10 CFR 50.12
10 CFR 50.60(b)
10 CFR 50.90

APS

A subsidiary of Pinnacle West Capital Corporation

Palo Verde Nuclear Generating Station

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102-06112-JHH/DAF
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, 50-529 and 50-530
Response to Request for Additional Information for Technical Specification Amendment and Exemption from 10 CFR 50, Appendix G, to Relocate the Reactor Coolant System Pressure and Temperature Limits and the Low Temperature Overpressure Protection Enable Temperatures

By letter no. 102-05960, dated February 19, 2009 (Agencywide Document Access and Management System [ADAMS] Accession No. ML090641014), Arizona Public Service Company (APS) submitted a "Request for Technical Specification Amendment and Exemption from 10 CFR 50, Appendix G, to Relocate the Reactor Coolant System Pressure and Temperature Limits and the Low Temperature Overpressure Protection Enable Temperatures."

By correspondence dated August 25, 2009, the NRC issued a request for additional information (RAI) related to this submittal. Enclosure 1 is APS's response to the August 25, 2009, RAI.

Enclosure 2 provides updated retyped Technical Specification pages 5.6-8 and 5.6-9 to reflect approved changes through Operating License Amendment No. 174. In addition, Enclosure 3 provides corrected Technical Requirements Manual Tables TA2-3 and TA2-4 that were inadvertently truncated in APS's February 19, 2009 letter.

APS requests that the implementation date for this amendment be changed from 90 days to 150 days to accommodate training the licensed operators at PVNGS.

APS makes no commitments in this letter. Should you need further information regarding this response, please contact Russell A. Stroud, Licensing Section Leader, at (623) 393-5111.

A138
NRR

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

Executed on 12-22-2009.
(Date)

Sincerely,

DCM/RAS/DAF

Enclosures:

1. Response to August 25, 2009, Request for Additional Information for Technical Specification Amendment and Exemption from 10 CFR 50, Appendix G
2. Retyped Updated Technical Specification Pages 5.6-8 and 5.6-9 to Reflect Amendment No. 174
3. Corrected Technical Requirements Manual Tables TA2-3 and TA2-4 From APS's February 19, 2009 Letter

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 1

Response to August 25, 2009, Request for Additional Information for Technical Specification Amendment and Exemption from 10 CFR 50, Appendix G

Response to August 25, Request for Additional Information for Technical Specification Amendment and Exemption from 10 CFR 50, Appendix G

By letter no. 102-05960, dated February 19, 2009, Arizona Public Service Company (APS) submitted a license amendment request to relocate the Reactor Coolant System (RCS) pressure and temperature limits and the Low Temperature Overpressure Protection (LTOP) enable temperatures from the current Technical Specifications to the Technical Requirements Manual and an associated request for exemption from 10 CFR 50, Appendix G for Palo Verde Nuclear Generating Station (PVNGS), Units 1, 2, and 3.

The U.S. Nuclear Regulatory Commission (NRC) staff reviewed the License Amendment Request and determined that the additional information specified below is needed for the staff to complete its evaluation of the amendment request and the exemption request.

NRC RAI (1)a.

(1) Appendix G of Part 50 of Title 10 of the Code of Federal Regulations (10 CFR Part 50) requires reactor pressure vessel pressure-temperature (P-T) limits to be generated for heatup, cooldown, criticality, and hydrostatic and leak tests. Please demonstrate that the P-T limits on pages TA-6 and TA-7 of the proposed PVNGS Pressure and Temperature Limits Report satisfy this requirement by addressing the following:

a. Although the WCAP-16835 report, "Palo Verde Nuclear Generating Station Units 1, 2 and 3; Basis for RCS Pressure and Temperature Limits Report," stated that the composite P-T limits for PVNGS Units 1, 2, and 3 includes core critical values, the proposed PVNGS P-T limits do not seem to support it. Please clarify and revise the P-T limits, if necessary.

APS Response to RAI (1)a.

Core critical P-T limits applicable to PVNGS Units 1, 2 and 3 are listed in Tables 5-5 (Core Critical Limits for Heatup at 75°F/hr) and Table 5-6 (Core Critical Limits for Cooldown at 100°F/hr) of WCAP-16835. These core critical P-T limits are established based on fracture toughness considerations and are separate from the minimum temperature for criticality of 545°F derived from core physics analyses and specified in Technical Specification LCO 3.4.2, "RCS Minimum Temperature for Criticality." LCO 3.4.2 is applicable in Modes 1 and 2 with $K_{eff} \geq 1.0$ and provides a substantial margin to the core critical P-T limits of Tables 5-5 and 5-6. Since core criticality is not permitted below a cold leg temperature of 545°F, the core critical P-T limits in WCAP-16835 are not operationally limiting. In addition, plant operation in Mode 1 and Mode 2 is above the temperature range of concern for non-ductile vessel failure and is supported by stress analyses that have been performed for normal maneuvering. Therefore, as indicated in Section TA2.0, "Operating Limits" of the PVNGS Pressure and Temperature Limits Report (PTLR), the P-T limits only apply during lower mode operation, including heatup and cooldown, when the core is sub-critical and the vessel pressure exceeds 514 psia.

NRC RAI (1)b.

b. Unlike the current P-T limits, the proposed P-T limits now have part of hydrostatic test and normal operation curves on the left hand side of the lowest service temperature line of 153.2 °F. Please demonstrate that the proposed P-T limits are clear for the operators to use.

APS Response to RAI (1)b.

The minimum flange limit (193.2°F) for normal operation is higher than the lowest service temperature (153.2°F), thus the flange establishes the lower bound for P-T limits during normal operation. Curves to the left of the flange limit and above the 20% pre-service hydrostatic test pressure limit in PTLR Figures TA2-1 and TA2-2 are shown for information but are not an operational concern since the flange limit is governing. For clarity, the limiting RCS temperatures and RCS heatup and cooldown rate limits are also shown in tabular form in Tables TA2-1 and TA2-2. These RCS pressure-temperature limits are incorporated into operator training programs and procedures. Discussions with PVNGS reactor operators confirm that the P-T tables and figures in the PTLR provide clear limits for plant heatup and cooldown operations, in conjunction with the training for licensed operators for this amendment.

NRC RAI (1)c.

c. Criterion 1b of Table 1 of 10 CFR Part 50, Appendix G for the hydrostatic test results in a minimum test temperature of 163.2 °F. This is more limiting than the "lowest service temp 153.2 °F" marked in the proposed P-T limits. Again, please demonstrate that the proposed P-T limits are clear for the operators to use considering that a critical limiting temperature is not shown there.

APS Response to RAI (1)c.

The minimum flange limit (163.2°F) for hydrostatic test is higher than the lowest service temperature (153.2°F), thus the flange establishes the lower bound for the P-T hydrostatic test limits. For clarity, the limiting RCS temperatures and RCS heatup and cooldown rate limits are shown in tabular form in Tables TA2-1 and TA2-2. These RCS pressure-temperature limits are incorporated into operator training programs and procedures. Discussions with PVNGS reactor operators confirm that the P-T tables and figures in the PTLR provide clear limits for plant heatup and cooldown operations, in conjunction with the training for licensed operators for this amendment.

NRC RAI (2)

Please confirm that the 2-dimensional finite element method (FEM) model that you used to calculate the applied stress intensity factor, K_{IM}, at a pressure of 1000 psi is plant-specific. If a generic FEM model was used, explain how the results from such a model are applicable to PVNGS Units 1, 2 and 3.

APS Response to RAI (2)

A generic 2-dimensional axisymmetric finite element method model was used to calculate the stress intensity factors corresponding to membrane tension resulting from internal pressure loading. This 2-dimensional model was developed with a 1/4 inch thickness inside crack as well as a 1/4 inch thickness outside crack as described in CE NPSD-683 and implemented for PVNGS in WCAP-16835. Results of the generic 2-D model were then scaled to be specific to the PVNGS reactor vessel. Pressure stress coefficients (K_{IM}) of 24.994 (ksi/√in)/1000 psi for an inside crack and 23.348 (ksi/√in)/1000 psi for an outside crack are specific to PVNGS and were used to develop the P-T limits for Units 1, 2 and 3.

NRC RAI (3)

Table 5-2 of the WCAP-16835 report shows that an identical pressure of 1195.2 psia is obtained at the temperature of 153.2 °F for cooldown rates from 10 °F per hour to 100 °F per hour, indicating the cooldown thermal stress intensity factor (K_{IT}) values are zero at a specific point during the transient for P-T limit calculations regardless of the cooldown rates. However, Figure 5-8 shows different K_{IT} values at the temperature of 153.2 °F for different cooldown rates. Please explain, at what point during the cooldown can the cooldown K_{IT} values of Figure 5-8 be used to arrive at the P-T limits tabulated in Table 5-2 for the cooldown transient and, at what point during the heatup can the heatup K_{IT} values of Figure 5-6 be used to arrive at the P-T limits tabulated in Table 5-1 for the heatup transient.

APS Response to RAI (3)

A thermal stress intensity factor (K_{IT}) value of zero only occurs during isothermal conditions. Since the crack tip temperatures lag behind the fluid temperature, any thermal transient that causes a temperature difference between the reactor coolant and the location of the postulated crack results in a non-zero value for K_{IT}.

Cooldown K_{IT} values shown in Figure 5-8 apply throughout the transient for all RCS temperatures and all cooldown rates. Each K_{IT} value, when subtracted from the fracture toughness, K_{IC}, yields the allowable pressure stress intensity, K_{IM}, for a specific combination of cooldown rate and RCS temperature. The allowable P-T limit is then established by solving for the RCS pressure that will produce the allowable pressure stress intensity. Finally, the resulting family of cooldown P-T curves is reduced to a conservative, composite curve by selecting the minimum RCS pressure allowed for each RCS temperature. This limiting cooldown P-T envelope is illustrated by the 100ºF/hr curve in Figure 5-2 of WCAP-16835 and is why an RCS pressure of 1195.2 psia governs for all cooldown rates at an RCS temperature of 153.2ºF in Table 5-2. A similar process is used to arrive at the P-T limits tabulated in Table 5-1 and shown in Figure 5-1 for the heatup transient.

NRC RAI (4)

In WCAP-15589, "Analysis of Capsule 38° from the Arizona Public Service Company Palo Verde Unit 1 Reactor Vessel Radiation Surveillance Program," two surveillance data from Capsule 38° were labeled as intermediate shell plate M-6701-2 and used in the chemistry factor calculation for this plate. However, in WCAP-16374, "Analysis of Capsule 230° from the Arizona Public Service Company Palo Verde Unit 1 Reactor Vessel Radiation Surveillance Program," the two surveillance data from Capsule 38° are dropped from the chemistry factor calculation for intermediate shell plate M-6701-2. No explanation was given in the report, except a statement on page D-3 which may allude to a possible misidentification of specimens: "The lower shell plate M4311-1 also has surveillance data but only one set up to this point (from Capsule 38°), thus it will not be evaluated." Please confirm your misidentification of surveillance specimens and explain the cause(s) of the error. Or, if correct, explain the basis of discarding the surveillance data from Capsule 38° in calculating the chemistry factor for intermediate shell plate M-6701-2.

APS Response to RAI (4)

Two PVNGS Unit 1 Capsule 38º data points were inadvertently labeled as intermediate shell plate M-6701-2 in Revision 0 of WCAP-15589, October 2000, which was submitted to the NRC in APS letter no. 102-04500, October 20, 2000. This labeling error was corrected in Revision 1 to WCAP-15589, March 2003. All PVNGS Unit 1 base metal data from Capsule 38º are correctly labeled as lower shell plate M-4311-1 in Revision 1 to WCAP-15589. APS submitted Revision 1 to WCAP-15589 (Reference 1) to the NRC in letter no. 102-06094, dated November 13, 2009 (Agencywide Document Access and Management System [ADAMS] Accession No. ML093290263).

WCAP-16374-NP, Revision 0, "Analysis of Capsule 230º from Arizona Public Service Company Palo Verde Unit 1 Reactor Vessel Radiation Surveillance Program," excluded the Capsule 38º data from the chemistry factor calculation for intermediate shell plate M-6701-2 because those data were from lower shell plate M-4311-1. Data from plate M-4311-1 were not evaluated in WCAP-16374 because results were available from only a single surveillance capsule, and thus were insufficient to evaluate the chemistry factor.

A possible contributor to the initial mislabeling of Unit 1 Capsule 38° data points in WCAP-15589 as intermediate shell plate M-6701-2 is that three of the Unit 1 capsules are lower shell plate M-4311-1 base metal material, and the other three are intermediate shell plate M-6701-2 base metal material (Updated Safety Analysis Report (UFSAR) Table 5.3-13). The 38° capsule report inadvertently labeled the capsule with the material in one of the other Unit 1 capsules.

For PVNGS Units 2 and 3, there is a single surveillance plate (lower shell) base metal material in each surveillance program as shown in UFSAR Tables 5.3-14 and 5.3-15. The current reactor vessel surveillance program reports and the current UFSAR, Revision 15, correctly identify the surveillance program plate for Units 2 and 3. Therefore, it is confirmed that PVNGS Units 2 and 3 did not experience similar misidentifications as did PVNGS Unit 1 with respect to the surveillance plate material.

NRC RAI (5)

Section 3.2.1 of WCAP-16835 discusses the assumptions and results for the analysis of the mass and energy addition events. Provide a discussion to demonstrate that the analysis for these events is a bounding analysis over the operating temperature and pressure ranges of the LTOP system in terms of the minimum margin between the allowable P/T limits and the calculated peak pressure during transients of the two events.

APS Response to RAI (5)

Assurance of bounding transient analysis results is achieved by the conservative application of transient assumptions, as described in Section 3.2.1 of WCAP-16835. The bounding transient analysis methodology is further described in Section 3.3 of CE NPSD-683-A, Reference 2. Examples of the assumptions which are addressed in the PVNGS specific mass addition and energy addition transient analyses include crediting relief from a single LTOP relief valve in spite of Technical Specification limitations requiring two valves to be operable, a water-solid pressurizer, activation and consequential heat addition from pressurizer heaters, maximizing decay heat, taking no credit for the chemical and volume control system letdown, and pressure boundary expansion or heat absorption. These conservative applications of input parameters to the analyses assure the results do not challenge the minimum margin between the calculated peak pressure and the allowable P-T limits.

NRC RAI (6)

In the middle portion of page 3-2 of WCAP-16835, it states that "... [d]ecay heat, with two sigma uncertainty, is ... at value consistent with the earliest time after shutdown that the transient can occur." Discuss the decay heat model and specify the decay heat value used in the analysis of the mass and energy addition events, and justify the adequacy of the model and value of the decay heat.

APS Response to RAI (6)

The decay heat curve that supports the transient analysis is one that was developed specifically for PVNGS and is based on the ANS 5.1, 1979 Standard (Reference 3). The curve data accounts for fission product capture, analysis uncertainties of two sigma and decay of U239 and Np239 up to 105 seconds. The curve also accounts for the decay of other actinides beyond 105 seconds. Conservatively, decay heat is maximized for the specific conditions of the mass or energy addition transient by determining the minimum (elapsed) time after reactor shutdown to reach a specified transient temperature during cooldown. Elapsed time after shutdown is determined based upon the difference between the cold leg temperature immediately following a reactor trip and the specific initial temperature of the transient divided by the maximum allowable cooldown rate(s) per proposed PTLR Table TA2-1, RCS Heatup and Cooldown Rate Limits through 32 EFPY. Thus, each transient analyzed uses a conservative decay heat value that is specific to that event. For the energy addition transient, a decay heat value of 146.9E+06 BTU/hr is assigned; similarly, a conservative decay heat value of 147.2E+06 BTU/hr is assigned when evaluating a mass addition transient.

NRC RAI (7)

Paragraph 3 of Section 3.2.1.2 discusses the High Pressure Safety Injection (HPSI) flow rate and a low temperature for the supply water used in the analysis of the mass addition event. Specify the low temperature of the supply water used in the analysis and justify that it "will result in the greatest rate of mass addition" over the applicable temperature range.

APS Response to RAI (7)

The applicable temperature range of the LTOP analysis is 80°F (bolt up temperature) to 221°F (LTOP enable temperature). At PVNGS, the maximum HPSI injection pump flow rates were determined using the maximum level of water in the Refueling Water Tank (RWT) at the minimum RWT water temperature of 60°F. This temperature is consistent with minimum RWT temperature per the Technical Specifications.

HPSI coolant that is at a lower temperature than the primary coolant when injected into the RCS results in shrinkage of the RCS liquid volume. This occurs since the heat exchange between these fluids results in a greater shrinkage of the RCS liquid volume than the expansion created by the injected coolant. The mass addition methodology does not acknowledge this thermal exchange and thus, in combination with the assumptions listed in the response to RAI (5), represents an added measure of conservatism in the analysis.

NRC RAI (8)

Section 3.2.1.3 indicates that the energy addition analysis assumes the initial RCS pressure of 435 psig. Specify the allowable operating pressure range for the LTOP system and show that the analysis with the assumed initial RCS pressure of 435 psig is a limiting analysis, resulting in a highest peak pressure during the energy addition transient.

APS Response to RAI (8)

The operator decision setpoint for entry into shutdown cooling at PVNGS, either initially or from a standby condition is limited by procedure 40OP-9SI01, Shutdown Cooling Initiation, to 385 psia indicated pressurizer pressure. This value is conservative and was selected to prevent inadvertent lifting of the LTOP relief valves under normal or post-accident conditions.

The energy addition transient analysis assumes that the RCS has been cooled and depressurized to 435 psia as a result of shutdown cooling system operation while the steam generators remain a maximum of 100°F hotter than the RCS. Conservatively, the 435 psia shutdown cooling initiation pressure for the energy addition transient in Section 3.2.1.3 is bounded by the maximum design pressure of the shutdown cooling system and is greater than the normal shutdown cooling system operating limit at PVNGS.

NRC RAI (9)

Section 3.3.3.3 of CENPSD-683-A states that for the LTOP analysis, the pressure drop in the piping from the hot leg to the SDC relief valve inlet and the elevation head from the valve to the pressurizer must be considered in the adjustment of the peak pressure at the valve inlet to the pressurizer. Section 3.3.4 states that for the energy addition analysis, fluid properties and heat transfer coefficients should be determined at the highest RCS temperature. Address compliance with the above guidance specified in CENPSD-683.

APS Response to RAI (9)

The energy addition analysis in WCAP-16835 is based upon the assumption that during a plant shutdown, as a result of shutdown cooling system operation, the steam generators are at the shutdown cooling system initiation temperature (no forced or ambient cooling assumed) and a significant portion of the RCS is cooled to the assumed 100°F (maximum) primary-to-secondary system temperature difference. Consequently, the highest temperatures assumed in the analysis of record for PVNGS for the primary and secondary system fluid correspond to a shutdown cooling system initiation temperature for the secondary system, procedurally limited by 40OP-9SI01, Shutdown Cooling Initiation, to 350°F, with the cooled portion of the RCS being 100°F less, or 250°F. This represents the maximum temperature used for fluid property determination.

Compensating adjustments are included in the transient analysis and adjust for the shutdown cooling system relief valve location relative to the RCS in the suction piping attached to the RCS hot leg and at an elevation below the RCS and pressurizer. The effect of these adjustments is to add several psi (based on flow loss and elevation) to the peak transient pressure results prior to comparison with the allowable P-T limits in the LTOP evaluation. Other compensating adjustments include the plant specific length of pipe and piping components, the transient discharge flow rate, and fluid conditions.

NRC RAI (10)

Section 3.2.1.1 of WCAP-16835 indicated that the capacity of the SCS relief value is 5635 gpm at 10% accumulation of the valve lift point of 467 psig. The corresponding relief valve capacity of 4000 gpm is stated in Section 5.2.2.11.2.3 (page 5.2-39) of the updated safety analysis report, Revision 13, for the Palo Verde plant. Clarify the inconsistency of the above SCS relief valve capacities.

APS Response to RAI (10)

The difference in relieving capacity for the shutdown cooling system relief valve has been identified by PVNGS staff and is being addressed through Condition Report/Disposition Request (CRDR) Number 3149490. PVNGS Engineering confirmed that the LTOP transient analyses use the correct relief valve capacity of 5635 gpm and this value is consistent with that stated on the vendor drawing and used in the piping stress calculation. The UFSAR is being revised in accordance with 10 CFR 50.71(e) to be consistent with the manufacturer's documentation on file in the APS document management system.

4.0 References

1. APS letter no. 102-06094, "Revision to Reactor Vessel Material Surveillance Capsule Report," dated November 13, 2009.

2. Combustion Engineering Report CE NPSD-683-A, Rev. 6, "The Development of a RCS Pressure and Temperature Limits Report for the Removal of P-T Limits and LTOP Setpoints from the Technical Specifications," April 2001.

3. ANSI/ANS-5.1-1979, American National Standard, "Decay Heat Power in Light Water Reactors."

ENCLOSURE 2

Retyped Updated Technical Specification Pages 5.6-8 and 5.6-9 to Reflect No. Amendment 174

5.6 Reporting Requirements (continued)

5.6.6 PAM Report

When a report is required by Condition B or F of LCO 3.3.10, "Post Accident Monitoring (PAM) Instrumentation," a report shall be submitted within the following 14 days. The report shall outline the preplanned alternate method of monitoring, the cause of the inoperability, and the plans and schedule for restoring the instrumentation channels of the Function to OPERABLE status.

5.6.7 Tendon Surveillance Report

Any abnormal degradation of the containment structure detected during the tests required by the Pre-Stressed Concrete Containment Tendon Surveillance Program shall be reported to the NRC within 30 days. The report shall include a description of the tendon condition, the condition of the concrete (especially at tendon anchorages), the inspection procedures, the tolerances on cracking, and the corrective action taken.

5.6.8 Steam Generator Tube Inspection Report

A report shall be submitted within 180 days after the initial entry into MODE 4 following completion of an inspection performed in accordance with the Specification 5.5.9, Steam Generator (SG) Program. The report shall include:

a. The scope of inspections performed on each SG.

b. Active degradation mechanisms found.

c. Nondestructive examination techniques utilized for each degradation mechanism.

d. Location, orientation (if linear), and measured sizes (if available) of service induced indications.

e. Number of tubes plugged during the inspection outage for each active degradation mechanism.

f. Total number and percentage of tubes plugged to date.

g. The results of condition monitoring, including the results of tube pulls and in-situ testing.

(continued)

5.6 Reporting Requirements (continued)

5.6.9 Reactor Coolant System (RCS) PRESSURE AND TEMPERATURE LIMITS REPORT (PTLR)

a. RCS pressure and temperature limits for heatup, cooldown, low temperature operation, criticality, and hydrostatic testing as well as heatup and cooldown rates shall be established and documented in the PTLR for the following Technical Specifications (TSs):

   1. TS 3.4.3, RCS Pressure and Temperature (P/T) Limits;
   2. TS 3.4.6, RCS Loops - Mode 4;
   3. TS 3.4.7, RCS Loops - Mode 5 Loops Filled;
   4. TS 3.4.11, Pressurizer Safety Valves - Mode 4; and
   5. TS 3.4.13, Low Temperature Overpressure Protection (LTOP) System.

b. The analytical methods used to determine the RCS pressure and temperature limits shall be those previously reviewed and approved by the NRC, specifically those described in the following document:

   - CE NPSD-683-A, "Development of a RCS Pressure and Temperature Limits Report for the Removal of P-T Limits and LTOP Requirements from the Technical Specifications."

c. The PTLR shall be provided to the NRC upon issuance for each reactor vessel fluence period and for any revision or supplement thereto.

ENCLOSURE 3

Corrected Technical Requirements Manual Tables TA2-3 and TA2-4 From APS's February 19, 2009 Letter

Table TA2-3
PVNGS Unit 1, 2 and 3
RCS Heatup P/T Limits through 32 EFPY

Indicated Temperature (°F)[1]	Pressure Isothermal (psia)	Indicated RCS Pressure (psia)[1] @ Heatup Rate						Hydrostatic Test[2] (psia)
		@10°F/hr	@20°F/hr	@30°F/hr	@40°F/hr	@50°F/hr	@75°F/hr	
80	680.6	680.6	680.6	671.1	650.2	622.2	602.2	954.4
83.2	690.2	690.2	690.2	676.2	650.2	622.2	602.2	967.2
93.2	727.2	727.2	705.2	676.2	650.2	622.2	602.2	1016.2
103.2	772.2	772.2	710.2	676.2	650.2	622.2	602.2	1075.2
113.2	826.2	826.2	735.2	681.2	650.2	622.2	602.2	1148.2
123.2	893.2	893.2	778.2	700.2	653.2	622.2	602.2	1237.2
133.2	974.2	974.2	839.2	738.2	672.2	627.2	602.2	1346.2
143.2	1074.2	1074.2	918.2	790.2	705.2	645.2	602.2	1478.2
153.2	1195.2	1195.2	1018.2	862.2	754.2	676.2	604.2	1640.2
163.2	1344.2	1335.2	1142.2	954.2	819.2	721.2	617.2	1838.2
171.5	1494.8	1467.5	1269.5	1049.0	889.9	772.8	638.0	2039.1
172.1	1507.0	1478.3	1279.9	1057.0	896.0	777.3	598.0	2053.6
173.2	1525.2	1494.2	1295.2	1068.2	904.2	783.2	600.2	2080.2
183.2	1747.2	1689.2	1484.2	1213.2	1014.2	865.2	637.2	2375.2
186.7	1841.7	1772.5	1565.4	1275.5	1062.2	902.0	655.4	2500.0
193.2	2017.2	1927.2	1716.2	1391.2	1151.2	970.2	689.2	
203.2	2347.2	2217.2	1998.2	1610.2	1320.2	1101.2	757.2	
207.0	2500.0	2351.5	2129.3	1713.2	1399.2	1162.4	790.6	
211.2		2500.0	2274.2	1827.0	1486.6	1230.0	827.6	
213.2			2343.2	1881.2	1528.2	1262.2	845.2	
213.2			2327.2	1865.2	1512.2	1246.2	829.2	
217.3			2500.0	1998.9	1616.3	1327.8	874.7	
223.2				2191.2	1766.2	1445.2	940.2	
230.8				2500.0	2008.6	1634.4	1045.8	
233.2					2085.2	1694.2	1079.2	
243.2					2474.2	2000.2	1250.2	
243.7					2500.0	2018.8	1260.8	
253.2						2372.2	1461.2	
256.0						2500.0	1533.4	
263.2							1719.2	
273.2							2034.2	
283.2							2418.2	
284.9							2500.0	

(1) Corrected for instrument uncertainty and for RCS pressure and elevation effects.

(2) A gradual change in reactor coolant system temperature of ±10°F in any 1-hour period is the maximum permitted during inservice hydrostatic and leak testing.

(continued)

Table TA2-4
PVNGS Unit 1, 2 and 3
RCS Cooldown P/T Limits through 32 EFPY

Indicated Temperature (°F)[1]	Indicated RCS Pressure (psia)[1] @ Cooldown Rate							
	Isothermal	@10°F/hr	@20°F/hr	@30°F/hr	@40°F/hr	@50°F/hr	@75°F/hr	@100°F/hr
80	680.6	612.3	589.0	527.1	469.5	416.6	329.2	237.6
83.2	690.2	623.2	601.2	541.2	485.2	433.2	329.2	272.2
90.9	718.6	655.4	638.0	583.4	533.5	492.2	402.8	372.6
91.3	720.1	657.2	598.0	585.7	536.1	495.4	406.8	378.1
93.2	727.2	665.2	607.2	596.2	548.2	510.2	425.2	403.2
99.6	756.1	698.0	644.5	638.0	597.1	559.7	501.1	493.2
99.9	757.5	699.6	646.3	598.0	599.4	562.1	504.7	497.5
103.2	772.2	716.2	665.2	619.2	624.2	587.2	543.2	543.2
104.7	780.4	725.6	676.1	631.3	638.0	604.8	565.0	565.0
104.9	781.6	727.0	677.7	633.1	598.0	607.3	568.2	568.2
107.6	795.8	743.4	696.7	654.2	622.1	638.0	606.3	606.3
107.8	796.8	744.4	698.0	655.6	623.6	598.0	608.7	608.7
109.8	807.8	757.0	712.6	671.9	642.1	621.6	638.0	638.0
109.9	808.5	757.9	713.6	673.0	643.4	623.2	598.0	598.0
113.2	826.2	778.2	737.2	699.2	673.2	661.2	645.2	645.2
123.2	893.2	854.2	823.2	798.2	781.2	776.2	776.2	776.2
133.2	974.2	947.2	929.2	918.2	918.2	918.2	918.2	918.2
143.2	1074.2	1060.2	1057.2	1057.2	1057.2	1057.2	1057.2	1057.2
153.2	1195.2	1195.2	1195.2	1195.2	1195.2	1195.2	1195.2	1195.2
163.2	1344.2	1344.2	1344.2	1344.2	1344.2	1344.2	1344.2	1344.2
173.2	1525.2	1525.2	1525.2	1525.2	1525.2	1525.2	1525.2	1525.2
183.2	1747.2	1747.2	1747.2	1747.2	1747.2	1747.2	1747.2	1747.2
193.2	2017.2	2017.2	2017.2	2017.2	2017.2	2017.2	2017.2	2017.2
203.2	2347.2	2347.2	2347.2	2347.2	2347.2	2347.2	2347.2	2347.2
207.1	2500.0	2500.0	2500.0	2500.0	2500.0	2500.0	2500.0	2500.0

(1) Corrected for instrument uncertainty and for RCS pressure and elevation effects.

(continued)