Advanced Passive 1000 (AP1000)
Generic Technical Specification Traveler (GTST)

Title: Changes Related to LCO 3.6.9, pH Adjustment

I. Technical Specifications Task Force (TSTF) Travelers, Approved Since Revision 2 of STS NUREG-1431, and Used to Develop this GTST

TSTF Number and Title:

TSTF-425, Rev. 3, Relocate Surveillance Frequencies to Licensee Control - RITSTF Initiative 5b
TSTF-440-A, Rev. 0, Eliminate Bases Requirement for Performing a System Walkdown.

STS NUREGs Affected:

TSTF-425, Rev. 3: NUREG-1430, 1431, 1432, 1433, 1434
TSTF-440-A, Rev. 0: NUREG-1430, 1431, 1432

NRC Approval Date:

TSTF-425, Rev. 3: 06-Jul-09
TSTF-440-A, Rev. 0: 11-Oct-02

TSTF Classification:

TSTF-425, Rev. 3: Technical Change
TSTF-440-A, Rev. 0: Bases Only Change

II. Reference Combined License (RCOL) Standard Departures (Std. Dep.), RCOL COL Items, and RCOL Plant-Specific Technical Specifications (PTS) Changes Used to Develop this GTST

RCOL Std. Dep. Number and Title:

None

RCOL COL Item Number and Title:

None

RCOL PTS Change Number and Title:

VEGP LAR DOC A038:	SR 3.6.9.1 and SR 3.6.9.2 clarification revision
VEGP LAR DOC A089:	TS 3.6.9 Condition A revision
VEGP LAR DOC A090:	SR 3.6.9.1 revision for consistency with LCO statement
VEGP LAR DOC M13:	Combined TS 3.6.6 and TS 3.6.7
VEGP LAR DOC D08:	TS 3.6.9 chemical formula for TSP removed
VEGP LAR DOC L19:	TS 3.6.9 TSP unit of measure change

III. Comments on Relations Among TSTFs, RCOL Std. Dep., RCOL COL Items, and RCOL PTS Changes

This section discusses the considered changes that are: (1) applicable to operating reactor designs, but not to the AP1000 design; (2) already incorporated in the GTS; or (3) superseded by another change.

TSTF-425 is deferred for future consideration.

TSTF-440-A revises the Bases to remove specific requirements to perform a system walkdown when verifying that a flow path is isolated or that valves are in the correct position. The change deletes the words “through a system walkdown” from the Bases for STS (NUREG-1431) Surveillance Requirement (SR) 3.6.7.1. The AP1000 GTS 3.6.9 does not contain an equivalent SR. This change is not applicable and therefore is not incorporated into AP1000 GTS 3.6.9.

IV. Additional Changes Proposed as Part of this GTST (modifications proposed by NRC staff and/or clear editorial changes or deviations identified by preparer of GTST)

In the “Surveillance Requirements” section of the Bases, in the third sentence of the second paragraph “lbm/ft^3” is changed to “lbs/ft^3”.

APOG Recommended Changes to Improve the Bases

Throughout the Bases, references to Sections and Chapters of the FSAR do not include the “FSAR” modifier. Since these Section and Chapter references are to an external document, it is appropriate to include the acronym “FSAR” to modify “Section” and “Chapter” in references to the FSAR throughout the Bases. (DOC A003)

Revise the “Surveillance Requirements” section of the Bases, under heading “SR 3.6.8.2” delete the last sentence.

V. Applicability

Affected Generic Technical Specifications and Bases:

Section 3.6.9, pH Adjustment

Changes to the Generic Technical Specifications and Bases:

TS 3.6.9 is renumbered as TS 3.6.8. (DOC M13)

LCO 3.6.9 statement is revised to change the quantity of trisodium phosphate from volume to weight. (DOC L19)

Condition A and Required Action A.1 is revised to change “volume” to “weight” and clarify trisodium phosphate is in the pH adjustment baskets. (DOC L19 and DOC A089)

SR 3.6.9.1 is revised to remove the word “that”. The phrase “at least” is replaced with “≥” and the chemical formula for TSP is removed. (DOC A038, DOC A090, DOC L19, and DOC D08)

SR 3.6.9.2 is revised to remove the word “that”. (DOC A038)

TS 3.6.9 “LCO”, “Actions”, and “Surveillance Requirements” sections of the bases are revised to change the quantity of trisodium phosphate from volume to weight. (DOC L19)

In the “Surveillance Requirements” section of the Bases, in the third sentence of the second paragraph “lbm/ft^3” is changed to “lbs/ft^3”. (NRC staff proposed change)

The acronym “FSAR” is added to modify “Section” and “Chapter” in references to the FSAR throughout the Bases. (DOC A003) (APOG Comment)

The “Surveillance Requirements” section of the Bases, under heading “SR 3.6.8.2” the last sentence is deleted. (APOG Comment)

VI. Traveler Information

Description of TSTF changes:

None

Rationale for TSTF changes:

None

Description of changes in RCOL Std. Dep., RCOL COL Item(s), and RCOL PTS Changes:

VEGP LAR DOC A038 deletes the word “that” from SR 3.6.9.1 and SR 3.6.9.2.

VEGP LAR DOC A089 revises Required Action A.1 to refer to trisodium phosphate as “TSP” and add the phrase “in the pH adjustment baskets.” Also, the basis is revised to add the phrase “pH adjustment” before “baskets”.

VEGP LAR DOC A090 revises SR 3.6.9.1 by replacing “at least” with “≥” when referring to the required amount of TSP.

VEGP LAR DOC M13 renumbers TS 3.6.9 to TS 3.6.8.

VEGP LAR DOC D08 revises SR 3.6.9.1 by deleting the chemical formula for TSP.

VEGP LAR DOC L19 revises LCO 3.6.9 statement, SR 3.6.9.1 by changing how the required amount of TSP is measured. The required amount of TSP is revised from a volume measurement of 560 ft^3 to a weight measurement of 26,460 lbs. Also, corresponding sections in the bases are revised.

Rationale for changes in RCOL Std. Dep., RCOL COL Item(s), and RCOL PTS Changes:

VEGP LAR DOC A038 deletes the word “that” from SR 3.6.9.1 and SR 3.6.9.2, which is consistent with guidance provided in TSTF-GG-05-01.

VEGP LAR DOC A089 changes to Required Action A.1 and associated basis provides consistency with SR 3.6.9.1 and 3.6.9.2 when referring to the location of TSP.

VEGP LAR DOC A090 change to SR 3.6.9.1 provides consistency with the TS 3.6.9 LCO statement by replacing “at least” with “≥” when referring to the required amount of TSP.

VEGP LAR DOC M13 deletes TS 3.6.7 and subsequent sections are renumbered.

VEGP LAR DOC D08 change to SR 3.6.9.1 by deleting the chemical formula for TSP is a removal of detail from the SR.

VEGP LAR DOC L19 changes to LCO 3.6.9 statement and SR 3.6.9.1 provides a more appropriate parameter to determine quantity of TSP. Since volume will decrease over time (i.e.,

density of TSP may increase after installation due to compaction and agglomeration from humidity inside the containment), the more appropriate parameter to establish the LCO requirement against is weight.

Description of additional changes proposed by NRC staff/preparer of GTST:

In the “Surveillance Requirements” section of the Bases, in the third sentence of the second paragraph “lbm/ft^3” is changed to “lbs/ft^3”.

The acronym “FSAR” is added to modify “Section” and “Chapter” in references to the FSAR throughout the Bases. (DOC A003) (APOG Comment)

The “Surveillance Requirements” section of the Bases, under heading “SR 3.6.8.2” the last sentence is deleted. (APOG Comment)

Rationale for additional changes proposed by NRC staff/preparer of GTST:

The change from “lbm/ft^3” to “lbs/ft^3” is an editorial change.

Since Bases references to FSAR Sections and Chapters are to an external document, it is appropriate to include the “FSAR” modifier.

Deleting the last sentence from the “Surveillance Requirements” section of the Bases, under heading “SR 3.6.8.2” is a technical improvement.

VII. GTST Safety Evaluation

Technical Analysis:

VEGP LAR DOC D08: Deleting the chemical formula for TSP (Na_3PO_4-$12H_2O$) from SR 3.6.9.1 removes detail from the SR. The removal of the chemical formula for TSP from the SR is acceptable because this type of information is not necessary to be included in the TS to provide adequate protection of public health and safety. The proposed TS retains the necessary requirements to ensure the pH adjustment baskets contain the required TSP, both in the LCO statement and SR 3.6.9.1. Additionally, the Bases present the specific formula for TSP.

VEGP LAR DOC L19: GTS LCO 3.6.9 requires the pH adjustment baskets to contain ≥ 560 ft^3 of TSP. GTS SR 3.6.9.1 requires verification of this volume (560 ft^3) every 24 months. The pH adjustment baskets are part of the Passive Containment Cooling System (PXS), and are provided to adjust the pH of the water in containment following an accident where the containment floods. Following an accident with a large release of radioactivity, the containment pH is automatically adjusted to ≥ 7.0 to enhance iodine retention in the containment water. The desired pH value significantly reduces formation of elemental iodine and the total airborne iodine in the containment. The dodecahydrate form of TSP contained in the pH adjustment baskets provides the passive means of pH control for such accidents. The amount of TSP needed to perform this pH adjustment is 26,460 lbs.

The current value is in volume since the weight cannot be readily measured during operation. However, the conversion from weight to volume is more appropriately controlled in the Surveillance procedure that performs GTS SR 3.6.9.1. Specifically, since volume will decrease over time (i.e., density of TSP may increase after installation due to compaction and agglomeration from humidity inside the containment), the more appropriate parameter to establish the LCO requirement against is weight. The GTS specified volume of 560 ft^3 will decrease later in the cycle. The intent of the 560 ft^3 (which includes approximately 10% additional margin) is to establish the pre-compaction and pre-agglomeration volume and not to establish the operability criteria for later in cycle. The TS Bases discusses that the initial loading of TSP includes this 10% volume margin and that the required loading volume prior to compaction and agglomeration is ≥ 560 ft^3. The Surveillance procedure can adequately control the actual volume necessary to meet the weight requirement, similar to other Surveillances whose measured values must be adjusted to ensure the actual LCO limit is met.

This change is less restrictive since the proposed LCO will allow for a lesser volume over time consistent with expected compaction and agglomeration. However, the accident analysis assumptions concerning the weight of the TSP will still be met by the proposed LCO weight limit of 26,460 lbs.

Other Changes: The remaining changes are editorial, clarifying, grammatical, or otherwise considered administrative. These changes do not affect the technical content, but improve the readability, implementation, and understanding of the requirements, and are therefore acceptable.

Having found that this GTST's proposed changes to the GTS and Bases are acceptable, the NRC staff concludes that AP1000 STS Subsection 3.6.8 is an acceptable model Specification for the AP1000 standard reactor design.

References to Previous NRC Safety Evaluation Reports (SERs):

None

VIII. Review Information

Evaluator Comments:

STS (NUREG-1431) 3.6.7 is equivalent to AP1000 GTS 3.6.9.

Steve Short
Pacific Northwest National Laboratory
509-375-2868
steve.short@pnnl.gov

Review Information:

Availability for public review and comment on Revision 0 of this traveler approved by NRC staff on 5/23/2014.

APOG Comments (Ref. 7) and Resolutions:

1. (Internal #3) Throughout the Bases, references to Sections and Chapters of the FSAR do not include the “FSAR” modifier. Since these Section and Chapter references are to an external document, it is appropriate (DOC A003) to include the “FSAR” modifier. This is resolved by adding the FSAR modifier to every FSAR reference in the Bases.

2. (Internal #6) The GTST sections often repeat VEGP LAR DOCs, which reference “existing” and “current” requirements. The inclusion in the GTST of references to “existing” and “current,” are not always valid in the context of the GTS. Each occurrence of “existing” and “current” should be revised to be clear and specific to GTS, MTS, or VEGP COL TS (or other), as appropriate. This is resolved by making the APOG recommended changes to the GTST.

3. (Internal #13) The NRC approval of TSTF-425, and model safety evaluation provided in the CLIIP for TSTF-425, are generically applicable to any design’s Technical Specifications. As such, the replacement of certain Frequencies with a Surveillance Frequency Control Program should be included in the GTST for AP1000 STS NUREG.

   However, implementation in the AP1000 STS should not reflect optional (i.e., bracketed) material showing retention of fixed Surveillance Frequencies where relocation to a Surveillance Frequency Control Program is acceptable. Since each represented AP1000 Utility is committed to maintaining standardization, there is no rationale for an AP1000 STS that includes bracketed options.

   Consistent with TSTF-425 criteria, replace applicable Surveillance Frequencies with “In accordance with the Surveillance Frequency control Program” and add that Program as new AP1000 STS Specification 5.5.15.

   NRC Staff disagreed with implementing TSTF-425 in the initial version of the STS. Although the APOG thinks the analysis supporting this traveler is general enough to be applicable to AP1000, staff thinks an AP1000-specific proposal from APOG is needed to identify any GTS SRs that should be excluded. Also, with the adoption of a Surveillance Frequency Control Program (SFCP) in the AP1000 STS, bracketed Frequencies, which provide a choice between the GTS Frequency and the SFCP Frequency, are needed

because the NRC will use the AP1000 STS as a reference, and to be consistent with NUREG-1431, Rev. 4. APOG was requested to consider proposing an AP1000 version of TSTF-425 for a subsequent revision of the STS.

4. (Internal #378) Delete SR 3.6.9.2 Bases last sentence. This sentence, describing compliance to the SRP, is confusing and not necessary in this context. The paragraph begins with “Agitation of the test solution is prohibited,” which is not related to ensuring compliance with the SRP. As such, the last sentence is deleted. This is resolved by making the APOG recommended change to the “Surveillance Requirements” section of the Bases.

5. (Internal #379) RCOL PTS Change Number and Title for VEGP LAR DOC A089 says it is for TS 3.6.9 Condition “B.” It affects Condition “A” not “B”. This is resolved by making the APOG recommended change to GTST Section II “RCOL PTS Change Number and Title:”.

NRC Final Approval Date: 12/15/2015

NRC Contact:

Hien M. Le
United States Nuclear Regulatory Commission
301-415-1511
Hien.Le@nrc.gov

IX. Evaluator Comments for Consideration in Finalizing Technical Specifications and Bases

None

X. References Used in GTST

1. AP1000 DCD, Revision 19, Section 16, “Technical Specifications,” June 2011 (ML11171A500).

2. Southern Nuclear Operating Company, Vogtle Electric Generating Plant, Units 3 and 4, Technical Specifications Upgrade License Amendment Request, February 24, 2011 (ML12065A057).

3. Southern Nuclear Operating Company, Vogtle Electric Generating Plant, Units 3 and 4, Response to Request for Additional Information Letter No. 01 Related to License Amendment Request LAR-12-002, ND-12-2015, October 04, 2012 (ML12286A363 and ML12286A360).

4. TSTF-GG-05-01, “Writer's Guide for Plant-Specific Improved Technical Specifications,” June 2005 (ML070660229).

5. NRC Safety Evaluation (SE) for Amendment No. 13 to Combined License (COL) No. NPF-91 for Vogtle Electric Generating Plant (VEGP) Unit 3, and Amendment No. 13 to COL No. NPF-92 for VEGP Unit 4, September 9, 2013, ADAMS Package Accession No. ML13238A337, which contains:

ML13238A355	Cover Letter - Issuance of License Amendment No. 13 for Vogtle Units 3 and 4 (LAR 12-002).
ML13238A359	Enclosure 1 - Amendment No. 13 to COL No. NPF-91
ML13239A256	Enclosure 2 - Amendment No. 13 to COL No. NPF-92
ML13239A284	Enclosure 3 - Revised plant-specific TS pages (Attachment to Amendment No. 13)
ML13239A287	Enclosure 4 - Safety Evaluation (SE), and Attachment 1 - Acronyms
ML13239A288	SE Attachment 2 - Table A - Administrative Changes
ML13239A319	SE Attachment 3 - Table M - More Restrictive Changes
ML13239A333	SE Attachment 4 - Table R - Relocated Specifications
ML13239A331	SE Attachment 5 - Table D - Detail Removed Changes
ML13239A316	SE Attachment 6 - Table L - Less Restrictive Changes

The following documents were subsequently issued to correct an administrative error in Enclosure 3:

ML13277A616	Letter - Correction To The Attachment (Replacement Pages) - Vogtle Electric Generating Plant Units 3 and 4-Issuance of Amendment Re: Technical Specifications Upgrade (LAR 12-002) (TAC No. RP9402)
ML13277A637	Enclosure 3 - Revised plant-specific TS pages (Attachment to Amendment No. 13) (corrected)

6. RAI Letter No. 01 Related to License Amendment Request (LAR) 12-002 for the Vogtle Electric Generating Plant Units 3 and 4 Combined Licenses, September 7, 2012 (ML12251A355).

7. APOG-2014-008, APOG (AP1000 Utilities) Comments on AP1000 Standardized Technical Specifications (STS) Generic Technical Specification Travelers (GTSTs), Docket ID NRC-2014-0147, September 22, 2014 (ML 14265A493).

XI. MARKUP of the Applicable GTS Subsection for Preparation of the STS NUREG

The entire section of the Specifications and the Bases associated with this GTST is presented next.

Changes to the Specifications and Bases are denoted as follows: Deleted portions are marked in strikethrough red font, and inserted portions in bold blue font.

3.6 CONTAINMENT SYSTEMS

3.6.~~9~~8 pH Adjustment

LCO 3.6.~~9~~8 The pH adjustment baskets shall contain ~~≥ 560 ft^3~~**26,460 lbs** of trisodium phosphate (TSP).

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. The ~~volume~~**weight** of ~~trisodium phosphate~~**TSP in the pH adjustment baskets** not within limit.	A.1 Restore ~~volume~~**weight** of ~~trisodium phosphate~~**TSP in the pH adjustment baskets** to within limit.	72 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3. AND B.2 Be in MODE 5.	6 hours 84 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.~~9~~8.1	Verify ~~that~~ the pH adjustment baskets contain ~~at least 560 ft^3~~**≥ 26,460 lbs** of TSP ~~(Na3PO4-12 H2O)~~.	24 months
SR 3.6.~~9~~8.2	Verify ~~that~~ a sample from the pH adjustment baskets provides adequate pH adjustment of the post-accident water.	24 months

B 3.6 CONTAINMENT SYSTEMS

B 3.6.~~9~~8 pH Adjustment

BASES

BACKGROUND

The Passive Core Cooling System (PXS) includes four pH adjustment baskets which provide adjustment of the pH of the water in the containment following an accident where the containment floods.

Following an accident with a large release of radioactivity, the containment pH is automatically adjusted to greater than or equal to 7.0, to enhance iodine retention in the containment water. Chemical addition is necessary to counter the affects of the boric acid contained in the safety injection supplies and acids produced in the post-LOCA environment (nitric acid from the irradiation of water and air and hydrochloric acid from irradiation and pyrolysis of electric cable insulation). The desired pH values significantly reduce formation of elemental iodine in the containment water, which reduces the production of organic iodine and the total airborne iodine in the containment. This pH adjustment is also provided to prevent stress corrosion cracking of safety related containment components during long-term cooling.

Dodecahydrate trisodium phosphate (TSP) contained in baskets provides a passive means of pH control for such accidents. The baskets are made of stainless steel with a mesh front that readily permits contact with water. These baskets are located inside containment at an elevation that is below the minimum floodup level. The baskets are placed at least a foot above the floor to reduce the chance that water spills will dissolve the TSP. Natural recirculation of water inside the containment, following a LOCA, is driven by the core decay heat and provides mixing to achieve a uniform pH. The dodecahydrate form of TSP ($Na_3PO_4 \cdot 12H_2O$) is initially loaded into the baskets because it is hydrated and will undergo less physical and chemical change than would anhydrous TSP as a result of the humidity inside containment. (Refs. 1 and 2)

APPLICABLE SAFETY ANALYSES

In the event of a Design Basis Accident (DBA), iodine may be released from the fuel to containment. To limit this iodine release from containment, the pH of the water in the containment sump is adjusted by the addition of TSP. Adjusting the sump water to neutral or alkaline pH (pH ≥ 7.0) will augment the retention of the iodine, and thus reduce the iodine available to leak to the environment.

BASES

APPLICABLE SAFETY ANALYSES (continued)

pH adjustment satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

The requirement to maintain the pH adjustment baskets with ≥ ~~560 ft^3~~ **26,460 lbs** of TSP assures that for DBA releases of iodine into containment, the pH of the containment sump will be adjusted to enhance the retention of the iodine.

~~A required volume is specified instead of mass because it is not feasible to weigh the TSP in the containment. The minimum required volume is based on the manufactured density of TSP. This is conservative because the density of TSP may increase after installation due to compaction.~~

APPLICABILITY

In MODES 1, 2, 3, and 4 a DBA could cause release of radioactive iodine to containment requiring pH adjustment. The pH adjustment baskets assist in reducing the airborne iodine fission product inventory available for release to the environment.

In MODES 5 and 6, the probability and consequences of these events are reduced due to the pressure and temperature limitations of these MODES. Thus, pH adjustment is not required to be OPERABLE in MODES 5 and 6.

ACTIONS

A.1

If the TSP ~~volume~~**weight** in the **pH adjustment** baskets is not within limits, the iodine retention may be less than that assumed in the accident analysis for the limiting DBA. Due to the very low probability that the ~~volume~~**weight** of TSP may change, the variations are expected to be minor such that the required capability is substantially available. The 72 hour Completion Time for restoration to within limits is consistent with times applied to minor degradations of ECCS parameters.

BASES

ACTIONS (continued)

B.1 and B.2

If the Required Actions and associated Completion Times are not met, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 84 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

SR 3.6.~~9~~8.1

The minimum amount of TSP is **26,460 lbs**~~560 ft^3~~. ~~A volume is specified since it is not feasible to weigh the TSP contained in the pH adjustment baskets.~~ This ~~volume~~**weight** is based on providing sufficient TSP to buffer the post accident containment water to a minimum pH of 7.0. Additionally, the TSP ~~volume~~**weight** is based on treating the maximum volume of post accident water (908,000 gallons) containing the maximum amount of boron (2990 ppm) as well as other sources of acid. The minimum required mass of TSP is 26,460 pounds at an assumed assay of 100%.

While a weight is specified, the normal manner to confirm the weight limit is met is by measuring the volume of the TSP contained in the pH adjustment baskets. The ~~minimum required~~**measured** volume of TSP is based on this minimum required mass of TSP **(26,460 lbs)**, ~~the~~**and normally assumes the** minimum density of TSP plus margin **(about 10%)** to account for degradation **(agglomeration)** of TSP during plant operation. The minimum TSP density is based on the manufactured density (54 ~~lbm~~**lbs**/ft^3), since the density may increase and the volume decrease, during plant operation, due to agglomeration from humidity inside the containment. **This results in a TSP volume of TSP 560 ft^3 at the initial loading (i.e., prior to compaction and agglomeration).**~~The minimum required TSP volume also has about 10% margin to account for degradation of TSP during plant operation.~~

The periodic verification is required every 24 months, since access to the TSP baskets is only feasible during outages, and normal fuel cycles are scheduled for 24 months. Operating experience has shown this Surveillance Frequency acceptable due to the margin in the volume of TSP placed in the containment building.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.6.~~9~~**8**.2

Testing must be performed to ensure the solubility and buffering ability of the TSP after exposure to the containment environment. A representative sample of 2.39 grams of TSP from one of the baskets in containment is submerged in ≥ 1 liter of water at a boron concentration of 2990 ppm and at the standard temperature of 25 ± 5°C. Without agitation, the solution pH should be raised to ≥ 7.0 within 4 hours.

The minimum required amount of TSP is sufficient to buffer the maximum amount of boron 2990 ppm, the maximum amount of other acids, and the maximum amount of water 908,000 gallons that can exist in the containment following an accident and achieve a minimum pH of 7.0.

Agitation of the test solution is prohibited, since an adequate standard for the 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 sump area, rapid mixing would occur due to liquid flow, significantly decreasing the actual amount of time before the required pH is achieved. ~~This would ensure compliance with the Standard Review Plan requirement of a pH ≥ 7.0 by the onset of recirculation after a LOCA.~~

REFERENCES

1. **FSAR** Section 6.3.2.1.4, “Containment pH Control.”
2. **FSAR** Section 6.3.2.2.4, “pH Adjustment Baskets.”

XII. Applicable STS Subsection After Incorporation of this GTST's Modifications

The entire subsection of the Specifications and the Bases associated with this GTST, following incorporation of the modifications, is presented next.

3.6 CONTAINMENT SYSTEMS

3.6.8 pH Adjustment

LCO 3.6.8 The pH adjustment baskets shall contain 26,460 lbs of trisodium phosphate (TSP).

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. The weight of TSP in the pH adjustment baskets not within limit.	A.1 Restore weight of TSP in the pH adjustment baskets to within limit.	72 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3. AND B.2 Be in MODE 5.	6 hours 84 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.8.1	Verify the pH adjustment baskets contain ≥ 26,460 lbs of TSP.	24 months
SR 3.6.8.2	Verify a sample from the pH adjustment baskets provides adequate pH adjustment of the post-accident water.	24 months

B 3.6 CONTAINMENT SYSTEMS

B 3.6.8 pH Adjustment

BASES

BACKGROUND

The Passive Core Cooling System (PXS) includes four pH adjustment baskets which provide adjustment of the pH of the water in the containment following an accident where the containment floods.

Following an accident with a large release of radioactivity, the containment pH is automatically adjusted to greater than or equal to 7.0, to enhance iodine retention in the containment water. Chemical addition is necessary to counter the affects of the boric acid contained in the safety injection supplies and acids produced in the post-LOCA environment (nitric acid from the irradiation of water and air and hydrochloric acid from irradiation and pyrolysis of electric cable insulation). The desired pH values significantly reduce formation of elemental iodine in the containment water, which reduces the production of organic iodine and the total airborne iodine in the containment. This pH adjustment is also provided to prevent stress corrosion cracking of safety related containment components during long-term cooling.

Dodecahydrate trisodium phosphate (TSP) contained in baskets provides a passive means of pH control for such accidents. The baskets are made of stainless steel with a mesh front that readily permits contact with water. These baskets are located inside containment at an elevation that is below the minimum floodup level. The baskets are placed at least a foot above the floor to reduce the chance that water spills will dissolve the TSP. Natural recirculation of water inside the containment, following a LOCA, is driven by the core decay heat and provides mixing to achieve a uniform pH. The dodecahydrate form of TSP ($Na_3PO_4 \cdot 12H_2O$) is initially loaded into the baskets because it is hydrated and will undergo less physical and chemical change than would anhydrous TSP as a result of the humidity inside containment. (Refs. 1 and 2)

APPLICABLE SAFETY ANALYSES

In the event of a Design Basis Accident (DBA), iodine may be released from the fuel to containment. To limit this iodine release from containment, the pH of the water in the containment sump is adjusted by the addition of TSP. Adjusting the sump water to neutral or alkaline pH (pH ≥ 7.0) will augment the retention of the iodine, and thus reduce the iodine available to leak to the environment.

BASES

APPLICABLE SAFETY ANALYSES (continued)

pH adjustment satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

The requirement to maintain the pH adjustment baskets with ≥ 26,460 lbs of TSP assures that for DBA releases of iodine into containment, the pH of the containment sump will be adjusted to enhance the retention of the iodine.

APPLICABILITY

In MODES 1, 2, 3, and 4 a DBA could cause release of radioactive iodine to containment requiring pH adjustment. The pH adjustment baskets assist in reducing the airborne iodine fission product inventory available for release to the environment.

In MODES 5 and 6, the probability and consequences of these events are reduced due to the pressure and temperature limitations of these MODES. Thus, pH adjustment is not required to be OPERABLE in MODES 5 and 6.

ACTIONS

A.1

If the TSP weight in the pH adjustment baskets is not within limits, the iodine retention may be less than that assumed in the accident analysis for the limiting DBA. Due to the very low probability that the weight of TSP may change, the variations are expected to be minor such that the required capability is substantially available. The 72 hour Completion Time for restoration to within limits is consistent with times applied to minor degradations of ECCS parameters.

B.1 and B.2

If the Required Actions and associated Completion Times are not met, the plant must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 84 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner and without challenging plant systems.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.6.8.1

The minimum amount of TSP is 26,460 lbs. This weight is based on providing sufficient TSP to buffer the post accident containment water to a minimum pH of 7.0. Additionally, the TSP weight is based on treating the maximum volume of post accident water (908,000 gallons) containing the maximum amount of boron (2990 ppm) as well as other sources of acid. The minimum required mass of TSP is 26,460 pounds at an assumed assay of 100%.

While a weight is specified, the normal manner to confirm the weight limit is met is by measuring the volume of the TSP contained in the pH adjustment baskets. The measured volume of TSP is based on this minimum required mass of TSP (26,460 lbs), and normally assumes the minimum density of TSP plus margin (about 10%) to account for degradation (agglomeration) of TSP during plant operation. The minimum TSP density is based on the manufactured density (54 lbs/ft^3), since the density may increase and the volume decrease, during plant operation, due to agglomeration from humidity inside the containment. This results in a TSP volume of TSP 560 ft^3 at the initial loading (i.e., prior to compaction and agglomeration).

The periodic verification is required every 24 months, since access to the TSP baskets is only feasible during outages, and normal fuel cycles are scheduled for 24 months. Operating experience has shown this Surveillance Frequency acceptable due to the margin in the volume of TSP placed in the containment building.

SR 3.6.8.2

Testing must be performed to ensure the solubility and buffering ability of the TSP after exposure to the containment environment. A representative sample of 2.39 grams of TSP from one of the baskets in containment is submerged in ≥ 1 liter of water at a boron concentration of 2990 ppm and at the standard temperature of 25 ± 5°C. Without agitation, the solution pH should be raised to ≥ 7.0 within 4 hours.

The minimum required amount of TSP is sufficient to buffer the maximum amount of boron 2990 ppm, the maximum amount of other acids, and the maximum amount of water 908,000 gallons that can exist in the containment following an accident and achieve a minimum pH of 7.0.

BASES

SURVEILLANCE REQUIREMENTS (continued)

Agitation of the test solution is prohibited, since an adequate standard for the 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 sump area, rapid mixing would occur due to liquid flow, significantly decreasing the actual amount of time before the required pH is achieved.

REFERENCES

1. FSAR Section 6.3.2.1.4, “Containment pH Control.”

2. FSAR Section 6.3.2.2.4, “pH Adjustment Baskets.”