



A subsidiary of Pinnacle West Capital Corporation

Palo Verde Nuclear
Generating Station

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102-06364-DCM/DFS
May 25, 2011

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 the Second Request for Additional Information
Regarding License Amendment Request to Revise the Feedwater
Line Break with Loss of Offsite Power and Single Failure Analysis
(TAC NOS. ME4596, ME4597, and ME4598)**

By letter no. 102-06244, dated August 27, 2010 (Agencywide Documents Access and Management System [ADAMS] Accession No. ML102510161), Arizona Public Service Company (APS) submitted a request to revise the methodology in the feedwater line break with loss of offsite power and single failure event (FWLB/LOP/SF) analysis summarized in the Palo Verde Nuclear Generating Station (PVNGS) Updated Final Safety Analysis Report (UFSAR).

By letter no. 102-06321, dated February 11, 2011 (ADAMS Accession No. ML110550323) APS submitted supplemental information in response to an NRC request for additional information dated December 21, 2010 (ADAMS Accession No. ML103500510). The enclosure to this letter contains APS's response to the second NRC request for additional information provided in an e-mail dated April 1, 2011, and revised in an e-mail and its attachment dated April 26, 2011 (ADAMS Accession Nos. ML111160544 and ML111160554).

No commitments are being made to the NRC by this letter. Should you need further information regarding this response, please contact Russell A. Stroud, Licensing Section Leader, at (623) 393-5111.

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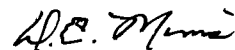
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Response to the Second Request for Additional Information Regarding License
Amendment Request to Revise the Feedwater Line Break with Loss of Offsite Power
and Single Failure Analysis

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

Executed on 5/25/11
(Date)

Sincerely,



DCM/RAS/DFS/gat

Enclosure:

Response to the Second Request for Additional Information (RAI) Regarding License
Amendment Request (LAR) to Revise the Feedwater Line Break with Loss of Offsite
Power and Single Failure Analysis (FWLB/LOP/SF)

cc:	E. E. Collins Jr.	NRC Region IV Regional Administrator
	L. K. Gibson	NRC NRR Project Manager for PVNGS
	J. R. Hall	NRC NRR Senior Project Manager
	M. A. Brown	NRC Senior Resident Inspector for PVNGS
	A. V. Godwin	Arizona Radiation Regulatory Agency (ARRA)
	T. Morales	Arizona Radiation Regulatory Agency (ARRA)

Enclosure

**Response to the Second Request for Additional Information (RAI)
Regarding License Amendment Request (LAR) to Revise the
Feedwater Line Break with Loss of Offsite Power and Single Failure
Analysis (FWLB/LOP/SF)**

Introduction:

By letter no. 102-06244, dated August 27, 2010 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML102510161) (Reference 1), Arizona Public Service Company (APS) submitted a license amendment request (LAR) to revise the methodology in the feedwater line break with loss of offsite power and single failure event (FWLB/LOP/SF) analysis summarized in the Palo Verde Nuclear Generating Station (PVNGS) Updated Final Safety Analysis Report (UFSAR). The LAR would change the credited operator action time from 30 minutes to 20 minutes.

By letter dated December 21, 2010 (ADAMS Accession No. ML103500510) (Reference 2), the NRC provided a request for additional information (RAI). APS responded to that RAI with supplementary information in letter no. 102-06321, dated February 11, 2011 (ADAMS Accession No. ML110550323) (Reference 3). Based on the NRC review of the LAR and supplemental information, the Health Physics and Human Performance Branch requested additional information in an e-mail dated April 1, 2011 (Reference 4), and modified that request in an e-mail and its attachment dated April 26, 2011 (ADAMS Accession Nos. ML111160544 and ML111160554) (Reference 5). This enclosure contains APS's response to the second RAI.

NRC Request 1:

The licensee has based its evaluation of the reduced time available to initiate control of pressurizer level on the guidance of ANSI/ANS-58.8 "Time Response Design Criteria for Nuclear Safety Related Operator Actions," 1984.

The current version of ANSI/ANS-58.8 is ANSI/ANS-58.8-1994, reaffirmed on August 25, 2008. Please review your submittals in light of this most current version of ANSI/ANS-58.8 and identify any changes you would like to make based on the review.

APS Response:

The use of ANSI/ANS-58.8-1984 (Reference 6) to establish design times for operator actions is consistent with the current PVNGS licensing basis as discussed in UFSAR Section 15.6.3.2.2 and in recently approved License Amendment No. 182, "Palo Verde Nuclear Generating Station, Units 1, 2, and 3 - Issuance of Amendment Re: Technical Specification Changes to Minimum Refueling Water Tank Volume and Setpoints," dated November 24, 2010 (ADAMS Accession No. ML102710301) (Reference 7). In support of the proposed change, APS has also followed NRC Information Notice (IN) 97-78, "Crediting of Operator Actions in Place of Automatic Actions and Modifications of Operator Actions, Including Response Times," dated October 23, 1997 (Reference 8). IN 97-78 discusses and suggests the use of ANSI/ANS-58.8-1984 for estimating reasonable response times for operator actions.

In support of the proposed change, APS also considered the human factors and operator actions described in the Standard Review Plan (NUREG-0800) Section 15.2.8 and Chapter 18.

As requested in the RAI, APS reviewed the 1994 version of ANSI/ANS-58.8 (Reference 9) and found that the overall methodology was similar to the earlier revision with no

significant changes in the requirements. APS reviewed the differences between the two revisions and no changes were required. The 1984 version of the standard remains the PVNGS licensing basis.

As discussed in the supplemental information provided in APS's letter dated February 11, 2011, and further discussed in the response to NRC RAI Request 3 below, the results of APS's evaluation were validated by three simulator runs. These simulator runs demonstrated that the actual operator action times for opening of an ADV were less than four minutes after the initiation of the event. This is significantly below the 20 minutes credited in the analysis and provides significant margin over that assumption.

NRC Request 2:

In its submittals, the licensee requests credit for operator action "at 20 minutes." This terminology implies a start time rather than a duration. Use of this terminology is vague and could mean that the action (including recognition and diagnosis) is initiated at 20 minutes, or that the physical act of opening an ADV (NOT including recognition and diagnosis) is initiated at 20 minutes, or that the entire action from recognition to successful completion of the safety function takes place in 20 minutes or less.

Examples from the licensee's submittal dated August 27, 2010 are:

"...the analysis assumes operator action to open an ADV (on the intact steam generator) to preclude a direct challenge to the RCS [Reactor Coolant System] Inventory Control and RCS Pressure Control Safety Functions twenty (20) minutes after the event initiation.";

"The FWLB/LOP/SF event analysis is revised such that operator action is now credited after 20 minutes (1200 seconds) of the transient instead of the previous 30-minute (1800 seconds) time frame.";

"The assumption of operator action within 20 minutes after the first few alarms are triggered is based on ANSI/ANS Standard 58.8, "Time Response Design Criteria for Nuclear Safety Related Operator Actions" (Reference 6.5).";

"20 minutes is considered by the industry as a reasonable length of time for the operators to determine what has happened, assess the current conditions, and initiate required actions to mitigate the conditions."

Please clarify what is meant by "at 20 minutes"; is it a start time or a duration?

APS Response:

The time at which the operator takes action to open the ADV in the analysis is 20 minutes ($t_m=20$ minutes). Thus, it is the start time of the action permitted by the ANSI 58.8. However, the start time ($t_m=20$ minutes) is determined based on the duration of diagnosis period (or interval Time Test Value 1). This diagnosis period is consistent with ANSI 58.8 and APS's response to the first RAI Request #4 in Reference 3. Therefore, 20 minutes is used in various portions of the submittal either to indicate start time or duration as defined in the standard, depending on the context of a specific section.

NRC Request 3:

Please provide more information on the simulator verification. For example, what were the make-ups of the crews, and how many times was the scenario run? Furthermore, are the required actions also part of a more frequently performed set of procedures that the individuals have more experience performing? If so, please describe whether that experience supports the basis for the time associated with the actions.

APS Response:

APS simulated the FWLB event scenario with three separate operating crews to validate the available margin and conservatism for the operator action assumed in the analysis. Two of the crews were composed of PVNGS licensed control room (CR) personnel who were in their normal scheduled simulator training, and the third crew consisted of certified simulator instructors that were available at the time. The resultant time to open an ADV after event initiation for the three crews varied between 2-4 minutes (i.e. 3 minutes +/- 1 minute).

The two CR crews that performed the simulation consisted of a Shift Manager, a Control Room Supervisor, two reactor operators (ROs) (one primary and one secondary operator), a Shift Technical Advisor (STA) and a third operator. The two CR crews were comprised of personnel that normally work together on shift and attend continuing training together. As noted above, the third simulation was performed by available operations trainers that are senior reactor operator certified that do not normally work or train together as a crew. The third simulation provided additional validation of the conservatism in the analysis assumption of 20 minutes to open an ADV.

In each of these simulations, the scenarios and the associated conditions were not communicated to any of the crew members prior to the simulation. This is the standard practice at PVNGS for a simulator training environment and ensures there is no pre-conditioning for the event or scenario. However, the PVNGS normal training schedule requires each CR crew to perform simulator exercises for each emergency operating procedure (EOP) event at least once per year. Many of these scenarios, including excess steam demand (ESD), require the use of ADVs for plant cooldown. As explained in Reference 3, in response to the first RAI Request 1, the ESD simulation can be either a FWLB or steam line break.

In addition to the simulations described above, independent operations personnel interviews confirmed that the opening of an ADV within two to three minutes after main steam safety valves (MSSVs) opening is the preferred action to prevent MSSV cycling. This observation further supports the results of the three simulator runs. The proposed operator response time of 20 minutes assumed in the analysis is, therefore, conservative.

NRC Request 4:

Although the licensee believes that it has addressed all credible errors, the staff would like the licensee to consider the case where an operator inadvertently sets the ADV thumbwheel for open/close demand at 10% closed (90% open) instead of 10% open. How long would it take the operator(s) to recognize the mistake (based on instrument responses or annunciator alarms) and correct the setting? Are there any adverse consequences if the operators do not recognize the error?

APS Response

Having an ADV 90 percent open would provide increased cooling capability for mitigation of the postulated FWLB accident which is a heat-up event. Therefore, an ADV position of 90 percent open would be a more beneficial ADV position than the assumed 10 percent open for a FWLB event in the analysis. The table below is provided to demonstrate the effects of an ADV open position of 10 percent versus 90 percent with respect to pressurizer level.

ADV Position (% Open)	Maximum Pressurizer Level (ft ³)	Time of Max. Pressurizer Level (sec)	Pressurizer Level trend at the end of simulation
10	1683.1	1800	Increasing
90	1665.4	1177	Decreasing

As indicated in the table, the increased cooling capability provided by having an ADV 90 percent open results in less water volume and level in the Pressurizer which provides an increase in the margin to passing water through the pressurizer safety valves (PSVs). As stated in Reference 1, the PSVs are qualified only for passing steam.

To assist in monitoring heat removal and/or control cooldown, an ADV position indicator is available to the CR Operators which displays the initial ADV demand setting and indicates changes in valve position as the operator makes adjustments. PVNGS operating procedure 40OP-9SG01, "Main Steam," instructs the operator to provide a minimum 30 percent initial demand signal for an ADV (Reference 10). That level of demand signal is optimal for the actuator to provide timely valve response. As a result, the initial opening for any ADV will be at least 30 percent, and the operators would subsequently adjust valve position to maintain an appropriate cooldown rate. Operator action to adjust the ADV position would be based on the control room displays and alarms that provide the continual status of the RCS and associated secondary side systems during an event. However, in the FWLB analysis, the initial ADV valve position is conservatively assumed at 10 percent open and remains in that position throughout the transient to minimize the heat removal capability of the ADV.

References:

1. APS letter number 102-06244, "Request for Operating License Amendment – Revision of Feedwater Line Break with Loss of Offsite Power and Single Failure Analysis," dated August 27, 2010 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML102510161)
2. NRC letter dated December 21, 2010, "Palo Verde Nuclear Generating Station, Units 1, 2, and 3 Request for Additional Information Regarding License Amendment Request to Revise the Feedwater Line Break with Loss of Offsite Power and Single Failure Analysis (TAC NOS. ME4596, ME4597, and ME4598) (ADAMS Accession No. ML103500510)"
3. APS letter number 102-06321, "Response to Request for Additional Information Regarding License Amendment Request to Revise the Feedwater Line Break with Loss of Offsite Power and Single Failure Analysis (TAC Nos. ME4596, ME4597, and ME4598)," dated February 11, 2011 (ADAMS Accession No. ML110550323)
4. NRC e-mail, dated April 1, 2011, "Draft Request for Additional Information Revision of Feedwater Line Break with Loss of Offsite Power and Single Failure Analysis (TAC Nos. ME4596,7,8)"
5. NRC e-mail and attachment dated April 26, 2011, "Revised Draft Request for Additional Information- Revision of Feedwater Line Break with Loss of Offsite Power and Single Failure Analysis (TAC Nos. ME4596,7,8)" (ADAMS Accession Nos. ML111160544 and ML111160554)
6. ANSI/ANS-58.8 "Time Response Design Criteria for Nuclear Safety Related Operator Actions," 1984
7. NRC letter dated November 24, 2010, "Palo Verde Nuclear Generating Station, Units 1, 2, and 3-Issuance of Amendment Re: Technical Specification Changes to Minimum Refueling Water Tank Volume and Setpoints" (ADAMS Accession No. ML102710301)
8. NRC Information Notice (IN) 97-78, "Crediting of Operator Actions in Place of Automatic Actions and Modifications of Operator Actions, Including Response Times," dated October 23, 1997
9. ANSI/ANS-58.8, "Time Response Design Criteria for Nuclear Safety Related Operator Actions," 1994
10. PVNGS operating procedure 40OP-9SG01, "Main Steam"