10 CFR 50.90

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U.S. Nuclear Regulatory Commission
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References:

1. Arizona Public Service Company (APS) Letter 102-07060, *License Amendment Request to Revise Technical Specifications to Adopt TSTF-505-A, Revision 1, Risk-Informed Completion Times*, dated July 31, 2015 [Agencywide Documents Access and Management System (ADAMS) Accession number ML15218A300]

2. APS Letter 102-07587, *License Amendment Request Supplement for Risk-Informed Completion Times,* dated November 3, 2017 (ADAMS Accession number ML17307A188)

3. APS Letter 102-07691, *APS Response to Request for Additional Information for Risk-Informed Completion Times,* dated May 18, 2018 (ADAMS Accession number ML18138A480)

4. APS Letter 102-07716, *Response to Electrical Engineering Operating Reactor Branch (EEOB) Request for Additional Information for Risk-Informed Completion Times,* dated June 1, 2018 (ADAMS Accession number ML16102A463)

Dear Sirs:

Subject: **Palo Verde Nuclear Generating Station Units 1, 2, and 3 Docket Nos. STN 50-528, 50-529, and 50-530 Response to Request for Additional Information for Risk-Informed Completion Times**

On July 31, 2015, as supplemented by letter dated November 3, 2017, APS submitted a license amendment request (LAR) to modify the Palo Verde Nuclear Generating Station (PVNGS) Technical Specification requirements to permit the use of risk-informed completion times in accordance with Risk-Informed Technical Specification Task Force Initiative 4b, References 1 and 2, respectively.

During the week of February 20, 2018, the NRC staff conducted an audit at PVNGS to gain an understanding of the planned risk-informed completion time program at PVNGS and to review the probabilistic risk assessment model that will be used by APS for this risk-informed LAR. The NRC staff communicated that additional information was required to complete their review and APS responded in References 3 and 4. By letter dated August 23, 2018 (ADAMS Accession number ML18221A510) the NRC staff provided another request for additional information (RAI) and the enclosure to this letter provides the APS response to the RAI.

In addition, following conference calls with the NRC staff on August 7 and September 14, 2018, APS is providing supplemental information in the enclosure regarding RAIs 11 and 16 that were originally provided in Reference 3. APS plans to provide the requested supplemental information regarding RAIs 17f and 21 of Reference 3 by separate correspondence no later than October 5, 2018.

APS has reviewed the information supporting a finding of no significant hazards consideration previously provided to the NRC in Reference 1. APS has concluded that the information provided in this response does not affect the basis for concluding that the proposed license amendment does not involve a significant hazards consideration under the standards set forth in 10 CFR 50.92.

No new commitments are being made to the NRC by this letter.

Should you need further information regarding this letter, please contact Michael DiLorenzo, Nuclear Regulatory Affairs, at (623) 393-3495.

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

Executed on: September 21, 2018
(Date)

Sincerely,

Thomas N. Weber for
Maria L. Lacal

MLL/MDD/CJS/sma

Enclosure: APS Response to Request for Additional Information for Risk-Informed Completion Times

cc:	K. M. Kennedy	NRC Region IV Regional Administrator
	M. D. Orenak	NRC NRR Project Manager for PVNGS
	C. A. Peabody	NRC Senior Resident Inspector for PVNGS

ENCLOSURE

APS Response to Request for Additional Information for Risk-Informed Completion Times

Attachment 1 – Revised Table A5-1 Pertaining to Electrical LCOs from November 3, 2017 LAR Supplement

Attachment 2 - Table 4-1: Risk Management Actions During a RICT Program Entry

Introduction

On July 31, 2015, as supplemented by letter dated November 3, 2017, Arizona Public Service Company (APS) submitted a license amendment request (LAR) to modify the Palo Verde Nuclear Generating Station (PVNGS) Technical Specification (TS) requirements to permit the use of risk-informed completion times (RICT) in accordance with Risk-Informed Technical Specification Task Force (RITSTF) Initiative 4b [Agencywide Documents Access and Management System (ADAMS) Accession numbers ML15218A300 and ML17307A188].

During the week of February 20, 2018, the NRC staff conducted an audit at PVNGS to gain an understanding of the risk-informed completion time program at PVNGS and to review the probabilistic risk assessment (PRA) model that will be used by APS for this risk-informed LAR. The NRC staff communicated that additional information was required to complete their review and APS responded by letter numbers 102-07691 and 102-07716, dated May 18, and June 1, 2018, respectively (ADAMS Accession numbers ML18138A480 and ML16102A463).

By letter dated August 23, 2018 (ADAMS Accession number ML18221A510), the NRC staff provided another request for additional information (RAI) and this enclosure provides the APS response to the RAI.

In addition, following conference calls with the NRC staff on August 7 and September 14, 2018, APS is providing, in this enclosure, supplemental information regarding RAIs 11 and 16 that were originally provided in APS letter number 102-07691, dated May 18, 2018 (ADAMS Accession number ML18138A480).

The APS response is provided after each RAI.

RAI 1

The following conditions of TS 3.8.1, "AC Sources - Operating," do not appear to meet the design success criteria (DSC) listed in Table A5-1, "In Scope TS/LCO [Limiting Condition for Operation] Conditions to Corresponding PRA Functions," of Attachment 5, "List of Revised Required Actions to Corresponding Probabilistic Risk Assessment (PRA) Functions," of the letter dated November 3, 2017. The DSC were defined in Attachment 5 as the summary of the success criteria from the design-basis analyses.

Table 1

TS 3.8.1 Condition	SSCs Covered by TS LCO/Condition	Design Success Criteria
Condition C – Two required offsite circuits inoperable.	Two offsite circuits	One of two offsite circuits
Condition E – Two diesel generators (DGs) inoperable.	Two DGs	One of two DGs

Table 1A

TS 3.8.1 Condition	SSCs Covered by TS LCO/Condition	Design Success Criteria
Condition H – Three or more required AC sources inoperable.	Two offsite circuits and Two DGs	One of two offsite circuits and One of two DGs

The structures, systems, and components (SSCs) covered by TS 3.8.1 include two offsite circuits and two DGs (a total of four alternating current (AC) sources). The "SSCs covered by TS LCO/Condition" in Table A5-1 of Attachment 5 (and Table 1 above) do not include all SSCs that can perform the safety function. Therefore, in TS 3.8.1, Conditions C, E, and H, it appears that the DSC cannot be met unless other AC sources are scoped into "SSCs covered by TS LCO/Condition."

Please provide a discussion of the following:

a) A clarification of the scope of the "SSCs covered by TS LCO/Condition" in Table A5-1 of Attachment 5 for all TS 3.8.1 Conditions;

b) A description of how the DSC is established; and

c) A demonstration of how the TS conditions in Table 1 and Table 1A above meet the DSC given the current scope of the SSCs covered by the TS conditions and current DSC described in the LAR.

APS Response to RAI 1

a) Attachment 1 of this enclosure, which is a partial revision to LAR Table A5-1 for the electrical LCOs, revises the "SSCs Covered by TS LCO/Condition," "Function Covered by TS LCO/Condition," "Disposition," and "Design Success Criteria" for TS 3.8.1 Conditions A, B, C, D, E, and H. TS 3.8.1, Condition F, was not revised, as Condition F pertains solely to the automatic load sequencers, not the AC sources.

b) The design success criteria are established per the TS Bases and the PVNGS Updated Final Safety Analysis Report (UFSAR). The TS Bases, *Applicable Safety Analyses,* for TS 3.8.1 states:

> The OPERABILITY of the AC electrical power sources is consistent with the initial assumptions of the accident analyses and is based upon meeting the design basis of the unit. This results in maintaining at least one train of the onsite or offsite AC sources OPERABLE during accident conditions in the event of:

a. An assumed loss of all offsite power or all onsite AC power; and
b. A worst case single failure.

Per the PVNGS UFSAR, Revision 19, Table 15.0-0, the Chapter 15 transient analysis assumes the following as single failures: a loss of offsite power following turbine trip, failure to achieve fast transfer of a non-Class 1E bus to the startup transformer, and failure of one emergency generator to start, run or load.

c. Attachment 1 of this enclosure, which is a partial revision to LAR Table A5-1 for the electrical LCOs, revises the "SSCs Covered by TS LCO/Condition," "Function Covered by TS LCO/Condition," and "Design Success Criteria" for TS 3.8.1, Conditions A, B, C, D, E, and H. The SSCs, functions, and design success criteria are consistent for each applicable TS 3.8.1 condition. Note that Conditions E and H are treated as a Loss of Function in the application of Risk-Informed Completion Times.

RAI 2

The following TS conditions do not appear to meet the DSC listed in Table A5-1 of Attachment 5:

Table 2

TS Conditions	Design Success Criteria
TS 3.8.4 Condition C – Two direct current (DC) electrical power subsystems inoperable.	One of two electrical power subsystems
TS 3.8.7 Condition B – Two or more required inverters inoperable	One of two inverter train
TS 3.8.9 Condition D – Two or more electrical power [distribution] subsystems inoperable	One of two AC subsystems One of two vital AC subsystems One of two vital DC subsystems

Please provide a discussion of the following:

a) A demonstration of how the TS Conditions in Table 2 above meet the DSC;

b) A clarification of the term "vital DC" used in TS 3.8.9 Condition C DSC in Table A5-1 of Attachment 5; and

c) A clarification of whether the DSC SSCs of TS 3.8.9 conditions in Table A5-1 of Attachment 5 are "subsystems" or "distribution subsystems"

APS Response to RAI 2

a) TS 3.8.4, Condition C, does not meet the DSC and is therefore considered a Loss of Function (LOF). This is currently documented in LAR Table A5-2.

   Depending upon the combination of inoperable inverters, TS 3.8.7, Condition B, may or may not meet the DSC. See the PVNGS response to RAI 3a discussion of the combinations of inoperable inverters that are considered a LOF and, therefore, do not meet the DSC.

   TS 3.8.9, Condition D, does not meet the DSC and is considered a LOF. This is currently documented in LAR Table A5-2.

b) The DSC for TS 3.8.9, Condition C, is being be changed from:

   1 of 2 vital DC subsystems

   to:

   1 of 2 DC distribution subsystems

   Attachment 1 of this enclosure provides a partial revision of LAR Table A5-1 for electrical LCOs.

c) The onsite Class 1E AC, DC, and AC vital instrument bus electrical power distribution systems are divided into two trains. Each train has redundant and independent AC, DC, and AC vital instrument bus electrical power distribution subsystems. Therefore the DSC SSCs of TS 3.8.9 conditions in Table A5-1 of Attachment 5 are "distribution subsystems."

   Attachment 1 of this enclosure provides a partial revision of LAR Table A5-1 for electrical LCOs.

RAI 3

Table A5-2, "Units 1/2/3 In Scope TS/LCO Conditions RICT [Risk-Informed Completion Time] Estimate," of Attachment 5, in the letter dated November 3, 2017, states that "TS 3.8.7 Condition B - Two or More Required Inverters Inoperable" may be a loss of function (LOF). TS 3.8.7 LCO requires Train A and Train B inverters shall be operable. Table A5-1 of Attachment 5 indicates that the SSCs covered by TS 3.8.7 Condition B include two inverters per train (four inverters in total).

In the worst case, when all four required inverters are inoperable, TS 3.8.7 Condition B appears to be an LOF condition. Note 1 of the proposed changes to TS 3.8.7 Condition B states "Not applicable when the second or a subsequent required inverter intentionally made inoperable resulting in loss of safety function." This note implies that two or more inverters may be inoperable resulting in a LOF. Furthermore, TS 3.8.1 Condition H - Three or More Required AC Sources Inoperable is defined as a LOF in Table A5-2 of Attachment 5. TS 3.8.1 Condition H implies that the term "or more" takes into consideration the worst case when it defines LOF. It is not clear what the difference is between TS 3.8.1 Condition H and TS 3.8.7 Condition B. Please provide a discussion of the following:

a) An explanation as to why TS 3.8.7 Condition B is not a LOF; and

b) A description of the difference between TS 3.8.1 Condition H and TS 3.8.7 Condition B in terms of a LOF determination.

APS Response to RAI 3

a) PVNGS design has two trains of inverters, Train A and Train B, with a total of four inverter channels (A, B, C and D). Train A consists of channels A and C. Train B consists of channels B and D. If two inverters in the same train are inoperable and the other two inverters on the opposite train remain operable, it is not a LOF. Per the PVNGS UFSAR, Revision 19, Table 15.0-0, the Chapter 15 transient analysis assumes as a single failure that power (either offsite or standby) to one of the two Class 1E AC busses will fail. Therefore, if the inoperable inverters impact both trains, it is considered a LOF, as the remaining channel(s) do not constitute a redundant train assumed in UFSAR Chapter 15. Table 3-1 provides a list of combinations that represent when a LOF exists. Combinations of 3 or 4 inoperable inverters are considered a LOF, as both trains are impacted.

Table 3-1: TS 3.8.7 Condition B Combinations

SSC	Loss of Function (YES/NO)	Disposition
Channel A & Channel C	NO	This is not a LOF; two inverters on the opposite train remain Operable.
Channel A & Channel B	YES	This is a LOF; one inverter on each train is Inoperable.
Channel A & Channel D	YES	This is a LOF; one inverter on each train is Inoperable.
Channel B & Channel D	NO	This is not a LOF; two inverters on the opposite train remain Operable.
Channel B & Channel C	YES	This is a LOF; at least one inverter on each train is Inoperable.
Channel C & Channel D	YES	This is a LOF; at least one inverter on each train is Inoperable.
Channel A, Channel C & Channel B	YES	This is a LOF; at least one inverter on each train is Inoperable.
Channel A, Channel C & Channel D	YES	This is a LOF; at least one inverter on each train is Inoperable.
Channel B, Channel D & Channel C	YES	This is a LOF; at least one inverter on each train is Inoperable.
Channel B, Channel D & Channel A	YES	This is a LOF; at least one inverter on each train is Inoperable.
Channel A, Channel B, Channel C & Channel D	YES	This is a LOF; all inverters are Inoperable.

b) *TS 3.8.1 AC Sources – Operating, Condition H – Three or more required AC sources Inoperable*

The Class 1E Electrical Power Distribution System AC sources consist of the offsite (preferred) power sources and the onsite standby power sources [Train A and Train B diesel generators (DGs)]. The onsite Class 1E AC Distribution System is divided into redundant load groups (trains) so that the loss of any one group does not prevent the minimum safety functions from being performed. Either one of the associated load groups is capable of providing power to safely shut down the unit. Each train has connections to two preferred offsite power sources (normal and alternate) and a single DG.

In the event of a loss of preferred power, the Engineered Safety Features (ESF) electrical loads are automatically connected to the DGs in sufficient time to provide for safe reactor shutdown and to mitigate the consequences of a Design Basis Accident (DBA).

Condition H corresponds to a level of degradation in which redundancy in the AC electrical power supplies has been lost. Given the lack of redundancy, Condition H is not expected to be a condition that would be voluntarily entered. Therefore, Condition H is treated as a LOF.

TS 3.8.7 Inverters – Operating, Condition B – Two or more required inverters Inoperable

PVNGS design has two trains of inverters, Train A and Train B, with a total of four inverter channels (A, B, C and D). Train A consists of channels A and C. Train B consists of channels B and D. If two inverters in the same train are inoperable and the other two inverters on the opposite train remain operable, it is not a LOF. Refer to Table 3-1 for a list of combinations that represent when a LOF exists. Combinations of 3 or 4 inoperable inverters are considered a LOF, given that both trains are impacted.

RAI 4

The NRC staff reviews the examples of risk management actions (RMAs) for each proposed TS condition to verify that the licensee's demonstration of identifying and implementing RMAs, in accordance with the RICT Program, is appropriate to monitor and control risk. Table A16-1, "Risk Management Actions During a RICT Program Entry," of Attachment 16 of the letter dated November 3, 2017, provides examples of RMAs that may be considered during a RICT program entry. However, this table does not include the RMA examples for all electrical power system TS conditions. Please provide the RMA examples for TS 3.8.1 Condition H, TS 3.8.4 Condition C, TS 3.8.7 Condition B, and TS 3.8.9 Condition D.

APS Response to RAI 4

Example of specific RMAs that may be considered during a RICT program entry for TS 3.8.1, Condition H, TS 3.8.4, Condition C, TS 3.8.7, Condition B, and TS 3.8.9, Condition D, are found in Table 4-1, which is provided as Attachment 2 of this enclosure.

The following two responses provide supplemental information regarding RAIs 11 and 16 that were originally provided in APS letter number 102-07691, dated May 18, 2018 (ADAMS Accession number ML18138A480).

RAI 11 APLA - F&O Closure

In a letter dated May 3, 2017, the NRC staff transmitted its review results of Appendix X to NEI 05-04, NEI 07-12 and NEI 12-13, "Close-out of Facts and Observations" (F&Os) (ADAMS Accession No. ML17079A427). Based on the NRC staff review, the NRC found the process proposed by Appendix X acceptable, with conditions as specified in the letter, for use by licensee's to close F&Os that were generated during a peer review process.

LAR Supplement Attachment 6 states that the F&O closure process was used for the F&Os associated with Internal Events, Internal Flood, Fire, and Seismic PRA models. The NRC staff has identified three primary issues based on recent observations of industry's implementation of the closure process: 1) closure with respect to Capability Category CC-II for the SR; 2) written justification of basis for why closure is determined to be maintenance or upgrade; and 3) independence of reviewers. Please summarize how the June 2017 F&O closure process fulfilled each of the guidelines below.

a. The documented licensee justification and associated F&O closure team assessment about whether each F&O finding resolution constitutes a PRA upgrade or maintenance update, as defined in ASME/ANS RA-Sa-2009, as qualified by RG 1.200, Revision 2.

b. The review team's summary rationale for determining the adequacy for closure of each finding in relation to the affected portions of the associated SR for every SR and weakness identified in the F&O.

c. The description of remote reviewer's participation (if used) confirming web and teleconference connection between any remote reviewers and the on-site review team and host utility to support full participation of the remote reviewers.

d. The confirmation that every weakness in each F&O has been addressed, that a closed finding has been achieved (for applicable F&Os), and that the documentation has been formally incorporated in the PRA Model of Record before closure in the final F&O closure report.

APS Response to RAI 11

APS conducted an Augmented F&O Closure Review in June 2018 in accordance with Appendix X to NEI 05-04, NEI 07-12, and NEI 12-13. The 2018 Augmented F&O Closure Review incorporated the entire scope of the June 2017 F&O Closure Review. Therefore, the responses provided below are in reference to the June 2018 Augmented F&O Closure Review.

a. The APS review and justification for determining whether each F&O finding resolution constitutes a PRA upgrade or maintenance is documented in PVNGS

Engineering Evaluation 18-00619-005, Revision 1. This engineering evaluation was provided to the F&O closure team during the June 2018 Augmented F&O Closure Review. The closure team documented their independent assessment of whether each F&O finding resolution constitutes a PRA upgrade or maintenance in Appendix A, Table A-1, of ABS Consulting Report R-3882824-2037, *Palo Verde Generating Station PRA Finding Level Fact and Observation Closure Review*, Revision 1, dated June 25, 2018.

b. The review team's summary rationale for determining the adequacy for closure of each finding in relation to the affected portions of the associated supporting requirement (SR) is documented in Appendix A Table A-1 of ABS Consulting Report R-3882824-2037, *Palo Verde Generating Station PRA Finding Level Fact and Observation Closure Review*, Revision 1.

   As part of the 2018 Augmented F&O Closure Review, the F&Os from the Internal Events PRA Combustion Engineering Owners Group (CEOG) peer review (Reference 1) were re-reviewed based on the review criteria specified in the corresponding SRs in ASME/ANS RA-Sa-2009 PRA Standard, Addendum A (Reference 2). As documented in PVNGS Engineering Evaluation 18-00619-012, this was accomplished by first mapping each CEOG Finding Level F&O to one or more ASME/ANS RA-Sa-2009 SR using two independent methods as described below.

   <u>Method 1</u> used a series of comparisons and industry documents to identify the corresponding 2009 ASME/ANS SRs for each F&O. First, the CEOG Finding F&O's were mapped to NEI 00-02 sub-elements using WCAP-15930 (Reference 3). Then, the applicable NEI 00-02 sub-elements were converted to the corresponding ASME/ANS RA-Sb-2005 (Reference 4) SRs using Table B-4 of Regulatory Guide 1.200, Revision 2 (Reference 5). Finally, the 2005 ASME/ANS SRs were mapped to the equivalent ASME/ANS SA-Sa-2009 SRs.

   <u>Method 2</u> utilized the PRA engineering staff's knowledge of the ASME Standards (References 2 and 4) to independently identify any other ASME Standard SRs related to the F&Os listed in the 1999 CEOG Internal Events Peer Review (Reference 1) not identified in Method 1. Any new SRs identified in Method 2 were then added to those found via Method 1.

   After mapping the CEOG peer review F&O findings to the ASME PRA Standard RA-Sa-2009 SRs, an assessment was performed to determine if the mapped ASME PRA Standard SRs met category CC II. If all mapped SRs for a finding were determined to be met, then the CEOG peer review F&O finding was assessed as closed. If one or more SRs mapped to a finding were determined to not meet CC II, then the CEOG peer review finding was assessed as open.

c. In accordance with the guidance in NEI 05-04, NEI 07-12, and NEI 12-13, a lead reviewer and at least one supporting reviewer were assigned to review each Finding F&O resolution and made the initial determination regarding adequacy of resolution of each Finding within their review scope. A consensus process was then conducted during which all of the relevant team members participated on the day of the associated consensus session to consider the proposed resolution. Because of the diverse nature of the Finding F&Os and the distribution of topics, certain team members were only needed at certain times during the independent review effort, so that the membership changed from day to day. Consensus sessions thus consisted of those members of the team that participated that day.

For example, in the 2017 F&O Closure Review, the remote reviewers for the seismic hazard analysis (SHA) and seismic fragility analysis (SFR) elements only participated in their respective consensus sessions. The lead and support reviewers as well as the overall team lead participated in the consensus sessions for the SPRA seismic hazard analysis and seismic fragility analysis. The consensus sessions for the remaining technical elements were attended by all of the onsite review team members. Onsite consensus sessions were conducted face-to-face, while those with remote reviewer participation utilized emails, telephone calls and conference calls. Table 11-1 provides the participants and format of the consensus sessions conducted in the 2017 F&O Closure Review.

Table 11-1. 2017 F&O Closure Review and Consensus Session Participation

Review Scope (Hazard, Technical Elements)	Lead & Support Reviewers	Consensus Session Participation	Communication Media
IEPRA (35 F&Os)	Onsite	All onsite reviewers 5/24/2017	Face-to-Face Meetings
IFPRA (7 F&Os)	Onsite	All onsite reviewers 5/24/2017	Face-to-Face Meetings
SPRA – SHA (2 F&Os)	Remote	Remote and Onsite participation 5/17/2017, 5/25/2017	E-mails, Telephone Calls
SPRA – SFR (4 F&Os)	Remote	Remote and Onsite participation 5/19/2017, 5/24/2017	E-mails, Telephone Conference Call, Telephone Calls
SPRA – SPR (4 F&Os)	Onsite	All onsite reviewers 5/24/2017	Face-to-Face Meetings
FPRA (8 F&Os)	Onsite	All onsite reviewers 5/24/2017	Face-to-Face Meetings

In the 2018 Augmented F&O Closure Review, the remote reviewers for the seismic fragility analysis, cable selection/location (CS) and circuit failure analysis (CF), and fire scenario selection and analysis (FSS) only participated in their respective consensus sessions. The consensus sessions for these technical elements, however, consisted of the lead and support reviewers for the F&Os covered by the consensus sessions, and all of the onsite review team members were present for these sessions through the use of internet conference media (GoToMeeting). The consensus sessions for the remaining technical elements were attended by all of the onsite review team members. Table 11-2 shows the participants and format of the consensus sessions conducted in the 2018 Augmented Closure Review.

Table 11-2. 2018 Augmented F&O Closure Review and Consensus Session Participation				
Review Scope (Hazard, Technical Elements)	**Lead & Support Reviewers**	**Consensus Session Participation**	**Observers**	**Communication Media**
SPRA – SFR (4 F&Os)	Remote	Remote and All onsite reviewers 5/24/2018	Remote and Onsite	Internet Conference Media: GoToMeeting
SPRA – SPR (2 F&Os)	Onsite	All onsite reviewers 5/24/2018	Remote and Onsite	Internet Conference Media: GoToMeeting
FPRA – CS,CF (3 F&Os)	Remote / Onsite	Remote and All onsite reviewers 5/23/2018	Remote and Onsite	Telephone calls, Internet Conference Media: GoToMeeting
FPRA – FSS (3 F&Os)	Remote / Onsite	Remote and All onsite reviewers 5/23/2018	Remote and Onsite	Telephone calls, Internet Conference Media: GoToMeeting
FPRA – PP, ES, QLS, PRM, IGN, QNS, HRA, FQ, MU (17 F&Os)	Onsite	All onsite reviewers 5/24/2018	Remote and Onsite	Internet Conference Media: GoToMeeting
OEH PRA – EXT (3 F&Os)	Onsite	All onsite reviewers 5/24/2018	Remote and Onsite	Internet Conference Media: GoToMeeting
IEPRA (35 F&Os)	Onsite	All onsite reviewers 6/14/2018	Remote	Internet Conference Media: GoToMeeting

d. Prior to submitting the Finding Level F&O resolutions to the F&O closure review team, APS ensured that any associated change was documented and formally incorporated into the PRA model. Using this information, the F&O closure review team confirmed that every deficiency identified in each F&O was addressed by the resolution in order to consider the F&O closed. It is noted that the review team found that some F&Os should remain open. All F&Os that were not closed by the June 2018 Augmented F&O Closure Review will be verified closed through a subsequent F&O closure peer review prior to implementing the RICT program.

<u>RAI 11 Response References:</u>

1. *Internal Events CEOG PSA Peer Review for Palo Verde Nuclear Station*, November 1999
2. ASME/ANS RA-Sa-2009 – Addenda to ASME/ANS RA-S-2009, *Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications*, February 2, 2009

3. WCAP-15930, *Comparison of CEOG PRA Peer Review Process with NEI-00-02*, Revision 0, October 2002
4. ASME/ANS RA-Sb-2005 – *Addenda to ASME RA-S-2002 Standard for Probabilistic Risk Assessment for Nuclear Power Plant Applications*, December 30, 2005
5. Regulatory Guide 1.200, *An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities*, Revision 2, March 2009

AI 16 APLA - RCP Seal Modeling

a. LAR Attachment 13, Table A13-1 states that reactor coolant pump (RCP) seal leakage is not modelled as a loss of reactor coolant system (RCS) inventory because the leakage is within the makeup ability of the charging pumps even if all four RCP seals fail. ASME/ANS RA-Sa-2009 provides for screening of initiating events and components as described in SRs IE-C6, SY-A15, and SY-B13. Please confirm that these screening criteria are met for screening out the RCP seal loss of coolant accident. If not met, please discuss your plans to resolve this issue prior to implementing the RICT program.

b. LAR Attachment 13, Table A13-1, indicated that WCAP-15749, "Guidance for the Implementation of the CEOG Model for Failure of RCP Seals Given Loss of Seal Cooling," Revision 0, December 2008, and pump seal vendor information was used to conclude that the leakage into the seal package from the RCS is limited to about 17 gallons per minute per pump. WCAP-15749 has not been endorsed by the NRC, however WCAP-16175-P-A, "Model for Failure of RCP Seals Given Loss of Seal Cooling in CE NSSS [Nuclear Steam Supply System] Plants," has been endorsed by the NRC (ADAMS Accession No. ML071130391). Please discuss the relationship between these two WCAP documents. Also please explain how the limitations and conditions of WCAP-16175-P-A have been addressed.

APS Response to RAI 16

a. Modeling of RCP seal leakage was developed for the internal fire PRA (FPRA) model and this model was reviewed in the Palo Verde FPRA Focused Scope Peer Review (Hughes Associates Report 001014-RPT-01). APS will include the RCP seal leakage model from the FPRA in the internal events PRA model. This modeling will be included in the estimated CDF and LERF for RAI 21.

   For the internal events model, the FPRA Loss of RCP Seal Cooling modeling was only revised by adding the initiating basic events for Loss of Nuclear Cooling Water (NC) and Loss of Plant Cooling Water (NC support system) from the existing internal events PRA model in lieu of fire as an initiator for loss of seal cooling.

b. WCAP-15749-P, Revision 1, contains detailed information on how to incorporate the NRC approved CEOG model for failure of RCP seals, as outlined in WCAP-16175-P-A, Revision 0, into a CE-designed plant-specific PRA model for RCP seal failure in the plant probabilistic safety assessment for Loss of Seal Cooling. WCAP-16175-P-A contains the background information and technical justification used in the development of the CEOG reactor coolant pump seal failure model. The NRC approved version of the Topical Report (TR), WCAP-16175-P-A, specifies a 17 gpm per pump seal leakage rate for a catastrophic failure of all seal stages for PVNGS (Tables 5.2-2 and 5.2-3).

The limitations and conditions of NRC SER Section 4 in WCAP-16175-P-A, Revision 0, are addressed in the PVNGS RCP seal leakage modeling.

- The seal materials described in WCAP-16175-P-A Appendix A Sections A.3 and A.2 were compared to the description of the seal materials in Section I of the Sulzer Inc. vendor technical manual (SDOC N001-0602-00344 Revision 4) and found to be essentially identical. A System Engineering review found no design changes to the RCP seal housing or seals that affected the basic design or material properties of the seals.

- Early CE operating experience was documented in Section 8 the topical report and reviewed by the NRC in WCAP-16175-P-A. The PVNGS event described in Table 8-1 of the topical report resulted in changes to plant procedures. INPO has issued a number of RCP Seal Topical Reports that have been reviewed by engineering (the latest evaluation #18-11600-001 addressed an INPO Event Report dated July 2018). PVNGS Engineering also participates in the Sulzer Seal Users Group. Concerning any future changes that might impact the RCP seal model, changes to the plant drawings and procedures are periodically reviewed by PRA as part of the model update process described in procedure 70DP-0RA03, "Probabilistic Risk Assessment Model Control."

- Each RCP is individually modeled including explicit modeling of seal injection from the chemical and volume control system (CH) and seal cooling from the nuclear cooling water system (NC). For loss of seal cooling (LOSC), operator actions to trip the RCPs from the control room and locally at the switchgear are modeled along with the actuated breakers and their control power. Operator actions to maintain charging are modeled but are not unique to RCP seal modeling. Consistent with NRC approved WCAP-16175-P-A, Revision 0, the assumed leakage from PVNGS RCP seals for internal events is 17 gpm per pump. The CH system is modeled for RCS makeup for RCP seal leakage.

  The PVNGS LOSC modeling conservatively implements the highest conditional RCP seal failure probability, thus the seal failure environmental inputs (CBO isolation, RCS subcooling, and exposure duration) are not factored into the LOSC modeling.

  The RCP motors are not assumed to fail to run upon loss of cooling. Operator actions are modeled for tripping the RCPs.

- The modeling is sufficiently detailed to address all components in the RCP seal cooling flow paths, their power supplies, and NC flow control instrumentation for each individual RCP. Loss of Seal Cooling is modeled as a result of fire induced failures or spurious operation and failures induced by other initiating events, in combination with random system or component failures.

- Operator actions are based on existing plant emergency operating procedures and operator training. Plant configurations for the model are based on normal plant operating procedures.

- Each RCP is individually modeled including explicit modeling of seal injection from the chemical and volume control system and seal cooling from the nuclear cooling water system. The CH system is modeled for RCS makeup for RCP seal leakage.

Attachment 1

Revised Table A5-1 Pertaining to Electrical LCOs from November 3, 2017 LAR Supplement

Partial Revision to Table A5-1: Revised TS/LCO Conditions to Corresponding PRA Functions						
TS LCO / Condition	**SSCs Covered by TS LCO/ Condition**	**SSCs Modeled in PRA**	**Function Covered by TS LCO/Condition**	**Design Success Criteria**	**PRA Success Criteria**	**Disposition**
3.8.1 AC Sources – Operating Condition A – One required offsite circuit inoperable.	2 offsite circuits, each with breakers, transformers, switches, interrupting devices, cabling and controls AND 2 diesel generators (DGs) (Train A and Train B)	Yes	Supply power to the 4.16 kV Class 1E buses. The offsite circuits provide preferred power from the transmission network. Upon loss of preferred power, the DGs supply the ESF loads in sufficient time to mitigate the consequences of a DBA.	1 of 4 AC Sources*	Same	SSCs are modeled consistent with the TS scope and so can be directly evaluated using the CRMP tool. The success criteria in the PRA are consistent with the design basis criteria. Two Station Blackout Generators (SBOG) are also credited in the PRA model. The SBOGs are not capable of supplying all loads as a DG. * One of four AC sources, either an offsite circuit or a DG, must be Operable to meet the DSC. PVNGS UFSAR Chapter 15 safety analyses consider single failures including a loss of offsite power following turbine trip, a failure to achieve fast transfer of a non-Class 1E bus to the startup transformer, and a failure of one emergency generator to start, run or load. Some safety analyses also treat a loss of offsite power as a coincident occurrence in addition to a separate single failure.
3.8.1 AC Sources – Operating Condition B – One Diesel Generator (DG) inoperable.	See LCO Condition 3.8.1.A					
3.8.1 AC Sources – Operating Condition C – Two required offsite circuits inoperable.	See LCO Condition 3.8.1.A					
3.8.1 AC Sources – Operating Condition D – One required offsite circuit inoperable. AND One DG inoperable.	See LCO Condition 3.8.1.A					
3.8.1 AC Sources – Operating Condition E – Two DGs inoperable.	See LCO Condition 3.8.1.A					

Attachment 1 (continued)

Partial Revision to Table A5-1: Revised TS/LCO Conditions to Corresponding PRA Functions						
TS LCO / Condition	**SSCs Covered by TS LCO/ Condition**	**SSCs Modeled in PRA**	**Function Covered by TS LCO/Condition**	**Design Success Criteria**	**PRA Success Criteria**	**Disposition**
3.8.1 AC Sources – Operating Condition F – One automatic load sequencer inoperable.	2 automatic load sequencers	Yes	Return loads to service within time limits after initiating signal, in predetermined sequence to prevent over-loading the power source by automatic load application.	1 of 2 automatic load sequencers	Same	SSCs are modeled consistent with the TS scope and so can be directly evaluated using the CRMP tool. The success criteria in the PRA are consistent with the design basis criteria.
3.8.1 AC Sources – Operating Condition H – Three or more required AC sources inoperable.	See LCO Condition 3.8.1.A					
3.8.9 Distribution Systems - Operating Condition A – One AC electrical power distribution subsystem inoperable.	2 distribution subsystems [4.16 kV Engineered Safety Feature (ESF) buses, secondary AC electrical power distribution panels, load centers and motor control centers]	Yes	Provide necessary power to ESF systems.	1 of 2 AC distribution subsystems	Same	SSCs are modeled consistent with the TS scope and so can be directly evaluated using the CRMP tool. The success criteria in the PRA are consistent with the design basis criteria.
3.8.9 Distribution Systems - Operating Condition B – One AC vital instrument bus electrical power distribution subsystem inoperable.	2 distribution subsystems (Train A and Train B), each with 2 channels per distribution subsystems	Yes	Provide necessary power to ESF systems.	1 of 2 vital AC distribution subsystems	Same	SSCs are modeled consistent with the TS scope and so can be directly evaluated using the CRMP tool. The success criteria in the PRA are consistent with the design basis criteria.
3.8.9 Distribution Systems - Operating Condition C – One DC electrical power distribution subsystems inoperable.	2 distribution subsystems (Train A and Train B), each with 2 channels per distribution subsystems	Yes	Provide necessary power to ESF systems.	1 of 2 DC distribution subsystems	Same	SSCs are modeled consistent with the TS scope and so can be directly evaluated using the CRMP tool model. The success criteria in the PRA are consistent with the design basis criteria.

Attachment 2

Table 4-1: Risk Management Actions During a RICT Program Entry	
TS LCO / Condition	**Risk Management Action(s)**
3.8.1 AC Sources – Operating Condition H – Three or more required AC sources Inoperable	1. Suspend/minimize discretionary activities on the Station Blackout Generators (SBOGs), the main and unit auxiliary transformers associated with the unit, and the startup transformers. The SBOGs will not be used for non-safety functions (i.e., power peaking to the grid). 2. Should a severe weather warning be issued for the local area that could affect the switchyard or the offsite power supply during the Risk-Informed Completion Time, an operator will be available locally at the SBOGs should local operation of the SBOGs be required as a result of on-site weather related damage. 3. Suspend/minimize discretionary activities in the Salt River Project (SRP) switchyard and the unit's 13.8 kV power supply lines and transformers which could cause a line outage or challenge off site power availability to the unit. 4. The system load dispatcher will be contacted once per day to ensure no significant grid perturbations (high grid loading unable to withstand a single contingency of line or generation outage) are expected during the Risk-Informed Completion Time. 5. If applicable, the redundant train DG (along with all of its required systems, subsystems, trains, components, and devices) will be verified Available and no discretionary maintenance activities will be scheduled on the redundant Available DG. 6. Maintain Availability of 4160 VAC safety buses. 7. Consider staging and connecting portable generators to a 4160 VAC safety bus. 8. Consider establishing the Outage Control Center (OCC) for oversight and monitoring of the compensatory measures and the actions described in this section.

Attachment 2 (continued)

Table 4-1: Risk Management Actions During a RICT Program Entry	
TS LCO / Condition	**Risk Management Action(s)**
3.8.4 DC Sources - Operating Condition C - Two DC electrical power subsystems Inoperable	1. Suspend/minimize discretionary activities on the SBOGs, the main and unit auxiliary transformers associated with the unit, and the startup transformers. The SBOGs will not be used for non-safety functions (i.e., power peaking to the grid). 2. Suspend/minimize discretionary activities in the Salt River Project (SRP) switchyard or the unit's 13.8 kV power supply lines and transformers which could cause a line outage or challenge off site power Availability to the unit. 3. Suspend/minimize discretionary activities on the safety systems and important nonsafety equipment in the off-site power systems that can increase the likelihood of a plant transient (unit trip) or Loss of Offsite Power (LOOP). 4. Work to establish alternate power to the 125 VDC bus by temporary modification or by implementation of FLEX procedure 79IS-9ZZ07. 5. Maintain Availability of redundant and diverse electrical systems. 6. Evaluate weather predictions and take appropriate actions to mitigate potential impacts of severe weather per procedure 40AO-9ZZ21. 7. Consider establishing the OCC for oversight and monitoring of the compensatory measures and the actions described in this section.
3.8.7 Inverters - Operating Condition B - Two or more required inverters Inoperable	1. Suspend/minimize discretionary activities on the SBOGs, the main and unit auxiliary transformers associated with the unit, and the startup transformers. The SBOGs will not be used for non-safety functions (i.e., power peaking to the grid). 2. Suspend/minimize discretionary activities in the SRP switchyard and the unit's 13.8 kV power supply lines and transformers which could cause a line outage or challenge off site power Availability to the unit. 3. Maintain Availability of DC electrical systems within the same train and the redundant train, associated 480 V bus, and associated regulating transformer. 4. Evaluate weather predictions and take appropriate actions to mitigate potential impacts of severe weather per procedure 40AO-9ZZ21. 5. Consider establishing the OCC for oversight and monitoring of the compensatory measures and the actions described in this section.

Attachment 2 (continued)

Table 4-1: Risk Management Actions During a RICT Program Entry	
TS LCO / Condition	**Risk Management Action(s)**
3.8.9 Distribution Systems – Operating Condition D – Two or more electrical power subsystems Inoperable	1. Terminate in-progress maintenance/testing activities and defer scheduled maintenance/testing activities with the potential to cause loss of a Class 1E 4160 VAC bus, AC vital instrument bus, or DC electrical power distribution subsystem. 2. Suspend/minimize discretionary activities on the safety systems and important nonsafety equipment in the off-site power systems that can increase the likelihood of a plant transient (unit trip) or LOOP. 3. Maintain Availability of redundant and diverse electrical systems. 4. Evaluate weather predictions and take appropriate actions to mitigate potential impacts of severe weather per procedure 40AO-9ZZ21. 5. Consider establishing the OCC for oversight and monitoring of the compensatory measures and the actions described in this section.