10 CFR 50.46(a)(3)(ii)

A subsidiary of Pinnacle West Capital Corporation

Palo Verde Nuclear Generating Station

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102-06113-JHH/RKR
December 22, 2009

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 50-528/529/530
30-Day Report Pursuant to 10 CFR 50.46(a)(3)(ii) and Submittal of Large Break Loss of Coolant Accident Reanalysis Results

Pursuant to 10 CFR 50.46(a)(3)(ii), Arizona Public Service Company (APS) hereby submits information regarding a significant change associated with the Large Break Loss of Coolant Accident (LBLOCA) Emergency Core Cooling System (ECCS) performance evaluation for Palo Verde Nuclear Generating Station (PVNGS) Units 1, 2, and 3, and a summary description of a LBLOCA reanalysis associated with the significant change.

The Enclosure to this letter describes two discretionary changes that affect the PVNGS LBLOCA ECCS performance evaluation. The changes include an increase in the amount of uncoated carbon steel in containment and the installation of a Simplified Head Assembly (SHA) associated with a Replacement Reactor Vessel Closure Head (RRVCH). APS evaluated these changes relative to the licensing basis LBLOCA Analysis of Record (AOR) and determined that they may increase the calculated Peak Clad Temperature (PCT) by as much as 2°F for the additional uncoated carbon steel in containment and 18°F for the installation of an SHA associated with the RRVCH. As explained in the Enclosure to this letter, implementation of these discretionary changes constitutes a significant change as defined in 10 CFR 50.46(a)(3)(i), because the cumulative effect of these changes, as well as previously reported errors and changes associated with the licensing basis LBLOCA AOR, may affect the calculated PCT by more than 50°F.

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This letter satisfies the 30-day report requirement of 10 CFR 50.46(a)(3)(ii) for a significant change in an ECCS Evaluation Model (EM) or application thereof. The SHA was recently installed in PVNGS Unit 2 during the Fall 2009 refueling outage. For reporting purposes, APS has determined that the 30-day reporting period effectively began on November 25, 2009, when Unit 2 entered Mode 4 (Hot Shutdown) and PVNGS Technical Specifications required that certain ECCS equipment be in an operable status.

This letter also satisfies the schedule requirements of 10 CFR 50.46(a)(3)(ii) by providing a summary description of a new LBLOCA reanalysis that demonstrates compliance with the ECCS acceptance criteria of 10 CFR 50.46. This LBLOCA reanalysis was performed with an NRC-approved ECCS EM and predicts a PCT value of 2106°F for the Unit 2 Operating Cycle 16 plant configuration at a Rated Thermal Power (RTP) of 3990 MWt with Replacement Steam Generators (RSGs) and an SHA.

APS has also determined that this LBLOCA reanalysis bounds the current plant configurations for PVNGS Units 1 and 3, as described in the Enclosure to this letter. APS continues to track AREVA Lead Test Assemblies (LTAs) now installed in the Unit 1 reactor core as a temporary change subject to 10 CFR 50.46(a)(3)(ii) annual reporting requirements, because those LTAs may increase the LBLOCA PCT reanalysis results by as much as 4°F. The LTAs are expected to be in the Unit 1 reactor core through Operating Cycle 17 (Spring 2013).

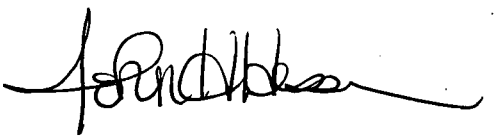
The LBLOCA reanalysis constitutes a new licensing basis AOR for PVNGS Units 1, 2, and 3. This new LBLOCA AOR forms the basis for evaluating future changes to or errors in the EM, and reporting pursuant to 10 CFR 50.46(a)(3)(ii).

The effects of this reanalysis will be incorporated into Chapter 6 of the PVNGS Updated Final Safety Analysis Report (UFSAR) in accordance with the requirements of 10 CFR 50.71(e). The Small Break Loss of Coolant Accident (SBLOCA) and Long-Term Cooling (LTC) ECCS analysis descriptions that also appear in Chapter 6 of the PVNGS UFSAR are not affected by the discretionary changes that are the subject of this letter.

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

Should you need further information regarding this report, please contact Russell A. Stroud, Licensing Section Leader, at (623) 393-5111.

Sincerely,



JHH/TNW/RAS/RKR/gat

Enclosure 30-Day Report Pursuant to 10 CFR 50.46 And Summary Description of Large Break LOCA ECCS Performance Evaluation Reanalysis Results

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

ENCLOSURE

30-DAY REPORT PURSUANT TO 10 CFR 50.46 AND SUMMARY DESCRIPTION OF LARGE BREAK LOCA ECCS PERFORMANCE EVALUATION REANALYSIS RESULTS

Enclosure
30-Day Report Pursuant To 10 CFR 50.46 And
Summary Description Of Large Break LOCA ECCS
Performance Evaluation Reanalysis Results

Introduction

This 30-day report is provided for Palo Verde Nuclear Generating Station (PVNGS) Units 1, 2, and 3 in accordance with the requirements of 10 CFR 50.46(a)(3)(ii) for reporting:

- Errors in or changes to an acceptable Emergency Core Cooling System (ECCS) Evaluation Model (EM) or in the application of such a model; and

- The estimated effects of such errors and changes on the limiting ECCS performance evaluation.

Specifically, this report is based on two discretionary changes in plant configuration that affect the PVNGS Large Break Loss of Coolant Accident (LBLOCA) ECCS performance analysis, and that postdate the errors and changes previously identified in the most recent 10 CFR 50.46(a)(3)(ii) annual report for PVNGS (Reference 1). Because these discretionary changes and the previously reported errors and changes may cumulatively affect the predicted Peak Clad Temperature (PCT) for the licensing basis LBLOCA Analysis of Record (AOR) by more than 50°F, they constitute a significant change as defined in 10 CFR 50.46(a)(3)(i) and are subject to the 30-day reporting requirements of 10 CFR 50.46(a)(3)(ii). These discretionary changes do not affect the Small Break Loss of Coolant Accident (SBLOCA) AOR or the ECCS Long-Term Cooling (LTC) AOR which, along with the LBLOCA AOR, are described in Chapter 6 of the PVNGS Updated Final Safety Analysis Report (UFSAR).

10 CFR 50.46(a)(3)(ii) requires that the 30-day report include a proposed schedule for providing a reanalysis or for taking other action as may be needed to show compliance with 10 CFR 50.46. Arizona Public Service Company (APS) considers the schedule requirements of 10 CFR 50.46(a)(3)(ii) to be fully satisfied because this 30-day report includes the results of a LBLOCA reanalysis performed with an acceptable ECCS EM that has been approved by the Nuclear Regulatory Commission (NRC). The LBLOCA reanalysis specifically applies to the PVNGS Unit 2 Operating Cycle 16 plant configuration, which includes previously installed Replacement Steam Generators (RSGs) as well as a new Simplified Head Assembly (SHA) associated with a new Replacement Reactor Vessel Closure Head (RRVCH).

APS also concludes that the LBLOCA reanalysis bounds the current plant configuration of PVNGS Units 1 and 3 with Replacement Steam Generators (RSGs) but without a RRVCH or SHA. APS continues to track AREVA Lead Test Assemblies (LTAs) now installed in the Unit 1 reactor core as a temporary change subject to 10 CFR 50.46(a)(3)(ii) reporting requirements, because those LTAs may affect the LBLOCA PCT reanalysis results by as much as +4°F. That +4°F change will be tracked until such time as the LTAs are permanently removed from the Unit 1 reactor core. The LTAs are expected to be in the Unit 1 reactor core through Operating Cycle 17 (Spring

2013). APS routinely tracks such adjustments to calculated PCT values, to ensure that reasonable margins to the acceptance criteria of 10 CFR 50.46 are maintained.

The LBLOCA reanalysis demonstrates continued compliance with the acceptance criteria of 10 CFR 50.46, and constitutes a new licensing basis AOR for PVNGS Units 1, 2, and 3. This new AOR forms the basis for evaluating and reporting future changes or errors in the NRC-approved ECCS EM for LBLOCA pursuant to 10 CFR 50.46(a)(3)(ii) . The effects of LBLOCA reanalysis will be incorporated into Chapter 6 of the PVNGS UFSAR as required by 10 CFR 50.71(e).

LBLOCA ECCS Performance Evaluation

Previous Licensing Basis LBLOCA AOR

Westinghouse Electric Company LLC prepared the previous licensing basis LBLOCA AOR for PVNGS in 2002, to support Power Uprate (PUR) conditions at a Rated Thermal Power (RTP) of 3990 MWt with RSGs, and reactor cores that used Zircaloy-4 and/or ZIRLO™ clad material. That AOR was described in APS letters to the NRC dated May 3 and October 11, 2002 (References 2 and 3). The NRC staff reviewed these APS letters and issued PVNGS license amendments and associated Safety Evaluations (SEs) on September 29, 2003 (Reference 4), and October 16, 2005 (Reference 5).

This previous AOR used the Westinghouse 1999 EM, an NRC-approved version of the LBLOCA ECCS EM for plants that were originally designed by Combustion Engineering (Reference 6). This previous AOR explicitly modeled the traditional Combustion Engineering 16x16 Zircaloy-4 fuel clad design, as well as ZIRLO™ clad material (Reference 7) that was first introduced at PVNGS in April 2002, during Unit 2 Operating Cycle 11.

Tables 1 and 2 summarize several important parameters and results associated with the previous licensing basis LBLOCA AOR, for the limiting case that resulted in a predicted PCT of 2110°F. Although this limiting case specifically modeled the PVNGS Original Steam Generators (OSGs) with 1750 plugged tubes per steam generator, and fuel assemblies with Erbia burnable poison and Zircaloy-4 clad material, Westinghouse and APS concluded that the analysis also bounded PVNGS plant configurations that used RSGs with as many as 1258 plugged tubes per steam generator and/or ZIRLO™ clad material.

The previous LBLOCA AOR has been used as the PVNGS licensing basis reference analysis since 2002, against which errors in or changes to the 1999 EM have been evaluated for potential impact on PCT.

Table 1
Comparison of Important Parameters Used in the Previous and New PVNGS Units 1, 2, and 3 LBLOCA ECCS Performance Analyses

Parameter	Previous Analysis	New Analysis
Large Break LOCA Evaluation Model	1999 EM	1999 EM
Core Power Level, MWt (Including 2% Power Measurement Uncertainty)	4070	4070
Peak Linear Heat Generation Rate, kW/ft	13.1	13.1
Hot Rod Pin-to-Box Factor	1.03	1.03
RCS Flow Rate, lbm/hr	147.6×10^6	147.6×10^6
RCS Pressure, psia	2250	2250
Cold Leg Temperature, °F	541	541
Hot Leg Temperature, °F	611	611
Steam Generators	Original/Replacement	Replacement
Plugged Steam Generator Tubes (Per Steam Generator)	1750 (Original)/ 1258 (Replacement)	1258

Table 2
Comparison of Important Results of the Previous and New PVNGS Units 1, 2, and 3 LBLOCA ECCS Performance Analysis

Parameter	Previous Analysis	New Analysis		
Limiting Break Size	0.6 DEG/PD[a,b]	0.6 DEG/PD[a,b,e]	0.8 DEG/PD[a,c,f]	0.8 DEG/PD[a,d,f]
Cladding Material	Zircaloy	ZIRLO™	ZIRLO™	ZIRLO™
Peak Clad Temperature, °F	2110	2106	2063	2045
Time of Peak Clad Temperature, seconds	266	308	330	286
Maximum Local Clad Oxidation, %	7.6	7.3	11.9	11.8
Maximum Core-Wide Clad Oxidation, %	<0.57	<0.51	<0.75	<0.79
Time of Clad Rupture, seconds	48	42	54	55

a. DEG/PD = Double-Ended Guillotine Break in Pump Discharge Leg
b. Case of Maximum Peak Clad Temperature (PCT)
c. Case of Maximum Local Clad Oxidation
d. Case of Maximum Core-Wide Clad Oxidation
e. Results are for Erbia fuel type at a burnup of 34 gigawatt days per metric ton uranium (GWD/MTU)
f. Results are for Erbia fuel type at a burnup of 0.5 GWD/MTU

Previously Reported Errors and Changes

APS submitted its most recent ECCS performance annual report to the NRC pursuant to 10 CFR 50.46(a)(3)(ii) on June 18, 2009 (Reference 1). This report identified all known errors or changes that affected the predicted PCT for the 2002 PVNGS licensing basis LBLOCA AOR, through the end of Calendar Year (CY) 2008. These previously reported errors and changes, the CY for which APS first reported them to NRC (References 1, 8, 9, 10), and their estimated effects (ΔPCT values) relative to the 2002 licensing basis case with a limiting PCT of 2110°F, are as follows:

- ECCS Model Assessments (Errors)
  - CY 2005 – STRIKIN-II steam cooling model error correction (ΔPCT = +2°F)
  - CY 2008 – Steam generator economizer error correction (ΔPCT = +22°F)
- Planned Plant Modifications (Changes)
  - CY 2006 – Revised containment passive heat sinks (ΔPCT = +4°F)
  - CY 2007 – Revised containment passive heat sinks (ΔPCT = +10°F)
  - CY 2008 – AREVA LTAs in PVNGS Unit 1 reactor core (ΔPCT = +4°F)

Therefore, as of the end of CY 2008, the cumulative ΔPCT value was 42°F for PVNGS Unit 1 and 38°F for PVNGS Units 2 and 3. Because these cumulative ΔPCT values are less than 50°F, the previously reported errors and changes did not constitute a significant error or change as defined in 10 CFR 50.46(a)(3)(i).

Additionally, when these cumulative ΔPCT values are added to the limiting 2002 licensing basis PCT of 2110°F, the estimated PCT values are 2152°F for PVNGS Unit 1 and 2148°F for PVNGS Units 2 and 3. Thus the estimated PCT for all three PVNGS units remained below the 10 CFR 50.46(b)(1) acceptance criterion of 2200°F through the end of CY 2008, and the previously reported errors and changes were not reportable pursuant to 10 CFR 50.72 or 10 CFR 50.73.

Additional Discretionary Changes

APS decided to implement two additional discretionary changes that affect the predicted PCT for the 2002 PVNGS licensing basis LBLOCA AOR. These changes postdate the errors and changes that were previously reported in the CY 2008 annual report pursuant to 10 CFR 50.46(a)(3)(ii) (Reference 1). Both of these discretionary changes, which are classified as Planned Plant Modifications, are described below.

Additional Uncoated Material in Containment

Westinghouse evaluated the ΔPCT effect of additional uncoated material in containment. This evaluation was intended to support the introduction of material such as steel cable into the containment building, as well as the temporary removal of coatings from steel and concrete surfaces. Westinghouse determined that the uncoated concrete surfaces would not affect the limiting PCT value predicted by the 2002 LBLOCA AOR. However, an increase of 1000 ft^2 of uncoated carbon steel was determined to affect PCT by +2°F.

Implementation of this discretionary change would increase the cumulative ΔPCT values for PVNGS Unit 1 to 44°F and PVNGS Units 2 and 3 to 40°F. Because these cumulative ΔPCT values are less than 50°F, this discretionary change does not, by itself, constitute a significant change as defined in 10 CFR 50.46(a)(3)(i). Implementation of this discretionary change would increase the estimated PCT values to 2154°F for PVNGS Unit 1 and 2150°F for PVNGS Units 2 and 3, which remain below the 10 CFR 50.46(b)(1) acceptance criterion of 2200°F.

Simplified Head Assembly

APS decided to replace the PVNGS Units 1, 2, and 3 Reactor Vessel Closure Heads (RVCHs) after the NRC and other licensees discovered that Alloy 600 penetration nozzles were susceptible to primary water stress corrosion cracking (References 11, 12, 13, 14, 15). APS selected Doosan Heavy Industries of South Korea as the manufacturer of the Replacement RVCHs, or RRVCHs, and NRC inspectors have independently confirmed that Doosan has met all design control requirements for the PVNGS RRVCHs (Reference 16). In conjunction with this replacement activity, APS is also implementing a Simplified Head Assembly (SHA). The SHA is an innovative design that may significantly reduce overall refueling outage duration by reducing demand on the containment polar crane during reactor destack and restack evolutions. The SHA involves modifications to the RRVCH lifting system; cooling system; shielding system; cable support structure; Heating, Ventilation, and Air Conditioning (HVAC) ducting; and associated components.

Westinghouse evaluated the ΔPCT effect of the RRVCH and SHA. Westinghouse determined that the RRVCH would not affect the LBLOCA ECCS performance analysis, given the available margin afforded by the 2002 AOR with respect to containment passive heat sinks. The SHA, however, involved modifications that directly affected the containment passive heat sinks. The Westinghouse evaluation concluded that installation of the SHA could affect the predicted LBLOCA PCT value by as much as +18°F.

Implementation of this discretionary change would therefore increase the cumulative

ΔPCT values for PVNGS Unit 1 to 62°F and PVNGS Units 2 and 3 to 58°F, when all other errors and changes are taken into consideration. Implementation of this change would likewise increase the estimated PCT values to 2172°F for PVNGS Unit 1 and 2168°F for PVNGS Units 2, and 3, which remains below the 10 CFR 50.46(b)(1) acceptance criterion of 2200°F. Because the cumulative ΔPCT values are greater than 50°F, implementation of the SHA in any of the PVNGS units would constitute a significant change as defined in 10 CFR 50.46(a)(3)(i) and would be subject to the 30-day reporting requirement.

APS has completed its first installation of a RRVCH and SHA in PVNGS Unit 2 during the Unit 2 Fall 2009 refueling outage. These components will be in service during Unit 2 Operating Cycle 16. For 10 CFR 50.46(a)(3)(ii) reporting purposes, APS has determined that the 30-day reporting period began when ECCS equipment was required to be operable in accordance with the PVNGS Technical Specifications (TS). Specifically, PVNGS TS 3.5.2, "Safety Injection Tanks (SITs) – Shutdown," requires that either three or four SITs be operable in Mode 4 (Hot Shutdown) when pressurizer pressure is less than 1837 psia; TS 3.5.4, "ECCS – Shutdown," requires that one High Pressure Safety Injection (HPSI) train be operable in Mode 4; and TS 3.5.5, "Refueling Water Tank (RWT)," requires that the RWT be operable in Mode 4. Additionally, TS 3.3.6, "Engineered Safety Features Actuation System (ESFAS) Logic and Manual Trip," requires that Safety Injection Actuation Signal (SIAS) initiation logic, actuation logic, and manual trip be operable in Mode 4. Therefore, the 30-day reporting period began when PVNGS Unit 2 first entered Mode 4 after the Operating Cycle 16 reactor core was loaded in the reactor pressure vessel. Core reload was completed on November 13, 2009; Mode 4 entry occurred on November 25, 2009.

APS expects to install RRVCHs and SHAs in PVNGS Units 1 and 3 during the PVNGS Unit 1 Spring 2010 and PVNGS Unit 3 Fall 2010 refueling outages.

New Licensing Basis LBLOCA AOR

Westinghouse performed a LBLOCA reanalysis to serve three primary purposes:

- To resolve previously reported LBLOCA EM errors and changes that incurred ΔPCT assessments against the 2002 licensing basis AOR (see the "Previously Reported Errors and Changes" section above). The LBLOCA reanalysis clears all previously reported ΔPCT assessments, with the sole exception of a +4°F assessment for the temporary installation of AREVA LTAs in the PVNGS Unit 1 reactor core as described below.

- To account for recent, additional discretionary changes in plant configuration (see the "Additional Discretionary Changes" section above). The most significant of these changes involves installation of an SHA associated with a RRVCH,

which was placed in service in PVNGS Unit 2 when that unit entered Operating Cycle 16 following the Fall 2009 refueling outage.

- To better manage analytical margins going forward. This involves the recovery of discretionary conservatisms from the 2002 licensing basis AOR, which were created primarily by: (1) the completion of RSG installation in all three PVNGS units; and (2) the transition from Zircaloy-4 to ZIRLO™ clad material in core reload design. Additionally, a containment passive heat sink margin was incorporated into the LBLOCA reanalysis so that future changes to the plant configuration could be controlled through established analytical margins rather than through ΔPCT assessments.

The LBLOCA ECCS reanalysis for Palo Verde Units 1, 2, and 3 was intended to be a bounding analysis for a full core of standard Combustion Engineering 16x16 fuel with ZIRLO™ clad material, after installation of RSGs and SHAs. Westinghouse performed this reanalysis with the 1999 EM for Pressurized Water Reactors (PWRs) designed by Combustion Engineering (Reference 6), as augmented by CENPD-404-P-A for analysis of ZIRLO™ clad material (Reference 7). These methodologies have received NRC approval for referencing in licensing applications, and have been incorporated into the PVNGS licensing basis as documented in PVNGS Technical Specification 5.6.5, "Core Operating Limits Report (COLR)." These methodologies constitute a 10 CFR 50 Appendix K EM that provides results that satisfy the ECCS acceptance criteria of 10 CFR 50.46.

Important input parameters and results for the LBLOCA reanalysis are summarized in Tables 1 and 2. The predicted PCT for this reanalysis is 2106°F.

The LBLOCA reanalysis used the Westinghouse Advanced Automated/Integrated Code System (AAICS), a version of the Automated/Integrated Code System (AICS) that was reviewed by the NRC in Reference 6. Westinghouse developed the AAICS for the 1999 EM to accommodate the needs of advanced analysis processes with advanced fuel designs. The AAICS reduces the need for manual preparation of computer code input, automates the flow of data between computer codes, ensures consistency of input between computer codes, and facilitates parametric studies. Analysts may use the AAICS to execute LBLOCA analysis cases from start-to-finish without analyst intervention. The automated transfer of interface data from one computer code to another produces more consistent and accurate transfer of interface parameters, which reduces analysis effort as well as discretionary conservatism.

Analyses were performed for a spectrum of four Double-Ended Guillotine (DEG) break sizes in the reactor coolant Pump Discharge (PD) leg (i.e., 1.0, 0.8, 0.6, and 0.4 DEG/PD cases). For the 1.0 DEG/PD, the leak path (break) area is equivalent to the cross-sectional area of the PD leg, or 4.9087 ft^2. For other break sizes, the break area is calculated by taking the ratio to the break area for the 1.0 DEG/PD. Additionally,

sensitivity studies were performed to address the worst single failure of an ECCS component, SIT conditions, fuel performance time-in-life, and fuel type to determine the limiting conditions for the break spectrum analysis. The limiting conditions resulting from this analysis are as follows:

- The limiting break size that yields the highest PCT value is the 0.6 DEG/PD.
- The worst single failure of an ECCS component is "no failure" with representation of maximum safety injection delivery to the Reactor Coolant System (RCS) and minimum RWT temperature.
- Limiting performance from the SITs is represented with maximum pressure and minimum liquid inventory, temperature, and flow resistance.
- The limiting fuel type is ZIRLO™ clad Erbia burnable absorber.

Plant design data for the containment (e.g., data for the containment initial conditions, containment volume, containment heat removal systems, and containment passive heat sinks) were selected to minimize the transient containment pressure. Additional margin for containment passive heat sinks, comprised of stainless steel, galvanized steel, and both coated and uncoated carbon steel, was also included in this analysis as a contingency to address potential future containment modifications. Therefore, although the analysis was specifically performed to address PVNGS Unit 2 Operating Cycle 16 plant configuration following installation of the SHA, the analysis results remain bounding for the current configuration of PVNGS Units 1 and 3 without SHAs.

The limiting initial fuel rod conditions used in the break spectrum analysis (i.e., the conditions that resulted in the highest calculated PCT, peak local clad oxidation, and core-wide clad oxidation) were determined by performing burnup-dependent calculations using bounding fuel performance data. The analysis used bounding data for both physics and fuel performance parameters for the purpose of producing results that will be applicable to future operating cycles of PVNGS Units 1, 2, and 3. Because the physics inputs are based on bounding values and are not necessarily representative of any specific operating cycle, the applicability of this analysis will be confirmed for future plant reload configurations using a comprehensive checklist that is already a part of the standard reload core design process for PVNGS. Additionally, because the current operating cycles of Units 1 and 3 use Zircaloy-4 clad in the center fuel assembly of each reactor core, APS evaluated these core designs to determine whether the LBLOCA reanalysis remained bounding for current plant configurations. APS concluded that the LBLOCA reanalysis bounded the current configurations of Units 1 and 3, because the Peak Linear Heat Generation Rate (PLHGR) of the Zircaloy-4 clad hot rod did not exceed 95% of the PLHGR of the ZIRLO™ clad hot rod in the core.

Westinghouse also evaluated the potential effect of AREVA LTAs with M5 clad material,

currently installed in the Unit 1 reactor core, on the predicted PCT for the LBLOCA reanalysis. Westinghouse confirmed that the ΔPCT assessment of +4°F, previously reported for the 2002 LBLOCA AOR, also applied to the 2009 LBLOCA reanalysis. APS continues to track the AREVA LTAs as a temporary change subject to 10 CFR 50.46(a)(3)(ii) reporting requirements, until such time as the LTAs are permanently removed from the Unit 1 core. The LTAs are expected to be in the Unit 1 reactor core through Operating Cycle 17 (Spring 2013). APS routinely tracks such adjustments to calculated PCT values, to ensure that reasonable margins to the acceptance criteria of 10 CFR 50.46 are maintained.

Summary

The results of the PVNGS LBLOCA reanalysis demonstrate compliance with Criteria 1 through 4 of 10 CFR 50.46. Specifically:

- The predicted PCT was 2106°F, which is less than the 10 CFR 50.46(b)(1) acceptance criterion of 2200°F. Margin to this acceptance criterion accommodates a ΔPCT assessment of +4°F for the current installation of AREVA LTAs in the PVNGS Unit 1 reactor core.

- The maximum local clad oxidation was predicted to be 11.9%, which is less than the 10 CFR 50.46(b)(2) acceptance criterion of 17%. Substantial margin to this acceptance criterion accommodates the presence of preexisting oxidation on clad surfaces, as well as an oxidation assessment associated with the current installation of AREVA LTAs in the PVNGS Unit 1 reactor core.

- The maximum core-wide clad oxidation was predicted to be less than 0.79%, which provides margin to the 10 CFR 50.46(b)(3) acceptance criterion of 1%.

- Calculated changes in core geometry are such that the core remains amenable to cooling, as required by 10 CFR 50.46(b)(4). The clad swelling and rupture models used in the LBLOCA reanalysis account for the effects of changes in core geometry that would occur if clad rupture is calculated to occur. Adequate core cooling was demonstrated for the changes in core geometry that were calculated to occur as a result of clad rupture. Additionally, the durations of the transient analysis cases were long enough to model decreasing clad temperatures with the RCS depressurized, thereby precluding any further clad deformation. Therefore, a coolable geometry was demonstrated.

The LBLOCA reanalysis constitutes a new licensing basis AOR for PVNGS Units 1, 2, and 3. The effects of this reanalysis will be incorporated into Chapter 6 of the PVNGS UFSAR in accordance with the requirements of 10 CFR 50.71 (e). Additionally, future changes to or errors in the NRC approved ECCS EM will be assessed against this new LBLOCA AOR and reported to the NRC pursuant to 10 CFR 50.46(a)(3)(ii).

References

1. APS Letter No. 102-06022-TNW/RKR, "Palo Verde Nuclear Generating Station (PVNGS) Units 1, 2, and 3; Docket Nos. STN 50-528/529/530; Emergency Core Cooling System (ECCS) Performance Evaluation Models, 10 CFR 50.46(a)(3)(ii) Annual Report for Calendar Year 2008," T.N. Weber (APS) to U.S. Nuclear Regulatory Commission, June 18, 2009 [NRC ADAMS Accession No. ML091810703].

2. APS Letter No. 102-04699-CDM/TNW/JAP, "Palo Verde Nuclear Generating Station (PVNGS) Units 1, 2, and 3; Docket Nos. STN 50-528/529/530; 10 CFR 50.46(a)(3)(ii) 30-Day Report for Changes in LOCA/ECCS Performance Evaluation Models," C.D. Mauldin (APS) to U.S. Nuclear Regulatory Commission, May 3, 2002 [NRC ADAMS Accession No. ML021340611].

3. APS Letter No. 102-04847-CDM/TNW/RAB, "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," C.D. Mauldin (APS) to U.S. Nuclear Regulatory Commission, October 11, 2002 [NRC ADAMS Accession No. ML022940385].

4. NRC Letter, "Palo Verde Nuclear Generating Station, Unit 2 (PVNGS-2) – Issuance of Amendment on Replacement of Steam Generators and Uprated Power Operations (TAC No. MB3696)," B.M. Pham (NRC) to G.R. Overbeck (APS), September 29, 2003 [NRC ADAMS Accession No. ML032720538].

5. NRC Letter, "Palo Verde Nuclear Generating Station, Units 1, 2, and 3; Issuance of Amendments RE: Replacement of Steam Generators and Uprated Power Operations and Associated Administrative Changes (TAC Nos. MC3777, MC3778, and MC3779)," M.B. Fields (NRC) to J.M. Levine (APS), October 16, 2005 [NRC ADAMS Accession No. ML053130275].

6. CENPD-132, Supplement 4-P-A, "Calculative Methods for the CE Nuclear Power Large Break LOCA Evaluation Model," April 2001 [NRC ADAMS Accession Nos. ML011030417 and ML011030447].

7. CENPD-404-P-A, Revision 0, "Implementation of ZIRLO™ Cladding Material in CE Nuclear Power Fuel Assembly Designs," November 2001 [NRC ADAMS Accession No. ML013270001].

8. APS Letter No. 102-05509-SAB/TNW/RKR, "Palo Verde Nuclear Generating Station (PVNGS) Units 1, 2, and 3; Docket Nos. STN 50-528/529/530; Emergency Core Cooling System (ECCS) Performance Evaluation Models, 10 CFR 50.46(a)(3)(ii) Annual Report for Calendar Year 2005," S.A. Bauer (APS) to U.S. Nuclear Regulatory Commission, June 2, 2006 [NRC ADAMS Accession No. ML061720086].

9. APS Letter No. 102-05693-TNW/RKR, "Palo Verde Nuclear Generating Station (PVNGS) Units 1, 2, and 3; Docket Nos. STN 50-528/529/530; Emergency Core Cooling System (ECCS) Performance Evaluation Models, 10 CFR 50.46(a)(3)(ii) Annual Report for Calendar Year 2006," T.N. Weber (APS) to U.S. Nuclear Regulatory Commission, April 26, 2007 [NRC ADAMS Accession No. ML071270252].

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