Omaha Public Power District

444 South 16th Street Mall
Omaha NE 68102-2247

May 21, 2004
LIC-04-0045

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

Reference: Docket No. 50-285

SUBJECT: Fort Calhoun Station Unit No. 1 License Amendment Request (LAR), "Trisodium Phosphate Volume"

Pursuant to 10 CFR 50.90, the Omaha Public Power District (OPPD) hereby requests the following amendment to the Fort Calhoun Station Unit No. 1 (FCS) Operating License.

OPPD proposes to revise Technical Specification (TS) 2.3(4) which concerns the volume of Trisodium Phosphate (TSP) required in Operating Modes 1 and 2. TSP placed in baskets in the containment sump is required to attain pH ≥ 7.0 in the recirculation water following a loss-of-coolant accident (LOCA). OPPD proposes to delete the requirement that the TSP be of the "dodecahydrate" form and instead specify that hydrated TSP (45 - 57% moisture content) is required. Also, rather than a fixed volume requirement, OPPD proposes a new figure (Figure 2-3), which shows the volume of TSP required over the operating cycle. The surveillance requirement of TS 3.6(2)d.(i) is revised to require a volume of TSP that is within the area of acceptable operation of Figure 2-3. Corresponding changes to the Basis of TS 2.3 and 3.6 are also proposed.

This amendment is necessary due to anticipated future fuel and core designs that will increase hot zero power (HZP) critical boron concentration (CBC) at the beginning of cycle (BOC). This will require a larger volume of TSP at BOC than currently required by TS 2.3(4). Figure 2-3, allows the required volume of TSP to gradually decrease as HZP CBC decreases during the operating cycle. As HZP CBC decreases, less TSP is required to achieve a pH of ≥ 7.0 in the containment sump. Figure 2-3 accounts for the effects of densification (agglomeration) during the operating cycle. Failure to account for densification could require OPPD to unnecessarily enter the TS 2.3(4) Limiting Condition for Operation (LCO) at EOC when the quantity of TSP in the baskets does not meet a fixed TS requirement yet is sufficient to neutralize the containment sump.

The revision to TS 2.3(4) will ensure that a pH of ≥ 7.0 is achieved in the post LOCA containment sump. The change to the Basis of TS 2.3 is consistent with Standard Technical Specifications Combustion Engineering Plants (NUREG-1432, Rev. 2).

A001

OPPD has evaluated these changes and determined that deleting the term "dodecahydrate" and allowing the required volume of active TSP to decrease as HZP CBC decreases does not significantly reduce the margin for pH control and neutralization of all borated water and acid sources post-LOCA. However, the change does provide additional safety margin for the equipment environmental qualification (EEQ) requirement that recirculation water pH not exceed 7.5.

Attachment 1 provides the No Significant Hazards Evaluation and the technical bases for this requested change to the TS. Attachment 2 contains a marked-up version of the TSs which shows the requested TS and Basis changes. Attachment 3 contains a clean version of the TSs, which incorporates the proposed TS and Basis changes.

OPPD requests approval of this LAR by December 27, 2004, with a 60 day implementation period to enable the amendment to be implemented prior to the start of FCS's 2005 refueling outage on February 25, 2005.

In accordance with 10 CFR 50.91, a copy of this application, with attachments, is being provided to the designated State of Nebraska official.

No commitments are made to the NRC in this letter. If you have any questions or require information, please contact Dr. R. Jaworski at 402-533-6833.

I declare under penalty of perjury that the foregoing is true and correct. (Executed on May 21, 2004.)

Sincerely,

R L Phelps 5-21-04

R. L. Phelps
Division Manager
Nuclear Engineering

RLP/MLE/mle

Attachments:
1. Fort Calhoun Station's Evaluation
2. Markup of Technical Specification Pages
3. Proposed Technical Specification Pages

c: B. S. Mallett, NRC Regional Administrator, Region IV
A. B. Wang, NRC Project Manager
J. G. Kramer, NRC Senior Resident Inspector
Division Administrator - Public Health Assurance, State of Nebraska

Fort Calhoun Station's Evaluation
for
Amendment of Operating License

1.0 INTRODUCTION

2.0 DESCRIPTION OF PROPOSED AMENDMENT

3.0 BACKGROUND

4.0 REGULATORY REQUIREMENTS & GUIDANCE

5.0 TECHNICAL ANALYSIS

6.0 REGULATORY ANALYSIS

7.0 NO SIGNIFICANT HAZARDS CONSIDERATION (NSHC)

8.0 ENVIRONMENTAL CONSIDERATION

9.0 PRECEDENCE

10.0 REFERENCES

Fort Calhoun Station's Evaluation
for
Amendment of Operating License

1.0 INTRODUCTION

The Omaha Public Power District (OPPD) is requesting to amend Operating License DPR-40 for Fort Calhoun Station Unit No. 1 (FCS) by revising Technical Specifications (TSs) 2.3(4) and 3.6(2)d and their associated Basis sections.

FCS Technical Specification 2.3(4) currently requires the dodecahydrate form of Trisodium Phosphate (TSP). The term "dodecahydrate" is proposed for deletion from TS 2.3(4) and the Basis of TS 2.3. The Basis of TS 2.3 is revised to state that the hydrated form (45-57% moisture) is used because of high humidity in the containment building during normal operation. These changes will make TS 2.3(4) and its Basis consistent with NUREG-1432, Rev. 2, "Standard Technical Specifications Combustion Engineering Plants," which does not require a specific type of TSP.

Currently, TS 2.3(4) requires a minimum active TSP volume of $\geq$ 126 ft^3. The TSP storage baskets at FCS have a maximum capacity of 131.9 ft^3. Future fuel and core designs are expected to increase the reactor coolant system (RCS) hot zero power (HZP) critical boron concentration (CBC) at the beginning of cycle (BOC). This in turn will require additional TSP volume at BOC to maintain a pH greater than or equal to 7.0. With the current requirement for $\geq$ 126 ft^3 of TSP, it is necessary to fill the baskets to their maximum capacity of 131.9 ft^3 at BOC to compensate for the effects of densification. Increasing the required volume of TSP beyond 126 ft^3 will further decrease the margin (volume of TSP above that required by TSs) meant to compensate for densification. If the volume of TSP required by TS 2.3(4) were based on the amount needed at BOC for the new fuel/core designs, this reduction in the densification margin would likely result in failure of the surveillance test (TS 3.6(2)d.(i)) measuring volume at the end of cycle (EOC).

To maintain or increase TSP margin, the maximum capacity of TSP could be increased by adding an additional basket to containment. However, increasing the maximum capacity of TSP would result in a pH greater than 7.5 at EOC when the HZP CBC is significantly lower. This would non-conservatively impact equipment environmental qualification (EEQ) considerations by making the containment sump pH too basic.

Allowing the required volume of TSP to trend downward during the operating cycle with decreasing HZP CBC will enable the containment sump to achieve a pH $\geq$ 7.0 but less than 7.5 in a post-loss-of-coolant accident (LOCA) environment.

This ensures that all borated water and acid sources are neutralized without impacting EEQ considerations. This option also provides adequate margin to compensate for the effect of densification.

The proposed revision incorporates a new figure (Figure 2-3) that shows the minimum required volume of TSP versus reactor coolant system HZP CBC over the operating cycle. The TSP volume requirements outlined in Figure 2-3 bound expected HZP CBC for any operating cycle. Based on historical data, the beginning of cycle HZP CBC is bounded by 1800 ppm and the EOC is bounded by 550 ppm. Thus, these points were chosen to generate the curve. The end of cycle HZP CBC could be less than 550 ppm so the curve is extended as a horizontal line at this point. Thus, the minimum required volume of TSP does not decrease below that required at a HZP CBC level of 550 ppm. It is proposed to revise TS 2.3(4) and TS 3.6(2)d.(i) to require compliance with Figure 2-3 during Operating Modes 1 and 2. Corresponding Basis changes are also proposed.

2.0 DESCRIPTION OF PROPOSED AMENDMENT

The proposed amendment deletes the term "dodecahydrate" from TS 2.3(4) and revises the Basis of TS 2.3 to require TSP that is of the hydrated form (45 - 57% moisture). These changes make TS 2.3(4) and its Basis consistent with NUREG-1432, Rev. 2, "Standard Technical Specifications Combustion Engineering Plants," which does not require a specific type of TSP. TS 2.3(4) also requires adherence to a new figure (Figure 2-3) that graphs the minimum required volume of TSP versus HZP CBC over the operating cycle. The TSP volume requirements outlined in Figure 2-3 bound expected HZP CBC for any operating cycle. Based on historical data, the beginning of cycle HZP CBC is bounded by 1800 ppm and EOC is bounded by 550 ppm. Thus these points were chosen to generate the curve.

The end of cycle HZP CBC could be less than 550 ppm so the curve is extended as a horizontal line at this point so that the volume of TSP required by TS 2.3(4) cannot be less than the amount required at a HZP CBC value of 550 ppm. The surveillance requirement of TS 3.6(2)d.(i) verifies that the volume of TSP is in compliance with Figure 2-3. Corresponding Basis changes to TS 3.6 are also proposed. The proposed changes are described below. A markup and clean copy of the TS pages are included in Attachments 2 and 3 respectively.

The title of TS 2.3(4) "Trisodium Phosphate Dodecahydrate (TSP)," is revised to delete the term "Dodecahydrate."

TS 2.3(4) is revised to read: "During Operating Modes 1 and 2, the TSP baskets shall contain a volume of active TSP that is within the area of acceptable operation shown in Figure 2-3".

The Basis of TS 2.3 is revised to delete the term "dodecahydrate." The Basis of TS 2.3 is revised to incorporate information from the Basis of 3.5.5 of NUREG-1432, Rev. 2 by stating: "The hydrated form (45-57% moisture) of TSP is used because of the high humidity in the containment building during normal operation. Since the TSP is hydrated, it is less likely to absorb large amounts of water from the humid atmosphere and will undergo less physical and chemical change than the anhydrous form of TSP."

A new Figure (Figure 2-3) is proposed for TS 2.3 to show the areas of acceptable and unacceptable operation for the volume of TSP required over the operating cycle versus HZP CBC.

TS 3.6(2)d.(i) is revised to read: "Verifying that the trisodium phosphate (TSP) baskets contain a volume of granular TSP that is within the area of acceptable operation of Figure 2-3".

The Basis of TS 3.6 is revised to provide additional detail concerning surveillance of TSP volume. Due to the revised volume of TSP required by TS 2.3(4), the description of pH testing of TSP samples in the Basis of TS 3.6 is also being revised.

3.0 BACKGROUND

FCS performs a core reload analysis for every operating cycle. Each core reload analysis determines many cycle operating parameters and limits. One of the limits determined by the core reload analysis is HZP CBC that is updated each cycle in Technical Data Book (TDB)-II, "Reactivity Curves," (Reference 10.1). The HZP CBC is the most limiting CBC and decreases approximately linearly over the operating cycle with core burnup.

The HZP CBC, together with other plant parameters, is then used in the core reload analysis to verify the TS 2.3(4) requirement for the minimum volume of active TSP required in the containment sump storage baskets. TSP is required to establish pH ≥ 7.0 in the containment sump after a LOCA to counteract the effect of the post LOCA generated acids and maintain the sump water at a neutral pH. The minimum required TSP volume is a function of several different factors including:

- The cycle specific HZP CBC,
- The cumulative maximum volumes, temperatures and maximum boron concentrations of borated water sources such as the RCS, the safety injection refueling water tank (SIRWT), safety injection tanks (SITs) and boric acid storage tanks (BASTs), and
- The acids generated from the degradation of electrical cable jackets post-LOCA and radiolysis of air.

System Description

After a LOCA, the components of the core cooling and containment spray systems will be exposed to high temperature borated water. Prolonged exposure to the core cooling water combined with stresses imposed on the components can cause stress corrosion cracking (SCC). SCC is a function of stress, oxygen and chloride concentrations, pH, temperature, and alloy composition of the components. High temperatures and low pH, which would be present after a LOCA, tend to promote SCC, which can lead to the failure of necessary safety systems or components.

The TSP is stored in stainless steel wire mesh dissolving baskets located in the containment on the basement level near the outer wall. The baskets have a maximum capacity of 131.9 ft^3, which is based on the EEQ consideration of maintaining pH below 7.5

As it fills containment, the safety injection water dissolves the TSP. Mixing is achieved as the solution is continuously recirculated. Control of pH is critical for the compatibility of the recirculation water with equipment located in containment. Post-accident containment sump pH values substantially greater than 7.0 may affect the EEQ and hydrogen generation design basis (Reference 10.2).

TSP neutralizes the recirculation water in the containment sump after a LOCA by adjusting the pH of the water to $\geq$ 7.0. This prevents significant amounts of iodine, released from failed fuel and dissolved in the recirculation water, from converting to a volatile form and evolving into the containment atmosphere. High levels of airborne iodine in containment could increase the radiological consequences of the accident. A pH $\geq$ 7.0 is also necessary to prevent SCC of austenitic stainless steel components located in containment, which could increase the probability of component failure.

Radiation levels in containment following a LOCA may cause the generation of hydrochloric and nitric acids from radiolysis of cable insulation and air. TSP mixed in the recirculation water neutralizes these acids.

USAR References

USAR Section 4.4.3 "Prevention of Stress Corrosion Cracking" (Reference 10.2), specifies that the containment baskets contain a minimum of 126 ft^3 of TSP. USAR Section 4.6 "Specific References" lists the calculations and engineering analyses that support plant operation with the present volume of TSP.

Existing Operating Condition

FCS is currently licensed to operate with the dodecahydrate form of TSP at a minimum TSP volume of $\geq$ 126 ft^3 and performs a surveillance test on a refueling frequency to verify that the baskets contain this volume. In addition, TS 3.6(2)d requires a chemistry test to ensure the solubility and buffering ability of the TSP after exposure to the containment environment. The baskets are then filled to their maximum capacity with 131.9 ft^3 of TSP. Surveillance test results show that the volume of TSP in the baskets typically decreases by approximately 5% (due to densification) over the core operating cycle from the "as-left" volume. Filling the baskets to their maximum capacity ensures that the current minimum required 126 ft^3 of TSP will be met when the "as found" volume is measured.

Proposed Operating Conditions

The term "dodecahydrate" is proposed for deletion from TS 2.3(4) and the Basis of TS 2.3. The Basis of TS 2.3 is revised to state that the hydrated form (45-57% moisture) is used because of high humidity in the containment building during normal operation. These changes make TS 2.3(4) and its Basis consistent with NUREG-1432, Rev. 2, (LCO/Basis of 3.5.5), which does not specify the type of TSP required. At BOC with future fuel/core designs, the higher concentration of boron in the RCS will require more TSP than currently required to achieve a pH of 7.0 or greater in the containment sump post LOCA. However, as EOC approaches, boron concentration in the RCS decreases and less TSP is required to perform the same function. Requiring the quantity of TSP in the baskets to comply with Figure 2-3 ensures that a sufficient quantity of TSP is available at any point in the operating cycle to neutralize the recirculation water without adversely impacting EEQ considerations.

4.0 REGULATORY REQUIREMENTS & GUIDANCE

The changes to TS 2.3(4), TS 3.6(2)d and their Basis sections are consistent with the applicable regulatory requirement in NUREG 0800, Section 6.5.2, "Containment Spray as a Fission Product Cleanup System." Subsection II.1.g specifies that the pH of all solutions in the containment sump and all additives for reactivity control, fission product removal, or other purposes (boric acid) should be maintained at a level high enough to assure that significant long-term iodine re-evolution does not occur. Long-term iodine retention may be assumed only when the equilibrium sump solution pH, after mixing and dilution with primary coolant and emergency core cooling system (ECCS) injection sources (SIRWT, SITs, and BASTs), is above 7.0.

OPPD calculations (Reference 10.7) conservatively assume that all borated water sources are at their maximum volume and maximum administrative limit of boric acid concentration in calculating the volume of TSP required to achieve recirculation water $pH \geq 7.0$.

No other regulatory requirements or regulatory guidance were identified to be applicable to these TS changes.

5.0 TECHNICAL ANALYSIS

5.1 Design Basis

The proposed change to TS 2.3(4) and its Basis section, which deletes reference to the dodecahydrate form of TSP is consistent with NUREG-1432, Rev. 2. The Basis of LCO 3.5.5 of NUREG-1432, Rev. 2 specifies that the hydrated form (45-57% moisture) of TSP is used because of high humidity in the containment building during normal operation. Since the TSP is hydrated, it is less likely to absorb large amounts of water from the humid atmosphere and will undergo less physical and chemical change than the anhydrous form of TSP.

TS 2.3(4) is also revised to replace the volume of active TSP currently required ($\geq$ 126 ft^3) with a requirement to comply with Figure 2-3. Figure 2-3 shows the minimum required volume of TSP as HZP CBC decreases over the operating cycle. Compliance with Figure 2-3 will ensure that containment sump pH is $\geq$ 7.0 but < 7.5 to meet EEQ and hydrogen generation design basis objectives. The changes to TS 3.6(2)d.(i) and the Basis of TS 3.6 will verify the volume of TSP in accordance with Figure 2-3 and verify the ability of the TSP to adjust pH.

The higher RCS boron concentration necessitated by new fuel and core designs will increase the HZP CBC at BOC (bounded by 1800 ppm) and require more TSP in the baskets. This additional TSP is unnecessary at EOC since HZP CBC is significantly lower (bounded by 550 ppm). Raising the minimum TSP requirement for the entire cycle will reduce the margin between the maximum capacity of the baskets and the minimum TSP volume required by TS 2.3(4). This margin is necessary to account for densification (agglomeration) of the TSP over the core operating cycle. Surveillance test results show that densification can account for a 5% loss in TSP over the operating cycle. Thus, a reduction in this margin could result in an inadequate amount of TSP at the EOC.

One option that was considered was to increase the maximum capacity of TSP by adding an additional basket. However, increasing the maximum capacity of TSP by adding another basket would result in a pH greater than 7.5 at EOC when HZP CBC is significantly lower. This would negatively impact EEQ and hydrogen generation design basis assumptions by making the containment sump too basic. Therefore, this option was rejected.

Another option that was considered was to have a TSP requirement that trends downward with decreasing HZP CBC. This provides adequate margin to account for densification and maintains pH between 7.0 and 7.5. This option is the basis for the license amendment request.

The proposed amendment meets regulatory and FCS design basis requirements. Throughout the operating cycle, the amendment requires a volume of TSP sufficient to neutralize all sources of borated water and acids formed from post LOCA degradation of electrical cable jackets and radiolysis of air. The amendment will maintain recirculation water pH below the maximum value assumed in the EEQ analysis.

This amendment credits the trend of the reactor coolant system HZP CBC to decrease with core burnup over the operating cycle in calculating the minimum required volume of TSP.

OPPD's evaluation encompassed a three step approach:

1. A new calculation (Reference 10.3) determined the boric acid concentration in the containment sump post LOCA considering the TS and administrative limits for all borated water sources. The design basis formula for calculating this value is established and controlled in Reference 10.4.

2. A second new calculation (Reference 10.5) established the nature of the TSP/boric acid relationship based on the original referenced calculation for the TSP volume needed to raise pH ≥ to 7.0 in the containment sump post LOCA (Reference 10.6).

3. An engineering analysis (Reference 10.7) incorporated the results of the above calculations (References 10.3 and 10.5) into a trend. The trend relates the boric acid maximum administrative limits (in ppm) for containment sump water sources to the TSP volume needed to raise pH ≥ 7.0 in the containment sump post LOCA.

The values of the refueling boric acid maximum administrative limits used as inputs to the analysis are as follows:

SIRWT	2350 ppm
SITs	2350 ppm
BASTs	4.5 wt% (7867.53 ppm)
RCS	Over the range of 550 – 1800 ppm (bounding values over the refueling cycle and re-verified by OPPD for each cycle)

OPPD's engineering analysis determined that compliance with Figure 2-3 will continue to provide a neutral or very slightly basic pH in the containment sump post LOCA. While the end of cycle HZP CBC could be somewhat less than 550 ppm, the allowable volume of TSP is not reduced below that required at 550 ppm as indicated by the horizontal line on Figure 2-3.

5.2 Risk Information

The scope, level of detail, and technical methods of the calculations (References 10.3 and 10.5) and the associated engineering analysis (Reference 10.7), conducted to justify the proposed TS change, are based on the as-built and asoperated and maintained plant, and reflect the operating experience at FCS. Assumptions, inputs and conclusions in the calculations and the associated engineering analysis were reviewed and independently verified. A risk-informed approach with the use of probabilistic risk assessment (PRA) or sensitivity study was not considered.

The original calculation (Reference 10.6) that stated the required TSP volume needed to raise containment sump pH $\geq$ 7.0 post-LOCA for specified containment sump boric acid concentrations included a QA independent verification of results.

6.0 REGULATORY ANALYSIS

The technical analysis and risk information provided in Section 5.0 satisfies all applicable regulatory requirements and guidance concerning the type and volume of active TSP required in the containment sump to ensure post LOCA recirculation water pH $\geq$ 7.0. Section 5.0 also explains why the post LOCA recirculation water pH must not exceed 7.5. OPPD verifies the TSP volume requirements every operating cycle based on the HZP CBC cycle limits as part of its core reload analysis process per Reference 10.4. Any change to the volume of TSP versus HZP CBC curve shown in Figure 2-3 would require a license amendment.

The proposed changes are limited in scope to the type and volume of active TSP required when FCS is in Operating Modes 1 and 2 during the operating cycle. As such, FCS must continue to perform all other currently approved TSP verification requirements. These requirements are performed on a refueling frequency and include:

1. Visually determining that the volume of active TSP required by Figure 2-3 is contained in the baskets and,

2. Performing a chemistry analysis to ensure the solubility and buffering ability of the TSP after exposure to the containment environment.

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 of the health and safety of the public.

7.0 NO SIGNIFICANT HAZARDS CONSIDERATION

OPPD has evaluated whether or not a significant hazards consideration is involved with the proposed amendment by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of Amendment," as discussed below:

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

Response: No

There are no changes to the design or operation of the plant that could affect system, component, or accident functions as a result of deleting the requirement for the "dodecahydrate" form of TSP, or replacing the volume of active TSP required during Operating Modes 1 and 2 with an amount dependent upon HZP CBC as shown in Figure 2-3. All systems and components function as designed and the performance requirements have been evaluated and found to be acceptable. Hydrated TSP in the range of 45 – 57% moisture content will maintain pH $\geq$ 7.0 in the recirculation water following a LOCA. This function is maintained with the proposed change. Allowing the required volume of active TSP to decrease over the operating cycle as HZP CBC decreases will ensure that the pH of the containment sump is $\geq$ 7.0 yet provides additional margin for EEQ concerns as containment sump pH is less likely to exceed 7.5.

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

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

Response: No

No new accident scenarios, failure mechanisms, or single failures are introduced as a result of the proposed change. All systems, structures, and components previously required for mitigation of an event remain capable of fulfilling their intended design function with this change to the TS. The proposed change has no adverse effects on any safety-related systems or component and does not challenge the performance or integrity of any safety related system. The proposed change has evaluated the TSP configuration such that no new accident scenarios or single failures are introduced.

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

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

Response: No

Deleting the requirement for the "dodecahydrate" form of TSP and allowing the required volume of active TSP to decrease as HZP CBC decreases still ensures that the pH of the containment sump is ≥ 7.0. Hydrated TSP in the range of 45 – 57% moisture content will maintain pH ≥ 7.0 in the recirculation water following a LOCA. This change provides additional margin for EEQ concerns as containment sump pH is less likely to exceed 7.5. Therefore, this change does not involve a significant reduction in the margin of safety. Evaluations were made that indicate that the margin for pH control is not altered by the proposed changes. A TSP volume that is dependent on HZP CBC has been evaluated with respect to neutralization of all borated water and acid sources. These evaluations concluded that there would be no impact on pH control, and hence no reduction in the margin of safety related to post LOCA conditions.

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

CONCLUSION: Operation of FCS in accordance with the proposed amendment will not result in a significant increase in the probability or consequences of any accident previously analyzed; will not result in a new or different kind of accident previously analyzed; and does not result in a significant reduction in a margin of safety.

Based on the above, OPPD concludes that the proposed amendment to delete the requirement for the "dodecahydrate" form of TSP and replace the required volume of TSP with a volume dependent upon HZP CBC as shown in Figure 2-3 presents no 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.

8.0 ENVIRONMENTAL CONSIDERATION

A review has determined that the proposed amendment would not 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 not change an inspection or surveillance requirement. The design function of the TSP storage baskets located in containment will not change nor does OPPD intend to change its current practice for filling the baskets with active TSP. The proposed amendment will delete the requirement for TSP of the dodecahydrate form and instead specify that hydrated TSP (45 -57% moisture content) is required. The proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent 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 assessment needs to be prepared in connection with the proposed amendment.

9.0 PRECEDENT

None.

10.0 REFERENCES

10.1 TDB-II, "Reactivity Curves"

10.2 FCS Updated Safety Analysis Report (USAR), Section 4.4.3

10.3 FCS FC06920, Revision 0, 9/11/03, "Containment Sump Boric Acid Concentration Post LOCA"

10.4 PED-NEI-4, "Interface Requirements for Reload Analysis Process"

10.5 FCS FC06921, Revision 0, 9/11/03, "Tri-Sodium Phosphate (TSP) Volume Needed to Neutralize Containment Sump Acids Post LOCA"

10.6 ABB Calculation O-PENG-CALC-002, Revision 1, 12/04/95, "Calculation of Tri-Sodium Phosphate Dodecahydrate Concentrations as a Function of Boric Acid Concentrations and pH Values"

10.7 FCS EA-FC-03-041, 10/14/03, "Minimum Trisodium Phosphate (TSP) Volume Required in Containment Sump as a Function of RCS Critical Boron Concentration (ARO, HZP, No Xenon)"

Markup of Technical Specification Pages

TECHNICAL SPECIFICATIONS - FIGURES

TABLE OF CONTENTS

Amendment No. ~~116,126,131,141,161,170,~~
~~172,188,192,197,207,221~~

2.0 LIMITING CONDITIONS FOR OPERATION
2.3 Emergency Core Cooling System (Continued)

(3) Protection Against Low Temperature Overpressurization

The following limiting conditions shall be applied during scheduled heatups and cooldowns. Disabling of the HPSI pumps need not be required if the RCS is vented through at least a 0.94 square inch or larger vent.

Whenever the reactor coolant system cold leg temperature is below 350°F, at least one (1) HPSI pump shall be disabled.

Whenever the reactor coolant system cold leg temperature is below 320°F, at least two (2) HPSI pumps shall be disabled.

Whenever the reactor coolant system cold leg temperature is below 270°F, all three (3) HPSI pumps shall be disabled.

In the event that no charging pumps are operable when the reactor coolant system cold leg temperature is below 270°F, a single HPSI pump may be made operable and utilized for boric acid injection to the core, with flow rate restricted to no greater than 120 gpm.

(4) Trisodium Phosphate (TSP) ~~Dodecahydrate~~

During operating Modes 1 and 2, the TSP baskets shall contain ~~≥ 126 ft³~~ a volume of active TSP that is within the area of acceptable operation shown in Figure 2-3.

a. With the above TSP requirements not within limits, the TSP shall be restored within 72 hours.

b. With Specification 2.3(4)a required action and completion time not met, the plant shall be in hot shutdown within the next 6 hours and cold shutdown within the following 36 hours.

Basis

The normal procedure for starting the reactor is to first heat the reactor coolant to near operating temperature by running the reactor coolant pumps. The reactor is then made critical. The energy stored in the reactor coolant during the approach to criticality is substantially equal to that during power operation and therefore all engineered safety features and auxiliary cooling systems are required to be fully operable.

2.0 LIMITING CONDITIONS FOR OPERATION
2.3 Emergency Core Cooling System (Continued)

With respect to the core cooling function, there is functional redundancy over most of the range of break sizes.[(3)(4)]

The LOCA analysis confirms adequate core cooling for the break spectrum up to and including the 32 inch double-ended break assuming the safety injection capability which most adversely affects accident consequences and are defined as follows. The entire contents of all four safety injection tanks are assumed to be available for emergency core cooling, but the contents of one of the tanks is assumed to be lost through the reactor coolant system. In addition, of the three high-pressure safety injection pumps and the two low-pressure safety injection pumps, for both large break analysis and small break analysis it is assumed that one high pressure pump and one low pressure pump operate [(5)]; and also that 25% of their combined discharge rate is lost from the reactor coolant system out of the break. The transient hot spot fuel clad temperatures for the break sizes considered are shown in USAR Section 14.

The restriction on HPSI pump operability at low temperatures, in combination with the PORV setpoints ensure that the reactor vessel pressure-temperature limits would not be exceeded in the case of an inadvertent actuation of the operable HPSI and charging pumps.

Removal of the reactor vessel head, one pressurizer safety valve, or one PORV provides sufficient expansion volume to limit any of the design basis pressure transients. Thus, no additional relief capacity is required.

Technical Specification 2.2(1) specifies that, when fuel is in the reactor, at least one flow path shall be provided for boric acid injection to the core. Should boric acid injection become necessary, and no charging pumps are operable, operation of a single HPSI pump would provide the required flow path. The HPSI pump flow rate must be restricted to that of three charging pumps in order to minimize the consequences of a mass addition transient while at low temperatures.

Trisodium Phosphate (TSP) ~~dodecahydrate~~ is required to adjust the pH of the recirculation water to ≥ 7.0 after a loss of coolant accident (LOCA). This pH value is necessary to prevent significant amounts of iodine, released from fuel failures and dissolved in the recirculation water, from converting to a volatile form and evolving into the containment atmosphere. Higher levels of airborne iodine in containment may increase the releases of radionuclides and the consequences of the accident. A pH of ≥ 7.0 is also necessary to prevent stress corrosion cracking (SCC) of austenitic stainless steel components in containment. SCC increases the probability of failure of components.

The hydrated form (45-57% moisture) of TSP is used because of the high humidity in the containment building during normal operation. Since the TSP is hydrated, it is less likely to absorb large amounts of water from the humid atmosphere and will undergo less physical and chemical change than the anhydrous form of TSP.

Radiation levels in containment following a LOCA may cause the generation of hydrochloric and nitric acids from radiolysis of cable insulation and sump water. TSP will neutralize these acids.

The required amount of TSP is represented in a volume quantity converted from the Reference 7 mass quantity using the manufactured density. Verification of this amount during surveillance testing utilizes the measured volume.

3.0 **SURVEILLANCE REQUIREMENTS**
3.6 Safety Injection and Containment Cooling Systems Tests (continued)

(i) Verifying that the trisodium phosphate (TSP) baskets contain ~~≥126 ft³ of~~ a volume of granular ~~trisodium phosphate dodecahydrate~~ TSP that is within the area of acceptable operation of Figure 2-3.

(ii) Verifying that a sample from the TSP baskets provides adequate pH upward adjustment of the recirculation water.

3.0 SURVEILLANCE REQUIREMENTS

3.6 Safety Injection and Containment Cooling Systems Tests (Continued)

Operation of the system for 10 hours every month will demonstrate operability of the filters and adsorbers system and remove excessive moisture build-up on the adsorbers.

Demonstration of the automatic initiation capability will assure system availability.

Periodic determination of the volume of TSP in containment must be performed due to the possibility of leaking valves and components in the containment building that could cause dissolution of the TSP during normal operation.

A refueling frequency shall be utilized to visually determine that ~~≥ 126 ft³ of TSP is contained in the TSP baskets.~~ the volume of TSP contained in the TSP baskets is within the area of acceptable operation based on the TSP volume required by Figure 2-3. A measured value or the Technical Data Book (TDB) II, "Reactivity Curves" may be used to obtain a hot zero power (HZP) critical boron concentration (CBC). The "as found" volume of TSP must be within the area of acceptable operation of Figure 2-3 using this HZP CBC value. Prior to exiting the refueling outage, another visual TSP volume determination is performed to ensure that the "as-left" volume of TSP contained in the baskets is ≥ 128.3 ft³. This requirement ensures that there is an adequate quantity of TSP to adjust the pH of the post-LOCA sump solution to a value ≥ 7.0 for HZP CBC up to 1800 ppm.

The periodic pH verification is also required on a refueling frequency. Operating experience has shown this surveillance frequency acceptable due to margin in the volume of TSP placed in the containment building.

~~Testing must be performed to ensure the solubility and buffering ability of the TSP after exposure to the containment environment. A~~ An "as left" representative sample of ~~1.76–1.79~~ 1.78 -1.81 grams of TSP from one of the baskets in containment is submerged in 0.99-1.01 liters of water at a boron concentration of ~~2415 – 2435~~ 2439 - 2459 ppm (equivalent to a RCS boron concentration of 1800 ppm - Figure 2-3). At a standard temperature of 115-125°F, without agitation, the solution should be left to stand for 4 hours. The liquid is then decanted and mixed, the temperature adjusted to 75 - 79°F and the pH measured. At this point the pH must be ≥ 7.0. The representative sample weight is based on the minimum required TSP weight at the beginning of cycle of ~~6,672~~ 6,800 lbs_m which, at a manufactured density of at least 53.0 lb_m/ft^3 corresponds to the minimum volume of ~~126~~ 128.3 ft³, and maximum possible post-LOCA sump volume of 397,183 gallons, normalized to buffer a 1.0 liter sample.

Testing of the "as found" condition must be performed to ensure the solubility and buffering ability of the TSP after exposure to the containment environment. The "as found" test is performed in the same manner as the "as left" test. However, a different sample size and boron concentration is used based on the end of cycle HZP CBC. The representative sample size, boron concentration of sample water, minimum required TSP weight, and minimum volume of TSP are all a function of the end of cycle HZP CBC as specified in EA-FC-03-041. The "as found" volume of TSP corresponds to the maximum possible boron concentration corresponding to the maximum possible post-LOCA sump volume of 397,183 gallons, normalized to a buffer a 1.0 liter sample.

The boron concentration of the test water is representative of the maximum possible boron concentration corresponding to the maximum possible post-LOCA sump volume. The post-LOCA sump volume originates from the Reactor Coolant System (RCS), the Safety Injection Refueling Water Tank (SIRWT), the Safety Injection Tanks (SITs) and the Boric Acid Storage Tanks (BASTs). The maximum post-LOCA sump boron concentration is based on a cumulative boron concentration in the RCS, SIRWT, SITs and BASTs of ~~2425~~ 2449 ppm at beginning of cycle (HZP CBC = 1800 ppm) and 2333 ppm at end of cycle (HZP CBC ≤ 550 ppm). These values are based on the SIRWT and SITs at 2350 ppm and the BASTS at 4.5 wt. % boron. Agitation of the test solution is prohibited, since an adequate standard for agitation intensity cannot be specified. The test time of 4 hours is necessary to allow time for the dissolved TSP to naturally diffuse through the sample solution. In the post-LOCA containment sump, rapid mixing would occur, significantly decreasing the actual amount of time before the required pH is achieved. This would ensure achieving a pH ≥ 7.0 by the onset of recirculation after a LOCA.

References

(1) USAR, Section 6.2
(2) USAR, Section 6.3
(3) USAR, Section 14.16
(4) USAR, Section 6.4
(5) EA-FC-03-041, 10/14/03, "Minimum Trisodium Phosphate (TSP) Volume Required in Containment Sump as a Function of RCS Critical Boron Concentration (ARO, HZP, No Xenon)"

Proposed Technical Specifications

TECHNICAL SPECIFICATIONS - FIGURES

TABLE OF CONTENTS

Amendment No. ~~116,126,131,141,161,170,~~
~~172,188, 192,197,207,221~~

2.0 LIMITING CONDITIONS FOR OPERATION

2.3 Emergency Core Cooling System (Continued)

(3) Protection Against Low Temperature Overpressurization

The following limiting conditions shall be applied during scheduled heatups and cooldowns. Disabling of the HPSI pumps need not be required if the RCS is vented through at least a 0.94 square inch or larger vent.

Whenever the reactor coolant system cold leg temperature is below 350°F, at least one (1) HPSI pump shall be disabled.

Whenever the reactor coolant system cold leg temperature is below 320°F, at least two (2) HPSI pumps shall be disabled.

Whenever the reactor coolant system cold leg temperature is below 270°F, all three (3) HPSI pumps shall be disabled.

In the event that no charging pumps are operable when the reactor coolant system cold leg temperature is below 270°F, a single HPSI pump may be made operable and utilized for boric acid injection to the core, with flow rate restricted to no greater than 120 gpm.

(4) Trisodium Phosphate (TSP)

During operating Modes 1 and 2, the TSP baskets shall contain a volume of active TSP that is within the area of acceptable operation shown in Figure 2-3.

a. With the above TSP requirements not within limits, the TSP shall be restored within 72 hours.

b. With Specification 2.3(4)a required action and completion time not met, the plant shall be in hot shutdown within the next 6 hours and cold shutdown within the following 36 hours.

Basis

The normal procedure for starting the reactor is to first heat the reactor coolant to near operating temperature by running the reactor coolant pumps. The reactor is then made critical. The energy stored in the reactor coolant during the approach to criticality is substantially equal to that during power operation and therefore all engineered safety features and auxiliary cooling systems are required to be fully operable.

2.0 LIMITING CONDITIONS FOR OPERATION
2.3 Emergency Core Cooling System (Continued)

With respect to the core cooling function, there is functional redundancy over most of the range of break sizes.[(3)(4)]

The LOCA analysis confirms adequate core cooling for the break spectrum up to and including the 32 inch double-ended break assuming the safety injection capability which most adversely affects accident consequences and are defined as follows. The entire contents of all four safety injection tanks are assumed to be available for emergency core cooling, but the contents of one of the tanks is assumed to be lost through the reactor coolant system. In addition, of the three high-pressure safety injection pumps and the two low-pressure safety injection pumps, for both large break analysis and small break analysis it is assumed that one high pressure pump and one low pressure pump operate (5); and also that 25% of their combined discharge rate is lost from the reactor coolant system out of the break. The transient hot spot fuel clad temperatures for the break sizes considered are shown in USAR Section 14.

The restriction on HPSI pump operability at low temperatures, in combination with the PORV setpoints ensure that the reactor vessel pressure-temperature limits would not be exceeded in the case of an inadvertent actuation of the operable HPSI and charging pumps.

Removal of the reactor vessel head, one pressurizer safety valve, or one PORV provides sufficient expansion volume to limit any of the design basis pressure transients. Thus, no additional relief capacity is required.

Technical Specification 2.2(1) specifies that, when fuel is in the reactor, at least one flow path shall be provided for boric acid injection to the core. Should boric acid injection become necessary, and no charging pumps are operable, operation of a single HPSI pump would provide the required flow path. The HPSI pump flow rate must be restricted to that of three charging pumps in order to minimize the consequences of a mass addition transient while at low temperatures.

Trisodium Phosphate (TSP) is required to adjust the pH of the recirculation water to ≥ 7.0 after a loss of coolant accident (LOCA). This pH value is necessary to prevent significant amounts of iodine, released from fuel failures and dissolved in the recirculation water, from converting to a volatile form and evolving into the containment atmosphere. Higher levels of airborne iodine in containment may increase the releases of radionuclides and the consequences of the accident. A pH of ≥ 7.0 is also necessary to prevent stress corrosion cracking (SCC) of austenitic stainless steel components in containment. SCC increases the probability of failure of components.

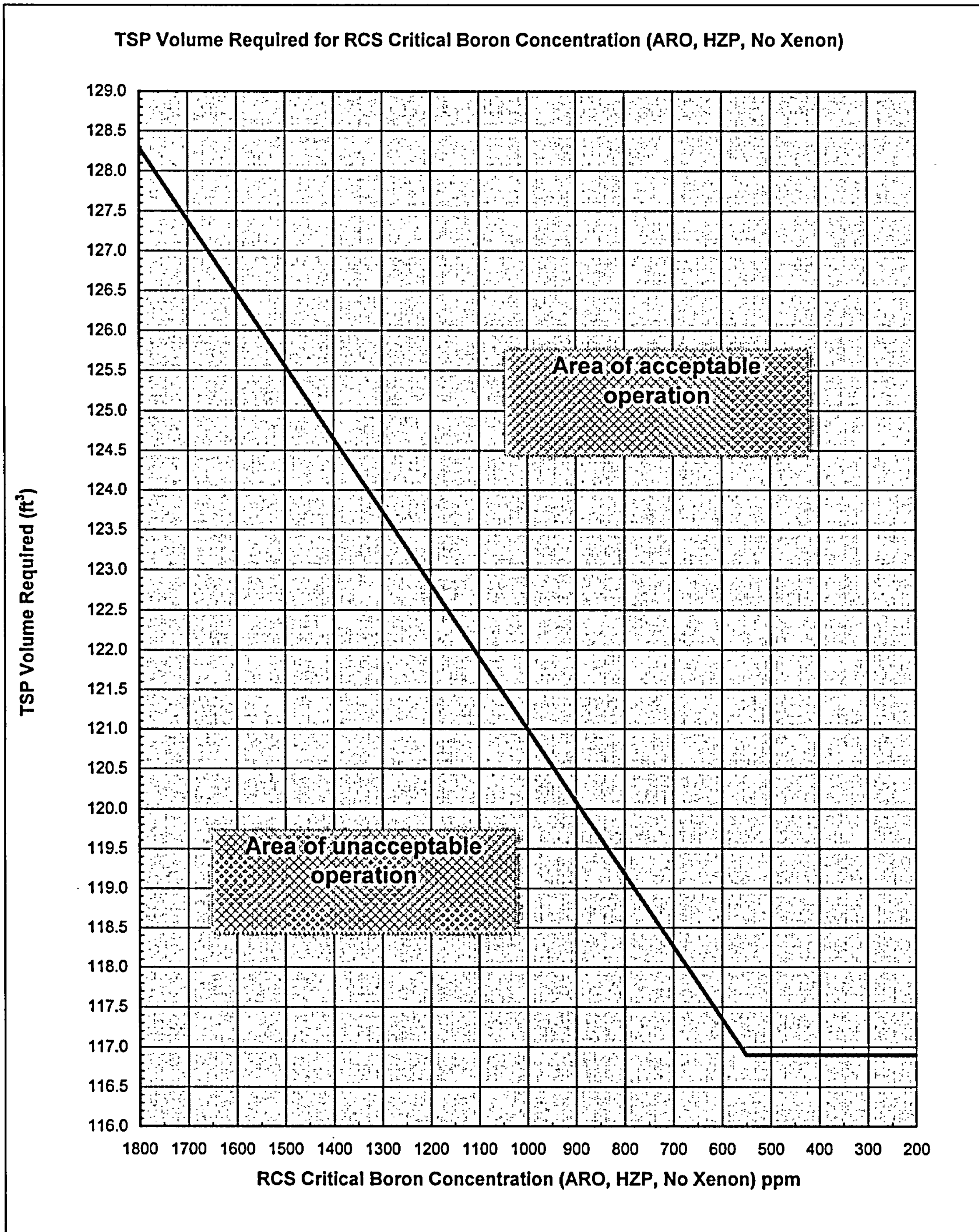
The hydrated form (45-57% moisture) of TSP is used because of the high humidity in the containment building during normal operation. Since the TSP is hydrated, it is less likely to absorb large amounts of water from the humid atmosphere and will undergo less physical and chemical change than the anhydrous form of TSP.

Radiation levels in containment following a LOCA may cause the generation of hydrochloric and nitric acids from radiolysis of cable insulation and sump water. TSP will neutralize these acids.

The required amount of TSP is represented in a volume quantity converted from the Reference 7 mass quantity using the manufactured density. Verification of this amount during surveillance testing utilizes the measured volume.

Amendment No. ~~39,47,64,74,77,100,161,~~
~~179, 201~~

Figure 2-3


TSP Volume Required for RCS Critical Boron Concentration (ARO, HZP, No Xenon)
TSP Volume Required (ft³)
129.0
128.5
128.0
127.5
127.0
126.5
126.0
125.5
125.0
124.5
124.0
123.5
123.0
122.5
122.0
121.5
121.0
120.5
120.0
119.5
119.0
118.5
118.0
117.5
117.0
116.5
116.0
1800 1700 1600 1500 1400 1300 1200 1100 1000 900 800 700 600 500 400 300 200
RCS Critical Boron Concentration (ARO, HZP, No Xenon) ppm
Area of acceptable operation
Area of unacceptable operation

3.0 **SURVEILLANCE REQUIREMENTS**
3.6 Safety Injection and Containment Cooling Systems Tests (continued)

(ii) Verifying that the trisodium phosphate (TSP) baskets contain a volume of granular TSP that is within the area of acceptable operation of Figure 2-3.

(ii) Verifying that a sample from the TSP baskets provides adequate pH upward adjustment of the recirculation water.

3.0 **SURVEILLANCE REQUIREMENTS**
3.6 Safety Injection and Containment Cooling Systems Tests (Continued)

Operation of the system for 10 hours every month will demonstrate operability of the filters and adsorbers system and remove excessive moisture build-up on the adsorbers.

Demonstration of the automatic initiation capability will assure system availability.

Periodic determination of the volume of TSP in containment must be performed due to the possibility of leaking valves and components in the containment building that could cause dissolution of the TSP during normal operation.

A refueling frequency shall be utilized to visually determine that the volume of TSP contained in the TSP baskets is within the area of acceptable operation based on the TSP volume required by Figure 2-3. A measured value or the Technical Data Book (TDB) II, "Reactivity Curves" may be used to obtain a hot zero power (HZP) critical boron concentration (CBC). The "as found" volume of TSP must be within the area of acceptable operation of Figure 2-3 using this HZP CBC value. Prior to exiting the refueling outage, another visual TSP volume determination is performed to ensure that the "as-left" volume of TSP contained in the baskets is ≥ 128.3 ft^3. This requirement ensures that there is an adequate quantity of TSP to adjust the pH of the post-LOCA sump solution to a value ≥ 7.0 for HZP CBC up to 1800 ppm.

The periodic pH verification is also required on a refueling frequency. Operating experience has shown this surveillance frequency acceptable due to margin in the volume of TSP placed in the containment building.

An "as left" representative sample of 1.78 -1.81 grams of TSP from one of the baskets in containment is submerged in 0.99-1.01 liters of water at a boron concentration of 2439 - 2459 ppm (equivalent to a RCS boron concentration of 1800 ppm - Figure 2-3). At a standard temperature of 115-125°F, without agitation, the solution should be left to stand for 4 hours. The liquid is then decanted and mixed, the temperature adjusted to 75 - 79°F and the pH measured. At this point the pH must be ≥ 7.0. The representative sample weight is based on the minimum required TSP weight at the beginning of cycle of 6,800 lbs_m which, at a manufactured density of at least 53.0 lb_m/ft^3 corresponds to the minimum volume of 128.3 ft^3, and maximum possible post-LOCA sump volume of 397,183 gallons, normalized to buffer a 1.0 liter sample.

3.0 SURVEILLANCE REQUIREMENTS

3.6 Safety Injection and Containment Cooling Systems Tests (Continued)

Testing of the "as found" condition must be performed to ensure the solubility and buffering ability of the TSP after exposure to the containment environment. The "as found" test is performed in the same manner as the "as left" test. However, a different sample size and boron concentration is used based on the end of cycle HZP CBC. The representative sample size, boron concentration of sample water, minimum required TSP weight, and minimum volume of TSP are all a function of the end of cycle HZP CBC as specified in EA-FC-03-041. The "as found" volume of TSP corresponds to the maximum possible boron concentration corresponding to the maximum possible post-LOCA sump volume of 397,183 gallons, normalized to a buffer a 1.0 liter sample.

The boron concentration of the test water is representative of the maximum possible boron concentration corresponding to the maximum possible post-LOCA sump volume. The post-LOCA sump volume originates from the Reactor Coolant System (RCS), the Safety Injection Refueling Water Tank (SIRWT), the Safety Injection Tanks (SITs) and the Boric Acid Storage Tanks (BASTs). The maximum post-LOCA sump boron concentration is based on a cumulative boron concentration in the RCS, SIRWT, SITs and BASTs of 2449 ppm at beginning of cycle (HZP CBC = 1800 ppm) and 2333 ppm at end of cycle (HZP CBC $\leq$ 550 ppm). These values are based on the SIRWT and SITs at 2350 ppm and the BASTs at 4.5 wt. % boron. Agitation of the test solution is prohibited, since an adequate standard for agitation intensity cannot be specified. The test time of 4 hours is necessary to allow time for the dissolved TSP to naturally diffuse through the sample solution. In the post-LOCA containment sump, rapid mixing would occur, significantly decreasing the actual amount of time before the required pH is achieved. This would ensure achieving a pH $\geq$ 7.0 by the onset of recirculation after a LOCA.

References

(1) USAR, Section 6.2
(2) USAR, Section 6.3
(3) USAR, Section 14.16
(4) USAR, Section 6.4
(5) EA-FC-03-041, 10/14/03, "Minimum Trisodium Phosphate (TSP) Volume Required in Containment Sump as a Function of RCS Critical Boron Concentration (ARO, HZP, No Xenon)"