TXU Power

TXU Power
Comanche Peak Steam
Electric Station
P. O. Box 1002 (E01)
Glen Rose, TX 76043
Tel: 254 897 5209
Fax: 254 897 6652
mike.blevins@txu.com

Mike Blevins
Senior Vice President &
Chief Nuclear Officer

Ref: 10CFR50.90

CPSES-200502434
Log # TXX-05199
File # 00236

December 16, 2005

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

SUBJECT: COMANCHE PEAK STEAM ELECTRIC STATION (CPSES)
DOCKET NOS. 50-445 AND 50-446
LICENSE AMENDMENT REQUEST (LAR) 05-010
REVISION TO TECHNICAL SPECIFICATION 3.3.2, "ESFAS INSTRUMENTATION," 3.5.2, "ECCS—OPERATING," AND 3.6.7, "SPRAY ADDITIVE SYSTEM'

REF: TXX-05162, RESPONSE TO REQUESTED INFORMATION PART 2 OF NRC GENERIC LETTER 2004-02, "POTENTIAL IMPACT OF DEBRIS BLOCKAGE ON EMERGENCY RECIRCULATION DURING DESIGN BASIS ACCIDENTS AT PRESSURIZED-WATER REACTORS"

Dear Sir or Madam:

Pursuant to 10CFR50.90, TXU Generation Company LP (TXU Power) hereby requests an amendment to the CPSES Unit 1 Operating License (NPF-87) and CPSES Unit 2 Operating License (NPF-89) by incorporating the attached change into the CPSES Unit 1 and 2 Technical Specifications (TS). This change request applies to both Units.

This request is being made pursuant to Generic Letter 2004-02 as described in the referenced letter. Changes are being requested to three Technical Specifications which are required to meet the commitments made in the CPSES response to the generic letter.

A116

The proposed change will revise TS 3.3.2, 3.5.2, and 3.6.7 entitled "ESFAS Instrumentation," "ECCS—Operating," and "Spray Additive System," respectively. License Amendment Request (LAR) 05-010 revises the Technical Specifications to allow modifications to the facility required to comply with NRC Generic Letter 2004-02. Each of these changes will significantly improve sump performance and nuclear safety. The change to TS 3.3.2 will increase emergency sump water levels and NPSH available for emergency core cooling. TXU Power has previously submitted LAR 04-002 via reference 7.9 of Attachment 1, which also proposes changes to TS 3.3.2. LAR 04-002 is currently being reviewed by the NRC. The change to TS 3.5.2 is required to reflect the design change from a flat screen sump strainer to a complex perforated plate strainer design. The change to TS 3.6.7 is required to reduce the impact of chemical effects on emergency sump performance. These three changes are being submitted as one request because they are interrelated and are an integral part of the resolution of Generic Safety Issue 191 for CPSES.

Attachment 1 provides a detailed description of the proposed changes, a technical analysis of the proposed changes, TXU Power's determination that the proposed changes do not involve a significant hazard consideration, a regulatory analysis of the proposed changes and an environmental evaluation. Attachment 2 provides the affected Technical Specification (TS) pages marked-up to reflect the proposed changes. Attachment 3 provides proposed changes to the Technical Specification Bases for information only. These changes will be processed per CPSES site procedures. Attachment 4 provides retyped Technical Specification pages which incorporate the requested changes. Attachment 5 provides retyped Technical Specification Bases pages which incorporate the proposed changes. Attachment 6 provides marked-up pages of the Final Safety Analysis Report (FSAR) (for information only) to reflect the proposed changes to the FSAR

TXU Power requests approval of the proposed License Amendment by July 1, 2006. TXU Power further requests that the proposed changes to Specification 3.5.2 and 3.6.7 be implemented within 120 days of approval of this License Amendment Request and Specification 3.3.2 be implemented within 120 days of completion of the 12^{th} refueling outage of Unit 1. This approval date was selected to be consistent with the requirements of NRC Generic Letter 2004-02 and to support installation of the new sump design during the next refueling outages for Units 1 and 2 scheduled for the spring of 2007 and the fall of 2006, respectively.

In accordance with 10CFR50.91(b), TXU Power is providing the State of Texas with a copy of this proposed amendment.

Should you have any questions, please contact Mr. J. D. Seawright at (254) 897-0140. I state under penalty of perjury that the foregoing is true and correct.

Executed on December 16, 2005.

Sincerely,

TXU Generation Company LP

By: TXU Generation Management Company LLC
Its General Partner

Mike Blevins

By: Fred W. Madden
Director, Regulatory Affairs

JDS

Attachments
1. Description and Assessment
2. Proposed Technical Specifications Changes
3. Proposed Technical Specifications Bases Changes (for information)
4. Retyped Technical Specification Pages
5. Retyped Technical Specification Bases Pages (for information)
6. Proposed FSAR changes (for information)

c - B. S. Mallett, Region IV
M. C. Thadani, Region IV
Resident Inspectors, CPSES

Ms. Alice Rogers
Bureau of Radiation Control
Texas Department of Public Health
1100 West 49th Street
Austin, Texas 78756-3189

ATTACHMENT 1 to TXX-05199

DESCRIPTION AND ASSESSMENT

LICENSEE'S EVALUATION

1.0 DESCRIPTION

By this letter, TXU Generation Company LP (TXU Power) requests an amendment to the CPSES Unit 1 Operating License (NPF-87) and CPSES Unit 2 Operating License (NPF-89) by incorporating the attached change into the CPSES Unit 1 and 2 Technical Specifications. Proposed change LAR 05-010 is a request to revise Technical Specifications (TS) 3.3.2, 3.5.2, and 3.6.7 entitled "ESFAS Instrumentation," "ECCS—Operating, " and "Spray Additive System," respectively, for Comanche Peak Steam Electric Station (CPSES) Units 1 and 2.

This request is being made to address Generic Letter 2004-02 as described in TXX-05162 dated September 1, 2005 (Reference 7.1).

Proposed changes to the FSAR are provided for information only and are included as Attachment 6.

2.0 PROPOSED CHANGE

The proposed change would revise Technical Specification Table 3.3.2-1 to reduce the Allowable Value for Refueling Water Storage Tank (RWST) Low-Low (ESFAS function 7.b), revise Technical Specification 3.5.2 to change the description of the sump screens to strainers, and revise Technical Specification 3.6.7 to remove the current surveillances for NaOH and insert a surveillance to ensure equilibrium sump pH is ≥ 7.1. Attachment 2 contains mark-ups of the affected TS pages for the above proposed changes. Attachment 3 contains mark-ups of the affected TS Bases pages for information only.

3.0 BACKGROUND

Generic Safety Issue 191 (GSI-191), "Assessment of Debris Accumulation on PWR Sump Performance," deals with the possibility that debris could accumulate on the Emergency Core Cooling System (ECCS) sump screen resulting in a loss of net positive suction head (NPSH) margin. The loss of NPSH margin to ECCS pumps drawing suction from the sump may impede or prevent the flow of water needed to meet the criteria of Title 10, Section 50.46 of the Code of Federal Regulations (10 CFR 50.46), "Acceptance Criteria for Emergency Core Cooling Systems for Light-Water Nuclear Power Reactors." 10CFR50.46 requires that licensees design their ECCS systems to meet five criteria, one of which is to provide the capability for long-term cooling. Following a successful system initiation, the ECCS must be able to provide cooling for a sufficient duration that the core temperature is maintained at an acceptably low value. In addition, the ECCS must be able to continue decay heat removal for the extended period of time required by the long-lived radioactivity remaining in the core.

Bulletin 2003-01 (Reference 7.2) requested information to verify compliance with NRC regulations and to ensure that any interim risks associated with post-accident debris blockage are minimized while evaluations of the latest sump knowledge proceed. NRC Generic Letter 2004-02 (Reference 7.3) is the follow-on generic communication to Bulletin 2003-01 and requested information on the results of the evaluations referenced in the bulletin.

TXU Power has evaluated the emergency recirculation sumps for adverse effects due to debris blockage of flowpaths necessary for ECCS and Containment Spray System (CSS) recirculation and containment drainage. The results of that evaluation were provided to the NRC by reference 7.1. That evaluation concluded that deeper water for NPSH margin and reduced debris transport, larger sump strainers of a different design, and a change to a less corrosive pH range are required. Each of these modifications is constrained by current Technical Specifications. Consequently, this license amendment request is to change the CPSES Technical Specifications to allow plant modifications required to meet the requested schedule in NRC Generic Letter 2004-02.

4.0 TECHNICAL ANALYSIS

CPSES has performed analyses to determine the susceptibility of the ECCS and CSS recirculation functions to the adverse effects of post-accident debris blockage and operation with debris-laden fluids. These analyses, which are substantially complete, were described in reference 7.1.

4.1 RWST Setpoint

Revisions to RWST setpoints and Allowable Values and flooding calculations will significantly increase the clean screen margins (i.e., by as much as a foot of water at the completion of switchover). The final design will ensure that the sump strainer will be fully submerged at the time of completion of RWST injection and switchover. The minimum level, at the time of the initiation of switchover to ECCS recirculation, will only partially submerge the strainers. However, the proposed RWST Low-Low setpoint will maximize the containment sump level at the start of switchover. This increased water level is required by the design of the new strainers.

The change in delivered water volume between the current RWST Low-Low nominal setpoint at 45% and the proposed 33% ensures an additional 60,900 gallons of water in the flood plane at the beginning of ECCS switchover. Not only will this increase available NPSH and reduce transport of debris to the emergency sumps, it will delay the start of switchover from 2.5 minutes to 5 hours depending on the break size. Delaying the start of sump recirculation is significant for small break LOCA events because it may be possible to align normal shutdown cooling, avoid sump recirculation, and retain RWST inventory for make up to the RCS.

In the event that ECCS sump recirculation is initiated, the increased water levels will reduce transport of debris during the remainder of flood up by containment spray operation. The Containment Spray System (CSS) will increase water levels, continuously adding clean strainer surface area until the strainer is fully submerged (prior to CSS switchover to recirculation).

The new RWST Low-Low nominal setpoint will continue to ensure that ECCS switchover is completed prior to receipt of the RWST Empty alarm. The CSS switchover will continue to occur based on level indication; however, the switchover will commence after the receipt of the RWST Empty alarm. The RWST Empty alarm is also being lowered from 12% to 9% to provide a conservative volume of water for ECCS transfer assuming no credit for containment backpressure and the worst single active failure. The revised RWST Empty alarm provides sufficient margin to ensure switchover is complete and suction to the RWST is isolated without allowing air entrainment from the RWST.

In order to implement the new lower RWST Low-Low nominal setpoint and the lower Empty alarm setpoint, the containment spray motor operated RWST isolation valves will be modified to reduce the closing stroke time from 90 seconds to less than 30 seconds. In addition, the tank Empty alarm logic will be changed from a 1/4 logic to a 2/4 logic to match the 2/4 logic for the Low-Low alarm. These changes are required to provide consistency between the "Low-Low" and the "Empty" alarm logic and to ensure that there is enough water to preclude air entrainment in the suction of the ECCS pumps and sufficient time between receipt of the "Low-Low" and the "Empty" alarms for performance of the required manual actions to complete ECCS switchover. Therefore, these valve modifications are prerequisites to the implementation of the RWST Low-Low nominal setpoint change. A nominal setpoint of 45% will be maintained until after these changes are complete.

The methodology and ECCS switchover acceptance criteria described in the FSAR for determining the new nominal setpoint is not changed from that previously used. No credit for containment overpressure was taken.

4.2 Strainer Modifications

Both Unit 1 and Unit 2 of CPSES will install new sump strainers to increase the available (i.e., submerged) strainer area from the current approximately 200 ft^2 per sump (at an RWST Low-Low nominal setpoint of 45%) to an area of approximately 4000 ft^2 per sump. The existing sump screen structures are 75 inches tall whereas the new strainers will be approximately 45 inches tall. In support of the new strainer design, RWST switchover nominal setpoints are being revised to ensure the new strainers are fully submerged at the completion of RWST injection. Significant head loss margin is gained when the strainers become fully submerged. The new strainers will have an approach velocity 95% less than the current screens, reducing both head loss and the ingestion of debris which could affect downstream components.

The current sump screens each consist of 10 wire mesh screens in frames mounted on a steel structure covered by a top deck. Each screen is protected from large debris by a trash rack. The new sump strainers will consist of two rows of modules made with perforated plates. Trash racks are not required to structurally protect the strainers as they were with the existing fine screens. The change to the TS surveillance will broaden the terminology to apply to both designs. In this case, the term "strainer" will apply to both the trash rack and the screens for the current design.

4.3 Spray Additive System

The CPSES design utilizes the Containment Spray System (CSS) to reduce radioiodine concentrations in the containment atmosphere following a design basis large break loss of coolant accident (LOCA). The current design includes a sodium hydroxide (NaOH) solution additive. This could raise the pH of the spray droplets to high levels during the NaOH injection phase (e.g., to 12.5). At the time this system was designed it was believed that a high pH level, maintained in the spray through the use of the sodium hydroxide additive, was required to effectively remove elemental iodine from the containment atmosphere and retain it in the sumps. However, studies on the behavior of iodine in the post-LOCA containment environment (Reference 7.4) have demonstrated that iodine removal during the injection phase can be effectively performed by boric acid sprays, without using a NaOH additive, and that long-term iodine retention in the sumps is assured as long as the equilibrium sump pH level is maintained above 7.0.

Since the initial pH of the RWST spray fluid is greater than or equal to 4.0 but less than 7.0, a buffering agent is needed to raise the pH. The impact of that buffering agent on emergency sump performance is currently being evaluated by the nuclear industry.

LA-UR-05-0124, Integrated Chemical Effects Test Project: Test #1 Data Report (Reference 7.7) demonstrated that the highly corrosive pH range of standard NaOH could chemically generate debris and sediment which poses a concern for sump performance. LA-UR-05-6146, Integrated Chemical Effects Test Project:

Test #2 Data Report (Reference 7.8) demonstrated that a lower pH is much less likely to produce chemical products detrimental to sump performance for plants like CPSES which utilize reflective metal and fiberglass insulation.

This warrants the consideration of a passive Spray Additive System to introduce a pH buffering agent in lieu of the current NaOH Spray Additive System and associated spray additive tank, controls, and instrumentation. The advantages of a passive Spray Additive System include: reduced safety-related component testing, maintenance and surveillance; eliminating personnel safety concerns with respect to concentrated NaOH spills; and elimination of the potential for expensive caustic cleanup of containment in the event of an inadvertent containment spray actuation. Trisodium Phosphate is the chemical additive which has been previously approved for use in PWRs similar to CPSES and its superior behavior related to plant materials during and after a LOCA has been qualitatively demonstrated by the Integrated Chemical Effects testing (Reference 7.7 and 7.8). Therefore, CPSES currently plans to implement modifications to switch from NaOH injection to Trisodium Phosphate crystalline (TSP-C) baskets.

The Standard Review Plan (SRP) 6.5.2, Revision 2, indicates that all iodine removal coefficients and decontamination factors (DFs) remain unaffected, provided the ECCS sump pH is maintained greater than or equal to 7.0 at the onset of and during spray recirculation. ECCS systems enter the recirculation mode prior to containment spray entering the recirculation mode. In the event of a large break LOCA, there would be 10 to 20 minutes of mixing in the Containment flood plane by ECCS recirculation and break/spray flow into the pool. Therefore, the ECCS sump would be well mixed at the onset of containment spray recirculation. Conservative limits on the elemental iodine DF and removal coefficient are prescribed in the analyses methodology to, in part, offset transient situations (e.g., ECCS sump pH becomes greater than 7.0 soon after, rather than prior to, the onset of the containment spray recirculation mode). Furthermore, it can be shown that the current calculation methodology in FSAR 6.5.2 is conservative with respect to the methods provided in SRP 6.5.2, Revision 2. Specifically, the method for calculating the elemental removal coefficients currently used in FSAR 6.5.2 result in smaller values than if the method given in SRP 6.5.2, Revision 2, were to be used. The method for calculating the particulate coefficient given in SRP 6.5.2, Revision 2, is the same as the current method used in FSAR 6.5.2. The iodine removal coefficients and DFs currently employed in the CPSES radiological analyses remain conservative and do not require revision. Therefore, all offsite, control room, and equipment doses remain unchanged.

In all cases, the equilibrium pH of the containment recirculation sump water would still be maintained above 7.0 in order to retain iodine in the sump solution and to minimize chloride induced stress corrosion cracking of austenitic stainless steels in the Emergency Core Cooling System (ECCS).

Criteria for pH level of post-accident emergency core cooling and Containment Spray water established in Branch Technical Position MTEB 6-1 (Reference 7.6) are implemented in the design of the CSS. The minimum pH to reduce the probability of stress-corrosion cracking of austenitic stainless steel components, nonsensitized or sensitized, nonstressed or stressed, is also 7.0.

The Integrated Chemical Effects Tests that were completed earlier this year did not quantify the impact on sump performance. However, a series of tests are in progress to quantify the effects of chemical additives on sump performance. Alternative buffering agents have been discussed in industry meetings. Significant data will become available by the first and second quarters of 2006 which are expected to confirm that TSP-C is the best chemical additive for CPSES. However, there is a possibility that another chemical additive option is superior. It is also possible that testing will show that a change in buffering agents is not required.

To provide pH control, TXU Power is currently considering the following:

- Retaining the NaOH spray additive system and reducing chemical effects by reducing the concentration of NaOH to achieve an equilibrium pH closer to 7.1.
- Using a buffering agent (such as TSP-C) stored in baskets located in the Containment flood plane for the recirculation sumps in sufficient quantities to achieve an equilibrium pH above 7.1.

Note: There are potential alternative buffering agents which may prove to be superior to either of the above. Possible alternates that have been mentioned include Sodium Borate, Sodium Tetraborate, Sodium Tri-polyphosphate and Sodium Hexametaphosphate.

Specifying the criteria for a buffering agent that ensures an equilibrium pH $\geq$ 7.1 in the TS Surveillance and referring to the Technical Requirements Manual (TRM) for specific details on how the surveillance is completed allows the specific requirement of an equilibrium pH in the TS Surveillance to ensure OPERABILITY of the Spray Additive System, regardless of the buffering agent used. TXU Power would then be able to use the appropriate buffering agent specifically for CPSES and maintain the details of complying with a pH of $\geq$ 7.1 in the TRM. Note that there is no Westinghouse Pressurized Water Reactor Standard Technical Specification for Trisodium Phosphate buffering. The proposed surveillance is consistent with the Improved Technical Specifications where details which are more appropriately controlled by 10CFR50.59 are relocated to another document such as the Technical Requirements Manual. This amendment request considers that NaOH may be kept for the buffering agent and would be bounded by the analysis provided herein for TSP-C. The current TS Surveillances for NaOH and frequencies would be moved to the TRM until changes in buffering agents were implemented. For buffering agents located in baskets inside containment (Passive Spray Additive Systems), the TRM surveillance would specify the amount in pounds and location of the buffering agent, verified on an 18 month frequency (each refueling outage). This surveillance would be similar to that for other plants which have switched to TSP-C.

The passive Spray Additive System would include seismically designed baskets located in the flood plane for the two containment recirculation sumps strainers. The baskets will be designed to contain the minimum weight of TSP-C that must be contained within the baskets to ensure an equilibrium sump pH of at least 7.1. The weight will be verified by assuring a minimum level in the baskets. The baskets will be located at an elevation that will ensure dissolution by the sump fluids.

The calculation of the minimum and maximum depths of TSP-C includes conservative allowances for compaction, spillage, density variations, and the limited transformation of TSP-C into disodium triphosphate which is a weaker base (expected to have a small impact in the outer surface layer).

4.4 Implementation

Activities are currently underway to ensure that the Emergency Core Cooling System (ECCS) and Containment Spray System (CSS) recirculation functions under debris loading conditions at Comanche Peak Steam Electric Station (CPSES) Units 1 and 2 will be in full compliance with the regulatory requirements listed in the Applicable Regulatory Requirements section of Generic Letter 2004-02 (Ref. 7.3) by December 31, 2007. Full compliance will be achieved through analysis, testing, modifications to increase the available sump screen area, other changes to the plant to reduce the potential debris loading on the installed containment recirculation sump strainers, and programmatic and process changes to ensure continued compliance.

This proposed amendment to the Technical Specifications requests revising Technical Specifications (TS) 3.3.2, 3.5.2, and 3.6.7 entitled "ESFAS Instrumentation," "ECCS—Operating, " and "Spray Additive System." TXU Power has requested approval of this License Amendment Request by July 1,

2006. TXU Power further requests that the proposed changes to Specification 3.5.2 and 3.6.7 be implemented within 120 days of approval of this License Amendment Request while Specification 3.3.2 will be implemented within 120 days of completion of the 12th refueling outage of Unit 1. As a result of reducing the RWST Low-Low nominal setpoint and potential changes to a passive Spray Additive System, revised operator actions are necessary for completion of containment spray switchover to recirculation. Since CPSES is a dual unit plant with operators licensed on both facilities, it is desirable to minimize the time period of any unit differences.

Therefore, in order to minimize differences between the units, TXU plans to complete the implementation of the lower RWST Allowable Values and nominal setpoint and any changes to the buffering agent while at power for Unit 2. The changes for Unit 1 may also be implemented at power following refueling outage 12 for Unit 1. To avoid any potential for mixing of different buffering agents, CPSES would enter LCO 3.6.7 Condition A Required Action during the filling of the TSP-C baskets. This activity is expected to take less than 24 hours. All plant changes will be completed by the end of 2007 as required by NRC Generic Letter 2004-02. The period of significant unit differences in the RWST switchover procedures and chemical additive would be minimized since the modifications would be coordinated for both units over a relatively short period. Details of the proposed implementation of Technical Specifications 3.3.2, 3.5.2, and 3.6.7 are individually discussed below.

Upon approval of this proposed amendment request, the emergency sump trash racks and screens will be replaced with strainers during the refueling outage for Unit 2 Cycle 9 (Fall 2006) and Unit 1 Cycle 12 (Spring 2007). Surveillance Requirement (SR) 3.5.2.8 for Technical Specification 3.5.2 currently describes the debris filters for the containment emergency sumps as trash racks and screens. The descriptive terminology of trash racks and screens is not descriptive of the new sump debris filters. The revised description for this Specification would replace "trash racks and screens" with "strainers." The descriptive terminology of "strainer" is descriptive of both the trash racks and screens (since these debris filters act as strainers) and of the new debris filters. Therefore, the revised wording for SR 3.5.2.8 is acceptable for both the current CPSES Units 1 and 2 emergency sump debris filter design as well as the new CPSES debris filter design. This change can therefore be implemented at any time after approval of the requested amendment.

The proposed changes to Technical Specification 3.3.2, specifically Table 3.3.2-1, include reducing the Allowable Value for RWST Low-Low (ESFAS function 7.b). Currently, the Allowable Value for Unit 1 is $\geq$ 43.9% and the Allowable Value for Unit 2 is $\geq$ 44.1%. This License Amendment Request proposes to reduce the Allowable Value for both Units to $\geq$ 31.9%. As discussed earlier, in order to adopt the new RWST Low-Low nominal setpoint, and the lower EMPTY alarm setpoint, the Containment Spray motor operated RWST isolation valves will be modified to reduce the closing stroke time from 90 seconds to less than 30 seconds. In addition, the RWST EMPTY alarm logic will be changed from a 1/4 logic to a 2/4 logic to match the 2/4 logic for the RWST Low-Low alarm. These changes will ensure that there is enough water inventory for the operators to complete the switchover of the ECCS pumps suction from the RWST to the Containment Sump prior to emptying the RWST.

Upon receipt of the proposed TS changes, TXU Power plans to maintain the actual RWST Low-Low (ESFAS function 7.b) Allowable Value at the current values for each Unit (i.e., 43.9 % for Unit 1 and 44.1% for Unit 2) until completion of refueling outage 12 for Unit 1, at which point both Units will have completed the necessary modifications to support the switch in buffering agents. After both Units have completed the necessary modifications, the RWST Low-Low (ESFAS function 7.b) Allowable Value for both Units will be reduced to the new value of $\geq$ 31.9% to support the use of TSP-C for pH control. Retaining the current Allowable Value for Units 1 and 2 until completion of the prerequisite plant modifications will not affect the calculated containment flood levels, which is based on the opening of the sump valves and minimizes the differences between the units during implementation.

The proposed changes to the surveillance requirements of Technical Specification 3.6.7 request replacing the surveillance details for use of NaOH as a buffering agent with the requirements to ensure equilibrium sump pH is $\geq$ 7.1. Specific details for ensuring a sump pH of $\geq$ 7.1 would then be relocated to the Technical Requirements Manual (TRM). Implementing a different chemical buffering agent than NaOH will require containment buffering agent basket design such that the chemical buffering agent will be fully submersed at the final minimum containment flood levels. TXU Power plans to relocate the current NaOH surveillance details to the TRM until the baskets for the passive spray additive system and the buffering agent are installed. To avoid any potential for mixing of different buffering agents, CPSES would de-activate the NaOH spray additive system and enter LCO 3.6.7 Condition A Required Action while moving the TSP-C into containment. This activity is expected to take less than 24 hours. Upon completion of moving the TSP-C into containment, a revised TRM surveillance would be performed in order to verify Operability of the new chemical buffering agent for Technical Specification 3.6.7, "Spray Additive System."

Therefore, the changes requested for Specifications 3.5.2 and 3.6.7 can be implemented for both units upon approval of this License Amendment Request. The changes requested for Specification 3.3.2 can not be implemented until after containment sump valve modifications are completed during the 9th refueling outage of Unit 2 and the 12th refueling outage of Unit 1. In order to avoid unit differences and maintain operator training consistent between Units 1 and 2, TXU Power plans to implement Specification 3.3.2 on both units after the containment sump valve modifications are completed during the 12th refueling outage of Unit 1. The revised TS and TRM Surveillances will continue to ensure that all LCOs are met for the current design. Mode Applicability and Actions for the Specifications are unchanged from the current Specifications. The Surveillance Requirements for TS 3.6.7 will be revised to reference the TRM for specific detail of the surveillance. The Bases for Technical Specifications 3.3.2, 3.6.6, and 3.6.7 will be revised accordingly.

Therefore, in summary, the TS changes will be implemented for both units in coordination with all plant modifications as described below.

TXU Power plans to complete major physical modifications to each facility (sump screen replacement and valve modifications) during the next refueling for each unit (refueling outage 9 for Unit 2 and refueling outage 12 for Unit 1, fall 2006 and spring 2007, respectively). Other modifications may be completed while at power. (see summary chart below)

Technical Specification	Proposed Change	Discussion
Table 3.3.2-1, ESFAS function 7.b, RWST Low-Low	Lower the RWST Low-Low Allowable Value	Current RWST Allowable Values are conservative with respect to the proposed changes. Implementation of the new Allowable Values will be constrained by the modifications to reduce the CSS MOV closure time.
TS 3.5.2, ECCS – Operating	Change the description of the sump screens to strainers in surveillance	Current Trash Racks and Screens are strainers. The terminology change bounds all types of passive strainers.
TS 3.6.7, Spray Additive System	Remove the current surveillances for NaOH (to be relocated to the Technical Requirements Manual) and insert a surveillance to ensure equilibrium sump pH is ≥ 7.1	Details for completion of the surveillance will be included in the Technical Requirements Manual and can be changed under 10CFR50.59 to match the buffering agent credited for pH control.

Plant changes will be completed by the end of 2007 as required by NRC Generic Letter 2004-02.

4.5 Summary

This proposed license amendment revises Technical Specification Table 3.3.2-1 to lower the RWST Low-Low nominal setpoint, Specification 3.5.2 to change the description of the sump screens to strainers, and Specification 3.6.7, Spray Additive System, to allow changes to the chemical buffering agent for pH control inside containment during an accident. The change would allow a change from sodium hydroxide (NaOH) to trisodium phosphate (TSP) by revising the surveillance requirements to utilize a new surveillance requirement for surveilling the minimum pH to be provided by the chemical buffering agent and its delivery system. The NaOH Spray Additive System may be phased out for both units, pending approval of this amendment request, and replaced with a passive chemical buffering agent for pH control, consisting of stainless steel baskets containing TSP-C. Baskets will be located in containment on the same elevation as the recirculation sump strainers and will contain sufficient buffering agent to ensure a minimum equilibrium sump pH of 7.1. Mode Applicability and the Actions for the specification are unchanged while the Surveillance Requirements have been revised to correspond to the passive nature of the new chemical buffering agent Spray Additive System. The Bases for 3.3.2, 3.6.6, and 3.6.7 have been revised accordingly.

5.0 REGULATORY ANALYSIS

5.1 No Significant Hazards Consideration

TXU Power 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 10CFR50.92, "Issuance of amendment," as discussed below:

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

   Response: No

   None of the changes impact the initiation or probability of occurrence of any accident.

   The consequences of accidents evaluated in the FSAR that could be affected by this proposed change are those involving the pressurization of the containment and associated flooding of the containment and recirculation of this fluid within the ECCS or the Containment Spray System (e.g., LOCAs).

Although the water level in the containment flood plain will be higher at the start of ECCS switchover, the maximum water levels observed for the duration of the accident are unchanged by the nominal setpoint changes.

The increase in the minimum water delivered to containment by the RWST setpoint change will reduce the radiological consequences of LOCAs by diluting the radioiodine concentrations in the recirculating sump fluid which could be released by Engineered Safety Features (ESF) leakage. This increase in water will also reduce the maximum pH and its deleterious effects on equipment and sump performance.

The increase in water level and the change in strainer design will significantly increase NPSH and headloss margins required to assure long term core cooling.

The change to a minimum pH of 7.1 will not result in a significant increase in the radiological consequences of a LOCA as described below.

The buffering agent will dissolve in the containment sump fluid resulting from these accidents raising the pH of the fluid, which would initially be greater than or equal to 4.0 but less than 7.0 during the injection phase of containment spray operation. The equilibrium spray pH during the recirculation phase resulting from this change will be greater than or equal to 7.1. The pH range for the spray will be bounded by the water spray solution which is borated water with a maximum of 2600 ppm boron buffered to a final spray solution pH much less than the 10.5 as described in the current FSAR Section 3.11(B) for the postulated spray solution environment. The maximum pH is the limiting parameter for equipment qualification. Since the resulting pH level will be closer to neutral using the lower limit of 7.1, post-LOCA corrosion of containment components will not be increased. Post-LOCA hydrogen generation will be reduced. There will not be an adverse radiation dose effect on any safety-related equipment. Thus, the potential for failures of the ECCS or safety-related equipment following a LOCA will not be increased as a result of the proposed change.

This modification affects the Containment Spray System which is intended to respond to and mitigate the effects of a LOCA. The chemical additive baskets serve a passive function to provide a buffering agent to neutralize the sump solution. Failure of a basket would not initiate an accident. The Containment Spray System will continue to function in a manner consistent with the plant design basis. There will be no degradation in the performance of nor an increase in the number of challenges to equipment assumed to function during an accident situation.

As such, these Technical Specification revisions do not affect the probability of any event initiators. There will be no adverse changes to normal plant operating parameters, ESF actuation setpoints, or accident mitigation capabilities.

The proposed change allows a passive Spray Additive System to replace the active Spray Additive System currently used to mitigate the consequences of an accident. By substituting a passive system for an active system, the probability of occurrence of a malfunction of equipment associated with the Spray Additive System will be reduced since the number of active components subject to malfunction is reduced. This TS surveillance change will maintain the equilibrium sump pH at greater than or equal to 7.1 to minimize chloride-induced stress corrosion cracking in austenitic stainless components important to safety located inside containment. Therefore, the proposed changes will not increase the probability of an accident or malfunction of equipment important to safety previously evaluated in the FSAR.

The offsite and control room doses will continue to meet the requirements of 10 CFR 100, 10 CFR 50 Appendix A GDC 19, SRP 15.6.5.11, and SRP 6.4.11. The deletion of the active Spray Additive System and replacement with a sump pH control system using TSP-C will not increase the reported radiological consequences of a postulated LOCA. The proposed new pH control system will provide satisfactory retention of iodine in the sump water, as well as provide adequate pH control to minimize the potential of chloride-induced stress corrosion cracking of austenitic stainless steel components.

The baskets which will contain the trisodium phosphate are seismically designed and located in the post-accident flood plane area to ensure mixing with the recirculating fluid. The consequences of a malfunction of any piece of equipment associated with the Containment Spray System would not be affected by the change from an active Spray Additive System to a passive system. The consequences of a failure in the active Spray Additive System are eliminated by this passive system. The proposed changes do not increase the malfunction of equipment important to safety previously evaluated in the FSAR. Therefore, the proposed changes do not involve a significant increase in the probability or consequences of an accident previously evaluated.

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

   Response: No

   The changes to the new Containment Spray Additive System are essentially a passive system, i.e., no operator or automatic action of electrical devices is required to actuate the system. There are no electrical components being added whose failure could prevent the new system from functioning. The only new components being added are the storage baskets for the chemical buffering agent. Seismic requirements have been included in the design to ensure the structural integrity of the baskets will be maintained during a seismic event.

   No new accident scenarios, transient precursors, or limiting single failures are introduced as a result of these changes. There will be no adverse effect or challenges imposed on any safety-related system as a result of these changes. The use of dry sodium phosphates is allowed for adjustment of the post-LOCA sump solution pH as discussed in SRP 6.1.1. The quantity of trisodium phosphate or any other buffering agent chosen will provide a minimum equilibrium sump pH of 7.1 following dissolution and mixing. Therefore, the possibility of a new or different type of accident is not created.

   There are no changes which would cause the malfunction of safety-related equipment, assumed to be operable in the accident analyses, as a result of the proposed Technical Specification changes. No new equipment performance burdens are imposed; however, there is the potential for an unlikely, but possible, event in which an initially concentrated solution of buffering agent could be transported to the stagnant volume of an inactive sump during blowdown and pool fill. This situation would be short-lived since, as the recirculated sump fluid is cooled in the RHR heat exchangers, sufficient buoyancy-driven circulation within containment will result to displace the stagnant solution and eventually yield a uniform, equilibrium solution. In the current design, all of the chemical additive is delivered to the recirculation sump even in the event of the worst single active failure. The possibility of a malfunction of safety-related equipment with a different result is not created. Therefore, the proposed change does not create the possibility of a new or different kind of accident from any previously evaluated.

3. Do the proposed changes involve a significant reduction in a margin of safety?

   Response: No

   The RWST Low-Low nominal setpoint, in conjunction with the plant modifications, ensures that both the ECCS and Containment Spray Systems can be transferred from injection to recirculation without stopping the pumps and with no credit for containment overpressure. Analyses have been performed which show that, even with worst case single active failures, suction to the pumps would not be lost.

The only function of the NaOH spray additive solution is to provide pH control of the post-accident containment recirculation sump water, since the borated water from the Refueling Water Storage Tank (RWST) used as the containment spray pump suction source during injection is sufficient to remove iodine from the containment atmosphere following a LOCA. The net effect on the pH control function of reducing the amount of NaOH or replacing NaOH with the chemical buffering agent TSP-C is that the equilibrium sump pH will be lowered to a minimum of 7.1. There will be no change to the current Technical Specification acceptance limits on RWST volume and boron concentration. The resulting equilibrium sump pH level from this change will be closer to neutral; therefore, the post-LOCA corrosion of containment components will not be increased.

Because the long term pH will be maintained greater than or equal to 7.1, margin to minimize the potential for stress corrosion cracking is maintained.

The radiological analysis as discussed in the technical analysis above, is shown not to be impacted. There will be no change to the DNBR Correlation Limit, the design DNBR limits, or the safety analysis DNBR limits discussed in Bases Section 2.1.1. There will be no effect on the manner in which Safety Limits or Limiting Safety System Settings are determined nor will there be any effect on those plant systems necessary to assure the accomplishment of protection functions. There will be no adverse impact on DNBR limits, F_Q, F-delta-H, LOCA PCT, peak local power density, or any other margin of safety. Therefore the proposed change does not involve a reduction in a margin of safety.

Based on the above evaluations, TXU Power concludes that the proposed amendment presents no significant hazards under the standards set forth in 10CFR50.92(c) and, accordingly, a finding of "no significant hazards consideration" is justified.

5.2 Applicable Regulatory Requirements/Criteria

The Containment Spray system is designed to meet the requirements of 10 CFR 50, Appendix A, GDC 38, "Containment Heat Removal," GDC 39, "Inspection of Containment Heat Removal Systems," GDC 40, "Testing of Containment Heat Removal Systems," GDC 41, "Containment Atmosphere Cleanup," GDC 42, "Inspection of Containment Atmosphere Cleanup Systems," and GDC 43, "Testing of Containment Atmosphere Cleanup Systems".

NRC regulations in Title 10, of the Code of Federal Regulations Section 50.46, 10CFR50.46, require that the ECCS have the capability to provide long-term cooling of the reactor core following a LOCA. That is, the ECCS must be able to remove decay heat, so that the core temperature is maintained at an acceptably low value for the extended period of time required by the long-lived radioactivity remaining in the core.

CPSES credits, in part, a Containment Spray System with performing the safety functions to satisfy the above requirements. In addition, CPSES also credits the Containment Spray System with reducing the accident source term to meet the limits of 10CFR Part 100 or 10CFR 50.67. The changes described herein to the Containment Spray system continue to provide containment atmosphere cooling to limit post accident pressure and temperature in containment to less than the design values. Reduction of containment pressure and the iodine removal capability of the spray reduces the release of fission product radioactivity from containment to the environment, in the event of a Design Basis Accident (DBA), to within limits.

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.

6.0 ENVIRONMENTAL CONSIDERATION

TXU Power has determined that the proposed amendment would change requirements with respect to the installation or use of a facility component located within the restricted area, as defined in 10CFR20, or would change an inspection or surveillance requirement. TXU Power has evaluated the proposed changes and has determined that the changes do not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amount of effluent that may be released offsite, or (iii) a significant increase in the individual or cumulative occupational radiation exposure. Accordingly, the proposed change meets the eligibility criterion for categorical exclusion set forth in 10CFR51.22 (c)(9). Therefore, pursuant to 10CFR51.22 (b), an environmental assessment of the proposed change is not required.

7.0 REFERENCES

7.1 TXX-05162, Response to Requested Information Part 2 of NRC Generic Letter 2004-02, "POTENTIAL IMPACT OF DEBRIS BLOCKAGE ON EMERGENCY RECIRCULATION DURING DESIGN BASIS ACCIDENTS AT PRESSURIZED-WATER REACTORS," from Mike Blevins to the USNRC dated September 1, 2005

7.2 NRC Bulletin 2003-01, "POTENTIAL IMPACT OF DEBRIS BLOCKAGE ON EMERGENCY SUMP RECIRCULATION AT PRESSURIZED-WATER-REACTORS"

7.3 Generic Letter 2004-02, "POTENTIAL IMPACT OF DEBRIS BLOCKAGE ON EMERGENCY RECIRCULATION DURING DESIGN BASIS ACCIDENTS AT PRESSURIZED-WATER REACTORS"

7.4 SRP 6.5.2, "Containment Spray as a Fission Product Cleanup System," Revision 2

7.5 NUREG/CR-4697, "Chemistry and Transport of iodine in Containment", 1986.

7.6 Branch Technical Position MTEB 6-1, "pH for Emergency Cooling Water for PWRs," Revision 2, 1981

7.7 LA-UR-05-0124, "Integrated Chemical Effects Test Project: Test #1 Data Report," June 2005

7.8 LA-UR-05-6146, "Integrated Chemical Effects Test Project: Test #2 Data Report," September 2005

7.9 TXX-04049, "LAR-04-002, Revision to Technical Specification (TS) 3.3.2, Engineered Safety Actuation System (ESFAS) Instrumentation," from Mike Blevins to the USNRC dated April 13, 2004

ATTACHMENT 2 to TXX-05199

PROPOSED TECHNICAL SPECIFICATION CHANGES (MARK-UP)

Pages 3.3-34
3.5-7
3.6-21

Table 3.3.2-1 (page 6 of 6)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE(a)
7. Automatic Switchover to Containment Sump					
a. Automatic Actuation Logic and Actuation Relays	1, 2, 3, 4	2 trains	C	SR 3.3.2.2 SR 3.3.2.4 SR 3.3.2.6	NA
b. Refueling Water Storage Tank (RWST) Level - Low Low	1, 2, 3, 4	4	K	SR 3.3.2.1 SR 3.3.2.5 SR 3.3.2.10 SR 3.3.2.12	≥ ~~43.9~~ 31.9 % instrument span ~~(Unit 1)~~ ~~≥ 44.1% instrument span (Unit 2)~~
Coincident with Safety Injection	Refer to Function 1 (Safety Injection) for all initiation functions and requirements.				
8. ESFAS Interlocks					
a. Reactor Trip, P-4	1, 2, 3	1 per train, 2 trains	F	SR 3.3.2.11	NA
b. Pressurizer Pressure, P-11	1, 2, 3	3	L	SR 3.3.2.5 SR 3.3.2.9	≤ 1975.2 psig (Unit 1) ≤ 1976.4 psig (Unit 2)

(a) The Allowable Value defines the limiting safety system setting. See the Bases for the Trip Setpoints.

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.5.2.6	Verify each ECCS pump starts automatically on an actual or simulated actuation signal.	18 months
SR 3.5.2.7	Verify, for each ECCS throttle valve listed below, each mechanical position stop is in the correct position. Valve Number 8810A 8810B 8810C 8810D 8822A 8822B 8822C 8822D 8816A 8816B 8816C 8816D	18 months
SR 3.5.2.8	Verify, by visual inspection, each ECCS train containment sump suction inlet is not restricted by debris and the suction inlet ~~trash racks and screens~~ strainers show no evidence of structural distress or abnormal corrosion.	18 months

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.7.1	Verify the spray additive system ensures an equilibrium sump pH $\geq$ 7.1. ~~Verify each spray additive manual, power operated, and automatic valve in the flow path that is not locked, sealed, or otherwise secured in position is in the correct position.~~	In accordance with the Technical Requirements Manual ~~31 days~~
~~SR 3.6.7.2~~	~~Verify spray additive tank solution level is □ 81% and □ 94%.~~	~~184 days~~
~~SR 3.6.7.3~~	~~Verify spray additive tank NaOH solution concentration is □ 28% and □ 30% by weight.~~	~~184 days~~
~~SR 3.6.7.4~~	~~Verify each spray additive automatic valve in the flow path that is not locked, sealed, or otherwise secured in position, actuates to the correct position on an actual or simulated actuation signal.~~	~~18 months~~
~~SR 3.6.7.5~~	~~Verify spray additive flow from each solution's flow path.~~	~~5 years~~

ATTACHMENT 4 to TXX-05199

RETYPED TECHNICAL SPECIFICATION PAGES

Pages 3.3-34
3.5-7
3.6-21

Table 3.3.2-1 (page 6 of 6)
Engineered Safety Feature Actuation System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE(a)
7. Automatic Switchover to Containment Sump					
a. Automatic Actuation Logic and Actuation Relays	1, 2, 3, 4	2 trains	C	SR 3.3.2.2 SR 3.3.2.4 SR 3.3.2.6	NA
b. Refueling Water Storage Tank (RWST) Level - Low Low	1, 2, 3, 4	4	K	SR 3.3.2.1 SR 3.3.2.5 SR 3.3.2.10 SR 3.3.2.12	≥ 31.9% instrument span
Coincident with Safety Injection	Refer to Function 1 (Safety Injection) for all initiation functions and requirements.				
8. ESFAS Interlocks					
a. Reactor Trip, P-4	1, 2, 3	1 per train, 2 trains	F	SR 3.3.2.11	NA
b. Pressurizer Pressure, P-11	1, 2, 3	3	L	SR 3.3.2.5 SR 3.3.2.9	≤ 1975.2 psig (Unit 1) ≤ 1976.4 psig (Unit 2)

(a) The Allowable Value defines the limiting safety system setting. See the Bases for the Trip Setpoints.

SURVEILLANCE REQUIREMENTS (continued)

	SURVEILLANCE	FREQUENCY
SR 3.5.2.6	Verify each ECCS pump starts automatically on an actual or simulated actuation signal.	18 months
SR 3.5.2.7	Verify, for each ECCS throttle valve listed below, each mechanical position stop is in the correct position. <u>Valve Number</u> 8810A 8810B 8810C 8810D 8822A 8822B 8822C 8822D 8816A 8816B 8816C 8816D	18 months
SR 3.5.2.8	Verify, by visual inspection, each ECCS train containment sump suction inlet is not restricted by debris and the suction inlet strainers show no evidence of structural distress or abnormal corrosion.	18 months

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.7.1	Verify the spray additive system ensures an equilibrium sump pH $\geq$ 7.1.	In accordance with the Technical Requirements Manual

ATTACHMENT 3 to TXX-05199

PROPOSED TECHNICAL SPECIFICATIONS BASES CHANGES
(Markup For Information Only)

Pages B 3.3-122
B 3.6-38
B 3.6-39
B 3.6-46
B 3.6-47
B 3.6-48
B 3.6-49
B 3.6-50
B 3.6-51

Table B 3.3.2-1 (page 3 of 3)
ESFAS Trip Setpoints

Function		Nominal Trip Setpoint
6.	Auxiliary Feedwater	
a.	Automatic Actuation Logic and Actuation Relays (SSPS)	NA
b.	Not Used	
c.	SG Water Level - Low-Low	25% NR (Unit 1) 35.4% NR (Unit 2)
d.	Safety Injection	See Function 1.
e.	Loss of Power	NA
f.	Not Used	
g.	Trip of All Main Feedwater Pumps	NA
h.	Not Used.	
7.	Automatic Switchover to Containment Sump	
a.	Automatic Actuation Logic and Actuation Relays	NA
b.	Refueling Water Storage Tank (RWST) Level - Low-Low Coincident with Safety Injection	~~45.0~~33.0% span
8.	ESFAS Interlocks	
a.	Reactor Trip, P-4	NA
b.	Pressurizer Pressure, P-11	1960 psig

B 3.6 CONTAINMENT SYSTEMS

B 3.6.6 Containment Spray System

BASES

BACKGROUND

The Containment Spray system provides containment atmosphere cooling to limit post accident pressure and temperature in containment to less than the design values. Reduction of containment pressure and the iodine removal capability of the spray reduces the release of fission product radioactivity from containment to the environment, in the event of a Design Basis Accident (DBA), to within limits. The Containment Spray system is designed to meet the requirements of 10 CFR 50, Appendix A, GDC 38, "Containment Heat Removal," GDC 39, "Inspection of Containment Heat Removal Systems," GDC 40, "Testing of Containment Heat Removal Systems," GDC 41, "Containment Atmosphere Cleanup," GDC 42, "Inspection of Containment Atmosphere Cleanup Systems," and GDC 43, "Testing of Containment Atmosphere Cleanup Systems" (Ref. 1).

The Containment Spray System is an Engineered Safety Feature (ESF) system. It is designed to ensure that the heat removal capability required during the post accident period can be attained. The Containment Spray System provides a method to limit and maintain post accident conditions to less than the containment design values.

The Containment Spray System consists of two separate trains of equal capacity, each capable of meeting the design bases. Each train includes two containment spray pumps, spray headers, nozzles, valves, and piping. Each train is powered from a separate ESF bus. The refueling water storage tank (RWST) supplies borated water to the Containment Spray System during the injection phase of operation. In the recirculation mode of operation, containment spray pump suction is transferred manually from the RWST to the containment sumps. The Containment Spray System provides a spray of cold borated water ~~mixed with sodium hydroxide (NaOH) from the spray additive tank~~ into the upper regions of containment to reduce the containment pressure and temperature and to reduce fission products from the containment atmosphere during a DBA.

(continued)

BASES

BACKGROUND (continued)

The RWST solution temperature is an important factor in determining the heat removal capability of the Containment Spray System during the injection phase. In the recirculation mode of operation, heat is removed from the containment sump water by the residual heat removal and containment spray heat exchangers. Each train of the Containment Spray System provides adequate spray coverage to meet the system design requirements for containment heat removal.

The Spray Additive System ~~injects an NaOH~~ adds a buffering agent ~~solution~~ into the spray. The resulting alkaline pH of the spray enhances the ability of the spray to scavenge fission products from the containment atmosphere. The ~~NaOH~~ buffering agent ~~added in the spray also~~ ensures an alkaline pH for the solution recirculated in the containment sump. The alkaline pH of the containment sump water minimizes the evolution of iodine and minimizes the occurrence of chloride and caustic stress corrosion on mechanical systems and components exposed to the fluid.

The Containment Spray System is actuated either automatically by a containment High-3 pressure signal or manually. An "S" signal automatically starts the four containment spray pumps. If containment pressure continues to increase, a "P" signal (Containment Pressure Hi-3) opens the containment spray pump discharge valves and begins the injection phase. A manual actuation of the Containment Spray System requires the operator to actuate two separate switches on the main control board to begin the same sequence. The injection phase continues until ECCS transfer is complete (Ref. 7) and RWST level indicators ensure sufficient volume of water has been injected for switchover of containment spray to the sumps (Ref. 4). The Containment Spray System in the recirculation mode maintains an equilibrium temperature between the containment atmosphere and the recirculated sump water. Operation of the Containment Spray System in the recirculation mode is controlled by the operator in accordance with the emergency operating procedures.

(continued)

3.6 CONTAINMENT SYSTEMS

B 3.6.7 Spray Additive System

BASES

BACKGROUND

The Spray Additive System is a subsystem of the Containment Spray System that assists in reducing the iodine fission product inventory in the containment atmosphere resulting from a Design Basis Accident (DBA).

Radioiodine in its various forms is the fission product of primary concern in the evaluation of a DBA. It is absorbed by the spray from the containment atmosphere. To enhance the iodine absorption capacity of the spray, the spray solution is adjusted to an alkaline pH with either sodium hydroxide (NaOH) or trisodiium phosphate (TSP) that promotes iodine hydrolysis, in which iodine is converted to nonvolatile forms. ~~Because of its stability when exposed to radiation and elevated temperature, sodium hydroxide (NaOH) is the preferred spray additive. The~~ When NaOH is added to the spray ~~also ensures a~~ pH value of between 8.25 and 10.5 of the solution recirculated from the containment sump is ensured. When the chemical buffering agent, TSP-C, is added to the spray, a pH value $\geq$ 7.1 of the solution recirculated from the containment sump is ensured. This pH band minimizes the evolution of iodine as well as the occurrence of chloride and caustic stress corrosion on mechanical systems and components.

NaOH Spray Additive System:

The NaOH Spray Additive System consists of one spray additive tank that is shared by the two trains of spray additive equipment. Each train of equipment provides a flow path from the spray additive tank to two containment spray pumps and consists of an eductor for each containment spray pump, valves, instrumentation, and connecting piping. Each eductor draws the NaOH spray solution from the common tank using a portion of the borated water discharged by the containment spray pump as the motive flow. The eductor mixes the NaOH solution and the borated water and discharges the mixture into the spray pump suction line. The spray additive system, including the eductors, is designed to ensure the contents of the Chemical Additive Tank is injected into containment given any single active failure. Consequently, in the short term, the pH of a train of spray can vary from acidic (pH of approximately 4.5) to strong basic (pH of approximately 12.5). The low spray pH can only occur during injection prior to switchover to recirculation. The equilibrium sump solution pH, after mixing and dilution with the primary

(continued)

BASES

BACKGROUND (continued)

coolant and ECCS injection, is above 7 and adequate spray pH for long term iodine retention is achieved with the onset of the spray recirculation mode. The high spray pH can only occur after switchover to recirculation from the sump when spray additive is added to recirculated sump water. The high pH condition transient is bounded by the hydrogen generation analysis.

The Containment Spray System actuation signal opens the valves from the spray additive tank to the spray pump suctions. The 28% to 30% NaOH solution is drawn into the spray pump suctions. The spray additive tank capacity provides for the addition of NaOH solution to the water sprayed from the RWST into containment. The percent solution and volume of solution sprayed into containment ensures the appropriate long term containment sump pH. This ensures the continued iodine retention effectiveness of the sump water during the recirculation phase of spray operation and also minimizes the occurrence of chloride induced stress corrosion cracking of the stainless steel recirculation piping.

Passive Spray Additive System:

The Passive Spray Additive System includes stainless steel baskets containing a chemical buffering agent for pH control, trisodium phosphate crystalline (TSP-C). Baskets will be located within the recirculation path of each containment recirculation sump. The baskets contain sufficient TSP-C to ensure a minimum equilibrium sump pH of 7.1. One seismically designed TSP-C basket is located within the confines of the containment reactor cavity. Each basket at Elevation 808 is designed to contain a minimum of 3180 lbm of TSP-C. The baskets are located at an elevation that will ensure dissolution by the sump fluids. The baskets have a stainless steel frame with walls constructed of stainless steel grating and lined with woven wire mesh stainless steel screening. The calculation of the minimum and maximum depths of TSP-C includes conservative allowances for compaction, spillage through the wire mesh, density variations, and the limited transformation of TSP-C into disodium triphosphate which is a weaker base (expected to have a small impact in the outer surface layer). The minimum equilibrium sump pH of 7.1 corresponds to a minimum of [15000] lbm of TSP-C in the baskets and a maximum sump boron concentration of 2500 ppm. If the maximum of [20,000] lbm of TSP-C were contained in the baskets at the end of cycle life such that a minimum sump boron concentration of [2000]ppm would occur, the maximum equilibrium sump pH would be less than 8.1.

APPLICABLE SAFETY ANALYSES

The Spray Additive System is essential to the removal of airborne iodine within containment following a DBA.

Following the assumed release of radioactive materials into containment, the containment is assumed to leak at its design value volume following the accident. The analysis assumes that 56.3% of the containment free volume is covered by the spray (Ref. 1).

The DBA response time assumed for the Spray Additive System is the same as for the Containment Spray System and is discussed in the Bases for LCO 3.6.6, "Containment Spray System." The DBA analyses assume that one train of the Containment Spray System/Spray Additive System is inoperable and that the entire spray additive tank volume is added to the remaining Containment Spray System flow path.

The Spray Additive System satisfies Criterion 3 of 10CFR50.36(c)(2)(ii).

(continued)

BASES (continued)

LCO

The Spray Additive System is necessary to reduce the release of radioactive material to the environment in the event of a DBA. To be considered OPERABLE, the ~~volume and concentration of the spray additive solution must be sufficient to provide NaOH injection into the spray flow to raise the average long term containment sump solution pH to a level conducive to iodine removal, namely, to between 8.25 and 10.5. This pH range maximizes the effectiveness of the iodine removal mechanism without introducing conditions that may induce caustic stress corrosion cracking of mechanical system components. In addition, it is essential that valves in the Spray Additive System flow paths are properly positioned, that automatic valves are capable of activating to their correct positions, and that the eductors are capable of adding the NaOH solution to the CSS flow. the~~ volume of pH buffering agent subsystem must be sufficient to raise the average long term containment sump solution pH to a level conducive to iodine removal and retention, namely, to greater than [7.1]. This pH level maximizes the effectiveness of the iodine removal and retention mechanisms without introducing conditions that may induce caustic stress corrosion cracking of mechanical system components.

APPLICABILITY

In MODES 1, 2, 3, and 4, a DBA could cause a release of radioactive material to containment requiring the operation of the Spray Additive System. The Spray Additive System assists in reducing the iodine fission product inventory thus reducing potential releases to the environment.

In MODES 5 and 6, the probability and consequences of these events are reduced due to the pressure and temperature limitations in these MODES. Thus, the Spray Additive System is not required to be OPERABLE in MODE 5 or 6.

ACTIONS

A.1

If the Spray Additive System is inoperable, it must be restored to OPERABLE within 72 hours. The pH adjustment of the Containment Spray System flow for corrosion protection and iodine removal enhancement is reduced in this condition. The Containment Spray System would still be available and would remove some iodine from the containment atmosphere in the event of a DBA. The 72 hour Completion Time takes into account the redundant flow path capabilities and the low probability of the worst case DBA occurring during this period.

(continued)

ACTIONS (continued)

B.1 and B.2

If the Spray Additive System cannot be restored to OPERABLE status within the required Completion Time, 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 Time of 6 hours is reasonable, based on operating experience, to reach MODE 3 from full power conditions in an orderly manner and without challenging plant systems. The extended interval to reach MODE 5 allows 48 hours for restoration of the Spray Additive System in MODE 3 and 36 hours to reach MODE 5. This is reasonable when considering the reduced pressure and temperature conditions in MODE 3 for the release of radioactive material from the Reactor Coolant System.

SURVEILLANCE REQUIREMENTS

SR 3.6.7.1

Verifying that the available buffering agent is sufficient to ensure that the equilibrium containment sump pH is greater than or equal to 7.1

For NaOH this entails ~~V~~verifying the correct alignment of Spray Additive System manual, power operated, and automatic valves in the spray additive flow path provides assurance that the system is able to provide additive to the Containment Spray System in the event of a DBA. This ~~SR~~ does not apply to valves that are locked, sealed, or otherwise secured in position, since these valves were verified to be in the correct position prior to locking, sealing, or securing. This ~~SR~~ does not require any testing or valve manipulation. Rather, it involves verification through a system walkdown (which may include the use of local or remote indicators), that those valves outside containment and capable of potentially being mispositioned are in the correct position.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

~~SR 3.6.7.2~~

~~To provide effective iodine removal, the~~The containment spray must be an alkaline solution. Since the RWST contents are normally acidic, the volume of the spray additive tank must provide a sufficient volume of spray additive to adjust pH for all water injected. This ~~SR~~ is performed to verify the availability of sufficient NaOH solution in the Spray Additive System. The required volume may be surveilled using an indicated level band of 91% to 94% for the Spray Additive Tank which corresponds to an analytical limit band of 4900 gallons to 5314 gallons, respectively, and includes a 3.36% measurement uncertainty. The 184 day Frequency was developed based on the low probability of an undetected change in tank volume occurring during the ~~SR~~ interval (the tank is isolated during normal unit operations). Tank level is also indicated and alarmed in the control room, so that there is high confidence that a substantial change in level would be detected.

~~SR 3.6.7.3~~

~~This SR provides verification~~Verification of the NaOH concentration in the spray additive tank ~~and~~ is sufficient to ensure that the spray solution being injected into containment is at the correct pH level. The 184 day Frequency is sufficient to ensure that the concentration level of NaOH in the spray additive tank remains within the established limits. This is based on the low likelihood of an uncontrolled change in concentration (the tank is normally isolated) and the probability that any substantial variance in tank volume will be detected.

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

~~SR 3.6.7.4~~

~~This SR provides verification~~ Verification that each automatic valve in the Spray Additive System flow path actuates to its correct position on a Containment Spray Actuation signal~~. This Surveillance~~ is not required for valves that are locked, sealed, or otherwise secured in the required position under administrative controls. The 18 month Frequency is based on the need to perform ~~this Surveillance~~ it under the conditions that apply during a plant outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown that these components usually pass the Surveillance when performed at the 18 month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

~~SR 3.6.7.5~~

To ensure correct operation of the Spray Additive System, flow through the Spray Additive System eductors is verified once every 5 years. Flow of between 50 and 100 gpm through the eductor test loops (supplied from the RWST) simulates flow from the Chemical Additive Tank. Due to the passive nature of the spray additive flow controls, the 5 year Frequency is sufficient to identify component degradation that may affect flow.

For a passive buffering agent such as Trisodium Phosphate this entails: Verifying that the chemical buffering agent baskets are in place in each containment and there is sufficient volume of buffering agent available in the spray additive system to maintain the containment recirculation sump greater than or equal to 7.1. The 18 month Frequency is based on entry into the containment for routine refueling outages and on the low probability of an undetected change in basket level occurring during the SR interval.

REFERENCES

1. FSAR, Chapter 6.5.

ATTACHMENT 5 to TXX-05199

RETYPED TECHNICAL SPECIFICATION BASES PAGES

Pages B 3.3-122
B 3.6-38
B 3.6-39
B 3.6-46
B 3.6-47
B 3.6-48
B 3.6-49
B 3.6-50
B 3.6-51

Table B 3.3.2-1 (page 3 of 3)
ESFAS Trip Setpoints

Function		Nominal Trip Setpoint
6.	Auxiliary Feedwater	
a.	Automatic Actuation Logic and Actuation Relays (SSPS)	NA
b.	Not Used	
c.	SG Water Level - Low-Low	25% NR (Unit 1) 35.4% NR (Unit 2)
d.	Safety Injection	See Function 1.
e.	Loss of Power	NA
f.	Not Used	
g.	Trip of All Main Feedwater Pumps	NA
h.	Not Used.	
7.	Automatic Switchover to Containment Sump	
a.	Automatic Actuation Logic and Actuation Relays	NA
b.	Refueling Water Storage Tank (RWST) Level - Low-Low Coincident with Safety Injection	33.0% span
8.	ESFAS Interlocks	
a.	Reactor Trip, P-4	NA
b.	Pressurizer Pressure, P-11	1960 psig

B 3.6 CONTAINMENT SYSTEMS

B 3.6.6 Containment Spray System

BASES

BACKGROUND

The Containment Spray system provides containment atmosphere cooling to limit post accident pressure and temperature in containment to less than the design values. Reduction of containment pressure and the iodine removal capability of the spray reduces the release of fission product radioactivity from containment to the environment, in the event of a Design Basis Accident (DBA), to within limits. The Containment Spray system is designed to meet the requirements of 10 CFR 50, Appendix A, GDC 38, "Containment Heat Removal," GDC 39, "Inspection of Containment Heat Removal Systems," GDC 40, "Testing of Containment Heat Removal Systems," GDC 41, "Containment Atmosphere Cleanup," GDC 42, "Inspection of Containment Atmosphere Cleanup Systems," and GDC 43, "Testing of Containment Atmosphere Cleanup Systems" (Ref. 1).

The Containment Spray System is an Engineered Safety Feature (ESF) system. It is designed to ensure that the heat removal capability required during the post accident period can be attained. The Containment Spray System provides a method to limit and maintain post accident conditions to less than the containment design values.

The Containment Spray System consists of two separate trains of equal capacity, each capable of meeting the design bases. Each train includes two containment spray pumps, spray headers, nozzles, valves, and piping. Each train is powered from a separate ESF bus. The refueling water storage tank (RWST) supplies borated water to the Containment Spray System during the injection phase of operation. In the recirculation mode of operation, containment spray pump suction is transferred manually from the RWST to the containment sumps. The Containment Spray System provides a spray of cold borated water mixed with a chemical buffering agent into the upper regions of containment to reduce the containment pressure and temperature and to reduce fission products from the containment atmosphere during a DBA.

(continued)

BASES

BACKGROUND (continued)

The RWST solution temperature is an important factor in determining the heat removal capability of the Containment Spray System during the injection phase. In the recirculation mode of operation, heat is removed from the containment sump water by the residual heat removal and containment spray heat exchangers. Each train of the Containment Spray System provides adequate spray coverage to meet the system design requirements for containment heat removal.

The Spray Additive System add a buffering agent into the spray or dissolves TSP inside containment. The resulting alkaline pH of the spray enhances the ability of the spray to scavenge fission products from the containment atmosphere. The buffering agent or TSP ensures an alkaline pH for the solution recirculated in the containment sump. The alkaline pH of the containment sump water minimizes the evolution of iodine and minimizes the occurrence of chloride and caustic stress corrosion on mechanical systems and components exposed to the fluid.

The Containment Spray System is actuated either automatically by a containment High-3 pressure signal or manually. An "S" signal automatically starts the four containment spray pumps. If containment pressure continues to increase, a "P" signal (Containment Pressure Hi-3) opens the containment spray pump discharge valves and begins the injection phase. A manual actuation of the Containment Spray System requires the operator to actuate two separate switches on the main control board to begin the same sequence. The injection phase continues until ECCS transfer is complete (Ref. 7) and RWST level indicators ensure sufficient volume of water has been injected for switchover of containment spray to the sumps (Ref. 4). The Containment Spray System in the recirculation mode maintains an equilibrium temperature between the containment atmosphere and the recirculated sump water. Operation of the Containment Spray System in the recirculation mode is controlled by the operator in accordance with the emergency operating procedures.

(continued)

3.6 CONTAINMENT SYSTEMS

B 3.6.7 Spray Additive System

BASES

BACKGROUND

The Spray Additive System is a subsystem of the Containment Spray System that assists in reducing the iodine fission product inventory in the containment atmosphere resulting from a Design Basis Accident (DBA).

Radioiodine in its various forms is the fission product of primary concern in the evaluation of a DBA. It is absorbed by the spray from the containment atmosphere. To enhance the iodine absorption capacity of the spray, the spray solution is adjusted to an alkaline pH with either sodium hydroxide (NaOH) or trisodium phosphate (TSP) that promotes iodine hydrolysis, in which iodine is converted to nonvolatile forms. When NaOH is added to the spray a pH value of between 8.25 and 10.5 of the solution recirculated from the containment sump is ensured. When the chemical buffering agent, TSP-C, is added to the spray, a pH value ≥ 7.1 of the solution recirculated from the containment sump is ensured. This pH band minimizes the evolution of iodine as well as the occurrence of chloride and caustic stress corrosion on mechanical systems and components.

NaOH Spray Additive System:

The NaOH Spray Additive System consists of one spray additive tank that is shared by the two trains of spray additive equipment. Each train of equipment provides a flow path from the spray additive tank to two containment spray pumps and consists of an eductor for each containment spray pump, valves, instrumentation, and connecting piping. Each eductor draws the NaOH spray solution from the common tank using a portion of the borated water discharged by the containment spray pump as the motive flow. The eductor mixes the NaOH solution and the borated water and discharges the mixture into the spray pump suction line. The spray additive system, including the eductors, is designed to ensure the contents of the Chemical Additive Tank is injected into containment given any single active failure. Consequently, in the short term, the pH of a train of spray can vary from acidic (pH of approximately 4.5) to strong basic (pH of approximately 12.5). The low spray pH can only occur during injection prior to switchover to recirculation. The equilibrium sump solution pH, after mixing and dilution with the primary

(continued)

BASES

BACKGROUND (continued)

coolant and ECCS injection, is above 7 and adequate spray pH for long term iodine retention is achieved with the onset of the spray recirculation mode. The high spray pH can only occur after switchover to recirculation from the sump when spray additive is added to recirculated sump water. The high pH condition transient is bounded by the hydrogen generation analysis.

The Containment Spray System actuation signal opens the valves from the spray additive tank to the spray pump suctions. The 28% to 30% NaOH solution is drawn into the spray pump suctions. The spray additive tank capacity provides for the addition of NaOH solution to the water sprayed from the RWST into containment. The percent solution and volume of solution sprayed into containment ensures the appropriate long term containment sump pH. This ensures the continued iodine retention effectiveness of the sump water during the recirculation phase of spray operation and also minimizes the occurrence of chloride induced stress corrosion cracking of the stainless steel recirculation piping.

Passive Spray Additive System:

The Passive Spray Additive System includes stainless steel baskets containing a chemical buffering agent for pH control, trisodium phosphate crystalline (TSP-C). One such basket will be located within the confines of each containment recirculation sump. The baskets contain sufficient TSP-C to ensure a minimum equilibrium sump pH of 7.1. One seismically designed TSP-C basket is within the confines of each of the two containment recirculation sumps. Each basket is designed to contain a maximum of 6720 lbm of TSP-C. The baskets are located at an elevation that will ensure dissolution by the sump fluids. The baskets have a stainless steel frame with walls constructed of stainless steel grating and lined with wire mesh stainless steel screening. The calculation of the minimum and maximum depths of TSP-C includes conservative allowances for compaction, spillage through the wire mesh, density variations, and the limited transformation of TSP-C into disodium triphosphate which is a weaker base (expected to have a small impact in the outer surface layer). The minimum equilibrium sump pH of 7.1 corresponds to a minimum of [15000] lbm of TSP-C in the baskets and a maximum sump boron concentration of 2500 ppm. If the maximum of [20,000] lbm of TSP-C were contained in the baskets at the end of cycle life such that a minimum sump boron concentration of [2000] ppm would occur, the maximum equilibrium sump pH would be less than 8.1.

(continued)

BASES (continued)

APPLICABLE SAFETY ANALYSES	The Spray Additive System is essential to the removal of airborne iodine within containment following a DBA. Following the assumed release of radioactive materials into containment, the containment is assumed to leak at its design value volume following the accident. The analysis assumes that 56.3% of the containment free volume is covered by the spray (Ref. 1). The DBA response time assumed for the Spray Additive System is the same as for the Containment Spray System and is discussed in the Bases for LCO 3.6.6, "Containment Spray System." The DBA analyses assume that one train of the Containment Spray System/Spray Additive System is inoperable and that the entire spray additive tank volume is added to the remaining Containment Spray System flow path. The Spray Additive System satisfies Criterion 3 of 10CFR50.36(c)(2)(ii).
LCO	The Spray Additive System is necessary to reduce the release of radioactive material to the environment in the event of a DBA. To be considered OPERABLE, the volume of pH buffering agent subsystem must be sufficient to raise the average long term containment sump solution pH to a level conducive to iodine removal and retention, namely, to greater than 7.1. This pH level maximizes the effectiveness of the iodine removal and retention mechanisms without introducing conditions that may induce caustic stress corrosion cracking of mechanical system components.
APPLICABILITY	In MODES 1, 2, 3, and 4, a DBA could cause a release of radioactive material to containment requiring the operation of the Spray Additive System. The Spray Additive System assists in reducing the iodine fission product inventory thus reducing potential releases to the environment. In MODES 5 and 6, the probability and consequences of these events are reduced due to the pressure and temperature limitations in these MODES. Thus, the Spray Additive System is not required to be OPERABLE in MODE 5 or 6.

(continued)

BASES (continued)

ACTIONS

A.1

If the Spray Additive System is inoperable, it must be restored to OPERABLE within 72 hours. The pH adjustment of the Containment Spray System flow for corrosion protection and iodine removal enhancement is reduced in this condition. The Containment Spray System would still be available and would remove some iodine from the containment atmosphere in the event of a DBA. The 72 hour Completion Time takes into account the redundant flow path capabilities and the low probability of the worst case DBA occurring during this period.

B.1 and B.2

If the Spray Additive System cannot be restored to OPERABLE status within the required Completion Time, 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 Time of 6 hours is reasonable, based on operating experience, to reach MODE 3 from full power conditions in an orderly manner and without challenging plant systems. The extended interval to reach MODE 5 allows 48 hours for restoration of the Spray Additive System in MODE 3 and 36 hours to reach MODE 5. This is reasonable when considering the reduced pressure and temperature conditions in MODE 3 for the release of radioactive material from the Reactor Coolant System.

SURVEILLANCE REQUIREMENTS

SR 3.6.7.1

Verifying that the available buffering agent is sufficient to ensure that the equilibrium containment sump pH is greater than or equal to 7.1

For NaOH this entails:
Verifying the correct alignment of Spray Additive System manual, power operated, and automatic valves in the spray additive flow path provides assurance that the system is able to provide additive to the Containment Spray System in the event of a DBA. This does not apply to valves that are locked, sealed, or otherwise secured in position, since these valves were verified to be in the correct position prior to locking, sealing, or securing. This does not require any testing or valve manipulation. Rather, it involves verification through a system walkdown (which may include the use of local or remote indicators), that those valves outside containment and capable of potentially being mispositioned are in the correct position.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.6.7.1 (continued)

The containment spray must be an alkaline solution. Since the RWST contents are normally acidic, the volume of the spray additive tank must provide a sufficient volume of spray additive to adjust pH for all water injected. This is performed to verify the availability of sufficient NaOH solution in the Spray Additive System. The required volume may be surveilled using an indicated level band of 91% to 94% for the Spray Additive Tank which corresponds to an analytical limit band of 4900 gallons to 5314 gallons, respectively, and includes a 3.36% measurement uncertainty. The 184 day Frequency was developed based on the low probability of an undetected change in tank volume occurring during the SR interval (the tank is isolated during normal unit operations). Tank level is also indicated and alarmed in the control room, so that there is high confidence that a substantial change in level would be detected.

Verification of the NaOH concentration in the spray additive tank and is sufficient to ensure that the spray solution being injected into containment is at the correct pH level. The 184 day Frequency is sufficient to ensure that the concentration level of NaOH in the spray additive tank remains within the established limits. This is based on the low likelihood of an uncontrolled change in concentration (the tank is normally isolated) and the probability that any substantial variance in tank volume will be detected.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.6.7.1 (continued)

Verify that each automatic valve in the Spray Additive System flow path actuates to its correct position on a Containment Spray Actuation signal. This is not required for valves that are locked, sealed, or otherwise secured in the required position under administrative controls. The 18 month Frequency is based on the need to perform this under the conditions that apply during a plant outage and the potential for an unplanned transient if it were performed with the reactor at power. Operating experience has shown that these components usually pass the Surveillance when performed at the 18 month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

Ensure correct operation of the Spray Additive System, flow through the Spray Additive System eductors is verified once every 5 years. Flow of between 50 and 100 gpm through the eductor test loops (supplied from the RWST) simulates flow from the Chemical Additive Tank. Due to the passive nature of the spray additive flow controls, the 5 year Frequency is sufficient to identify component degradation that may affect flow.

For a passive buffering agent such as Trisodium Phosphate this entails: Verifying that the chemical buffering agent baskets are in place in each containment recirculation sump and there is sufficient volume of buffering agent available in the spray additive system to maintain the containment recirculation sump greater than or equal to 7.1. The 18 month Frequency is based on entry into the sumps for routine inspection and on the low probability of an undetected change in basket level occurring during the SR interval.

REFERENCES

1. FSAR, Chapter 6.5.

ATTACHMENT 6 to TXX-05199

PROPOSED FSAR PAGES

Pages 6.3-19
6.3-20
6.3-21
6.3-22
6.3-23
6.3-24
Table 6.3-7 (Sheets 1-4)
Table 6.3-11 (Sheets 1 and 2)

6.3.2.5.5 Submerged Valve Motors

An evaluation of the potential for the submersion of ECCS valve motors concludes that all motors are above the local maximum post-accident water level.

The RHR suction isolation valves (Numbers 1-8701A, 1-8701B, 1-8702A and 1-8702B) are located inside the Containment at approximately elevation 817 ft. This elevation is above the local maximum post-accident water level.

6.3.2.6 Protection Provisions

The provisions taken to protect the system from damage that might result from dynamic effects are discussed in Section 3.6N. The provisions taken to protect the system from missiles are discussed in Section 3.5. The provisions to protect the system from seismic damage are discussed in Sections 3.7N, 3.9N and 3.10N. Thermal stresses on the RCS are discussed in Section 5.2.

6.3.2.7 Provisions for Performance Testing

Test lines are provided for performance testing of the ECCS as well as individual components. These test lines and instrumentation are shown in Figure 6.3-1. All pumps have miniflow lines which may be used for testing operability. Additional information on testing can be found in Section 6.3.4.2.

6.3.2.8 Manual Actions

No manual actions are required of the operator for proper operation of the ECCS during the injection mode of operation. Only limited manual actions are required by the operator to realign the system for the cold leg recirculation mode of operation, and, after several hours (as specified in Appendices 4A and 4B for Units 1 and 2, respectively), the hot leg recirculation mode of operation. These actions are delineated in Table 6.3-7.

The changeover from the injection mode to recirculation mode is initiated automatically and completed manually by operator action from the Control Room. The ECCS switchover from safety injection to cold leg recirculation is initiated automatically upon receipt of the RWST switchover initiation (RWST low-low level) signal, and is completed via timely operator action at the main control board. Protection logic is provided to automatically open the two Safety Injection System (SIS) recirculation sump isolation valves (8811 A&B), when two of four Refueling Water Storage Tank (RWST) level channels indicate an RWST level less than a low-low level setpoint, in conjunction with the engineered safeguards actuation signal ("S" signal). This automatic action aligns the suction of the two Residual Heat Removal (RHR) pumps to the containment recirculation sump to ensure continued availability of a suction source. It should be noted that the RHR pumps continue to operate during this changeover from injection mode to recirculation mode.

The two charging pumps and the two safety injection pumps would continue to take suction from the RWST, following the above automatic action, until manual operator action is taken to align these pumps in series with the residual heat removal pumps.

The RWST low-low level protection logic consists of four level channels with each level channel assigned to a separate process control protection set. Four RWST level transmitters provide level signals to corresponding normally deenergized level channel bistables. Each level channel bistable would be energized on receipt of an RWST low-low level signal.

A two out of four coincident logic is utilized in both protection cabinets A and B to ensure a trip signal in the event that two of the four level channel bistables are energized. This trip signal, in conjunction with the "S" signal, provides the actuation signal to automatically open the corresponding containment sump isolation valves.

The low-low RWST level signal is also alarmed to inform the operator to initiate the manual action required to realign the charging and safety injection pumps for the recirculation mode. The manual switchover sequence that must be performed by the operator is delineated in Table 6.3-7.

The switchover procedure is designed to minimize the time required to align the ECCS pumps to the containment sump, utilizing switchover steps in which the operator simultaneously switches both trains of the ECCS from injection to recirculation. As the switchover actions are completed, RWST outflow is reduced. Manual actions 1 thru 6 of Table 6.3-7 must be performed following switchover initiation prior to loss of the RWST transfer allowance to ensure that all ECCS pumps are protected with suction flow available from the containment recirculation sump.

Following the automatic and manual switchover sequence, the two residual heat removal pumps would take suction from the containment recirculation sump and deliver borated water directly to the RCS cold legs. A portion of the number 1 residual heat removal pump discharge flow would be used to provide suction to the two charging pumps which would also deliver directly to the RCS cold legs. A portion of the discharge flow from the number 2 residual heat removal pump would be used to provide suction to the two safety injection pumps which would also deliver directly to the RCS cold legs. As part of the manual switchover procedure (Table 6.3-7, Action 6), the suctions of the safety injection and charging pumps are cross connected so that one residual heat removal pump can deliver flow to the RCS and both safety injection and charging pumps, in the event of the failure of the second residual heat removal pump.

greater than

The minimum delay between the RWST "low" level signal and the "low-low" level signal, with all systems operating (based on maximum allowable Technical Specification instrument errors in each of the four RWST level channels involved is 9.5 minutes. Operator action to initiate ECCS switchover is not required until 30 seconds later (following automatic opening of the recirculation sump isolation valves (8811A & B).

Thus, operator action to initiate ECCS switchover is not required prior to 10 minutes after event initiation.

The RWST switchover is then performed by transferring the ECCS to cold leg recirculation followed by transferring containment spray to recirculation.

The time available for switchover is dependent on the flowrate out of the RWST as the switchover manual actions are performed. As valves are repositioned, the flowrate out of the RWST is reduced in magnitude. In order to analyze the shortest time available for switchover, the following conservative bases were established.

1. The minimum RWST transfer allowance available [between Low-Low and Empty] is ~~approximately 146,000~~ [greater than 117,760] gallons.

2. Containment and RCS pressures for large break conditions are conservatively assumed to be 0 psig; thus, no credit is taken for the reduction in RWST outflow that will result with higher containment and RCS pressures following a large break. The same assumption is made for the small break conditions, except that RCS pressure is assumed to be greater than RHR pump shutoff head resulting in no RHR pump flow to the RCS for small break conditions.

3. Flow out of the RWST during switchover includes allowances for both pumped flow to the RCS and containment and the possibility of gravity flow (backflow) to the containment sump based on the 0 psig containment pressure assumption and ECCS operating conditions. Specific flowrate allowances are addressed in Table 6.3-11.

4. Flowrate out of the RWST for the worst single failure condition is determined assuming one of the RWST isolation valves (8812A or B) fails to close on demand. This single failure maximizes RWST outflow during switchover. Flowrates out of the RWST assume no operator corrective action to mitigate the single failure (i.e., stop the affected RHR pump and close the appropriate sump isolation valves).

5. Containment flood level [above] ~~at~~ RWST Low-Low plus ~~2.5 percent~~ instrument uncertainty is assumed constant throughout ECCS switchover to minimize sump flow.

6. Containment flood level [above RWST 6% plus instrument uncertainty is conservatively] ~~at RWST 24% indicated plus 4 percent instrument uncertainty is~~ assumed constant throughout containment spray switchover to minimize sump flow.

7. Flowrate out of the RWST for the worst containment spray single failure condition is determined assuming one of the sump isolation valves (HV-4782 or HV-4783) fails to open on demand. ~~This single failure is bounded by the single failure in the ECCS.~~ Flowrate out of the RWST assumes the operator will stop the affected containment spray pump.

8. The operator ~~must complete~~ initiates the opening of the sump to containment spray pump isolation valves (HV-4872 and HV-4873) at 6% after ~~prior to~~ receipt of the Empty Alarm (9%). There is sufficient volume between the ~~Empty Alarm~~ 6% indication minus instrument uncertainy and the minimum level for pump suction for the tank isolation valves to fully close.

Sufficient NPSH is available at the time of assumed changeover of the ESF pumps; the single RHR pump (due to the single failure assumption) and the four containment spray pumps continue to draw suction from the RWST. The RHR pump minimum NPSH requirement is below the elevation of the RWST discharge nozzle; therefore, the operator has adequate time to shut down the RHR pump associated with the failed valve. The NPSH requirement for the containment spray pumps is also below the elevation of the RWST discharge nozzle. A monitor light indication is provided to the operator during the recirculation mode when the valve is not in its proper position.

Based on the above criteria, the calculated flowrates out of the RWST as a function of switchover manual action are itemized in Table 6.3-11 for a large break with a single failure, which constitutes the condition where RWST outflow is greatest. Table 6.3-11 also identifies the operator action time assumed, as well as the change in RWST volume, per switchover step. Analyzing the flowrate out of the RWST for the large LOCA with the worst single failure indicates that ~~approximately 142,000~~ less than 117,760 gallons are consumed prior to the full opening of the containment spray pump sump isolation valves in performing RWST switchover manual actions. This volume is less than the RWST transfer allowance ~~of approximately 146,000 gallons,~~ which ensures that the switchover steps necessary to protect all ECCS pumps can be accomplished before the transfer allowance is depleted.

See Section 7.5 for process information available to the operator in the control room following an accident. For further information on RHR pumps, and related operator action, see Section 6.3.2.2.4.

Although startup and shutdown are transient events and accidents are not to be considered coincidentally, the following protection is afforded the plant for a secondary side pipe rupture. Safety injection actuation on low pressurizer pressure and low steam line pressure may be manually blocked when NSSS pressure falls below P-11. Specific blocking features are addressed in Section 7.3.2.2.6. Between P-11 and 1000 psig, all safety equipment in the ECCS is aligned for safety injection with the exception of the disarmed pressurizer and steam line pressure safety injection signals. At this time, the operator is monitoring the pressurizer pressure and water level and RCS temperature per the plant cooldown procedure. Also, Technical Specifications impose minimum temperature requirements as a function of pressure on the operator to avoid exceeding NDT limitations. The operator, as a matter of course, has available the pressurizer pressure and water level and RCS temperature measurements on the control board strip chart recorders.

For large LOCAs, sufficient mass and energy is released to the containment to automatically actuate safety injection when the containment high pressure setpoint is reached. At this time, the operator is alerted of the occurrence of a LOCA by the following safety-related indications:

1. Loss of pressurizer level,
2. Rapid decrease of RCS pressure,
3. Containment pressure increase.

In addition, the following indications are normally available to the operator at the control board:

1. Radiation alarms inside containment,
2. Sump water level increasing,
3. Accumulator water levels and pressure decreasing,
4. ECCS valve and pump position and status light in ECCS energized indication. Annunciators will light as safeguards equipment becomes energized,
5. Flow from ECCS pumps is indicated on control board.

For small LOCA's, approximately less than two inches in diameter, where the containment high pressure setpoint may not be reached, the operator observes the safety-related indications plus the first two normally available indications. In addition, there is a charging flow/letdown mismatch which provides the operator with another indication of leakage from the RCS. Since the operator is observing the pressurizer level and is getting additional indications that a LOCA has occurred, the operator immediately initiates manual safety injection. As noted in WCAP-8356, ECCS Plant Sensitivity Studies, the time to uncover the core following a small break is relatively long (e.g., greater than 10 minutes for a 2-inch break). The operator, therefore, has sufficient time to manually initiate safety injection.

At less than 1000 psig, the operator closes and locks out the safety injection accumulator isolation valves. At less than 350 F, the operator renders the high head safety injection pumps inoperable in accordance with Technical Specifications. At this time, at least one low head safety injection pump and at least one charging pump are available from either automatic or manual safety injection actuation. At less than 350 F, the operator aligns the RHR System. The valves in the line from the RWST are closed.

The significance of these actions on the mitigation of a LOCA when power is locked out to the isolation valves is that between 1000 psig and reaching 350 F, a portion of the ECCS can be actuated automatically (containment hi-1 signal) or manually by the operator. The equipment that can be energized are two low head safety injection and two high head charging pumps, two high head safety injection pumps and, subsequent to the operator reinstituting power to the accumulator isolation valves.

Below 350 F, the system is in the RHR cooling mode. The operator realigns the RHR system per plant startup procedure; places all safeguards systems valves in the required positions for ECCS operation; and then manually actuates the individual ECCS components.

Comparing plant cooldown and heatup, the limiting case for a LOCA is during cooldown rather than heatup because the core decay heat generation is higher. The ECCS analysis presented in Chapter 15 conforms to the acceptance criteria of 10CFR50.46 (initiation of the LOCA is at 100.6% of full licensed power rating for Unit 1 and Unit 2 with corresponding RCS conditions), and is more limiting than a LOCA during shutdown, since:

1. A LOCA initiated during shutdown has reduced decay heat generation; the reactor would have been at zero power for an extended period of time.

2. The core stored energy during shutdown is reduced due to the RCS isothermal condition at a reduced temperature.

3. The energy content of the RCS is lower.

Furthermore, the probability of an occurrence of a LOCA during this time along with the critical flaw size needed to rupture the RCS piping at reduced pressure is considered to be incredible. (Note: Unit 1 LOCA initiation is at 102% of full licensed power until completion of 1RF09).

Emergency operating procedures are written such that the operator is permitted to manually reset the SIS signal after two minutes following protection system actuation. This enables the operator to shut down a safeguards pump or to change the position of a valve receiving an SIS signal, as necessary. In the unlikely event that a blackout occurs following an SIS reset, ECCS valve positions remain unchanged; the operator only needs to depress the manual safety injection switches to restart safety injection. Manual resets are discussed in greater detail in Section 7.3.2.2.6.

6.3.3 PERFORMANCE EVALUATION

Accidents which require ECCS operation are the following:

1. Inadvertent opening of a steam generator relief or safety valve (see Section 15.1.4).

2. Loss of reactor coolant from small ruptured pipes or from cracks in large pipes which actuates the ECCS (see Section 15.6.5).

3. Major reactor coolant system pipe ruptures (LOCA) (see Section 15.6.5).

4. Steam system piping failure (see Section 15.1.5).

5. Steam generator tube failure (see Section 15.6.3).

TABLE 6.3-7

Table provided for information only.

(Sheet 1 of 4)

SEQUENCE OF SWITCHOVER OPERATIONS (BASED ON NO SINGLE FAILURES)

SWITCHOVER FROM INJECTION TO COLD LEG RECIRCULATION

The following manual operator actions are required to perform the switchover operation from the ECCS cold leg injection mode to the cold leg recirculation mode. Following event initiation and upon receipt of the RWST low level alarm, the operator is in the process of anticipating the RWST low-low level switchover initiation alarm. The operator monitors the RWST level and containment recirculation sump in anticipation of switchover. During the cold leg injection mode and prior to the receipt of the RWST Low-Low level alarm, the operator is to:

(a) verify that all ECCS pumps are operating and are delivering flow to the RCS cold legs, and

(b) monitor the RWST and the containment recirculation sump levels.

Upon receipt of the RWST low-low level signal, the operator is required to reset SI and to verify that the component cooling water isolation valves for the heat exchangers are open. The emergency procedure includes cautions and notes, as required. The operator is then required to verify the sump isolation valves are open and to perform the manual actions listed below in an orderly and timely manner, and in the proper sequence. Manual actions 1 thru 6 function to align the suction of the residual heat removal pumps to the containment sump and to align the suction of the charging & safety injection pumps to the discharge of the residual heat removal pumps, thereby assuring an available suction source for all ECCS pumps. The remaining operator actions serve only to provide redundant isolation of the RWST from the recirculation fluid.

SWITCHOVER STEPS (1)

The RWST low-low level signal automatically initiates opening of the containment sump isolation valves (8811 A&B). Upon receipt of the RWST low-low level signal the operator is to immediately enter the emergency procedure for transfer to cold leg recirc and perform the following actions:

STEP 1: When each sump isolation valve (8811 A&B) has reached the full open position, take immediate action to close the corresponding RWST to residual heat removal pump suction isolation valve (8812 A&B).

STEP 2: Close the three Safety Injection Pump miniflow valves (8813, 8814A, and 8814B).

TABLE 6.3-7

(Sheet 2)

STEP 3: Close the two valves in the crossover line downstream of the residual heat removal heat exchangers (8716 A&B).

STEP 4: Close the CCP miniflow to RWST valves (8511A, 8511B, 8512A, 8512B).

STEP 5: Open the two parallel valves in the common suction lines between the charging pump suction and the safety injection pump suction (8807 A&B).

STEP 6: Open each valve from each residual heat removal pump discharge line to the charging pump suction and to the safety injection pump suction (8804 A&B respectively).

All ECCS pumps are now aligned with suction flow from the containment sump. See Table 6.3-11 for additional information on these switchover steps.

STEP 7: Verify proper operation and alignment of all ECCS components. Complete the following manual actions to provide redundant isolation of the RWST from the recirculation fluid.

STEP 8: Close the two parallel valves in the line from the RWST to the charging pump suction (LCV-112 D&E).

STEP 9: Restore power to and close the valve in the common line from the RWST to both safety injection pumps (8806).

The RWST level indication then informs the operator that sufficient water has been injected into containment and to initiate switchover of the containment spray system.

STEP 10: Switchover all four (4) containment spray pumps.

The ECCS is now aligned for cold leg recirculation as follows:

a. Both residual heat removal pumps are delivering from the containment sump directly to the RCS cold legs and are also delivering to the suction of the safety injection and charging pumps.

b. Both safety injection and charging pumps are delivering to the RCS cold legs.

   (1) The operator actions for switchover from injection to cold leg recirculation are not to be interrupted until all of the steps in the switchover are completed; however, if the RWST EMPTY level alarm is received any time during the switchover, immediately stop any pumps still taking suction from the RWST, then complete the switchover and restart any pump which was stopped, starting with the residual heat removal pump.

CPSES/FSAR

TABLE 6.3-7

(Sheet 3)

SWITCHOVER FROM COLD LEG-RECIRCULATION TO HOT LEG RECIRCULATION

At several hours after the accident, hot leg recirculation shall be initiated. The time of hot leg recirculation is provided in Appendices 4A and 4B for Units 1 and 2, respectively. The following manual operator actions are required to perform the switchover operation from the cold leg recirculation mode to the hot leg recirculation mode. These steps are the general steps required to complete the switchover for both trains of ECCS. Plant procedures may direct completion of steps by individual train as necessary based on component availability.)

SWITCHOVER STEPS

STEP 1: Close the residual heat removal pump discharge cold leg header isolation valves (8809 A/B).

STEP 2: Open the residual heat removal pump discharge crossover isolation valves (8716 A/B).

*STEP 3: Open the residual heat removal pump discharge hot leg header isolation valve (8840).

STEP 4: Stop safety injection pump No. 1.

STEP 5: Close the corresponding safety injection pump discharge crossover header isolation valve (8821A).

STEP 6: Open the corresponding safety injection pump discharge hot leg header isolation valve (8802A).

*STEP 7: Restart safety injection pump No. 1.

STEP 8: Stop safety injection pump No. 2.

STEP 9: Close the corresponding safety injection pump discharge crossover isolation valve (8821B).

STEP 10: Open the corresponding safety injection pump discharge hot leg header isolation valve (8802B).

*STEP 11: Restart safety injection pump No. 2.

STEP 12: Close the safety injection pump discharge cold leg header isolation valve (8835).

TABLE 6.3-7

(Sheet 4)

STEP 13: Open Valve 8821A or 8821B. No preference, however, only one valve may be opened.

The ECCS is now aligned for hot leg recirculation as follows:

a. Both residual heat removal pumps are delivering from the containment sump directly to the RCS hot legs and are also delivering to the suction of the safety injection and charging pumps.

b. Both safety injection pumps are delivering to the RCS hot legs. Hot leg flow will dilute the reactor vessel boron concentration by passing relatively dilute boron solution from the hot leg through the vessel to the cold leg break location.

c. Both charging pumps are delivering to the RCS cold legs. High head charging flow will continue to be provided to the RCS cold legs to preclude boron concentration buildup in the vessel for breaks in the hot leg.

* Note: If the alignment of a residual heat removal or safety injection pump for hot leg recirculation is not successful, the affected pump is returned to delivering cold leg recirculation flow, plant staff is consulted, and applicable steps not yet performed are taken to align remaining pump(s) for hot leg recirculation.

TABLE 6.3-11

Sheet 1 of 2

RWST OUTFLOW LARGE BREAK - WORST SINGLE FAILURE[9]

Step (1)	Table 6.3-7 Step	Action	Time Req. Per Step (sec) (3) (5) (10)	RWST Outflow Per Step (gpm) (2) (6) (7)		Cumulative Change in RWST Vol. (gal)	
1	-	Reset SI	30	~~22,610~~	24694	~~11,305~~	12347
2	-	Verify CCW flow from RHR heat exchangers	30	~~22,362~~	21596	~~22,486~~	23145
3a (4)	-	Verify 8811A&B open (emergency sump to RHRPs)	30	~~21,993~~	21245	~~33,483~~	33767
3b	1	Close 8812A&B (RWST to RHRPs)	50	~~21,623~~	20888	~~51,502~~	51174
3c	2	Close 8814A&B, 8813 (SIP miniflow)	40	~~19,000~~	19290	~~64,769~~	64034
3d	3	Close 8716A&B (RHRP crosstie)	45	~~19,551~~	18999	~~79,432~~	78282
3e	4	Close 8511A&B, 8512A&B (CCP Alt Miniflow)	40	~~19,136~~	18609	~~92,180~~	90688
3f	5	Open 8807A&B (SI to Charging Suction Header Crosstie)	45	~~18,759~~	18254	~~106,258~~	104379
3g (8)	6	Open 8804A&B (RHRP to SIP Suction)	45	~~18,315~~	17842	~~110,004~~	117760
4a		Check RWST level ~~<24%~~ </= 6% (11)	~~30~~	~~16,787~~		~~128,388~~	
4b1		Open HV-4782/4783 (emergency sump to CT pumps)	~~50~~	~~15,833~~		~~141,582~~	
		Stop ECCS pumps still taking suction from RWST (12)	~~30~~	~~11,604~~		~~147,384~~	
4b2		Close HV-4758/4759 (RWST to CT pumps)	~~30(11)~~	~~11,275~~		~~153,022~~	
			~~45(11)~~	~~11,275~~		~~155,841~~	
			~~75(11)~~	~~10,787~~		~~160,324~~	

NOTES:

(1) Emergency operating procedure steps for transfer to cold leg recirculation. See Table 6.3-7 switchover steps 1 through 6 for a description of the steps 3b through 3g (manual switchover actions for ECCS).

(2) It is assumed that the RHR, SI, charging and containment spray pumps operate at conservative flowrates. Pumped flowrates are assumed to be constant during each step of switchover and the specified number of pumps of each type are operating:

TABLE 6.3-11

Sheet 2

RHR pump	=	2 pumps operating
CCHG pump	=	2 pumps operating
SI pump	=	2 pumps operating
CS pump	=	4 pumps operating

(3) ECCS Valve operating times are maximum operating times from Table 6.3-1.

(4) An allowance of time for valves 8811A/B to automatically open occurs prior to completion of step 1.

(5) Time required to complete the required action includes a conservative 30 seconds for operator response time for each manual procedure.

(6) The flowrate in this column is assumed to occur during the entire time interval for its respective step. This is conservative since valve repositioning may reduce the flowrate during the time interval.

(7) Flow out of the RWST during switchover includes allowances for both pumped flow to the RCS and containment and for backflow to the containment sump.

(8) Following the completion of this step all ECCS pumps are aligned with suction flow from the containment sump with the exception of one RHR pump due to the single failure. The containment spray pumps continue to take suction from the RWST until the RWST level indication is less than or equal to ~~24%~~ 6% and the operator initiates switchover of the Containment Spray System.

(9) Based on a Large Break LOCA in conjunction with a single failure of one of the RWST to RHR pump isolation valves (e.g., 8812A or 8812B fails to close on demand).

(10) Containment Spray valve operating times are maximum operating times of 20 seconds for HV-4782 and HV-4783 (sump isolation valves) and ~~90~~ 30 seconds for HV-4758 and HV-4759 (RWST isolation valves).

(11) ~~Step 4b2 is broken down into 30 seconds for the operator response time and the 90 second valve stroke time. The valve stroke time is broken into 15 and 75 second increments to reflect the decreasing flow rate as RWST level drops.~~

(12) ~~The minimum RWST transfer volume (146,000 gallons) and associated Empty Alarm could occur during the valve stroke time for step 4b2.~~ A 30 second delay is conservatively assumed prior to ~~step 4b2~~ for the operator to execute an ECCS pump protection caution.

The operator is directed to stop any ECCS pump still taking suction from the RWST upon receipt of the Empty alarm (9%).

Containment spray switchover starts after the empty alarm (i.e., after any ECCS pump protection steps) when RWST level decreases to 6%. Less than 13,450 gallons is required to complete the CT switchover including the worst single active failure during switchover. There is sufficient RWST usable volume to complete CT switchover including the worst single active failure.