APS

Palo Verde Nuclear
Generating Station

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U. S. Nuclear Regulatory Commission
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Reference: APS Letter No. 102-04641-CDM/RAB, dated December 21, 2001, from C. D. Mauldin, APS to U. S. Nuclear Regulatory Commission, "Request for a License Amendment to Support Replacement of Steam Generators and Uprated Power Operations"

Dear Sirs:

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Unit 2, Docket No. STN 50-529
Response to Request for Additional Information Regarding Steam Generator Replacement and Power Uprate License Amendment Request

In the referenced letter, Arizona Public Service Company (APS) submitted a license amendment request to support steam generator replacement and uprated power operation for PVNGS Unit 2. On January 24, 2002 a conference call was held to discuss questions developed by NRC personnel from the Electrical and Instrumentation and Controls Branch and the APS responses to those questions. APS is providing written responses to these questions in Attachment 2 to this letter.

In the referenced letter, APS requested approval of the proposed amendments by September 1, 2002. After discussion with the NRC Staff, it was mutually agreed that this date would be changed to December 31, 2002.

No commitments are being made to the NRC in this letter.

Should you have any questions, please contact Thomas N. Weber at (623) 393-5764.

Sincerely,

David Mauldin

CDM/RAB/

A001

Attachments:

1. Notarized Affidavit
2. NRC Electrical and Instrumentation and Controls Branch Questions and APS Responses
3. Summary of the PVNGS I & C Design Guide for Instrument Uncertainty and Setpoint Determination

cc:	E. W. Merschoff	(NRC Region IV)	All w/attachments
	J. N. Donohew	(NRC Project Manager)	
	J. H. Moorman	(NRC Resident Inspector)	
	A. V. Godwin	(ARRA)	

Attachment 1

STATE OF ARIZONA)
) ss.
COUNTY OF MARICOPA)

I, David Mauldin, represent that I am Vice President Nuclear Engineering and Support, Arizona Public Service Company (APS), that the foregoing document has been signed by me on behalf of APS with full authority to do so, and that to the best of my knowledge and belief, the statements made therein are true and correct.

David Mauldin

David Mauldin

Sworn To Before Me This 13th Day Of March, 2002.

Tara Click

Notary Public

6/14/2002

Notary Commission Stamp

"OFFICIAL SEAL"
Tara Click
Notary Public-Arizona
Maricopa County
My Commission Expires 6/14/2002

Attachment 2

NRC Electrical and Instrumentation and Controls Branch Questions and APS Responses

Attachment 2

NRC Electrical and Instrumentation and Controls Branch Questions and APS Responses

NRC Question 1:

The PVNGS Unit 2 steam generators (SGs) are being replaced with larger SGs. Address the effect the replacement SG (RSG) dimensions, instrumentation, and proposed RSG operating conditions will have on plant protection system (PPS) analytical limits, allowable values, trip setpoints, margins, and response times. Include in this response a discussion of the set point methodology and analysis results used to establish the allowable values in Table 3.3.1-1, Reactor Protective Systems Instrumentation, and Table 3.3.5-1, Engineered Safety Features Actuation System Instrumentation.

Response:

Technical Specification allowable values, setpoints, and response times are not being changed except for the Low Steam Generator Pressure Trip setpoint and the Main Steam Isolation System Actuation setpoint. These setpoint changes are due to the new operating conditions. The analytical values and response times used in the safety analyses are provided in Attachment 6, Tables 6.3-3 and 6.3-4 of the referenced letter. As stated in Attachment 6, Sections 6.3.0.3 and 6.3.0.4 of the referenced letter, the analytical setpoints have been calculated for both normal and harsh environments. The analytical setpoints include instrument uncertainties that were applied to the Plant Protection System.

Although the RSG dimensions and tap locations differ from the current SG narrow range and wide range, percent level indications will not change. However, the SG water level (height) and mass corresponding to these percent levels are different, and the revised safety analyses use the appropriate values. A comparison of the physical differences in level instrumentation between the existing and replacement steam generators is provided in the following tables.

	Current SGs				Replacement SGs		
	Above Base (inch)	Above Tube Sheet (inch)	Setpoint (%)		Above Base (inch)	Above Tube Sheet (inch)	Setpoint (%)
SG Level Indication							
AFAS	383.32	240.07	25.8 (WR)		393.88	249.51	25.8 (WR)
LSGL Trip	452.55	309.30	44.2 (WR)		470.20	325.83	44.2 (WR)
LSGL Alarm	527.03	383.78	10.0 (NR)		548.76	404.39	10.0 (NR)
Nominal	587.24	443.99	50.0 (NR)		616.71	472.34	50.0 (NR)
HSGL Alarm	641.43	498.18	86.0 (NR)		677.86	533.49	86.0 (NR)
HSGL Trip	648.95	505.70	91.0 (NR)		686.35	541.98	91.0 (NR)

	Current SGs			Replacement SGs	
	Above Base (inch)	Above Tube Sheet (inch)		Above Base (inch)	Above Tube Sheet (inch)
Instrument Taps					
WR & NR Upper	662.50	519.25		701.64	557.27
NR Lower	511.98	368.73		531.77	387.40
WR Lower	286.25	143.00		286.87	142.50
Calibration Span					
NR	150.52			169.87	
WR	376.25			414.77	
Distance					
Base to Tube Sheet	143.25			144.37	

During the January 24, 2002 conference call, APS agreed to provide a summary of the "PVNGS I&C Design Guide for Instrument Uncertainty and Setpoint Determination." Attachment 3 provides this summary.

As part of the power uprate and steam generator replacement analyses, APS initiated a review of the instrument uncertainty and setpoint calculations, with several calculations being revised to reflect the operating conditions associated with the Replacement Steam Generators (RSGs) and environmental influences on the instrument uncertainties. The existing allocation for instrument uncertainties associated with the calculation of PPS analytical limits remain bounding for operation at power uprate conditions. (Note: Low SG Pressure Trip and Main Steam Isolation System Actuation setpoints are changing due to operating conditions, not instrument uncertainty).

Changes to the SG level instrumentation include RSG physical dimensions differing from those of the existing steam generators and different level transmitters. Due to the increased span of the instrument taps, (Wide Range span increases approximately 39 inches and Narrow Range span increases approximately 19 inches) the currently installed Barton transmitters are being replaced with Rosemount transmitters. Instrument loop uncertainties have been calculated using the uncertainties associated with the new transmitters. The revised instrument loop uncertainties remain bounded by the existing setpoint analyses. The impact on plant operation due to the instrument loop electronics is transparent due to the displayed engineering units of "% level". The difference in RSG physical dimensions is captured in the various safety analyses by converting analytical limits expressed in "% level" to RSG mass/volume/height.

Except for the Allowable Value associated with the Low SG Pressure Trip and Main Steam Isolation System Actuation setpoint changes mentioned above, the Technical Specification Allowable Values associated with the PPS setpoints will remain unchanged.

NRC Question 2:

Describe the effect the RSG design and operating conditions (i.e., feedwater flow rate, SG blowdown flow rate, main steam flow rate, and feedwater temperature) will have on secondary calorimetric uncertainties.

Response:

The effects of the RSG design and operating conditions on secondary calorimetric uncertainties are bounded by the 2% power uncertainty used in the PVNGS safety analyses. No credit is taken for the actual secondary calorimetric uncertainty, nor do the safety analyses apply measurement uncertainty recapture methodology to justify this power uprate request.

Question 3:

Identify any instrumentation that will be replaced on the RSGs.

Response:

The narrow range and the wide range level transmitters will be changed because of the SG replacement. Rosemount level transmitters will replace Barton level transmitters.

NRC Question 4:

Provide a summary of the environmental qualification (EQ) data for the safety related instrumentation on the replacement steam generators. This summary information should provide a comparison between the plant design basis conditions and the qualification data for each instrument, and the uncertainties in the EQ data and design basis conditions used in the comparisons. During the conference call, the reviewer clarified that the EQ data request applies only to the new instrumentation associated with the RSGs.

Response:

A comparison of the EQ data for the new steam generator level transmitters and the plant design data is provided in the following table:

Parameter	Plant Design Requirement	EQ Demonstrated Value
Operating Time	180 days	Greater than 180 days
Peak Temperature (°F)	383	350 (note 1)
Peak Pressure (psig)	58.0	85
Relative Humidity (%)	100	100
Radiation (rads T.I.D.)	2.79E+07	5.0E+07
Qualified Life	40 years	40 years
Submergence	No	N/A

Note 1. The specified peak temperature in containment is 383°F during a postulated main steam line break. The qualification test profile did not exceed 350°F, but remains bounding for the following reasons:

a) The PVNGS postulated environmental profile is shown in Attachment 6, Figure 6.2-11 of the referenced letter. The vendor (Rosemount) qualification test data shows that when tested at an ambient temperature of 420°F for 3 minutes followed by 350°F for 7 minutes, which is more severe than the plant accident profile, the corresponding maximum internal temperature was 323°F. Therefore, the PVNGS transmitters will not exceed an internal temperature of 323°F when exposed to the postulated peak temperature.

b) The severity of the tested conditions with long durations of high temperature is considered much greater than the severity of the postulated plant accident conditions in the containment.

The Palo Verde Equipment Qualification Manual prescribes the treatment of EQ uncertainties as follows:

> *Margin is required in electrical equipment environmental qualification programs to account for reasonable uncertainties in demonstrating satisfactory performance and normal variations in commercial production, thereby providing assurance that the equipment can perform under the most adverse service condition specified. Margins, therefore, represent the conservatism that exists when comparing the actual performance and environmental requirements established for plant equipment with those similar requirements demonstrated during test simulations. Margins are applied in addition to any conservatism applied during the derivation of the PVNGS design basis accident environmental conditions.*

Acceptable methods for ensuring that adequate margin exist include increasing the test parameter values, number of tests, test transients, operability time, or test duration. Acceptable margin values which, when applied, satisfy PVNGS environmental qualification requirements are developed using the guidelines provided in IEEE Standard 323. These values are only applied for design basis accident conditions, and include the following:

1. *Temperature: +15°F*
2. *Pressure: + 10 percent of gauge*
3. *Accident Radiation Dose: +10 percent.*

The above comparison of Plant Design Requirements and EQ Demonstrated Values indicates that sufficient margin is available to account for the uncertainties.

Attachment 3

Summary of the PVNGS I & C Design Guide for Instrument Uncertainty and Setpoint Determination

Attachment 3

Summary of the PVNGS I&C Design Guide for Instrument Uncertainty and Setpoint Determination

The following is excerpted from the "PVNGS I&C Design Guide for Instrument Uncertainty and Setpoint Determination" and summarizes the methodology used by APS.

This design guide establishes a methodology for the preparation of instrument channel uncertainty and setpoint calculations. A systematic method of identifying and combining instrument uncertainties is necessary to ensure that adequate margin has been provided for safety- related instrument channels that perform protective functions and for instrument channels that are important to safety. The methodology is based on the industry standard ANSI/ISA S67.04-1988, "Setpoints for Nuclear Safety-Related Instrumentation." Regulatory Guide 1.105 has been accepted with the exceptions specified in the UFSAR, section 1.8, for PVNGS as a basis for meeting the requirements of 10CFR50, Appendix A, General Design Criteria 13 and 20.

Instrument setpoints associated with safety functions are generally based on established safety or process limits while setpoints not associated with a safety function will frequently be based upon an estimated, or some qualitative limit, e.g., operating limits. Safety-related and non-safety related are categories used in this design guide to denote the classification of the function that a particular channel or control loop performs. Safety-related setpoints are those that perform a safety-related function and must be performed by qualified safety-related devices. However, safety-related devices may perform non-safety-related functions. The converse is not true: a non-safety related device may not have a safety-related function.

This design guide provides flexibility in the precise method by which a setpoint is determined, allowing for variations in function of a setpoint or an operator decision point. The intent is to provide a format for statistically combining uncertainties of components of a measurement or calculation of a measured value to ensure that there is adequate margin for the given plant parameter. This provides a consistent criterion for assessing the magnitude of uncertainties associate with each uncertainty component, thereby ensuring plant safety.

There are three major parts to instrument uncertainty and setpoint calculations:

Determination of total instrument channel uncertainty for appropriate environmental conditions (e.g. testing, normal operations, accident),

Determination of the instrument setpoint or operator decision point to ensure that the plant system or equipment operates as designed, and

Determination of testing acceptance criteria which enable plant personnel to be assured that the instruments are operating as intended.

Calculations intending to thoroughly evaluate instrument loop uncertainties will necessarily consider loop design in detail. Any modifications to the loop will require at least a review - and usually a revision - of such a calculation.