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102-04954-CDM/TNW/RAB  
June 10, 2003

U. S. Nuclear Regulatory Commission  
ATTN: Document Control Desk  
Mail Station P1-37  
Washington, DC 20555

Reference: Letter dated April 17, 2003 from B. M. Pham, USNRC, to G. R. Overbeck, APS, "Palo Verde Nuclear Generating Station, Unit 2 (PVNGS-2) – Draft Safety Evaluation Report (SER) of Amendment on Replacement of Steam Generators and Upgraded Power Operations (TAC No. MB3696)"

Dear Sirs:

**Subject: Results of Review for Factual Accuracy in Draft Safety Evaluation Report (SER)**

The referenced letter requests that Arizona Public Service Company (APS) review the Draft Safety Evaluation Report (SER) that was enclosed for factual accuracy and respond to the NRC by May 30, 2003. The results of this review by APS are summarized in Attachment 2 to this letter.

During previous discussions with the NRC Staff, the amendment would be approved approximately six weeks after receipt of these comments. This schedule is acceptable to APS.

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,

CDM/TNW/RAB

cc: Regional Administrator (NRC Region IV)  
J. N. Donohew (NRC Project Manager)  
B. M. Pham (NRC Project Manager)  
N. L. Salgado (NRC Resident Inspector)  
A. V. Godwin (ARRA)

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

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**Attachments:**

- 1. Notarized Affidavit**
- 2. Summary of the Review for Factual Accuracy in the Draft Safety Evaluation Report of Amendment on Replacement of Steam Generators and Up-rated Power Operations**

Attachment 1

STATE OF ARIZONA       )  
                                  ) ss.  
COUNTY OF MARICOPA   )

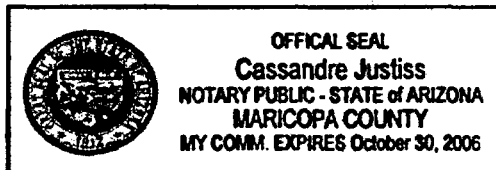
I, David Mauldin, represent that I am Vice President Nuclear Engineering and Support, Arizona Public Service Company (APS), that the foregoing document has been signed by me on behalf of APS with full authority to do so, and that to the best of my knowledge and belief, the statements made therein are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

*David Mauldin*

David Mauldin

Sworn To Before Me This 10<sup>th</sup> Day Of June, 2003.

*Cassandra Justiss*  
Notary Public



Notary Commission Stamp

## **Attachment 2**

### **Summary of the Review for Technical Accuracy of the Draft Safety Evaluation Report of Amendment on Replacement of Steam Generators and Up-rated Power Operations**

# **Summary of the Review for Technical Accuracy of the Draft Safety Evaluation Report of the Amendment on the Replacement of Steam Generators and Up-rated Power Operations**

## **Draft SER Section 1.0, Introduction**

1. Letters dated October 11, 2002, Letter No. 102-04847-CDM/TNW/RAB, from C. D. Mauldin, APS, to U. S. Nuclear Regulatory Commission, "Response to Request for Additional Information Regarding Steam Generator Replacement and Power Uprate License Amendment Request" and November 21, 2002, Letter No. 102-04866-CDM/TNW/RAB, from C. D. Mauldin, APS, to U. S. Nuclear Regulatory Commission, "Supplement to Request for a License Amendment to Support Replacement of Steam Generators and Up-rated Power Operations" should be added to the list of letters that supplement the application dated December 21, 2001.

## **Draft SER Section 2.1, Emergency Core Cooling System**

1. The second paragraph, second sentence currently states:  
"As this is shown with the analyses and the results of Section 4.1, "ECCS Performance Analysis," the staff concludes that the licensee's ECCS system is of the appropriate size and capacity to protect the reactor core during a LOCA event."

The second sentence should state:

"As this is shown with the analyses and the results of Section 6.1, "ECCS Performance Analysis," the staff concludes that the licensee's ECCS system is of the appropriate size and capacity to protect the reactor core during a LOCA event."

## **Draft SER Section 3.0, NUCLEAR STEAM SUPPLY SYSTEM COMPONENTS**

1. The third paragraph from the end of the section states:  
"The licensee applied leak-before-break (LBB) to reduce the dynamic...."

The third paragraph from the end of the section should state:

"The licensee applied leak-before-break (LBB) *methodology* to reduce the dynamic...."

2. The last paragraph, seventh sentence currently states:  
"As described in the PURLR, the licensee performed a benchmark of the new ANSYS computer models against the original STRUDL and CE-DAGS models."

Based on the PURLR Section 5.4.2, the sentence should state:

"As described in the PURLR, the licensee performed a benchmark of the new ANSYS computer models against the original STRUDL, *MEC-21*, and CE-DAGS models."

### **Draft SER Section 3.1, Reactor Pressure Vessel Components**

1. The first paragraph, second sentence states:  
“....analyzing the RCS at the RSG and PUR conditions.”

The sentence should state:

“....analyzing the RCS at the *combined* RSG and PUR conditions.”

2. The first paragraph, last sentence states:  
“....abnormal occurrence report (AOR)....”

The sentence should state:

“....*analysis* of record (AOR)...”

3. The third paragraph from the end of the section, first sentence currently states:  
“The licensee also evaluated the other RPV items for the RSG and PUR conditions.”

The sentence should state:

“The licensee also evaluated the *remaining* RPV components for the RSG and PUR conditions.”

### **Draft SER Section 3.2, Reactor Pressure Vessel Internals**

1. The second paragraph, second sentence currently states:  
“Since the RCS flow remains within the original design, the previous analysis for flow-induced vibration remains valid.”

Based on PURLR Table 2.1-1, the sentence should state:

“Since the RCS flow remains within the original design *bases*, the previous analysis for flow-induced vibration remains valid.”

### **Draft SER Section 3.3, Other Equipment on Reactor Pressure Vessel**

1. The third paragraph, first sentence states:  
“The head lift rig (HLR) is permanently attached to the RPV head.”

Based on the PURLR Section 5.3.4, the sentence should be deleted and the second sentence should be re-written as follows:

“...the licensee evaluated the *permanent head lift rig (HLR) structure*....”

2. Same paragraph, second sentence states:  
“....for the SG and PUR conditions.”

The sentence should state:

“.... for the *RSG* and PUR conditions.”

### **Draft SER Section 3.3.1 Control Element Drive Mechanisms**

1. The first paragraph states:  
"The evaluation of the CEDMs is provided in Section 5.3 of the PURLR. Additional information was provided in the licensee's September 6, 2002 response to the staff's RAI. The CEDMs were evaluated for normal conditions, upset conditions, and faulted conditions in accordance with the ASME Code, 1971 Edition with addenda through the Winter 1973 Addenda, which is the code of record."

Based on UFSAR Table 5.2-1, the paragraph should read:

"The evaluation of the CEDMs is provided in Section 5.3 of the PURLR. Additional information was provided in the licensee's September 6, 2002 response to the staff's RAI. The CEDMs were evaluated for normal conditions, upset conditions, and faulted conditions in accordance with the ASME Code, 1974 Edition with addenda through the Winter 1975 Addenda, which is the code of record."

### **Draft SER Section 3.4.1, Leak Before Break**

1. Add a sentence to the end of the eighth paragraph that states:  
"The application of LBB methodology to subcompartment loads and compliance with the appropriate General Design Criteria is discussed in Section 4.2.5 of this report."
2. The first indented paragraph regarding the conference call on December 12, 2002 (fourth complete paragraph from the end of this section) currently states:  
"....fracture toughness data available for the piping materials."

The first indented paragraph should state:

"....fracture toughness data available for the piping *and weld* materials."

### **Draft SER Section 4.1, Emergency Core Cooling System Performance Analysis**

1. The sixth paragraph uses the terms VANTAGE+ and VANTAGE-5. These are Westinghouse fuel designs that have not been used at Palo Verde. The terms should be replaced as follows throughout the SER:  

VANTAGE+	ZIRLO®-clad
VANTAGE-5	Zircaloy-clad
2. The sixth paragraph, second sentence states:  
"Both CENPD-404-P-A and WCAP-12610-P-A discuss LOCA analyses for mixed cores with Zircaloy-clad fuel and Vantage+ fuel."

The sentence should be deleted because CENPD-404-P-A does not discuss mixed cores. However, the NRC SER for this topical report does.

Also, WCAP-12610-P-A does not apply to CE-designed fuel. Therefore, references to this topical report should be deleted.

3. The sixth paragraph, third sentence states:  
"The NRC SERs for both of these applicable documents..."

The sentence should state:

"The NRC SER for CENPD-404-P-A states that: *"Because...."*

4. The seventh paragraph, first sentence states:  
"...LBLOCA analyses it performed..."

The sentence should state:

"...LBLOCA analyses *Westinghouse performed on its behalf...*"

5. The seventh paragraph, second sentence states:  
"The licensee explicitly...."

The sentence should state:

"*Westinghouse explicitly....*"

6. In the first table, "CEN" should be "CENPD" in all cases

7. Please remove "ft<sup>2</sup>" from the limiting break size in the first table of this section. This notation was inadvertently introduced in the APS to NRC letter dated October 11, 2002. For LBLOCA, break sizes are normalized to a specific break size. Note (a) to UFSAR Table 6.3.3.2-1 provides a description of the break sizes and locations. This change only applies to the LBLOCA; the use of the notation in second table is correct.

8. The first paragraph after the first table states:  
"...of analyses it performed for PVNGS-2 SBLOCA analyses power using both the CENPD-137, Supplement 1-P-A (S1M) SBLOCA methodology and CENPD-132, CENPD-137, Supplement 2-P-A (S2M) SBLOCA methodology."

The paragraph should state:

"...of analyses *Westinghouse performed on its behalf* for PVNGS-2 SBLOCA at the *RSG and uprated power conditions* using both the CENPD-137, Supplement 1-P-A (S1M) SBLOCA methodology and CENPD-137, Supplement 2-P-A (S2M) SBLOCA methodology."



9. The sentence before the second table states:  
“...provided bounding values.”

The sentence should state:  
“...provided bounding values *for the S2M analysis*.”

10. The first paragraph after the second table states:  
“In the licensee’s October 11, 2003, letter....”

The paragraph should state:  
“In the licensee’s October 11, 2002, letter....”

11. In the same paragraph the staff states that the licensee has provided information concerning fuel clad oxidation, including values for pre-transient oxidation. APS has no record of providing values for pre-transient oxidation. However, values for maximum cladding oxidation have been provided that demonstrate compliance with 10 CFR 50.46.

Please delete the paragraph or re-write it to clarify the discussion on pre-existing cladding oxidation values.

12. Same paragraph, last sentence:  
“....Framatome....”

Remove “Framatome”, PVNGS has never used Framatome fuel.

13. The last paragraph imposes a limitation on the removal of CENPD-137 Supplement 1-P-A from the Unit 2 Technical Specification COLR References. APS is holding its comment on this item in abeyance, pending further discussion with the NRC.

**Draft SER 4.1.1, Post Loss-of-Coolant Accident Long-Term Cooling and Table 3.1, Comparison of Characteristics**

1. References to Topical Report CENPD-254-P-A should be stated consistently throughout the section.
2. The first paragraph, first sentence states:  
“Regulatory requirements for long-term cooling (LTC) is....”  
  
The sentence should state:  
“Regulatory requirements for long term cooling (LTC) *are*....”
3. The statements regarding 2 to 3 hours to establish hot leg injection are directions provided in the Emergency Operating Procedures. This specific time duration may not be appropriate for an SER.

3. Table 3.1 states that the time to establish hot leg injection via emergency procedures is 2 to 3 hours.

A footnote should be added to indicate that the EOPs are consistent with the sequence of events described in UFSAR Sections 6.3.2.7 and 6.3.3.

#### **Draft SER Section 4.2.1, Containment Structure**

1. The third paragraph, last sentence states:  
"For the reactor cavity and SG subcompartment temperatures, the licensee performed a qualitative assessment by comparing the concrete thermal profiles that were generated using the COPATTA containment response code, and determined that the original analysis was bounding."

The third paragraph should state:

*"For containment temperature effects, the licensee performed a qualitative assessment that compared the RSG/PUR containment and basemat concrete thermal profiles that were generated using the COPATTA computer code to those values assumed in the original Bechtel Structural Analysis Program (BSAP) for containment internal structures. The results of this comparison determined that the original BSAP analysis remains bounding for RSG/PUR."*

#### **Draft SER 4.3.1.1, Increased Main Steam Flow**

1. The fourth paragraph, first sentence states:  
"The analysis was done using CENTS code with the CE-1 critical heat flux (CHF) correlation. The CETOP-D code was used for the DNBR."

The sentence should state:

*"The analysis was done using the CENTS code. The CETOP-D code, DNBR with the CE-1 critical heat flux (CHF) correlation, was used for the DNBR."*

#### **Draft SER Section 4.3.1.2, Inadvertent Opening of a Steam Generator Atmospheric Dump Valve (IOSGADV)**

1. The first paragraph, first sentence states:  
"...as in Section 6.3.1.3."

The sentence should state:

*"...as in PURLR Section 6.3.1.3."*

2. The first paragraph, second sentence states:  
"The IOSGADV is coincident with a LOP."

Based on PURLR Section 6.3.1.4, the sentence should state:

*"The analysis models IOSGADV with a LOP following turbine trip."*

3. The first paragraph, third sentence states:  
“...trip via the core protection computer (CPC).”

The sentence should state:

“...trip via the core protection *calculator* (CPC).”

#### **Draft SER Section 4.3.1.3.1, Steam System Piping Failures Inside and Outside Containment - Mode 1 Operation**

1. The first paragraph states:  
“...causes significant steam flow and energy removal,...”

The paragraph should state:

“...causes a significant *increase in* steam flow and energy removal,...”

2. The second paragraph states:  
“For an incident of moderate frequency, maximum RCS pressure must be kept within 110% of the design limit (2750 psia), DNBR must be kept above SAFDL limits, and the vessel should be above the brittle fracture limits. Some fuel damage is acceptable as long as the core coolability is maintained.”

The paragraph should state:

*“For PVNGS-2, the MSLB is a limiting fault event; maximum RCS pressure should be maintained below acceptable design limits, considering potential brittle as well as ductile failures. The potential core damage is evaluated on the basis that it is acceptable if the minimum DNBR remains above SAFDL limits. If the minimum DNBR falls below SAFDL values, fuel damage must be assessed. Some fuel damage is acceptable as long as the core remains in place and maintains a coolable geometry.”*

3. The fourth paragraph states:  
“Input parameters, such as the most negative material and fuel feedback coefficients....”

The paragraph should state: “Input parameters, such as the most negative *moderator* and fuel feedback coefficients....”

4. The last paragraph, first sentence states:  
“The reactor vessel pressure remains below 110% of design because the MSSVs will activate and the minimum DNBR will remains above 1.49.”

The sentence should state:

*"The results show that the reactor coolant system remains below acceptable design limits because the PSVs and MSSVs will actuate, and the minimum DNBR remains above the SAFDL limit."*

#### **Draft SER section 4.3.2, Decrease of Heat Removal by the Secondary System**

1. The third paragraph, first sentence states:

"The RCS response was analyzed using CENTS code with the CE-1 CHF correlation while the DNBR was calculated using the CETOP-D code."

The sentence should state:

*"The RCS response was analyzed using the CENTS code, while DNBR was calculated using the CETOP-D code with the CE-1 CHF correlation."*

2. The third paragraph, third sentence states:

"Loss of condenser vacuum was simulated with turbine trip, the TAV closed in 0.2 sec and FW flow zeroed in 0.1 sec."

The sentence should read:

*"Loss of condenser vacuum was simulated with turbine trip, TAV closure and main FW flow ramping to zero. TAV closure time and main FW flow ramp period were conservatively selected to bound the actual plant configuration."*

3. The fourth paragraph, last sentence states:

"The PSVs will open at 2549 psia and the maximum primary pressure will reach 2733 psia, i.e., below the limit if 2750 psia."

The sentence should state:

*"The PSVs will open at the setpoints defined in the Technical Specifications, and the maximum primary pressure will peak at 2733 psia, i.e., below the safety limit if 2750 psia."*

4. The fifth paragraph, first sentence states:

"MSSV banks 1, 2 and 3 will open at 1303, 1344 and 1370 psia, respectively. The maximum secondary pressure..."

The sentence should state:

*"The MSSVs will open at the setpoints defined in the Technical Specifications. The maximum secondary pressure..."*

#### **Draft SER Section 4.3.2.4, Feedwater System Pipe Breaks**

1. The third paragraph, third sentence states:

"A low SG trip would...."

The sentence should state:  
"A low SG *level* trip would...."

2. The third paragraph, fifth sentence states:  
"It is assumed that offsite power is also lost concurrent with the reactor trip."

The sentence should state:  
"It is assumed that offsite power is lost *several seconds after the turbine trip.*"

3. The sixth paragraph, second sentence states:  
"A 0.14 ft<sup>2</sup> size break was assumed and HPPT was conservatively assumed as the reactor trip."

The sentence should state:  
"*The limiting break size is conservatively determined based on the approved method, i.e., the break size is that which results in a simultaneous HPPT and Low SG Level Trip.*"

#### **Draft SER Section 4.3.3.1, Total Loss of Reactor Coolant Flow**

1. The second paragraph, last sentence states:  
"However, initial values were chosen to maximize the RCS pressure."

The sentence should state:  
"However, initial values were chosen to *minimize the DNBR.*"

2. The fourth paragraph refers to 6.3.2 for codes and assumptions. Please clarify which document contains the referenced section.

#### **Draft SER Section 4.3.3.2, Reactor Coolant Pump Shaft Break With Loss of Offsite Power**

1. The second paragraph states:  
"This is classified as a moderate frequency event, RCS heatup due to loss of cooling. The concerns are peak pressure and the MDNBR value. The acceptance criteria are that the peak RCS pressure remain below 110% of design value and MDNBR remain above the SAFDL criterion."

The paragraph should state:  
"*By including a LOP and stuck open ADV, this event is classified as a limiting fault event for PVNGS. The concerns are peak RCS pressure and the MDNBR value. The acceptance criteria are that the maximum RCS pressure should be maintained below acceptable design limits, and the potential for core damage is evaluated on the basis that it is acceptable if*

*the MDNBR remains above SAFDL limits. If the MDNBR falls below SAFDL values, fuel damage must be assessed. Some fuel damage is acceptable as long as the core remains in place and maintains a coolable geometry."*

2. The fourth paragraph states:  
"....the MDNBR falls to the SAFDL limit...."

PURLR Section 6.3.3.4.6 indicates that the paragraph should state:  
"....the MDNBR falls *below* the SAFDL limit..."

**Draft SER Section 4.3.4.6, Control Element Assembly Ejection**

1. The two indented items after the first paragraph are numbered 4 and 5. Please correct the numbering for these items.
2. The second paragraph, second sentence states:  
"The CEA ejection may lead to a rapid positive reactivity addition resulting in a rapid power excursion. Only the high pressurizer pressure trip..."

The sentence should state:

"The CEA ejection may lead to a rapid positive reactivity addition resulting in a rapid power excursion *and RCS pressurization.*"

3. The rest of the second paragraph that starts with "only the high pressurizer trip...." should be moved into the third paragraph, before the last sentence.

**Draft SER Section 4.3.5, Increase in Reactor Coolant Inventory**

1. The paragraph states:  
"...inadvertent activation of the core cooling system..."

The paragraph should state:

"...inadvertent activation of the *emergency* core cooling system..."

2. The Staff has not stated its conclusion for these events.

**Draft SER Section 4.3.6.1, Double Ended Break of a Letdown Line Outside of Containment (Upstream of the Letdown control valve)**

1. The third paragraph states:  
"No single failure was assumed."

The paragraph should state:

"No single *active* failure of a containment isolation valve was considered."

2. The Staff has not stated its conclusion for this event.

**Draft SER Section 4.3.6.2, Steam Generator Tube Rupture**

1. The third paragraph, second sentence states:  
"The air injector will...."

The paragraph should state:

"The *condenser air removal pumps* will...."

**Draft SER Section 4.3.6.2.1 Steam Generator Tube Rupture With Concurrent Loss of Offsite Power (No Stuck-Open ADV)**

1. The first paragraph, first sentence states:  
"..., and air ejector."

The sentence should state:

"..., and *the condenser air removal pumps*."

**Draft SER Section 4.3.7.1, AOOs In Combination With a Single Active Failure**

1. The second paragraph, first sentence states:  
"...MDNBR of infrequent events (including AOOs)."

The sentence should state:

"...MDNBR of infrequent events (including AOOs *in combination with a single failure*)."

2. The third paragraph states:  
"The acceptance criteria are those of AOOs, i.e., limited fuel damage and maximum RCS pressure within 120% of the pressure vessel design value."

The paragraph should state:

"The acceptance criteria are those *for infrequent events (including AOOs with single failure)*, i.e., limited fuel damage and maximum RCS pressure within *110% of the reactor coolant system* design value."

3. The fifth paragraph, third sentence states:  
"...because the RSVs have sufficient capacity to relieve overpressure. This transient increases confidence that the limiting AOO is well within prescribed limits."

The sentence should state:

"...because the *PSVs* have sufficient capacity to relieve overpressure. This transient increases confidence that the limiting *infrequent events (including AOOs in combination with a single failure)* are well within prescribed limits."

#### **Draft SER Section 4.4.1, Accident Dose Calculations**

1. The second paragraph, last bullet states:  
"Limiting Infrequent Events AOO"

The bullet should state:  
"Limiting Infrequent Events"

2. The third paragraph, last sentence states:  
"Table 1 to this SER tabulates the analysis assumptions found acceptable by the staff."

The sentence should state:  
"Table 1 to this SER tabulates the analysis assumptions *used by the staff in their confirmatory analyses.*"

3. The following sentence should be added at the end of the third paragraph:  
*It should be noted that the flashing fractions used for the affected generator in calculating control room doses were based on predicted primary temperature profiles.*

#### **Draft SER Section 4.4.2. IOSGADV with LOP**

1. The first paragraph, next to last sentence states:  
"Since the SG mass inventory is maintained, a DF of 100 for the affected SG, as used..."

The sentence should state:  
"Since the *SG inventory, i.e., level*, is maintained, a DF of 100 for the unaffected SG, as used..."

2. The second paragraph, first sentence states;  
"The assumptions found acceptable to the staff are presented in Table 1."

The paragraph should state:  
"The assumptions *used by the staff in their confirmatory analysis* are presented in Table 1."

#### **Draft SER Section 4.4.3, MSLB Outside Containment with LOP**

1. The second paragraph, first sentence states;  
"The assumptions found acceptable to the staff are presented in Table 1."

The sentence should state:  
"The assumptions *used by the staff in their confirmatory analysis* are presented in Table 1."

#### **Draft SER Section 4.4.4, FWLB Outside Containment with LOP**

1. The second paragraph, first sentence states;



"The assumptions found acceptable to the staff are presented in Table 1."

The paragraph should state:

"The assumptions *used by the staff in their confirmatory analysis* are presented in Table 1."

**Draft SER Section 4.4.5, Single RCP Sheared Shaft with LOP**

1. The first paragraph, third and fourth sentences state:

"As a bounding value, APS assumes that 17% of the fuel rods in the core fail instantaneously releasing all of the noble gases and iodine in the fuel rod gap. APS assumes that 10% of the core inventory of noble gases and iodine are located in the fuel rod gap. A radial peaking factor of 1.72 is applied."

APS determines dose consequences using the product of multiplying the failed fuel fraction and the radial peaking factor. For example, the control room dose calculation assumes that 17% of the fuel rods fail, and a radial peaking factor of 1.72 is applied. The EAB and LPZ dose calculation assumes that 20% of the fuel rods fail with a radial peaking factor of 1.45.

Based on this, the paragraph should state:

"*APS determines the limiting product of multiplying the failed fuel fraction and the radial peaking factor to meet acceptable EAB, LPZ and control room dose limits.* APS assumes that 10% of the core inventory of noble gases and iodine are located in the fuel rod gap."

2. The second paragraph, first sentence states;  
"The assumptions found acceptable to the staff are presented in Table 1."

The paragraph should state:

"The assumptions *used by the staff in their confirmatory analysis* are presented in Table 1."

**Draft SER Section 4.4.6, CEA Ejection**

1. The first paragraph after the bulleted items states:

"APS assumes that a containment purge is in progress at the start of the event and the purge is not isolated for 77 seconds."

Because the mass and energy releases to the containment for the event at RSG and PUR conditions are different than those stated in the UFSAR, the purge isolation times will be different. Therefore APS recommends that the paragraph be stated as follows:

"APS assumes that a containment purge is in progress at the start of the event."

2. The last paragraph, third sentence states;

"The assumptions found acceptable to the staff are presented in Table 1."

The paragraph should state:

"The assumptions *used by the staff in their confirmatory analysis* are presented in Table 1."

**Draft SER Section 4.4.8, SGTR with LOP and Single Failure of ADV**

1. The second paragraph, fourth sentence states;  
"The assumptions found acceptable to the staff are presented in Table 1."

The sentence should state:

"The assumptions *used by the staff in their confirmatory analysis* are presented in Table 1."

**Draft SER Section 4.4.9, SGTR with LOP**

1. The last paragraph states:  
"The EAB and LPZ doses estimated by APS for the SGTR with LOP event were found to be acceptable. APS determined that the control room doses..."

The paragraph should state:

"The EAB and LPZ doses estimated by APS for the SGTR with LOP event were found to be acceptable. APS determined that the *predicted EAB and LPZ doses remain bounded by those estimated for the SGTR with LOP and Single Failure of ADV, and that the control room doses...*"

2. The third paragraph, first sentence states;  
"The assumptions found acceptable to the staff are presented in Table 1."

The paragraph should state:

"The assumptions *used by the staff in their confirmatory analysis* are presented in Table 1."

**Draft SER Section 4.4.10, LBLOCA and SBLOCA**

1. The first paragraph after the bulleted items states:  
"For the containment purge path, APS assumes that a containment purge is in progress at the start of the event and that it takes 12 seconds to isolate the purge for the LBLOCA and 138 seconds for the 0.02 ft<sup>2</sup> SBLOCA."

Because the mass and energy releases to the containment for the SBLOCA event at RSG and PUR conditions are different than those stated in the UFSAR, the isolation times will be different. Therefore APS

recommends that the paragraph be stated as follows:

*"For the containment purge path, APS assumes that a containment purge is in progress at the start of the event."*

2. The last paragraph, first sentence states:  
"The assumptions found acceptable to the staff are presented in Table 1."

The paragraph should state:

*"The assumptions used by the staff in their confirmatory analysis are presented in Table 1."*

#### **Draft SER Section 4.4.14, Limiting Infrequent Events**

1. The first paragraph states:  
"This DBA is a composite of anticipated operational occurrences (AOO). The initial conditions and sequence of events were chosen to bound the AOOs."

The paragraph should state:

*"This DBA is a composite of infrequent events including anticipated operational occurrences (AOO) with a single failure. The initial conditions and sequence of events were chosen to bound the infrequent events and AOOs with single failure."*

2. The second paragraph, first sentence states:  
"The assumptions found acceptable to the staff are presented in Table 1."

The paragraph should state:

*"The assumptions used by the staff in their confirmatory analysis are presented in Table 1."*

#### **Draft SER Section 5.3.4, Rod Internal Pressure**

1. The second paragraph, last sentence states:  
"...burnup limit of 62000 MWD/MTU"

The sentence should state:

*"...burnup limit of 60,000 MWD/MTU."*

#### **Draft SER Section 5.3.5, Cladding Oxidation**

1. The first paragraph, last sentence states:  
"The licensee has adopted a corrosion limit of 100 microns in its UFSAR."

The sentence should state:

*"The licensee has adopted a corrosion limit of 100 microns for ZIRLO® clad fuel in its UFSAR."*

#### **Draft SER Section 5.3.6, Fuel System Design Conclusion**

1. The last sentence of the paragraph states:  
“...burnup of 62,000 MWD/MTU.”

The sentence should state:  
“...burnup of 60,000 MWD/MTU.”

#### **Draft SER Section 5.4, Neutron Fluence**

1. The section states:  
“The staff reviewed fluence calculational method including input parameters and approximations. Fluence values determine reactor pressure boundary material properties which are then used to calculate pressure-temperature limits for cold overpressure protection and pressurized thermal shock. The acceptance criteria are based on GDCs 14, 30 and 31. RG 1.190 describes acceptable methods for vessel fluence calculations.

The licensee performed fluence calculations in the existing analysis of record at the 4200 MWt power level. In addition the out-in type of fuel loading was assumed, however, the proposed PUR is for 3990 MWt and the loading pattern is for low leakage since cycle 2 for PVNGS-2. Both conditions are conservative and the analysis of record bounds the values calculated for the uprated power. PVNGS-2 has a calculated vessel fluence value which has been reviewed and approved with the approval of the 32 EFPY pressure temperature curves in amendment 117 dated May 20, 1998. The staff concludes that the fluence value of record are conservative and therefore, are acceptable. The staff also noted, however, that at the time of amendment 117's issuance, RG 1.190 had not been issued, therefore, the staff recommends that with the application for extension of the current pressure temperature limits, the licensee should state that the fluence methodology adheres to the guidance in RG 1.190.”

Since the Staff recognizes that RG 1.190 is not part of the the PVNGS licensing basis, APS recommends that the last sentence be deleted. The last sentence imposes new restrictions on future work regarding pressure temperature limits. APS recommends that the staff consider revising this section based on APS to the NRC letter number 102-04847-CDM/TNW/RAB, dated October 11, 2002, Attachment 2, response to Question 17 (see below).

#### **NRC Question 17:**

Attachment 6, Section 7.5, “Neutron Fluence”: The vessel fluence in the analysis of record (AOR) was calculated for a power level of 4200 MW<sub>t</sub>. Discuss the following: (1) does the AOR satisfy the guidance in Regulatory

Guide 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence," (2) what is the value of the end of life reference temperature for null ductility transition ( $RT_{NDT}$ ), and (3) in the  $RT_{NDT}$  computation process, were any adjustments made on the calculated fluence value based on dosimetry measurements? If yes, for Item (3), provide the data for the adjustment.

APS Response:

The AOR was not performed following the guidance in Regulatory Guide 1.190. The AOR dates back to the initial safety analysis, before issuance of Regulatory Guide 1.190, and is the basis for the design of the reactor pressure vessel. The AOR end-of-life fluence is  $3.29E+19$  n/cm<sup>2</sup> for the vessel inside surface. In 1994, WCAP-13935, "Analysis of 137 Degree Capsule from the Arizona Public Service Company Palo Verde Unit No. 2 Reactor Vessel Radiation Surveillance Program," was issued. Comparing the WCAP-13935 analysis to the PURLR showed that the projected end-of-life (32 EFPY) fluence was approximately one-third lower than the value in the AOR (i.e., one-third more conservative than the assessment done for the PURLR). The large difference between the AOR and the WCAP-13935 analysis is based on the fact that the latter did account for actual plant operation, and much of the difference is a reflection of the low leakage fuel management program employed.

The maximum predicted value of the end-of-life  $RT_{NDT}$  for the Palo Verde Unit 2 reactor pressure vessel is 78 °F and applies to the intermediate shell plate F 765-6. This value was based on the predicted peak fluence calculated in the AOR for the vessel inside surface,  $3.29E+19$  n/cm<sup>2</sup>, at end-of-life. The predicted value of end-of-life  $RT_{NDT}$  was calculated using Regulatory Guide 1.99, "Radiation Embrittlement of Reactor Vessel Materials," Revision 2, and includes the initial  $RT_{NDT}$ , the predicted shift, and an uncertainty value of 34 °F.

In the  $RT_{NDT}$  computation process, no adjustments were made on the calculated fluence value based on dosimetry measurements. The AOR end-of-life fluence,  $3.29E+19$  n/cm<sup>2</sup> for the vessel inside surface, was used directly, and that value was based solely on calculations.

**Draft SER Section 6.1, Balance of Plant Components**

1. The first paragraph, second sentence states:  
"The license evaluated the BOP piping, components, and supports in accordance with the provisions...."

The sentence should state:

"The license evaluated the *safety-related* BOP piping, components, and supports *affected by the replacement steam generators and uprated power operation* in accordance with the provisions...."

2. The fourth paragraph uses the phrase "steam quality" in four places. this phrase should be replaced with the phrase "moisture carryover" in all four places.

#### **Draft SER Section 6.2, Auxiliary Feedwater System**

1. The second paragraph states:  
"...,which are not used during startup..."

Based on UFSAR 10.4.9.3.F, the paragraph should state:  
"...,which are not *routinely* used during startup..."

2. The paragraph also states:  
"....(750 gpm net)...."

UFSAR Table 10.4-6 lists the seismic category I pump flow as 750 gpm,net. As stated in footnotes (a) and (b) to this table, net flow is 750 gpm and the value shown is based on design specifications. However, the safety analysis credit delivery of 650 gpm at a steam generator pressure 1270 psia or equivalent at the steam generator entrance for design basis accidents.

APS recommends deleting this value from the SER to avoid confusion, or correct it to reflect the value assumed in the Safety Analyses.

#### **Draft SER Section 6.6, Main Turbine Auxiliaries**

1. The first paragraph, first sentence states:  
"...circulating water system, and main and auxiliary condensers are designed...."

The sentence should state:  
"...circulating water system, and main condenser are designed...."

#### **Draft SER Section 6.8.3, Nuclear Cooling Water**

1. The first paragraph, second sentence states:  
"The NCWS circulates water from the cooling tower basin through the non-safety related components and heat exchangers and back to the cooling tower."

The sentence should state:  
"The NCWS *acts as an intermediate barrier between reactor auxiliary systems and equipment containing radioactive or potentially radioactive fluids and the plant cooling water system.*"

#### **Draft SER Section 6.8.4, Essential Cooling Water**

1. The first paragraph, first sentence states:

"The essential cooling water system (ECWS) is a closed loop system which serves as an intermediate barrier between the service water system and systems which contain radioactive or potentially radioactive fluids in order to eliminate the possibility of an uncontrolled release of radioactivity."

The sentence should state

"The essential cooling water system (ECWS) is a closed loop system which serves as an intermediate barrier between the *essential spray pond* system and systems which contain radioactive or potentially radioactive fluids in order to eliminate the possibility of an uncontrolled release of radioactivity."

#### **Draft SER Section 6.11.5, Environmental Qualification of Electrical Equipment**

1. The last paragraph, last sentence states:  
"...meets the relevant requirements of 10 CFR 50.49."

Based on PURLR Section 9.4.3, the sentence should state:

"...meets the relevant requirements of 10 CFR 50.49 *with the exception of the In-Core Instrument connectors and non-standard Raychem splices, which will be qualified before implementation of this amendment.*"

#### **Draft SER Section 6.12, Essential Spray Pond System**

1. The first paragraph, fourth sentence states:  
"...butterfly valves are provided between ponds, both trains can be operated from one pond if the other is unavailable."

The sentence should state:

"...butterfly valves are provided between ponds, *such that the total inventory from both ponds is available to either ESPS train.*"

2. The third paragraph, first sentence states:  
"....and that the ESPS has an insignificant or no impact on the UHS and ESPS."

The sentence should state:

"....and that the *PUR* has an insignificant or no impact on the UHS and ESPS."

**Draft SER Table 1**

1. The title to Table 1 should reflect that the content of the table represents the Staff's assumptions and inputs used for confirmatory analysis and not reflect the licensee's assumptions and inputs.
2. Several locations in both SGTR sections have parameters with a "2" superscript as if a footnote applied to the parameter. However, there are no footnotes to the table.