression systems every 18 months (along with the destructive testing of the Electro-Thermal Links (ETLs) and functional testing of the dampers which are both performed every 54 months) manages aging. Ten percent of each type of penetration seal is visually inspected at least once every 18 months. Fire barrier walls, ceilings, and floors including coatings and wraps are visually inspected at least once every 18 months.

Prior to the period of extended operation, the following enhancements will be implemented:

- ~~Procedures will be enhanced to state trending requirements for the diesel-driven fire pump.~~
- Procedures will be enhanced to inspect for mechanical damage, corrosion and loss of material of the CO_2 system discharge nozzles.
- Procedures will be enhanced to state the qualification requirements for inspecting penetration seals, fire rated doors, fire barrier walls, ceilings and floors.

A1.13 FIRE WATER SYSTEM

The Fire Water System program manages loss of material for water-based fire protection systems. Periodic hydrant inspections, fire main flushing, sprinkler inspections, and flow tests are performed considering applicable National Fire Protection Association (NFPA) codes and standards. The fire water system pressure is continuously monitored such that loss of system pressure is immediately detected and corrective actions are initiated. The Fire Water System program conducts an air or water flow test through each open head spray/sprinkler head to verify that each open head spray/sprinkler nozzle is unobstructed. Visual inspections of the fire protection system exposed to water, evaluating wall thickness to identify evidence of loss of material due to corrosion, are covered by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program (A1.22). The Buried Piping and Tanks Inspection program (A1.18) is credited with the management of aging effects on the external surface of buried fire water system piping.

Prior to the period of extended operation, the following enhancements will be implemented:

Table A4-1 License Renewal Commitments

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].
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, the following enhancements will be implemented: • Procedures will be enhanced to state trending requirements for the diesel-driven fire pump. **(Completed)** • Procedures will be enhanced to include visual inspection of the fuel supply line to detect degradation. (Completed) • Procedures will be enhanced to inspect for mechanical damage, corrosion and loss of material of the halon discharge pipe header (Completed) and the CO_2 system discharge nozzles. • Procedures will be enhanced to state the qualification requirements for inspecting penetration seals, fire rated doors, fire barrier walls, ceilings and floors. (RCTSAI 3246901)	A1.12 B2.1.12 Fire Protection	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	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]) ~~(Completed)~~	A1.17 B2.1.17 Selective Leaching Of Materials	Within the 10-year period prior to the period of extended operation[1]. ~~Ongoing~~
20	The Buried Piping and Tanks Inspection program is a new program that will be implemented prior to the period of extended of operation. Within the ten year period prior to entering the period of extended operation, an opportunistic or planned inspection will be performed. Upon entering the period of extended operation a planned inspection within ten years will be required unless an opportunistic inspection has occurred within this ten year period. Industry and plant-specific operating experience will be evaluated in the development and implementation of this program. (RCTSAIs 3246909 [U1]; 3247263 [U2]; 3247264 [U3])	A1.18 B2.1.18 Buried Piping And Tanks Inspection	Prior to the period of extended operation[1].

B2.1.12 Fire Protection

Program Description

The Fire Protection program manages loss of material for fire rated doors, fire dampers, diesel-driven fire pumps, and the CO_2 and halon fire suppression systems, cracking, spalling, and loss of material for fire barrier walls, ceilings, and floors, and hardness and shrinkage due to weathering of fire barrier penetration seals. Periodic visual inspections of fire barrier penetration seals, fire dampers, fire barrier walls, ceilings and floors, and periodic visual inspections and functional tests of fire-rated floors are performed to ensure that they can perform their intended function.

The Fire Protection program manages aging by a visual inspection on ten percent of each type of penetration seal at least once every 18 months. This sample set method ensures that each penetration seal is inspected at least once every 15 years.

The Fire Protection program manages aging by a visual inspection every 18 months of the fire barrier walls, ceilings, and floors, including coating and wraps of Thermo-lag enclosures, examining for any signs of aging such as cracking, spalling, and loss of material.

The Fire Protection program manages aging by drop testing on ten percent of all accessible fire dampers on an 18 month basis.

The Fire Protection program manages aging by performing visual inspections every 18 months on fire-rated doors to verify the integrity of door surfaces and for clearances to detect aging of the fire doors prior to the loss of intended function.

The diesel-driven fire pumps are under observation during performance tests such as flow tests, start/run tests for detecting any aging of the fuel supply line. The fuel oil supply line is also managed by the Fuel Oil Chemistry program (B2.1.14) and External Surface Monitoring Program (B2.1.20).

A visual inspection and function test of the halon and CO_2 fire suppression systems is performed every 18 months (with the exception of destructive testing of the Electro-Thermal Links (ETLs) and functional testing of the dampers which are performed every 54 months).

NUREG-1801 Consistency

The Fire Protection program is an existing program that, following enhancement, will be consistent with ~~exception to~~ NUREG-1801, Section XI.M26, "Fire Protection," with an exception.

Exceptions to NUREG-1801

Program Elements Affected

Parameters Monitored or Inspected - Element 3 and Detection of Aging Effects – Element 4

NUREG-1801 recommends a visual inspection and function test of the halon and CO_2 systems every six months. The PVNGS procedures for visual inspections and function testing of the halon and CO_2 fire suppression systems are performed every 18 months ~~(excluding dampers which are integrity validated every 54 months per TSR 3.11.103.6 and TSR 3.11.106.6)~~ (excluding destructive testing of the Electro-Thermal Links (ETLs) and functional testing of the dampers, which are both performed every 54 months per TSR 3.11.103.5, 3.11.103.6, 3.11.106.5 and 3.11.106.6) per Technical Requirements Manual Surveillance Requirement (TSR) 3.11.106.4 and 3.11.103.4, respectively. These functional tests will also identify any mechanical damage of the halon and CO_2 fire suppression system that prevents the system from performing its intended function. With respect to the 54 month destructive testing of the Electro-Thermal Links (ETLs), PVNGS has performed an engineering analysis, consistent with the methodology described within EPRI Technical Report 1006756 "Fire Protection Equipment Surveillance Optimization and Maintenance Guide 2003" to extend the frequency of the test so that the confidence of functionality obtained by successful completion of the test is aligned with reliability and logistical concerns of the test. The calculation indicates that a full functional test every six years of the dampers actuated by ETLs will maintain a 95% success rate assuming the same amount of failures as have occurred in the last 10 years and adjusting for uncertainty at the 99% level. The selection of a testing interval of 54 months, compared to the calculated value of 72 months for 95% success rate, provides an additional margin of protection. The test frequency is considered sufficient to ensure system availability and operability based on station operating history that indicates no loss of intended function due to aging. A review of the past ten years of operating experience and corrective action documentation has shown no degradation or loss of intended function between test intervals.

Enhancements

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

Parameters Monitored or Inspected – Element 3, Detection of Aging Effects – Element 4, ~~Monitoring and Trending – Element 5,~~ and Acceptance Criteria – Element 6

~~Procedures will be enhanced to state trending requirements for the diesel-driven fire pump.~~

Procedures will be enhanced to inspect for mechanical damage, corrosion and loss of material of the CO_2 system discharge nozzles.

Procedures will be enhanced to state the qualification requirements for inspecting penetration seals, fire rated doors, fire barrier walls, ceilings and floors.

Operating Experience

Plant operating experience indicates that there have been instances of Thermo-Lag degradation and cracking. These portions of affected Thermo-Lag envelopes have been reworked according to PVNGS specification. PVNGS has also experienced door skin cracks. These have been weld repaired according to specification.

During May of 2005, a fire protection audit was performed by members of APS and other industry representatives. The audit team observed current conditions and installations of the CO_2 and halon suppression systems during walk-downs of selected fire zones. All systems were found in good condition. Multiple walkdowns per unit were conducted to examine the current condition of existing fire barriers in the Unit 1 control building, the Unit 2 turbine building, and the Unit 3 auxiliary building. There was one adverse condition identified in the Unit 3 auxiliary building where copper piping was penetrating the floor barriers. The audit team found no degraded conditions (e.g., cracks, gouges, holes in material, joint/seal gaps) of installed electrical raceway fire barriers.

In September of 2006, it was discovered that a carbon steel pipe nipple was in need of replacement due to galvanic corrosion and was subsequently replaced. The nipple was located between a galvanized tee and a brass valve. This event is representative of the PVNGS experience of detecting degradations and leakage in time to take corrective action prior to the loss of intended function.

During the 2007 fire protection audit, a concern was raised for the need of a plan to identify fire protection equipment obsolescence issues. Design modifications have been identified to address these issues.

Conclusion

The continued implementation of the Fire Protection 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.

B2.1.19 One-Time Inspection of ASME Code Class 1 Small-Bore Piping

Program Description

The One-Time Inspection of ASME Code Class 1 Small-Bore Piping program manages cracking of stainless steel ASME Code Class 1 piping less than or equal to 4 inches.

For ASME Code Class 1 small-bore piping, volumetric examinations (by ultrasonic testing) will be performed on selected butt weld locations to detect cracking. Small-bore weld locations are selected for examination based on the guidelines provided in EPRI TR-112657. Volumetric examinations are conducted in accordance with ASME Section XI with acceptance criteria from Paragraph IWB-3131 and IWB-2430 for butt welds. If no socket welds are in the sample population, then at least one weld per unit will be selected. A different socket weld location will be selected for each unit.

Socket welds that fall within the weld examination sample will be examined following ASME Section XI Code requirements. If a qualified volumetric examination procedure for socket welds endorsed by the industry and the NRC is available and incorporated into the ASME Section XI Code at the time of PVNGS small-bore socket weld inspections then this will be used for the volumetric examinations. If no volumetric examination procedure for ASME Code Class 1 small bore socket welds has been endorsed by the industry and the NRC and incorporated into ASME Section XI at the time PVNGS performs inspections of small-bore piping, a plant procedure for volumetric examination of ASME Code Class 1 small-bore piping with socket welds will be used.

If evidence of an aging effect is revealed by a one-time inspection, evaluation of the inspection results will identify appropriate corrective actions.

This Program will be implemented and inspections completed and evaluated prior to the period of extended operation.

NUREG-1801 Consistency

The One-Time Inspection of ASME Code Class 1 Small-Bore Piping program is a new program that, when implemented, will be consistent~~,~~ with ~~exception to~~ NUREG-1801, Section XI.M35, "One-Time Inspection of ASME Code Class 1 Small-Bore Piping," with an exception.

Exceptions to NUREG-1801

Program Elements Affected

Scope of Program - Element 1

Guidelines from EPRI TR-112657, "Revised Risk-Informed Inservice Inspection Evaluation Procedure," Rev. B-A, were used for identifying susceptible piping instead of EPRI Report 1000701, "Internal Thermal Fatigue Management" Guidance (MRP-24). Guidelines for identifying piping susceptible to potential effects of thermal stratification or turbulent penetration that are provided in EPRI Report 1000701 are also provided in EPRI TR-112657. The recommended inspection volume for welds in EPRI Report 1000701 are identical to those for inspection of thermal fatigue in RI-ISI programs; thus, the PVNGS risk-informed process examination requirements meet the requirements of NUREG-1801 and no enhancements are required.

Enhancements

None.

Operating Experience

~~In order to estimate the extent of the problem of cracking in Class 1 piping socket welds, Nebraska Public Power District (NPPD) performed a search of LERs in the NRC ADAMS database relating to this topic. They found 22 examples. These events were the result of high-cycle fatigue cracking due to vibration or weld defects during installation. As noted by NPPD, cracking due to high-cycle fatigue is the result of improper design or installation that creates an unanalyzed condition that will lead to failure of the component early in life if not corrected. It is not related to the effects of aging. Typical industry response to cracking caused by high-cycle fatigue is to modify the design to prevent recurrence including using improved socket welds and changing the installation to eliminate the vibration.~~
In order to estimate the extent of the problem of cracking in Class 1 piping socket welds, NEI conducted a review of LERs available in the NRC ADAMS database. Of 141 LERs reviewed, 48 were determined to be associated with failures of Class 1 socket welds. For the 46 LERs where a cause was identified, 42 of the failures were due to either vibration-induced high cycle fatigue or improper installation and are not age-related. Of the four remaining failures, one was due to randomly applied loads during maintenance and not age-related, and three were related to aging: two due to insulation contamination on the outside surface, and one associated with IGSCC, although there were other contributing factors not associated with aging (poor weld fit up, weld repair, nearby missing support, etc.).

The NEI review indicates that there have been a relatively small number of Class 1 socket weld failures of which only three were related to aging.

~~PVNGS has experienced cracking of stainless steel ASME Code Class 1 piping less than or equal to NPS 4. A hair-line weld failure was caused by cyclic fatigue due to vibration combined with being improperly supported on a shutdown cooling suction line. Piping modifications have reduced the excessive vibration.~~

PVNGS has experienced three instances where failures have occurred in ASME Code Class 1 small-bore piping with socket welds. The failures were reported in the following LERs:

> 87-018 for a socket weld on the upstream side of the isolation valve for the flanged refueling water level indication;
>
> 96-006 for a cracked weld in the minimum flow recirculation line for the Train B High Pressure Safety Injection pump; and
>
> 04-001 for a cracked socket weld on a high pressure safety injection line.

Evaluations were performed to determine the cause of each of the failures. In each case, the failure was determined not to be cracking due to stress corrosion or thermal and mechanical loading and was not aging related.

A review of the second 10-year ISI Interval Summary Reports for Units 1, 2 and 3 indicates there were no code repairs or code replacements required for continued service of ASME IWB Code components during the second 10-year ISI Interval.

Conclusion

The implementation of the One-Time Inspection of ASME Code Class 1 Small-Bore Piping 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

Response to RAI B2.1.7-03 for GALL AMP XI.M3, Reactor Head Closure Studs

NRC RAI B2.1.7-03, Request 3 for GALL AMP XI.M3, Reactor Head Closure Studs

Explain how the aging effects of concern in NUREG-1339 will be managed during the period of extended operation for GALL AMP XI.M3.

APS Response RAI B2.1.7-03, Request 3 for GALL AMP XI.M3, Reactor Head Closure Studs

The aging effects of concern in NUREG 1339 will be managed during the period of extended operation for GALL AMP XI.M3 by the Reactor Head Closure Stud Program.

The PVNGS Reactor Head Closure Stud Program implements ASME Section XI code, Subsection IWB, 2001 Edition through the 2003 addenda requirements and detects reactor vessel stud, nut and washer cracking, loss of material due to wear, and reactor coolant leakage from the reactor vessel flange. Cracking or wear conditions are detected through visual or volumetric examinations in accordance with ASME Section XI requirements in PVNGS procedures. Reactor vessel flange leakage is detected through system pressure testing with visual examination in accordance with ASME Section XI requirements. The PVNGS ISI program covers reactor vessel flange closure stud hole threads, reactor head closure studs, nuts, and washers. PVNGS is committed to NRC Regulatory Guide 1.65, Materials and Inspections for Reactor Vessel Closure Studs, per UFSAR Sections 1.8 and 5.3.1.7 for closure stud materials. All closure studs and nuts are constructed from materials with a maximum tensile strength limited to less than 170 ksi.

PVNGS follows the preventive measures in RG 1.65 to prevent aging effects due to corrosion or hydrogen embrittlement. PVNGS reactor vessel closure studs are not metal-plated. PVNGS currently uses "Super Molly 402-40 or equivalent" as lubricant on reactor vessel flange stud hole threads, reactor head closure stud and nut threads, and washer faces after reactor head closure stud, nut, and washer cleaning and examinations are complete. Administrative controls limit the use of Super Molly 402-40 to the applications described. While Super Molly 402-40 is compatible with the reactor vessel flange, stud, nut, and washer materials, PVNGS is in the process of a phased withdrawal of lubricants containing molybdenum disulfide associated with these applications from the site. PVNGS has had minimal issues with galling of reactor head closure studs.

Studs, nuts, and washers are removed during refueling outages to allow visual and volumetric examinations in accordance with ASME Section XI requirements every ten years. Studs are also removed every refueling outage to prevent stud exposure to borated water during cavity flooding. After removal the studs, nuts, and washers are cleaned and stored in protective racks until reinstallation. Reactor vessel flange stud holes are plugged with water tight plugs to prevent water intrusion during cavity flooding. No cases of SCC or IGSCC have been identified with PVNGS reactor vessel studs, nuts, flange stud holes, or washers.

EXTERNAL CORRESPONDENCE ONLY

PVNGS Document Authorization Routing Slip

NUCLEAR REGULATORY AFFAIRS
DATE:

Special Instructions:	**Draft File Name: H:\NRA\Glenn\letters\ LRA Electrical, Structural, etc.doc**

BRIEF DESCRIPTION:

Response to February 19, 2010, Request for Additional Information Regarding Closure Bolting, Elastomer, Structures, and Electrical, for the Review of the PVNGS License Renewal Application, and License Renewal Application Amendment No. 12

DUE TO NRC ON: 3/22/10 HARD DUE DATE: Yes X No ____

TO FINAL APPROVER

Target Date: 3/15/10 Actual Date: __/__/__ Signature Date: __/__/__ *(To Final Reviewer 3 Days Prior to Due Date)* *(Date Final Reviewer Received)* *(Date Approved/Letter Date)*

ROUTE TO INDIVIDUAL	STA.	SIGNATURE REQUIRED	REVIEW REQUIRED	INITIALS AND DATE REVIEWED/APPROVED	COMMENTS
R. M. Wilferd			X		Concur with RCTSAI 3246901 change shown on Table A4-1, Item 14
A. K. Krainik			X		
R. A. Stroud			X		
T. N. Weber			X		
R. A. Barnes			X		
D. C. Mims		X			

RETURN TO: Glenn Michael	STA: 7636	FOR QUESTIONS, CONTACT: Glenn Michael	EXT.: 82-5750