



A subsidiary of Pinnacle West Capital Corporation

Palo Verde Nuclear  
Generating Station

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**102-06121-DCM/GAM**  
**January 13, 2010**

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

Dear Sirs:

**Subject: Palo Verde Nuclear Generating Station (PVNGS)**  
**Units 1, 2, and 3**  
**Docket Nos. STN 50-528, 50-529 and 50-530**  
**Follow-up Clarification to the Response to September 30, 2009,**  
**Request for Additional Information Regarding Severe Accident**  
**Mitigation Alternatives for the Review of the PVNGS License Renewal**  
**Application, and License Renewal Application Amendment No. 7**

By letter no. 102-06092, dated November 10, 2009, Arizona Public Service Company (APS) submitted a response to a September 30, 2009, request for additional information regarding severe accident mitigation alternatives for the review of the PVNGS license renewal application. By e-mails dated December 4, 2009, and December 10, 2009, the NRC staff requested follow-up clarification on the responses. Enclosure 1 contains the NRC-requested clarification and APS's responses. Enclosure 2 contains LRA Amendment No. 7 changes to reflect the RAI responses.

Commitments in this submittal are described in the LRA Amendment 7 changes 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 1/13/10  
(date)

Sincerely,

DCM/RAS/GAM/gat

A member of the **STARS** (Strategic Teaming and Resource Sharing) Alliance

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A138  
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Information for the Review of the Palo Verde Nuclear Generating Station License  
Renewal Application  
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Enclosures:

1. Follow-up Clarification to the Response to September 30, 2009, Request for Additional Information Regarding Severe Accident Mitigation Alternatives for the Review of the Palo Verde Nuclear Generating Station License Renewal Application
2. Palo Verde Nuclear Generating Station License Renewal Application Amendment No. 7

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 Safety Project Manager  
D. M. Drucker NRC License Renewal Environmental Project Manager

## **ENCLOSURE 1**

**Follow-up Clarification to the Response to September 30, 2009,  
Request for Additional Information (RAI) Regarding Severe Accident  
Mitigation Alternatives for the Review of the Palo Verde Nuclear  
Generating Station License Renewal Application**

**Follow-up Clarification to the Response to September 30, 2009, Request for Additional Information for the Review of the PVNGS License Renewal Application****NRC Follow-up RAI 1.a**

Provide the effective date for each Palo Verde Probabilistic Risk Assessment (PRA) revision.

Provide the CDF for Revision 16 of the PRA.

**APS Response to Follow-up RAI 1.a**

The following table provides the effective date for each Palo Verde PRA revision.

<b>PRA Revision No.</b>	<b>Effective Date</b>
0	1/28/99
1	2/5/99
2	5/20/99
3	8/19/99
4	3/17/00
5	9/27/00
6	1/12/01
7	7/20/01
8	10/10/01
9	3/20/02
10	2/5/03
11	4/1/03
12	5/12/03
13	6/2/04
14	1/11/06
15	9/28/07
16	12/17/08

The CDF for Revision 16 of the PRA model (internal events and fire) is 4.95E-6/yr.

**Follow-up Clarification to the Response to September 30, 2009, Request for Additional Information for the Review of the PVNGS License Renewal Application****NRC Follow-up RAI 1.e**

Table 1.e-1 providing Fractional Contribution to CDF by Initiator cannot be correlated to Figure D.2-1 of the Environmental Report (ER) because (1) Table 1.e-1 identifies 34 initiators while Figure D.2-1 only identifies 15 initiators, (2) the values in Table 1.e-1 are different than those in Figure D.2-1 for initiators that appear should be the same i.e., Loss of Offsite Power – 19.6% in Table 1.e-1 yet 6.2% in Figure D.2-1, Steam Generator Tube Rupture – 1.3% in Table 1.e-1 yet 2.0% in Figure D.2-1), and (3) the fractional contributions in Table 1.e-1 sum to less than 0.65 rather than 1.0.

Clarification is needed to understand the discrepancies between Table 1.e-1 provided in response to the RAI and Figure D.2-1 of the ER.

**APS Response to Follow-up RAI**

The discrepancies between ER Figure D.2-1 and Table 1.e-1 in response to RAI 1.e are due to the internal initiating event CDF in Figure D.2-1 versus the total (internal events and fire) CDF in Table 1.e-1. Figure D.2-1 in the ER only addresses internal initiating events. Table 1.e-1 in the response to RAI 1.e provided fractional contributions to CDF for each internal initiating event based on the total (internal events and fire) CDF.

Revision 1 to Table 1.e-1 is provided below to include the fractional contribution to the total (internal events and fire) CDF and the ER Figure D.2-1 initiating event grouping. In addition, a new Table 1.e-2 is provided below showing the percent contributions by initiator to the internal events CDF in ER Figure D.2-1 to address readability issues with the figure in the ER.

Enclosure 1

**Follow-up Clarification to the Response to September 30, 2009, Request for  
Additional Information for the Review of the PVNGS License Renewal Application**

**Table 1.e-1 (Revision 1)**  
**PRA Model Revision 15 CDF Breakdown by Fractional Contribution of Initiators to Total CDF** <sup>(Note 1)</sup>

Initiating Event Name	Description	Fractional Contribution to Total CDF <sup>(note 1)</sup>	ER Fig. D.2-1 Initiating Event Grouping
IEFIRE	All Internal Fires	3.50E-01	Not included
IELOOP <sup>(Note 2)</sup>	Loss of Offsite Power	1.96E-01	Loss of Off-Site Power Station Blackout
IEPBA	Loss of ESF Class Bus A	9.23E-02	Loss of ESF Train A or B Bus
IEMISC	Unplanned Reactor Trip	7.61E-02	Uncomplicated Reactor Trips
IECPST	Loss of Condensate Pumps	4.89E-02	Loss of Condensate, Feedwater or Vacuum
IEATWS4 <sup>(Note 3)</sup>	ATWS with no Turbine Trip, MFW available	4.78E-02	ATWS
IETT	Turbine Trip	3.72E-02	Turbine Trip
IESLOCA	Small LOCA	3.23E-02	Small Break LOCA
IEPBB	Loss of ESF Class Bus B	2.22E-02	Loss of ESF Train A or B Bus
IEMLOCA	Medium LOCA	1.64E-02	Other LOCAs (Medium and Large)
IECONDVAC	Loss of Condenser Vacuum	1.44E-02	Loss of Condensate, Feedwater or Vacuum
IETCW	Loss of Turbine Cooling Water	1.34E-02	Loss of Condensate, Feedwater or Vacuum
IESGTR	Steam Generator Tube Rupture	1.31E-02	Steam Generator Tube Rupture
IEFWP	Loss of MFW Pumps	7.78E-03	Loss of Condensate, Feedwater or Vacuum
IEATWS5 <sup>(Note 3)</sup>	ATWS with no TT and no MFW available	4.49E-03	ATWS
IEATWS2 <sup>(Note 3)</sup>	ATWS with TT and MFW available	4.09E-03	ATWS
IEMSIV	Closure of all Main Steam Isolation Valves	4.02E-03	Other (Clg. Wtr., IA, Sec. Line Brk, HVAC, MSIV)
IEPKBM42	Loss of Class 125VDC Channel B	3.56E-03	Loss of DC Power
IELLOCA	Large LOCA	2.92E-03	Other LOCAs (Medium and Large)

**Follow-up Clarification to the Response to September 30, 2009, Request for  
Additional Information for the Review of the PVNGS License Renewal Application**

Table 1.e-1 (Revision 1)

**PRA Model Revision 15 CDF Breakdown by Fractional Contribution of Initiators to Total CDF <sup>(Note 1)</sup> (Continued)**

Initiating Event Name	Description	Fractional Contribution to Total CDF <sup>(note 1)</sup>	ER Fig. D.2-1 Initiating Event Grouping
IEHPSC-NC-ISL	Tube Failure in High Pressure Seal Cooler	1.92E-03	Interfacing Systems LOCA
IEIAS	Loss of Instrument Air	1.85E-03	Other (Clg. Wtr., IA, Sec. Line Brk, HVAC, MSIV)
IEATWS1 <sup>(Note 3)</sup>	ATWS with LOOP (TT with no MFW available)	1.77E-03	ATWS
IEPCW	Loss of Plant Cooling Water	1.39E-03	Other (Clg. Wtr., IA, Sec. Line Brk, HVAC, MSIV)
IEPKAM41	Loss of Class 125VDC Channel A	1.19E-03	Loss of DC Power
IENAB	Loss of Non-class 13.8 kV to Bus B	8.15E-04	Loss of Off-Site Power to Train A or B
IENAA	Loss of Non-class 13.8 kV to Bus A	7.71E-04	Loss of Off-Site Power to Train A or B
IENCW	Loss of Nuclear Cooling Water	7.39E-04	Other (Clg. Wtr., IA, Sec. Line Brk, HVAC, MSIV)
IEATWS3 <sup>(Note 3)</sup>	ATWS with TT and no MFW	6.06E-04	ATWS
IEFLB	Feed Water Line Break	5.70E-04	Other (Clg. Wtr., IA, Sec. Line Brk, HVAC, MSIV)
IEPNA	Loss of Class 1E Vital AC Power Channel A	3.98E-04	Loss of Vital 120VAC
IESLB	Steam Line Break	1.85E-04	Other (Clg. Wtr., IA, Sec. Line Brk, HVAC, MSIV)
IEPNB	Loss of Class 1E Vital AC Power Channel B	1.58E-04	Loss of Vital 120VAC
IEDCHVAC	Loss of DC Equipment Room HVAC	8.98E-05	Other (Clg. Wtr., IA, Sec. Line Brk, HVAC, MSIV)
IEPKCM43	Loss of Class 125VDC Channel C	4.28E-05	Loss of DC Power
IEPKDM44	Loss of Class 125VDC Channel D	4.14E-05	Loss of DC Power

Note 1: Total CDF includes internal events and fire initiating events.

Note 2: Station Blackout is a subset of Loss of Off-Site Power.

Note 3: ATWS includes both RPS failure and CEA binding; however, no RPS failure cutsets survive truncation.

**Follow-up Clarification to the Response to September 30, 2009, Request for  
Additional Information for the Review of the PVNGS License Renewal Application**

**Table 1.e-2  
ER Figure D.2-1 Percent Contributions to Internal Events CDF**

<b>ER Fig. D.2-1 Initiating Event Grouping</b>	<b>Percent Contribution to Internal Events CDF in ER Fig. D.2-1</b>
Station Blackout	23.3%
Loss of ESF Train A or B Bus	17.6%
Uncomplicated Reactor Trips	11.7%
Loss of Condensate, Feedwater or Vacuum	10.9%
ATWS	9.0%
Loss of Off-Site Power	6.9%
Turbine Trip	5.7%
Small Break LOCA	5.0%
Other (Clg. Wtr., IA, Sec Line Brk, HVAC, MSIV)	3.4%
Other LOCAs (Medium and Large)	3.0%
Steam Generator Tube Rupture	2.0%
Loss of DC Power	0.7%
Interfacing Systems LOCA	0.3%
Loss of Off-Site Power to Train A or B	0.2%
Loss of Vital 120VAC	0.1%

**Follow-up Clarification to the Response to September 30, 2009, Request for Additional Information for the Review of the PVNGS License Renewal Application**

**NRC Follow-up RAI 2.e.i**

Response states “an updated initial core inventory was prepared for the analysis.” Is this updated initial core inventory the same as provided in Table D.3-1 of the ER and used in the SAMA analysis? If not, clarify the discrepancy.

**APS Response to Follow-up RAI 2.e.i**

Yes, ER Table D.3-1 reflects the updated initial core inventory as used in the SAMA analysis.

**NRC Follow-up RAI 3.a.ii**

Response did not address whether there had been other internal and/or external reviews of the Fire PRA since the 2003 peer review. Need an answer to this question and, if yes, provide a discussion of the significant review comments and the potential impact of their resolution on the SAMA analysis.

**APS Response to Follow-up RAI 3.a.ii**

There have been no internal or external peer reviews of the fire PRA since the 2003 peer review.

**NRC Follow-up RAI 5.a.ii**

SAMA 8 was found to be potentially cost-beneficial, after accounting for CDF uncertainty, after re-analysis of the cost-risk due to fire scenarios. Clarification is needed as to APS’s future intentions with regards to SAMA 8.

**APS Response to Follow-up RAI 5.a.ii**

Since the SAMA 8 was found to be potentially cost-beneficial after re-analysis, prior to the period of extended operation, APS will consider SAMA 8 for potential implementation. See Enclosure 2 for license renewal application (LRA) Amendment No. 7 containing this commitment.

**NRC Follow-up RAI 5.d**

Cost of installing automatic transfer switches for the AFW pumps is estimated to be \$2.3M. Response to RAI 1.f provides an estimated implementation cost of \$180K for installing automatic transfer switches for the vital AC on Unit 1 (based on similar

**Follow-up Clarification to the Response to September 30, 2009, Request for Additional Information for the Review of the PVNGS License Renewal Application**

modification made at Units 2 and 3). Provide additional justification for the \$2.3M estimate and explain reason for the large difference to the \$180K estimate.

**APS Response to Follow-up RAI 5.d**

The estimated cost of installing an automatic transfer switch for the AFW pump power supplies of \$2.3M is significantly higher than the estimated \$180K cost to replace the Unit 1 vital AC power supply manual transfer switches with automatic static transfer switches because modifications are significantly different. Some of the differences between the modifications are described below.

- Since the vital AC transfer switches have already been installed in Units 2 and 3, the engineering design work has already been completed and therefore it is not a major factor in the cost to install the modification in Unit 1. In contrast, the AFW pump automatic transfer switch modification would need to be designed and engineered for all three Palo Verde units.
- An AFW pump automatic transfer switch would transfer a 1250 HP load at 4.16 kV which is a significantly higher electrical load and voltage than the 120 V vital AC transfer switches. Due to the higher power requirements associated with the AFW pump transfer switch modification, the design would have to be accomplished through the use of additional large and costly medium voltage breakers, in contrast to the vital AC transfer switch which is self contained within the vital AC inverter.
- A costly expansion of the 4.16 kV switchgear may be required for the AFW pump transfer switch modification because there appear to be no spare breakers and limited space for expansion of the switchgear.
- An Appendix R electrical Panel for emergency diesel generator B may need to be relocated to gain required space for the AFW pump transfer switch modification.
- Numerous electrical calculation and procedure revisions would be required for the AFW pump transfer scheme modification.
- Adequate interlocks between the two power sources would need to be designed and added to the AFW pump transfer scheme modification.
- New wiring may need to be pulled into the main control room for the AFW pump transfer switch modification.
- Large and costly medium voltage cabling would need to be procured for the AFW pump transfer switch modification.

**ENCLOSURE 2**

**Palo Verde Nuclear Generating Station**

**License Renewal Application**

**Amendment No. 7**

**Palo Verde Nuclear Generating Station  
License Renewal Application  
Amendment No. 7**

**Source: Follow-up RAI 5.a.ii**

**LRA Table A4-1, License Renewal Commitments (page A-59), is revised as follows (new text underlined):**

<b>Item No.</b>	<b>Commitment</b>	<b>LRA Section or Source</b>	<b>Implementation Schedule</b>
<u>52</u>	<u>APS will consider SAMA 8 for potential implementation.</u> <u>(RCTSAI 3420542)</u>	<u>Follow-up Response to SAMA RAI (letter no. 102-06121, dated January 13, 2010)</u>	<u>Prior to the period of extended operation<sup>1</sup></u>