10 CFR 50.91(a)(6)
10 CFR 50.90

APS

A subsidiary of Pinnacle West Capital Corporation

Palo Verde Nuclear Generating Station

Dwight C. Mims
Vice President
Regulatory Affairs and Plant Improvement

Tel. 623-393-5403
Fax 623-393-6077

Mail Station 7605
P. O. Box 52034
Phoenix, Arizona 85072-2034

102-05844-DCM/GAM
April 10, 2008

Attn: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Dear Sirs:

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Unit 2
Docket No. STN 50-529
Request for Amendment to Technical Specification 3.5.5, Refueling Water Tank (RWT), to Increase the RWT Minimum Water Level for Unit 2 Under Exigent Circumstances

Pursuant to 10 CFR 50.90, Arizona Public Service Company (APS) hereby requests to amend the Palo Verde Nuclear Generating Station (PVNGS) Unit 2 Technical Specification (TS) 3.5.5, Refueling Water Tank (RWT). The proposed amendment would modify TS 3.5.5 to increase the minimum required RWT level indications and the corresponding borated water volumes in TS Figure 3.5.5-1 by 3%. This change will ensure that there is adequate water volume available in the RWT to ensure that the engineered safety feature (ESF) pumps and the new containment recirculation sump strainers will meet their design functions during loss of coolant accidents (LOCAs).

As a result of containment flooding calculation validation efforts in support of the NRC Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents At Pressurized-Water Reactors," dated September 13, 2004, the flooding calculations for PVNGS have been reevaluated. For the majority of the pipe break locations in the containment, the existing TS minimum RWT levels and corresponding water volumes are adequate to ensure sufficient flood level for strainer submergence and ESF pump operation. However, a more limiting break scenario has been identified that results in the current TS minimum RWT levels, as shown in TS Figure 3.5.5-1, being non-conservative. This may result in the strainers not being fully submerged post-LOCA at the time of RAS for this break scenario. There is no operability concern for any of the PVNGS Units because the RWT minimum level in the three PVNGS Units is being administratively maintained 3% above the current TS Figure 3.5.5-1 levels.

A001
NRR

This condition is exigent for Unit 2, as it entered into a refueling outage on March 29, 2008, and during that outage the new containment sump strainers will be installed as part of APS's commitments related to GL 2004-02. Without this amendment the 10 CFR 50.59 for the Unit 2 strainers modification can not be completed and Unit 2 would not be able to enter Mode 4 scheduled for May 11, 2008.

Approval of the proposed amendment is requested as soon as possible before May 11, 2008. Once approved, the amendment shall be implemented within one week.

In accordance with the PVNGS Quality Assurance Program, the Plant Review Board and the Offsite Safety Review Committee have reviewed and concurred with this proposed amendment. By copy of this letter, this submittal is being forwarded to the Arizona Radiation Regulatory Agency (ARRA) pursuant to 10 CFR 50.91(b)(1).

No commitments are being made to the NRC by this letter. If there are any questions or if additional information is needed, please contact Glenn Michael at (623) 393-5750.

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

Executed on 4/10/08
(Date)

Sincerely,

D.C. Morris

DCM/SAB/GAM/gat

Enclosure: Evaluation of the Proposed Change

cc:	E. E. Collins Jr.	NRC Region IV Regional Administrator
	M. T. Markley	NRC NRR Project Manager
	R. I. Treadway	NRC Senior Resident Inspector for PVNGS
	A. V. Godwin	Arizona Radiation Regulatory Agency (ARRA)
	T. Morales	Arizona Radiation Regulatory Agency (ARRA)

ENCLOSURE

Evaluation of the Proposed Change

Subject: **Request for Amendment to Technical Specification 3.5.5, Refueling Water Tank (RWT), to Increase the RWT Minimum Water Level for Unit 2 Under Exigent Circumstances**

ATTACHMENTS:

1. Technical Specification Markup
2. Retyped Technical Specification
3. Technical Specification Bases Markups

1. SUMMARY DESCRIPTION

This evaluation supports a request to amend Operating License NPF-51, for Palo Verde Nuclear Generating Station (PVNGS) Unit 2.

The proposed amendment would modify technical specification (TS) 3.5.5, Refueling Water Tank (RWT), to increase the minimum required RWT level indications and the corresponding borated water volumes in TS Figure 3.5.5-1 for Unit 2 by 3%. This change will ensure that there is adequate water volume available in the RWT to ensure that the engineered safety feature (ESF) pumps and the new containment recirculation sump strainers will meet their design functions during loss of coolant accidents LOCAs).

2. DETAILED DESCRIPTION

The proposed amendment would revise TS 3.5.5 to raise the required minimum RWT level indications and the corresponding water volume values shown in Figure 3.5.5-1 by 3%. This change revises the minimum level indications and the corresponding water volumes used to determine operability of the RWT from 210 °F through 600 °F (i.e., to ensure that there is adequate volume available for the design functions of the RWT). This change will ensure that there is adequate water volume in the containment to meet the functional requirements of the ESF pumps and the containment sump strainers for applicable design basis accidents and break scenarios.

The RWT water volumes corresponding to the TS Figure level instrument readings include margin to ensure the minimum required RWT water volumes are maintained available.

3. TECHNICAL EVALUATION

The licensing basis for the new containment recirculation sump strainers is described in UFSAR Section 6.2.2.2.2 for the strainers that have been installed in Units 1 and 3, and that are being installed in Unit 2 during the current refueling outage. The containment recirculation sumps provide for the collection of reactor coolant and chemically reactive spray solutions following a LOCA. Thus, the sumps serve as water sources to effect long-term recirculation for the functions of residual heat removal, emergency core cooling, and containment atmosphere cleanup.

Following a LOCA, the suction supply for emergency core cooling system (ECCS) and containment spray system (CSS) pumps during recirculation is provided by two containment recirculation sumps, one for each safety-related train. The sumps are located on the lowest floor in the containment building and are physically separated to preclude simultaneous damage to both.

Both the high pressure safety injection (HPSI) and the CSS pump suctions are automatically switched from the RWT to the containment recirculation sump by a

recirculation actuation signal (RAS) from the engineered safety features actuation system (ESFAS) at a specified RWT level.

UFSAR Section 6.2.2.2.2.G states that for the new sump strainer design: "With the horizontal cassette pocket (specialty) design, the strainers consist of both vertical and horizontal flow paths through the screening elements. All pockets are submerged at the minimum post-LOCA flood level."

TS Bases B 3.5.5 states that this limiting condition for operation (LCO) ensures that sufficient water volume exists in the containment sump to support continued operation of the engineered safety features pumps at the time of transfer to the recirculation mode of cooling and that insufficient water inventory in the RWT could result in insufficient cooling capacity of the ECCS when the transfer to the recirculation mode occurs.

As a result of containment flooding calculation validation efforts in support of the NRC Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents At Pressurized-Water Reactors," dated September 13, 2004, the flooding calculations for PVNGS have been reevaluated. For the majority of the pipe break locations in the containment, the existing TS minimum RWT levels and corresponding water volumes are adequate to ensure sufficient flood level for strainer submergence and ESF pump operation. However, a more limiting break scenario has been identified that results in the current TS minimum RWT levels, as shown in TS Figure 3.5.5-1, being non-conservative. This may result in the strainers not being fully submerged post-LOCA at the time of the RAS for this break scenario.

The scenario of concern is a small break LOCA involving a break at the top of the pressurizer. This break has a limited cross section and results in the reactor coolant system (RCS) pressure remaining above 600 psia which limits the spillage to the containment floor from the RCS and does not allow the safety injection (SI) tanks to inject.

In the evaluation of this scenario, the flood water source is limited to the volume of water in the RWT and considers potential flood volume losses from water diverted to the chemical volume and control system and water postulated to be held on wetted surfaces and delayed in containment. The strainers were designed based on a minimum flood level elevation of 84'-6". This minimum flood level ensures that the strainers are submerged to prevent vortexing and that adequate net positive suction head is available to support continued ESF pump operation after the switchover to recirculation. The evaluation shows that the minimum flood level equates to 543,200 gallons
(at 600 °F) of water delivered from the RWT to the RCS and containment prior to the RAS for the small break scenario. To ensure the required delivered volume is available, the RWT indicated level is conservatively set at 83% of scale. This indicated level conservatively considers instrument inaccuracies for the indicators used to verify RWT level, the switchover for RAS, and for average RCS temperature.

The analyses for determining the new minimum required RWT levels and associated water volumes are based on current design information and assumptions that in many cases provide an inherent margin in the analyses. Some of these assumptions include:

- The flooding calculation used inputs and assumptions that minimize credited spillage volumes and maximize hold up volumes.
- The water available from the RWT was limited to the upper limit of a RAS initiation signal. This conservatively assumes the RWT outlet check valves close on a high back pressure condition, which may not exist in some break scenarios.
- The instrument analysis used post-seismic conditions for establishing instrument uncertainties that are slightly larger than normal.
- Uncertainty for electrical instruments (the current to voltage converter and indicator in particular) was used that is larger than past operating experience has shown.
- The minimum required RWT level is established based on flooding to Elevation 84'-6" for the limiting flooding scenario (i.e., a small break LOCA at the top of the pressurizer). For this scenario, ESF pump flow would be lower and generated debris would be significantly less than for the design basis large break LOCA. However, the suction line head losses from the design basis large break LOCA were assumed.

The required minimum flood level of Elevation 84'-6" is approximately 2 inches above the top of the sump strainers. It is expected that further testing would demonstrate acceptable strainer performance (no vortexing) at a flood level below Elevation 84'-6" for the small break LOCA.

The impacts of the increased minimum RWT water volume on maximum containment flood level and sump pH were evaluated. The calculated maximum containment flood level is based on the RWT water level associated with the bottom of the RWT overflow nozzle. This change does not revise the location of the RWT overflow nozzle and there is no change in the calculated maximum flood level. As a result, the proposed change has no impact on the qualification of equipment above the maximum containment flood level. For the same reason the impact of the proposed change on post-LOCA sump pH is bounded by the current analysis for post-LOCA sump pH. In that analysis, the calculated minimum post-LOCA sump pH is based on the maximum RWT water level associated with the bottom of the RWT overflow nozzle. The maximum flood level is not affected by this change. In addition, the change is conservative with respect to the calculated maximum post-LOCA sump pH since it is increasing the minimum required RWT volume.

4. REGULATORY EVALUATION

4.1 Applicable Regulatory Requirements/Criteria

10 CFR 50 Appendix A, General Design Criteria (GDC) 13, "Instrumentation and Control," requires instrumentation and control to monitor variables and systems over their anticipated ranges for normal operation, for anticipated operational occurrences, and for accident conditions as appropriate to assure adequate safety, including those variables and systems that can affect the fission process, the integrity of the reactor core, the reactor coolant pressure boundary, and the containment and its associated systems. Appropriate controls shall be provided to maintain these variables and systems within prescribed operating ranges. The proposed change modifies the limits used by the associated instruments and controls to ensure that the ECCS, CSS and containment recirculation strainers will continue to operate as designed for all accident conditions.

10 CFR 50 Appendix A, General Design Criteria (GDC) 16, "Containment Design," requires a reactor containment and associated systems be provided to establish an essentially leak-tight barrier against the uncontrolled release of radioactivity to the environment and to ensure the containment design conditions important to safety are not exceeded for as long as postulated accident conditions require. The proposed change modifies the minimum water volume contained in the RWT, which will ensure that the CSS and containment recirculation strainers will continue to operate as designed to maintain the integrity of the containment for all accident conditions.

10 CFR 50 Appendix A, GDC 35, Emergency Core Cooling," requires abundant emergency core cooling be provided. The system safety function shall be to transfer heat from the reactor core following any loss of reactor coolant at a rate such that (1) fuel and clad damage that could interfere with continued effective core cooling is prevented and (2) clad metal-water reaction is limited to negligible amounts. The proposed change modifies the minimum water volume contained in the RWT, which will ensure that the ECCS and containment recirculation strainers will continue to operate as designed to maintain the integrity of the core for all accident conditions.

10 CFR 50 Appendix A, GDC 38, "Containment Heat Removal," requires a system to remove heat from the reactor containment be provided. The system function shall be to reduce rapidly, consistent with the functioning of other associated systems, the containment pressure and temperature following any LOCA and maintain them at acceptably low levels. The proposed change modifies the minimum water volume contained in the RWT, which will ensure that the CSS and containment recirculation strainers will continue to operate as designed to maintain the required heat removal from the containment for all accident conditions.

Regulatory Guide 1.82, Revision 0, Water Sources for Long-Term Recirculation Cooling Following a Loss-of-Coolant Accident, June 1974 -The proposed change modifies the minimum water volume contained in the RWT, which will ensure that the water sources available for long term cooling are adequate for all design basis accident conditions.

NUREG/CR-6874, "GSI-191: Experimental Studies of Loss-of-Coolant-Accident-Generated Debris Accumulation and Head Loss with Emphasis on the Effects of Calcium Silicate Insulation," April 2004 - The proposed change modifies the minimum water volume contained in the RWT, which will ensure that there is adequate head for the ECCS and CSS to operate as designed in all design basis accidents.

NRC Generic Letter 2004-02, dated September 13, 2004, Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents At Pressurized-Water Reactors - The proposed change modifies the minimum water volume contained in the RWT, which will ensure that there is adequate water level at the containment recirculation sump strainers for the ECCS and CSS to operate as designed in all design basis accidents.

4.2 Precedent

By letter dated December 16, 2005, Comanche Peak Steam Electric Station (CPSES) submitted License Amendment Request 05-010, Revision to Technical Specifications 3.3.2, "ESFAS Instrumentation," 3.5.2, "ECCS Operating," and 3.6.7, "Spray Additive System" to the NRC, requesting TS changes required to meet the commitments made in the CPSES response to Generic Letter 2004-02 (ADAMS Accession Nos. ML062780226, ML062560043, and ML062440420). On October 5, 2006, the NRC issued Amendments No. 129 for Unit 1 and 129 for Unit 2, approving the Comanche Peak amendment request (ADAMS Accession No. ML062550076).

Pacific Gas and Electric Company Letter to the NRC, License Amendment Request 07-02, Revision to Technical Specification (TS) 3.5.4, Refueling Water Storage Tank (RWST) dated October 2, 2007 (ADAMS Accession No. ML072840049) requested a revision to the RWST level as a result of the installation of their new containment sump strainers in response to GL 2004-02, which resulted in a non-conservative RWST level.

Southern Company letter to the NRC, License Amendment Request to Revise Technical Specifications (TS) 3.3.2, ESFAS Instrumentation." and TS 3.5.4. "Refueling Water Storage Tank (RWST), dated January 9, 2008 (ADAMS Accession No. ML080150161) requested changes to TS 3.3.2 and 3.5.4 to increase the emergency sump water levels and net positive suction head (NPSH) available for emergency core cooling (ECCS) at the time of switchover to cold leg recirculation.

4.3 No Significant Hazards Consideration Determination

The proposed amendment would modify technical specification (TS) 3.5.5, Refueling Water Tank (RWT), to increase the minimum required borated water volumes and corresponding level indications in TS Figure 3.5.5-1 by 3%. This change will ensure that there is adequate water volume available in the RWT to ensure that the engineered safety feature pumps and the new containment recirculation sump strainers will meet their design functions for all loss of coolant accidents (LOCAs).

Arizona Public Service Company (APS) has evaluated whether or not a significant hazards consideration is involved with the proposed amendment(s) by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of amendment," as discussed below:

1. Does the proposed amendment involve a significant increase in the probability or consequences of an accident previously evaluated?

   Response: No.

   The proposed change would raise the RWT minimum level by 3% to ensure that there is adequate water volume available at the containment recirculation sumps for the limiting small break LOCA scenario for submergence of the new strainer designs that are being installed in Unit 2 in the spring 2008 outage. The new strainers are designed and tested to operate submerged at the start of recirculation actuation post-LOCA. This change ensures that the level of water at the strainers supports this assumption of the design.

   The RWT water volume is not an initiator of any accident previously evaluated. As a result, the probability of an accident previously evaluated is not affected. The proposed change does not alter or prevent the ability of structures, systems, and components from performing their intended function to mitigate the consequences of an initiating event within the assumed acceptance limits.

   The effect on containment flood level, equipment qualification, and containment sump pH remain within the limits assumed in the design and accident analyses. The calculated maximum containment flood level is based on the RWT water level associated with the bottom of the RWT overflow nozzle. This change does not revise the location of the RWT overflow nozzle and there is no change in the calculated maximum flood level. As a result, the proposed change has no impact on the qualification of equipment above the maximum containment flood level. For the same reason the impact of the proposed change on post-LOCA sump pH is bounded by the current analysis for post-LOCA sump pH. In that analysis, the calculated minimum post-LOCA sump pH is based on the maximum RWT water level associated with the bottom of the RWT overflow nozzle. The maximum

flood level is not affected by this change. In addition, the change is conservative with respect to the calculated maximum post-LOCA sump pH since it is increasing the minimum required RWT volume..

The proposed change does not affect the source term, containment isolation, or radiological release assumptions used in evaluating the radiological consequences of an accident previously evaluated. Further, the proposed change does not increase the types or amounts of radioactive effluent that may be released offsite, nor significantly increase individual or cumulative occupational/public radiation exposures. The proposed change is consistent with the safety analysis assumptions and resultant consequences.

Therefore, the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed amendment create the possibility of a new or different kind of accident from any accident previously evaluated?

   Response: No.

   The change does not involve a physical alteration of the plant (i.e., no new or different components or physical changes are involved with this change) or a change in the methods governing normal plant operation. The change does not alter any assumptions made in the safety analysis.

   Therefore, the proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. Does the proposed amendment involve a significant reduction in a margin of safety?

   Response: No.

   The proposed change to raise the required RWT minimum water volume does not alter the manner in which safety limits, limiting safety system settings or limiting conditions for operation are determined. The safety analysis acceptance criteria are not affected by this change. The proposed change will not result in plant operation in a configuration outside of the design basis.

   Therefore, the proposed change does not involve a significant reduction in a margin of safety.

Based on the above, APS concludes that the proposed amendment does not involve a significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of "no significant hazards consideration" is justified.

4.4 Conclusions

In conclusion, based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

5. ENVIRONMENTAL CONSIDERATION

A review has determined that the proposed amendment would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, or would change an inspection or surveillance requirement. However, the proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or a significant increase in the amounts of any effluents that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

6. EXPLANATION OF EXIGENT CIRCUMSTANCES

In accordance with 10 CFR 50.91(a)(6)(vi), APS is providing the following explanation regarding the exigency and why it could not be avoided, and why APS has used its best efforts to make a timely application for the amendment.

In response to questions raised in 2007 concerning the conservatism in some flood water volume assumptions for some pipe breaks used in the containment flooding calculations, APS performed an evaluation of the containment flooding analysis. APS has been working to address these questions along with completing the testing and validation of the new strainer design provided in response to GL 2004-02. The potential RWT level issue was identified in APS letter no. 102-05819 to NRC, "Response to NRC Request for Additional Information Related to Generic Letter 2004-02, Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors," dated February 29, 2008 (ADAMS Accession No. ML080710546).

APS applied appropriate rigor in re-evaluating the minimum flood level available for a small break LOCA on the top of the pressurizer to ensure that the scenario was properly defined and that the assumptions were accurate and reasonable. A revision of the containment flooding calculation was performed including independent and third party verification. The NSSS vendor also analyzed the credibility of the scenario to ensure it

warranted being added to the design basis. The results of that effort indicate that the TS minimum RWT levels and associated volumes shown in TS Figure 3.5.5-1 will not result in sufficient flood level to assure submergence of the new containment recirculation sump strainers as designed. Therefore, the minimum TS RWT levels are non-conservative. Once that determination was made, APS identified that a TS change was required per 10 CFR 50.59 for Unit 2 to implement the new strainer modification and this amendment request was initiated.

There is no operability concern for any of the PVNGS Units because the RWT level in the three PVNGS Units is being administratively maintained at 3% above the current TS Figure 3.5.5-1 levels.

This condition is exigent for Unit 2, as it entered into a refueling outage on March 29, 2008, and during this outage the new containment sump strainers will be installed as part of APS's commitments related to GL 2004-02. Without this amendment the 10 CFR 50.59 for the Unit 2 strainers modification can not be completed and Unit 2 would not be able to enter Mode 4 scheduled for May 11, 2008. As a result, this amendment request meets 10 CFR 50.91 guidance in that a failure to act in a timely way would result in prevention of either resumption of operation or of increase in power output up to the plant's licensed power level.

7. REFERENCES

Calculation 13-MC-SI-0804, Revision 6, "Containment Building Water Level During LOCA."

Calculation 13-JC-CH-0209, Revision 8, "Refueling Water Tank Level Measurement."

Regulatory Guide 1.82, Revision 0, Water Sources for Long-Term Recirculation Cooling Following a Loss-of-Coolant Accident, June 1974.

NRC Generic Letter 2004-02, dated September 13, 2004, Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents At Pressurized-Water Reactors.

Palo Verde Nuclear Generating Station letter to NRC, Response to NRC Request for Additional Information Related to Generic Letter 2004 -02 , Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors, dated February 29, 2008 (ADAMS Accession No. ML080710546).

NUREG/CR-6874, "GSI-191: Experimental Studies of Loss-of-Coolant-Accident-Generated Debris Accumulation and Head Loss with Emphasis on the Effects of Calcium Silicate Insulation," April 2004.

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Pacific Gas and Electric Company Letter to the NRC, License Amendment Request 07-02, Revision to Technical Specification (TS) 3.5.4, Refueling Water Storage Tank (RWST) dated October 2, 2007. (ADAMS Accession No. ML072840049).

Southern Company letter to the NRC, License Amendment Request to Revise Technical Specifications (TS) 3.3.2, ESFAS Instrumentation." and TS 3.5.4. "Refueling Water Storage Tank (RWST), dated January 9, 2008. (ADAMS Accession No. ML080150161).

ENCLOSURE, ATTACHMENT 1

Technical Specification Markup

Page:
3.5.5-3
Attached Figure

Replace with Attached Figure

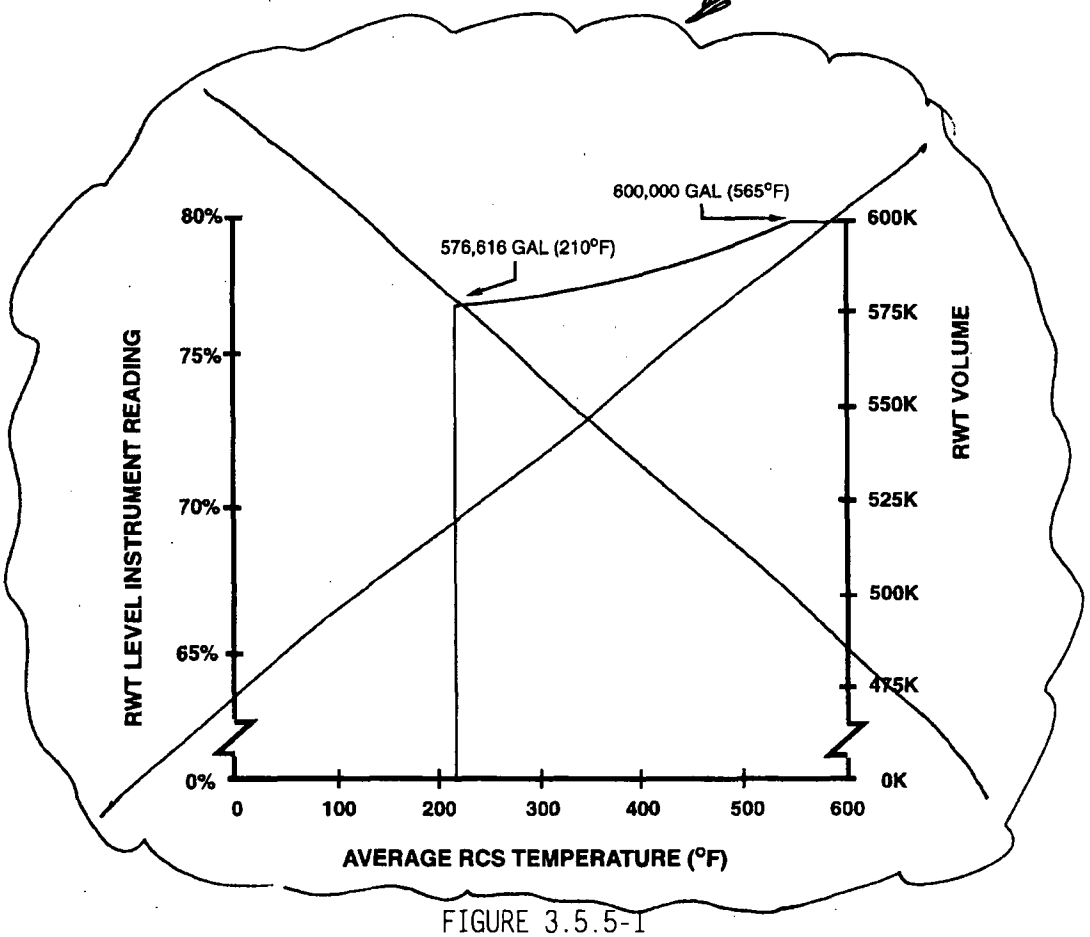
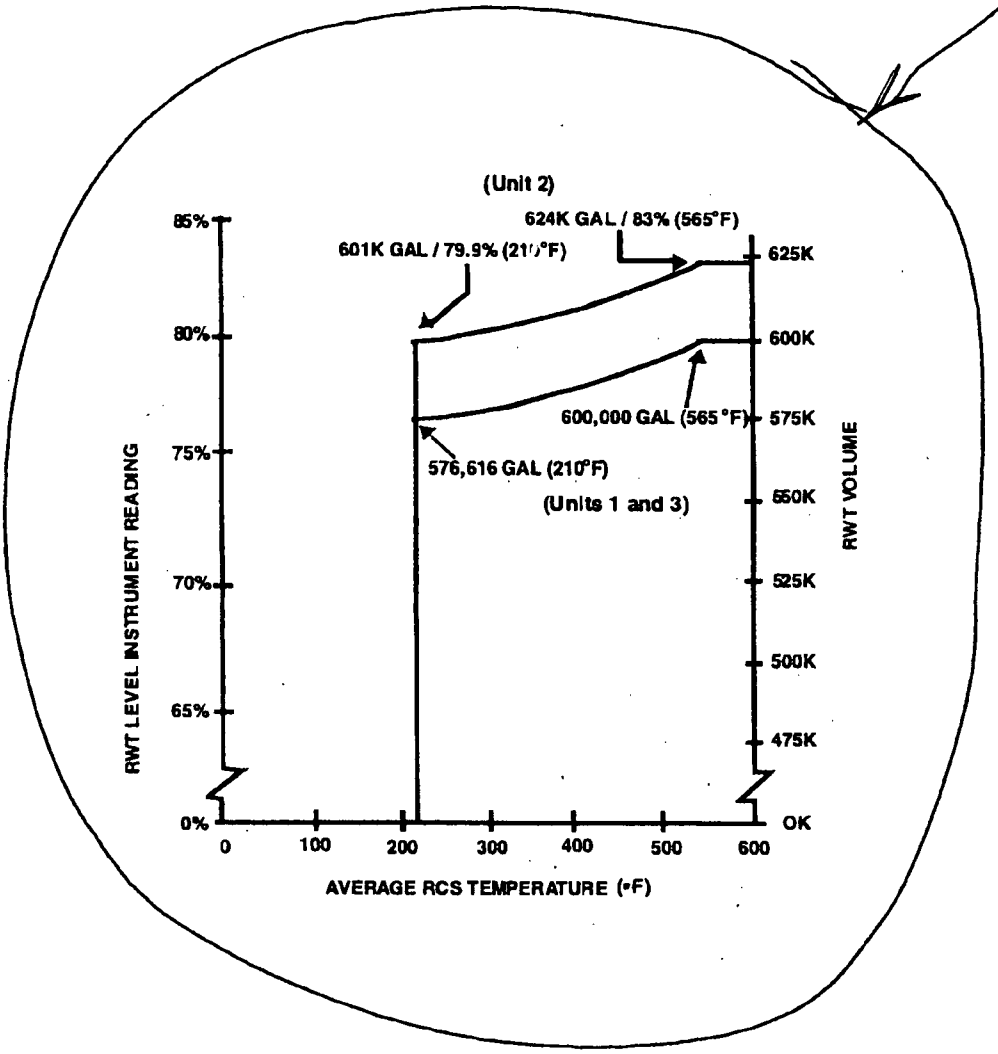


FIGURE 3.5.5-1
Minimum Required RWT Volume

Replacement Figure For Figure 3.5.5-1



ENCLOSURE, ATTACHMENT 2

Retyped Technical Specification

Page:
3.5.5-3

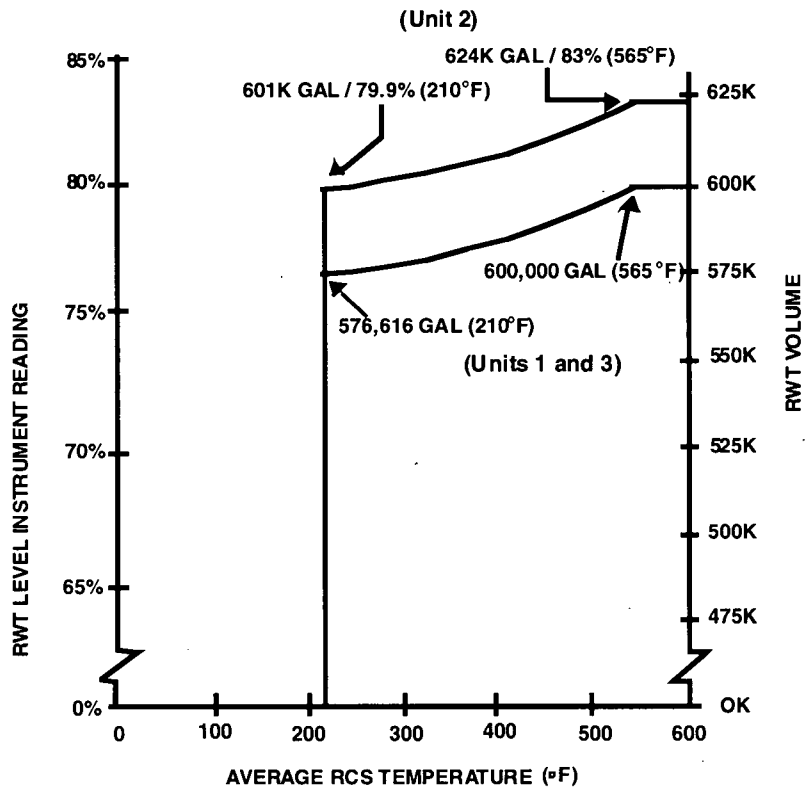


FIGURE 3.5.5-1
Minimum Required RWT Volume

ENCLOSURE, ATTACHMENT 3

Technical Specification Bases Markups

Pages:
B 3.5.5-1 (Unit 2)
B 3.5.5-2 (Unit 2)
B 3.5.5-3 (Unit 2)
B 3.5.5-7 (Unit 2)
Insert A (Unit 2)
Insert B (Unit 2)

B 3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

B 3.5.5 Refueling Water Tank (RWT)

BASES **(THIS FOR UNIT 2 ONLY)**

BACKGROUND

The RWT supports the ECCS and the Containment Spray System by providing a source of borated water for Engineered Safety Feature (ESF) pump operation.

The RWT supplies two ECCS trains by separate, redundant supply headers. Each header also supplies one train of the Containment Spray System. A motor operated isolation valve is provided in each header to allow the operator to isolate the usable volume of the RWT from the ECCS after the ESF pump suction has been transferred to the containment sump following depletion of the RWT during a Loss of Coolant Accident (LOCA). A separate header is used to supply the Chemical and Volume Control System (CVCS) from the RWT. Use of a single RWT to supply both trains of the ECCS is acceptable since the RWT is a passive component, and passive failures are not assumed to occur coincidently with the Design Basis Event during the injection phase of an accident. Not all the water stored in the RWT is available for injection following a LOCA; the location of the ECCS suction piping in the RWT will result in some portion of the stored volume being unavailable.

The High Pressure Safety Injection (HPSI), Low Pressure Safety Injection (LPSI), and containment spray pumps are provided with recirculation lines that ensure each pump can maintain minimum flow requirements when operating at shutoff head conditions. These lines discharge back to the RWT. **The RWT** ~~, which~~ vents to the Fuel Building Ventilation System. When the suction for the HPSI and containment spray pumps is transferred to the containment sump, this flow path must be isolated to prevent a release of the containment sump contents to the RWT. If not isolated, this flow path could result in a release of contaminants to the atmosphere and the eventual loss of suction head for the ESF pumps.

This LCO ensures that:

a. The RWT contains sufficient borated water to support the ECCS during the injection phase;

(continued)

BASES **(THIS FOR UNIT 2 ONLY)**

BACKGROUND (continued)

b. Sufficient water volume exists in the containment sump to support continued operation of the ESF pumps at the time of transfer to the recirculation mode of cooling; and

c. The reactor remains subcritical following a LOCA.

Insufficient water inventory in the RWT could result in **(1)** insufficient cooling capacity of the ECCS**, or (2) insufficient water level to support continued ESF pump operation** when the transfer to the recirculation mode occurs. Improper boron concentrations could result in a reduction of SDM or excessive boric acid precipitation in the core following a LOCA, as well as excessive caustic stress corrosion of mechanical components and systems inside containment.

The RWT also provides a source of borated water to the charging system for makeup to the RCS to compensate for contraction of the RCS coolant during plant cooldown while maintaining adequate shutdown margin. Although this charging system boration function is not required to be in a Technical Specification LCO per 10 CFR 50.36(c)(2)(ii) criteria, the RWT volume requirements of Figure 3.5.5-1 include this function in order to provide the plant operators with a single requirement for RWT volume.

ADD INSERT A HERE

~~For hot zero power temperature of 565 degrees F, the RWT volume requirement of 600,000 gallons will ensure adequate shutdown margin during a subsequent cooldown. For power levels greater than zero, with a corresponding increase in average RCS temperature, the volume of borated water to maintain the shutdown margin is the same as at zero power. Contraction requirements are greater at higher average RCS temperatures; however, the additional contraction is accommodated by an acceptable reduction in pressurizer level. Consequently, for operation at average RCS temperatures greater than 565 degrees F, the minimum volume required in the RWT is constant at 600,000 gallons.~~

(continued)

BASES **(THIS FOR UNIT 2 ONLY)**

APPLICABLE SAFETY ANALYSES

During accident conditions, the RWT provides a source of borated water to the HPSI, LPSI and containment spray pumps. As such, it provides containment cooling and depressurization, core cooling, and replacement inventory and is a source of negative reactivity for reactor shutdown (Ref. 1). The design basis transients and applicable safety analyses concerning each of these systems are discussed in the Applicable Safety Analyses section of Bases B 3.5.3, "ECCS – Operating," and B 3.6.6, "Containment Spray." These analyses are used to assess changes to the RWT in order to evaluate their effects in relation to the acceptance limits.

The ~~volume~~ **level** limit of Figure 3.5.5-1 for the ESF function is based on **the largest of the following**~~two~~ **four** factors:

a. A ~~required~~ volume of ~~558,978~~**476,338** gallons ~~(138' 11")~~ must ~~be available to~~ **be transferred to containment via** ~~provide inventory to~~ the ESF pumps prior to reaching a low level switchover to the containment sump for recirculation. This ESF Reserve Volume ensures that the ESF pump suction will not be aligned to the containment sump until the point at which 75% of the minimum design flow of one HPSI pump is capable of meeting or exceeding the decay heat boil-off rate.

b. A ~~required~~ volume of **543,200**~~576,616~~ gallons **(at 600°F) must** ~~to ensure that sufficient water will~~ be transferred to the **RCS and containment**~~sump~~ for **flooding of sump strainers to prevent vortexing and to ensure** adequate net positive suction head to support continued ESF pump operation after the switchover to recirculation occurs.

ADD INSERT B HERE

By time of recirculation, the water level in the containment sump must be sufficient to provide adequate Net Positive Suction Head (NPSH) for both trains of HPSI, LPSI, and containment spray pumps operating at runout conditions. Accounting for LPSI pump operation is conservative because

(continued)

BASES **(THIS FOR UNIT 2 ONLY)**

these pumps trip automatically upon RAS and are not required during recirculation. The minimum containment sump level can be achieved considering only the inventory specified in the RWT **with no**~~plus limited~~ contributions from safety injection tanks and the reactor coolant.

(continued)

BASES **(THIS FOR UNIT 2 ONLY)**

SURVEILLANCE REQUIREMENTS

SR 3.5.5.1 (continued)

The SR is modified by a Note that eliminates the requirement to perform this Surveillance when ambient air temperatures are within the operating temperature limits of the RWT. With ambient temperatures within this range, the RWT temperature should not exceed the limits.

SR 3.5.5.2

The RWT water volume level shall be verified every 7 days in accordance with Figure 3.5.5-1. This Frequency ensures that a sufficient initial water supply is available for injection and to support continued ESF pump operation on recirculation. Since the RWT volume is normally stable and is provided with a Low Level Alarm in the Control Room, a 7 day Frequency is appropriate and has been shown to be acceptable through operating experience.

SR 3.5.5.3

Boron concentration of the RWT shall be verified every 7 days to be within the required range. This Frequency ensures that the reactor will remain subcritical following a LOCA and the boron precipitation in the core will not occur earlier than predicted. Further, it ensures that the resulting sump pH will be maintained in an acceptable range such that the effect of chloride and caustic stress corrosion on mechanical systems and components will be minimized. Since the RWT volume is normally stable, a 7 day sampling Frequency is appropriate and has been shown through operating experience to be acceptable.

REFERENCES

1. UFSAR, Chapter 6 and Chapter 15.

2. Engineering Calculation 13-JC-CH-0209

INSERT A

The table below provides the required RWT level at selected RCS average temperature values, corresponding to Figure 3.5.5-1. The RWT volume is the total volume of water in the RWT above the vortex breaker. This volume includes the volumes required to be transferred, as discussed below, an allowance for instrument uncertainty, and the volume that will remain in the RWT after the switch over to the recirculation mode.

RWT Required Level at RCS Temperatures

RCS Temperature (°F) average	RWT Required Level (%)	RWT Volume * (Gallons)
210	79.9	601,000
250	80.1	603,000
300	80.4	605,000
350	80.8	608,000
400	81.2	611,000
450	81.6	614,000
500	82.1	618,000
565	83.0	624,000
600	83.0	624,000

* The volumes include instrument uncertainty and have been rounded up or down to the nearest 1,000 gallons.

INSERT B

c. A volume of 400,000 gallons must be available for Containment Spray System operation as credited in the containment pressure and temperature analyses.

d. A volume of borated water is needed during ECCS functions to ensure shut down margin (SDM) is maintained. The volume required is similar to that needed for the charging system function of compensating for contraction of the RCS coolant during plant cooldown. The volume required will vary depending upon the event and is bounded by the volume needed for a LOCA. The volume needed for boration purposes for a LOCA is smaller than the volumes discussed in a, b, and c above.

The quantities specified above are transfer volumes to be available for delivery to the ESF pumps. They are located between the required level of Figure 3.5.5-1 and the low level switchover to the containment sump for recirculation (RAS). The required level of Figure 3.5.5-1 also considers applicable instrument uncertainty for the indicators used to verify level, the switch that actuates the recirculation actuation signal, and the indicators for average RCS temperature.

The level required by Figure 3.5.5-1 ensures that adequate water volume exists in the tank to provide the transfer volumes discussed above. The temperatures of note on the Figure are (1) 600°F which bounds the highest expected average RCS temperature, (2) 565°F, which corresponds to hot zero power, and (3) 210°F, which is the lowest temperature for Mode 4, when this LCO is applicable. Between 600°F and 565°F the required level is constant for ease of use by operators to have a single value for all hot conditions. Between 565°F and 210°F the required level decreases as the volume required to makeup for RCS coolant contraction decreases.