PSEG Nuclear LLC
P.O. Box 236, Hancocks Bridge, New Jersey 08038-0236

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PSEG
Nuclear LLC

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

**REVISED REQUEST FOR CHANGES TO TECHNICAL SPECIFICATIONS
CONTAINMENT SYSTEMS – CONTAINMENT COOLING SYSTEM
SALEM NUCLEAR GENERATING STATION UNITS 1 and 2
FACILITY OPERATING LICENSES DPR-70 and DPR-75
DOCKET NOs. 50-272 and 50-311**

On April 15, 2004, PSEG submitted a request for revision to the Technical Specifications for the Salem Nuclear Generating Station Units 1 and 2. In the request PSEG Nuclear proposes to revise the Salem Unit 1 Technical Specifications to reflect the addition of a new non-safety grade chilled water system to provide normal cooling water to the Containment Fan Cooling Units (CFCUs).

As part of the standard engineering design process for the new Chilled Water System, certain changes were deemed necessary to the previous submittal and they have been included on this revised submittal. The changes include a new action statement requiring prompt action to restore containment cooling in the unlikely event of a loss of the normal containment cooling capability.

PSEG requests the replacement of the previous submittal (LR-N04-0089, LCR S03-07 dated April 15, 2004) with this submittal with the exception of Attachments 3 and 4, which are WCAP-16193 and System Description, respectively. The appropriate changes have been marked with revision bars.

Pursuant to 10 CFR 50.90, PSEG Nuclear LLC (PSEG) hereby requests a revision to the Technical Specifications (TS) for the Salem Nuclear Generating Station, Units 1 and 2. In accordance with 10 CFR 50.91 (b)(1), a copy of this submittal has been sent to the State of New Jersey.

PSEG Nuclear proposes to revise the Salem Unit 1 Technical Specifications to reflect the addition of the chilled water system to provide cooling water to the Containment Fan Cooling Units (CFCUs). This request also addresses a non-conservative Action Statement for Salem Units 1 and 2 as described in Item 3 below. The appropriate Bases are also included with this submittal.

The bases for these changes are:

1. PSEG proposes to modify the cooling water to the CFCUs as follows:
    a. Normal Containment Cooling Water System (NCCWS)- Installing a new non-safety related closed-loop chilled water cooling system to be used during normal operating conditions.
    b. Emergency Containment Cooling Water System (ECCWS)- Retaining the service water system as the safety related cooling source for postulated accident conditions with limited allowance for use during normal operations.

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2. In support of the proposed configuration, PSEG has obtained new containment response analysis from the NSSS Vendor (Westinghouse). This analysis (WCAP 16193) demonstrates that, when the modifications are complete, containment pressures and temperatures will remain within current analyzed limits with two containment cooling fans operating under design basis accident conditions, including loss of off-site power and the most limiting single failure. Due to restrictions on allowable doses within the current source term, PSEG is not submitting a request to revise the number of CFCUs required at this time. PSEG is currently working on the development of a full scope Regulatory Guide (RG) 1.183 Altemate Source Term (AST) dose conversion and following the approval of AST, as the Salem licensing basis, a submittal will be made to request the appropriate changes.

3. During the licensing review in preparation of this submittal, it was discovered that a potentially non-conservative Action Statement exists in the current TS for Salem Units 1 and 2. The Action Statement in question is TS 3.6.2.3 Action b., which allows 3 or more containment cooling fans to be inoperable provided both containment spray pumps are operable. PSEG was unable to find justification to support this Action Statement since it allows the plant to operate for 72 hours with less than 3 CFCUs operable. This Action Statement is being modified as shown in Attachment 2. In accordance with NRC Administrative Letter 98-10, PSEG has implemented temporary instructions that will require the affected Salem unit to enter TS 3.0.3 with less than 3 CFCUs operable regardless of the number of containment spray pumps operable. These restrictions will be in place until this amendment request is approved and implemented.

4. PSEG has evaluated the impact of the changes on the CFCUs, including two-phase flow and water-hammer issues identified in Generic Letter 96-06 and has determined that design of the system remains adequate and in accordance with design requirements and commitments.

5. PSEG has determined that the proposed modification substantially increases overall plant reliability through increased CFCU reliability (by elimination of raw water during normal operation and simplification of flow controls), reduced flow demand on the service water system under both normal and accident conditions, reduced electrical loading on emergency diesel generators during accident conditions, and lower containment temperatures during normal operation.

In support of facilitating your review of this submittal, a simplified system description is included as Attachment 4.

PSEG has evaluated the proposed changes in accordance with 10 CFR 50.91 (a)(1), using the criteria in 10 CFR 50.92 (c), and has determined this request involves no significant hazards considerations. This amendment to the Salem TS meets the criteria of 10 CFR 51.22 (c)(9) for categorical exclusion from an environmental impact statement.

The requested changes are provided in Attachment 1 to this letter. The proposed marked up Technical Specification pages are provided in Attachment 2. The revised Westinghouse containment response analysis, in the form of Westinghouse Non-Proprietary Class 3 WCAP 16193-NP, is provided in Attachment 3. A simplified System Description is provided in Attachment 4.

PSEG requests processing of the proposed License Amendment in accordance with the outage implementation schedule that follows: Unit 1- Refueling Outage 17(1R17) scheduled for October 2005. The proposed modification is a substantial undertaking. Design and fabrication activities will be proceeding in parallel with the licensing activities in order to permit the earliest possible

implementation with the final tie-ins and final turnover to Operations after successful pre-operational testing following the issuance of the respective license amendments. PSEG intends to make a similar submittal for Salem Unit 2 in the near future in accordance with the Unit 2 installation scheduled for Refueling Outage 15(2R15) in October 2006.
One new commitment, as stated below, is made in this submittal.

In accordance with NRC Administrative Letter 98-10, PSEG has implemented temporary instructions that will require the affected Salem unit to enter TS 3.0.3 with less than 3 CFCUs operable regardless of the number of containment spray pumps operable. These restrictions will be in place until this amendment request is approved and implemented.

Should you have any questions regarding this request, please contact Mr. John Nagle at 856-339-3171.

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

Sincerely,

Executed on 8/9/04

D. F. Garchow
Vice President
Engineering and Technical Support

Attachments (4)

cc Mr. Samuel J. Collins, Administrator - Region I
U. S. Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406

U. S. Nuclear Regulatory Commission
ATTN: Mr. Daniel Collins, Licensing Project Manager - Salem
Mail Stop 08C2
Washington, DC 20555-0001

USNRC Senior Resident Inspector - Salem (X24)

Mr. K. Tosch, Manager IV
Bureau of Nuclear Engineering
PO Box 415
Trenton, NJ 08625

SALEM NUCLEAR GENERATING STATION UNITS 1 AND 2
FACILITY OPERATING LICENSES DPR-70 AND DPR-75
DOCKET NOs. 50-272 AND 50-311

ATTACHMENT 1

EVALUATION OF REVISIONS TO THE TECHNICAL SPECIFICATIONS CONTAINMENT COOLING SYSTEM

REQUEST FOR CHANGE TO TECHNICAL SPECIFICATIONS
CONTAINMENT SYSTEMS – CONTAINMENT COOLING SYSTEM

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REQUEST FOR CHANGE TO TECHNICAL SPECIFICATIONS CONTAINMENT SYSTEMS – CONTAINMENT COOLING SYSTEM

1.0 DESCRIPTION

An independent Containment Fan Cooling Units (CFCUs) Normal Containment Cooling Water System (NCCWS) composed of a non-safety related chilled water (CH) system with redundant components is being installed at Salem Unit 1. The CFCU NCCWS, also referred to as the CH system, provides chilled water for containment cooling during normal power operation, normal shutdown, and refueling. It is not relied upon for design basis accident (DBA) cooling.

The Emergency Containment Cooling Water System (ECCWS) composed of service water (SW) cooling is required during any DBA that releases mass/energy into the containment, even if the CFCU NCCWS remains available, since the DBA heat load would trip out the chillers on overload. A revised Westinghouse analysis (WCAP 16193), that credits improved CFCU fouling factor and improvements in accident modeling, shows that only two CFCUs, each with a minimum of 1200 gpm SW flow, are adequate for DBA containment cooling. However, since the present dose calculation credits the equivalent of 3 CFCUs for DBA containment air mixing and iodine scrubbing, and a single active component failure (SACF) may disable two CFCUs, the Containment Cooling System Technical Specifications will retain the requirements to maintain five CFCUs operable. Following submittal and approval of the full scope Alternate Source Term (AST), for Salem Units 1 and 2, the analysis will support a licensing change to reduce the number of required operable CFCUs.

On a Safety Injection (SI) signal, the CFCU flow is automatically realigned from chilled water to service water. The CFCU chilled water supply is isolated and service water flow is automatically aligned. However if a Loss of Offsite Power occurs concurrently, the service water valve opening is delayed until after the SW pumps are loaded onto the emergency diesel generators and restarted. This sequence of events is completed in less than 60 seconds (TS Table 3.3-5, Item 2h). A revised Note 7 to this item is included to reflect the completion of the logic described above.

Since the CFCU chilled water system shares some common piping and components with the SW system, SW leakage into the chilled water system is prevented during normal operation by using two in-series, SW isolation valves in each SW header and by maintaining the cleaner system at a slightly higher pressure than the service water. All CFCU chilled water system components that are part of the safety related pressure boundary are designed to the higher standards imposed on the SW system. This includes the valves that isolate the non-safety related portion of the CFCU NCCWS.

One of the two SW accumulators is retained as a safety related accumulator. It keeps the CFCU piping full and the fluid under subcooled conditions. The other accumulator is used by the CFCU NCCWS as a head tank. It maintains Net Positive Suction Head (NPSH) and provides surge volume to accommodate thermal expansion, flow transients, and system leaks. The revised Westinghouse analysis allows a significant reduction in the accident SW flow and, as a benefit, the complex flow control valve scheme presently required to establish different CFCU SW flows is eliminated. The reduced accident flow per CFCU allows the SW pumps to be destaged from 3 to 2 stages since it eliminates the CFCU as the dominant pressure loop. All normal and accident flows can be met with a 2 stage SW pump. Each destaged pump reduces vital power consumption by ~250 KW. It is anticipated that the SW pump destaging will decrease the peak Emergency Diesel Generator (EDG) loading below the continuous rating, 2600 KW, even during the ECCS injection phase. The new chillers and pumps will be powered from the non-vital (group) buses. As part of the project, verification of the actual service water pumps KW will be performed following destaging.

SW cooling during power operation is retained (available in standby) to address the unlikely loss of normal chilled water cooling. With no CFCU cooling, both containment temperature and pressure will increase. Assuming a conservative scenario where the CFCU NCCWS (chilled water) is lost but power operation continues and there is no reduction in any heat load inside containment, it takes approximately 14 minutes for the containment temperature to exceed the TS limit of 120 °F (this credits a 90°F initial containment temperature). The rate of pressure increase depends on the initial containment pressure, and typically, during power operation this pressure is at or just above atmospheric (0 psig). At this condition a loss of NCCWS will result in exceeding the TS pressure limit (+0.3 psig) in less than 3 minutes (less time for higher initial pressure).

These noted TS limits are also the initial conditions assumed in the accident analysis for containment response to mass and energy release events. A new specific TS Action will be added to restore normal cooling, initiate Service Water cooling or shutdown within one hour following the loss of NCCWS. This will ensure that plant operation will not proceed in an unanalyzed condition. This action complements the current TS actions for primary containment internal pressure and average air temperature in that the proposed action is initiated from a loss of equipment standpoint and not a measured parameter. As part of the implementation of this amendment, Operations procedures will be revised to address the criteria for manual swap over to SW and CFCU restart based on containment conditions and loss of normal containment cooling capability.

The supporting Bases for this Specification documents that sufficient containment cooling is available in postulated accident conditions to support the assumptions of the containment response analysis, which ensure that containment pressure and temperature limits are not exceeded in postulated design basis accidents. Specifically, this analysis demonstrates that peak containment accident pressure and temperature remain below the design values for both limiting LOCA and MSLB accidents.

Overall, there is a significant gain in CFCU reliability and a significant reduction in maintenance by using clean water to reduce the corrosion, erosion, and fouling of the CFCUs and by eliminating the flow control valves. This overall increase in reliability is expected to significantly reduce TS Action Statement entries due to CFCU tube degradation and system leaks.

2.0 PROPOSED CHANGES

The revised analysis will become effective upon completion of a planned plant modification that will replace service water with a new chilled water system for CFCU cooling under normal operating conditions, while retaining service water as the safety related cooling source for accident mitigation.

The proposed changes to the Unit 1 Technical Specifications, except as noted below, would revise the following sections (marked up Technical Specification pages are included in Attachment 2):

a. TS Table 3.3-5, ESF Times – Correct a typographical error found in the title. Should read Engineered Safety Features Response Times instead of Items.
b. TS Table 3.3-5, ESF Response Times- Item 2h Note 7-Revise the note to include the isolation time for the chilled water supply.
c. TS 3.6.1.1, Containment Integrity- Relocate Action Statements c and d to TS 3.6.2.3 in order to have a consistent Section that addresses the SW accumulator surveillances and Action Statements.
d. TS Bases B3/4 6.1.1 Containment Integrity – Expand the Bases to reflect the relation between the required Surveillances and Action Statements for the SW accumulator.
e. TS Bases B3/4 6.2.1 Containment Spray System- Expand the Bases to include the WCAP analysis and crediting containment recirculation sprays.
f. Applicable to Units 1 and 2: TS 3.6.2.3 Action b. is modified to require that at least 3 CFCUs remain OPERABLE and delete the association with the number of containment spray pumps OPERABLE.

g. TS 3.6.2.3, Containment Cooling System – Add Action Statements c and d to reflect 1) the limitations for continuous operation when relying on SW for cooling method of the CFCUs and 2) restrict unit operation with the SW accumulator inoperable.

h. TS 4.6.2.3, Surveillances – 1) Revise the SW accumulator surveillances to reflect the new design parameters required to support the function of the accumulator to prevent water-hammer and to maintain sub-cooled conditions and prevent column separation, 2) the revision of chilled water flow requirements to ensure adequate containment heat removal capability, 3) the addition of a quarterly surveillance to perform valve stroke in accordance with the IST Program to verify that the safety functions of the NCCWS and ECCWS systems will be performed as intended, 4) the addition of a requirement to verify, once per 18 months, that the logic circuit functions as designed to allow the swap-over from the non-safety related chilled water supply to the safety related service water supply, and 5) the deletion of the surveillance requirements to test the accumulator vessel discharge valves since these are being removed as part of the project.

i. TS Bases 3.6.2.3, Containment Cooling System-Revised the Bases to expand on the description of the NCCWS and ECCWS. Included is a description of abnormal operations where limitations apply to the use of the SW for continued operations in the unlikely event of total loss of the chilled water supply.

j. TS Bases 3.6.1.5, Air Temperature – Added the reference to show that the OPERABILITY of the Containment Cooling System ensures that the temperature limitations of less than or equal to 120°F are met.

k. TS. Surveillance 4.7.4.1, Service Water System- Added an exception to Surveillance b., which would have required the introduction of Service Water into the otherwise clean CFCU piping. It is also consistent with Surveillance 4.6.2.3.d.2. On the same page, 3/4 7-16, deleted the one time footnote applicable to Unit 1 Cycle 15 which is no longer applicable.

l. TS 3.6.2.3, Containment Cooling System – Add Action Statement e to reflect the limitations required following a loss of containment cooling capability to minimize the time interval that the containment temperature and pressure may exceed the Technical Specification limits. This is considered a conservative action intended to minimize the risk of exceeding the initial conditions (containment temperature and pressure) assumed for DBA analyses for Salem.

3.0 BACKGROUND

PSEG is proposing to modify the configuration of the SW System alignment to the CFCUs for Salem Unit 1 during Refueling Outage 1R17 in October 2005. Under the new alignment for normal operation, the CFCUs will transfer heat to a new closed loop chilled water system in order to maintain the containment temperature at or below a specified limit (currently 120°F). Under accident conditions, the system alignment will change such that, heat will be transferred to the SW System. This plant modification will be referred to as the CFCU/SW Enhancement Project. PSEG will make a submittal to support a similar modification planned for Unit 2 during the 2R15 refueling outage in October 2006.

There are five CFCUs in the Salem Unit 1 containment. All CFCUs are currently cooled by SW during both normal and accident conditions. SW cooling has caused long-standing maintenance problems for the CFCUs related to both the nature and quality of the cooling water, exacerbated in the summer months by elevated river temperatures. Consequently, in order to provide more reliable and more effective containment cooling under normal operating conditions (including shutdown periods and refueling), PSEG Nuclear has initiated a CFCU/SW Enhancement Project that will install chilled water as the CFCU cooling source under normal conditions. The new Normal Containment Cooling Water System (NCCWS) composed of chilled water will be non-safety related, and therefore the safety related SW will be retained as the cooling medium under postulated accident conditions.

Once the NCCWS (chilled water) is installed, three CFCUs are capable of maintaining the containment temperature at approximately 90°F during normal operations. Furthermore, only two CFCUs are required for post-accident cooling, however, since the present dose calculation credits 3 CFCUs for DBA containment air mixing and iodine scrubbing, and a single active component failure (SACF) may disable two CFCUs, the Containment Cooling Technical Specifications will retain the requirements to maintain five CFCUs operable. When Alternate Source Term (AST) is implemented, the analysis will support a licensing change to reduce the number of required operable CFCUs.

The reliability of the modified system will be improved through greatly reduced tube fouling, substantial reductions in piping erosion, corrosion, and silting, reduced SW flow rates (allowing for continuous strainer backwash), elimination of the flow modulating valves that currently control CFCU cooling flow, and fewer required maintenance activities. Also, lower operating containment temperatures will improve the reliability of temperature sensitive components within the containment. As a result of destaging the Service Water pumps there will be a reduction of emergency diesel generators load requirements. In summary, when installed, this modification will directly improve the reliability of the containment cooling systems and the emergency diesel generators at Salem Unit 1.

4.0 TECHNICAL ANALYSIS

Additional system details are provided in Attachment 4, Simplified System Description.

Two primary sets of technical analyses support the proposed modification. The first is a revised containment pressure and temperature analysis by the NSSS Vendor (Westinghouse). The second set evaluates specific post-modification CFCU performance, including issues related to NRC Generic Letter 96-06. Each of these analyses is further discussed below.

4.1 Containment Pressure and Temperature Analysis

PSEG is proposing to modify the configuration of the SW System alignment to the CFCUs for Salem Unit 1. Under the new alignment for normal operation, the CFCUs will transfer heat to a new closed loop chilled water system in order to maintain the containment temperature at or below a specified limit (currently 120°F). Under accident conditions, the system alignment will change such that heat will be transferred to the SW System. Overall, the intent of the CFCU/SW Enhancement Project is to improve system performance and to reduce maintenance.

The purpose of the Westinghouse analysis was to execute a sufficient number of containment mass and energy (M&E) release scenarios to assure PSEG that the proposed CFCU/SW Enhancement Project will result in sufficient cooling under postulated mass and energy release accidents.

Containment Integrity Analysis has been performed for design basis Loss of Coolant Accident (LOCA) and Main Steam Line Break (MSLB) transients consistent with a proposed change to the Salem Nuclear Generating Station containment fan cooling units and service water system. The proposed change will affect the post-accident operation of the containment heat removal systems. The analysis is required to update the licensing basis to support the CFCU/SW Enhancement Project. The analysis is consistent with current licensed methodology for LOCA and MSLB.

The containment integrity analysis considers the containment response to both long-term MSLB and LOCA mass and energy releases. The results of the analysis demonstrate the acceptability of the containment safeguards systems to mitigate the containment consequences of a hypothetical design basis pipe break. The analysis ensures that the containment heat removal capability is sufficient to remove the maximum possible discharge of mass and energy release to containment from the Nuclear Steam Supply System without exceeding the containment design pressure and temperature limits. These calculations credit post-LOCA recirculation spray.

The peak calculated pressure for the minimum safeguards LOCA case for Salem Unit 1 with Model F steam generators was 40.1 psig.

For MSLB, the limiting containment pressure case is a 1.4 ft^2 double-ended rupture (DER) initiated at 30% power with a containment safeguards failure. The limiting containment temperature case is 0.88 ft^2 split rupture initiated at 30% power with a MSIV failure. For Unit 1, the peak pressure is 40.2 psig and the peak temperature is 345.7°F. While this is less than 351.3°F and the long-term temperature is less than the current profile, there is a period from approximately 140 seconds to 320 seconds where the new composite curve exceeds the current EQ envelope. The evaluation is addressed in Section 4.3.

The long-term containment integrity analysis demonstrates the acceptability of the containment safeguards systems to mitigate the consequences of a hypothetical loss of coolant accident or main steamline break. The calculations conservatively predict the containment pressure and temperature response subsequent to a postulated pipe break. This analysis demonstrates that the changes PSEG has proposed for the service water system and the containment fan cooler units provide adequate cooling to maintain the post-accident containment pressure and temperature within the allowable limits.

This evaluation identifies the most limiting LOCA and the most limiting MSLB configuration(s) for the containment for Salem Unit 1 with the revised containment heat removal systems. The impact of the most limiting single failure is applied to each scenario. This evaluation determined the limiting transients based on the containment analysis methodology described in the following sections.

The proposed CFCU/SW configuration includes an automatic swap to service water cooling (accident mode). The accident analysis assumes that containment heat removal (from the CFCUs) starts by 100 seconds following the actuation trip signal. This is conservative since the Response Time listed in TS Table 3.3-5; Item 2h remains unchanged at 60 seconds.

Although the proposed design maintains all 5 CFCUs operable, the revised containment analysis was based on a more limiting initial condition that only 3 CFCUs (one per vital bus) are operable. For those cases where the single failure is the loss of a safeguards train, the revised containment analysis only credits two CFCUs and one containment spray pump available for containment cooling (three CFCUs and two spray pumps for other single failure scenarios).

As part of the analysis performed in 1996 and 1997, the plant design change required to meet Generic Letter 96-06 (two accumulators connected to the service water headers utilizing a nitrogen gas cover to ensure the system remained pressurized) resulted in 10% degraded heat removal (due to gas entrainment) for the first two minutes that the CFCUs were running in accident mode. The new CFCU/SW configuration will not have this short term degraded heat removal since the new chilled water configuration is a closed loop with no potential for column separation during the period when the service water pumps are being restarted on the diesel-generators.

A revised containment response analysis is contained in WCAP 16193, Attachment 3.

4.2 <u>CFCU Post Modification Performance Evaluations</u>

CFCU FLOW RATES

As discussed above, current SW flow rates to the CFCUs are a nominal 1200 gpm for normal operating conditions and a nominal 2500 gpm under accident conditions. A complex control scheme automatically shifts service water flow from normal to accident conditions, when the CFCUs restart on an accident signal. The controls for each individual CFCU, include a pressure control valve (SW57), a two-position valve to provide a larger pressure drop for low-flow operation (SW65), and a modulating flow-control valve (SW223) receiving control signals from a flow element.

Under the proposed design, the complex CFCU flow controls will be eliminated and will be replaced by fixed resistances (orifices and locked throttle valves). SW 57 and SW65 valves will be removed and the SW223 valve will be changed to a locked, manual throttle valve. With fixed resistances, once the flow balance ic completed and the manual throttle valves are locked in place, the CFCU flow is determined by the differential head across the CFCU inlet and outlet headers.

As shown below, CFCU heat removal capacity assumes a service water flow rate of 1200 gpm/CFCU. But, as described in Reference 7.1, to account for both instrument and flow model uncertainties, the flow balance procedure for each SW header will be structured to target a minimum accident flow of 1300 gpm/CFCU to each of the three CFCUs in that header under appropriately degraded pump curves and the limiting postulatec single failure scenario.

Since the flow balance procedure will be performed under plant configurations different from postulated accident configurations (including single-failures), the procedure will typically balance at higher SW flow rates and the SW system hydraulic model will be used to assure that minimum required flow at the limiting conditions.

The NCCWS (chilled water) piping allows the total chilled water nominal flow (2600 gpm) to be directed to one or both of the two CFCU cooling headers. Anticipated operation is to direct the chilled water to both headers to provide a nominal flow of 520 gpm to each CFCU. The chilled water pumps will be conservatively sized to meet this flow rate assuming the fixed resistances for the CFCU flow paths established above.

Shortly after the initial SW flow balance described above is completed and the throttle valves locked in the required position, the chilled water system will be initiated. The chilled water flow to that header, as well as the exact chilled water configuration and chilled water pump performance, will be documented. The results of the SW flow and chilled water flow for each header will be used to document the CFCU header system resistance curve.

Procedures will be implemented to assure that uncontrolled changes are not made that would alter the CFCU flow path fixed resistances. Periodic testing with chilled water allows confirmation that the required system resistance curve has not changed. In turn, this ensures that the minimum SW accident flow can be met. Should it be necessary to manipulate one of the locked throttle valves, the balance can be reset using chilled water flow. Since the testing is performed using chilled water, periodic SW testing using SW is not required.

The design relies on four (4) 50% capacity chilled water pumps to provide high assurances that 100% of the rated flow will be maintained. Since changes in containment heat loads are automatically compensated by adjusting the chiller loading, the chilled water system will have a fixed flow rate.

If SW is ever introduced for the off-normal cooling mode, procedures will stipulate verification that the actual SW flow is in conformance with the flow predicted by the CFCU header resistance within 72 hours unless SW flow is terminated before then.

The only portions of the CFCU headers that are not flow tested with chilled water are short, dead legs that will be subject to routine flushing and inspection. The CFCU SW supply headers have a dead leg approximately 2.5' long between the bottom of the main headers to the Auxiliary Building and the upstream normally shut isolation valve. Likewise, the return header has a 2.5' long dead leg between the downstream normally shut isolation valve and the main header. A 2" flush valve connection at the bottom of these dead legs allows periodic blow down of silt and debris in the deadheaded portion of the line. A hose connection between the supply and return header flush connection allows the full SW system differential pressure to be used to flush these dead legs. Alternatively, the hose can be directed to an open container to allow periodic assessment of the type and amount of debris.

An inspection port near the dead leg allows inspections of the dead legs during Auxiliary Building SW header outages.

When testing the outboard SW isolation valve [outboard refers to the air operated valve (AOV) closest to the main SW header], a small manual by-pass around the "inboard" SW isolation valve is opened. This flush valve keeps the volume between the two valves

pressurized with the higher pressure, clean chilled water. Flow when testing the outboard isolation valve will then be into the SW header.

CFCU HEAT REMOVAL CAPACITY

Under the present configuration (current licensing basis), three CFCUs are credited for DBA cooling to account for the limiting single active component failure (SACF). CFCU heat removal capability was analyzed with a conservative fouling factor of 0.0032 because the CFCUs were constantly exposed to the raw water of the service water system. This fouling factor was applied because raw-water cooling, as indicated by the Tubular Exchanger Manufacturer's Association (TEMA) Manual (Reference 7.7), results in a high level of potential fouling of heat exchanger tubes.

The revised containment analysis assumes the total CFCU heat removal rate corresponding to two (2) CFCUs with low speed fan operation (40,000 cfm), 1200 gpm service water flow/CFCU, fouling factor of 0.0015, and a service water inlet temperature of 93°F, three degrees above the present Salem design basis number, 90°F. The assumed, total CFCU containment heat removal rate is tabulated below.

Containment Temperature, °F	Total CFCU Heat Removal Rate BTU/sec
280	33,000.20
271	31,325.00
260	29,251.20
240	25,413.00
220	21,634.00
200	17,712.80
180	13,817.60
160	9,965.20
140	6,397.40
120	3,241.60
105	1,297.20

Short-term usage of SW, 30 days, does not invalidate the heat removal assumptions. However, since the proposed design maintains all 5 CFCUs operable and no SACF will result in less than 3 CFCUs, there is a significant margin between the anticipated versus analyzed CFCU heat removal and the fouling factor is not critical. Reference 7.1 determined that the total heat removal from 3 CFCUs with a fouling factor corresponding to long-term SW usage, 0.0032, significantly exceeds the heat rate assumed by the revised containment analysis.

CFCU OUTLET TEMPERATURE

By reducing CFCU cooling flow rates and reducing fouling resistance, CFCU outlet temperatures under accident conditions will increase. As shown in Reference 7.1, CFCU outlet temperatures, at the minimum flow of 1200 gpm and with an extremely conservative zero fouling factor, would be 210°F. Reference 7.2 shows that even at 210°F, there will be no flashing or two-phase flow in the piping downstream of the CFCU. This is an expected result because the CFCU outlet piping remains above atmospheric pressure until it exits the containment and is discharged into the main SW return header. By that time, the 210°F has been cooled by (1) mixing with lower temperature flow from the motor cooler (2) mixing with return from other CFCUs (which would have some fouling factor) and (3) mixing with SW return flow from other components, such as the CCW heat exchangers. Consequently, CFCU outlet temperatures at minimum flow remain acceptable.

It should be noted that the SW configuration that produces the minimum of 1200 gpm flow to the CFCUs is based upon the most limiting SW single-failure scenario. Under most expected SW post-accident configurations CFCU flows will be much higher since the system is balanced for the limiting scenario. Consequently, under the more likely SW configurations, CFCU outlet temperatures will be well below 200°F and liquid flashing is not a consideration.

SYSTEM INTERFACES

In order to address long-term corrosion, silting, high maintenance, and high summer time temperatures associated with a once-though, raw water cooling, a closed loop, clean water CFCU Chilled Water System will be used for normal CFCU cooling. This has the added benefits of eliminating cavitation during normal operation and eliminating the risk of water column separation on flow interruption during normal operation. However, SW cooling to the CFCUs must be retained for accident conditions since the chilled water system is neither safety related nor does it have the capacity to meet the accident heat removal requirements. The option for SW CFCU cooling during power operation is retained, but it is considered an abnormal CFCU flow alignment.

The critical system functions during normal CFCU operation are to maintain reliable chilled water system flow and cooling to the CFCUs while maintaining the SW flow isolated. In a plant accident, plant emergency, or chilled water failure, the critical system functions are isolation of the non-safety related chilled water system and initiation of SW cooling to the CFCUs. Depending on the event, isolation of the chilled water, and subsequent initiation of SW cooling, is remote-manual or automatic.

To allow transfer between the two CFCU cooling options, the design requires modifications to the SW accumulators (which were added in 1997 to satisfy GL 96-06 concerns). The function of the accumulator remains the same. It must ensure no water column separation, and, in the case of a DBA, it must maintain the CFCU subcooled to prevent two-phase flow. A discussion of the GL 96-06 requirements can be found on Page 11 of this submittal.

In addition, the design requires valving changes. It requires the addition of air-operated valves and check valves for isolation between systems, and the addition of isolation and unisolation signals. The added valves will either be full open or full shut. The valve design must assure transition to SW cooling within the assumed time.

The CFCU flow transients listed below were evaluated. The acceptance criterion for non-DBA events is preventing water column separation in the CFCU headers. Eliminating water column separation allows the control room operators to remote-manually initiate SW flow to the CFCUs with minimal delay so as to mitigate the containment temperature transient resulting from the loss of normal containment cooling. The DBA events were evaluated against GL 96-06. The first three transients assume the Chilled Water System was in normal operation at the start of the transient.

- An interruption of chilled water flow does not place the CFCU flow path integrity at risk since the Chilled Water System is a closed loop and there is no water column separation concern. Although automatic isolation is not essential, the Chilled Water System is isolated on a loss-of-off-site power to the vital buses. The plant operators have the option to restart the chilled water system if off-site power is restored, or start SW cooling. The accumulator is not required to address this transient.

- A failure of the non-SR portion of the Chilled Water System pressure boundary will cause depressurization and automatic isolation of the Chilled Water System. However, the accumulator prevents water column separation in the CFCU headers.

- A Design Basis Accident (DBA) (with or without a concurrent loss-of-off-site power) initiates a safety injection signal, automatically isolates the Chilled Water System, and then automatically initiates SW flow to the CFCUs. Neither water column separation nor depressurization is anticipated since the Chilled Water System is a closed loop and the CFCU SW return header is opened only after the CFCU SW supply header is pressurized. The accumulator provides added assurances that the CFCU headers remain pressurized and subcooled.

The following three transients assume SW flow to the CFCUs was in operation at the start of the transient.

- A loss-of-offsite power will cause the SW pumps to trip and SW flow to be interrupted. The CFCU SW supply header and return header air-operated valves are immediately signaled to shut. In addition, the CFCU SW supply headers have a single check valve that provides immediate closure (prior to the closure of the air-operated valves) to prevent any backflow through the supply header. The accumulator maintains the CFCU piping water solid.

- A DBA with a concurrent loss-of-offsite power will cause SW flow interruption and valve closure as discussed above. Once power is restored to the vital buses, the CFCU SW valves are automatically sequenced to re-establish flow. The accumulator maintains the CFCU piping water solid and subcooled.

- A DBA without a concurrent loss-of-offsite power will not cause any SW flow interruption. No valve realignment is required in the CFCU supply or return headers. The accumulator is not required to address this transient.

The non-safety CH piping is isolated from the CFCU piping by redundant in-series check valves on the supply header and redundant in-series air-operated butterfly valves on the return header. The supply check valves will automatically prevent backflow and will remain shut by differential pressure from SW. The AOVs are signaled to shut by a SI signal, loss-of-vital power, or low-low chilled water supply pressure (which is indicative of a pressure boundary failure). In addition, the AOV's are fail-closed on a loss of air or loss of power. No single active failure can prevent isolation of the CH piping. All portions of the chilled water piping that are not isolated by the safety related chilled water valves, are designed to the same standards as the safety related CFCU headers.

All interface chilled water valves will be stroke tested on a quarterly basis to assure proper functioning in the event of an accident. Since the portion of the chilled water system that has these valves is redundant, the valves can be tested on-line without interruption of chilled water flow through the redundant header. If necessary, a failed valve can be isolated and removed for repairs.

The two SW CFCU supply and two return headers will be normally isolated. Each SW CFCU supply and return header will have two, in-series, normally shut, fail-closed, air-operated isolation valves. The in-series design minimizes leakage from the raw water system to the clean water system and it allows for testing one valve at a time to verify proper opening. To eliminate any single active component failure, other than a valve mechanical failure from preventing opening, these valves are supplied with redundant air supplies and redundant solenoid valves. Each solenoid valve is powered from a separate, battery-backed vital DC power source. This design has been selected because these isolation valves have safety functions in both the open and shut positions. They must remain shut or if already open, must shut, at the start of an accident in order to preclude voiding of the CFCU piping and subsequent water-hammer or two-phase flow.

Then, once the CFCUs are start in the accident mode, the valves must sequence open to initiate SW flow to the CFCUs.

The SW supply header check valve is normally shut but must open in response to an accident. The valve will be a testable check valve which allows verifying full stroke opening without introducing SW flow into the clean water system and with no valve disassembly. When automatically initiated, the SW valve sequence minimizes the risk of any water column separation and minimizes the outflow required from the accumulator. Specifically, the CFCU SW header remains shut until the chilled water system is isolated and the SW pumps are restarted (if they were tripped due to a loss-of-offsite power), and the corresponding SW pressurized. After the SW supply header valves are opened, the corresponding return header is opened. The revised containment DBA analysis assumes CFCU SW cooling commences in 100 seconds from the start of the DBA. However, the design ensures that full SW flow is initiated within the present 60 seconds required by Technical Specifications.

The remote-manual SW initiation sequence is similar. The SW supply header logic requires the chilled water to be isolated, vital power available, and the corresponding SW header pressurized. The return header valves open only after the corresponding supply header valves are open.

Consequently, with two valves in series in each supply and return header, no single active failure can prevent at least one valve from closing in each header to prevent voiding, and no single active failure (including failure of a DC bus) can prevent at least one full SW header from initiating flow. The system is flow balanced such that either SW header is capable of providing minimum required flow to three CFCUs under the most limiting SW scenario (i.e. degraded pumps, other flow loads, etc.).

The SW design basis for postulated long-term (greater than 24 hours) passive failure in an SW supply header, is not changed. The affected header would be isolated by the header isolation valves and containment cooling would continue to be provided from the other header. Should leaks develop within the containment during the long-term cooling period, these can be remotely isolated by shutting the containment isolation valves for the particular CFCU (the SW 58 and SW 72 valves).

GENERIC LETTER 96-06 REVIEW

Nitrogen pressurized SW accumulators were installed in 1997 to maintain the CFCU piping water filled on SW flow interruption (due to loss-of-offsite power causing the SW pumps to trip) and to maintain the CFCU water subcooled at the start of the DBA, until flow was restored. Since the CFCU return path had a single isolation path, and was subject to failing open, the accumulators were required to maintain flow until the SW pumps were restarted. To handle this capacity, two accumulators were added, one per SW header. The accumulators were normally isolated to ensure that SW operating pressures did not depressurize them. This in turn required redundant, parallel path quick opening valves.

With the Chilled Water System providing normal CFCU cooling, water column separation is prevented by (1) the closed-loop and redundant in series isolation valves that ensure that no single active component failure prevents fast isolation of the non safety-related portions of the chilled water system and (2) opening the SW return header only after the corresponding SW supply header is open. The accumulator is not required to prevent water column separation. In addition, the stagnant CFCU fluid is anticipated to remain subcooled during the transition since the CFCUs will remain pressurized throughout the transient. Relief valves provide overpressure protection of the isolated piping inside containment, but the reset pressure is well above the pressure required to maintain the fluid subcooled. The accumulator provides an added level of protection.

In case of a pressure boundary failure of the non safety-related portion of the Chilled Water System (located outside the safety related areas), the accumulator will maintain the CFCU piping water solid. Maintaining this piping water solid allows remote-manual initiation of SW cooling from the control room with minimal delay and without risking water hammer. This mitigates the containment temperature transient after a loss of normal cooling during power operation.

If the SW is used for containment cooling during normal power operation, the accumulator is required in order to address GL 96-06 concerns. However, the required volume outflow is greatly reduced from the present requirements allowing a single SW accumulator with lower nitrogen pressure to be used. The SW accumulator will have a specified water volume between 7,500 and 11,000 gallons and a specified nitrogen cover gas pressure equal or greater than 61 psig (typical nitrogen cover-gas pressure will be approximately 75 psig). Since this is lower than the CFCU supply header operating pressure, the accumulator can be isolated by a check valve (as opposed to the present AOV's). The specified values prevent (1) water column separation in case of SW flow interruption on a loss-of-off-site power and (2) water column separation and two-phase flow in postulated limiting pipe breaks inside containment with concurrent loss-of-off-site power.

During the swap-over from normal cooling or abnormal cooling to post-accident service water, the CFCU piping inside containment will be isolated and water solid. Relief valves will be provided to prevent thermal over-pressurization of the piping. Setpoints are low enough to prevent over-pressurization and high enough to maintain the fluid subcooled.

The proposed design changes do not adversely impact cavitation in a DBA when flow is restarted and the "hot slug" created in the CFCU coil is purged out of the piping. Assuming the limiting initial condition, SW flow providing the cooling at the initiation of the DBA, the cavitation concerns of the "hot slug" are reduced because (1) the lower accident SW flow results in a higher transient time for the "hot slug" in the return header and, subsequently, greater heat dissipation, and (2) the throttling across the SW223 valve is reduced. This reduction is due to spreading the required pressure drop across SW223 and a downstream flow orifice, as well as destaging the SW pumps from 3 stages to 2 stages. If CFCU Chilled Water System was in service at the start of the DBA, the "hot slug" concern will be further lessened since the CFCU Chilled Water System operates at lower temperatures well below the peak value assumed for SW operation.

SURVEILLANCE REQUIREMENTS

Proposed surveillance requirements, including changes from the current requirements, are shown in detail in Attachment 2. In general, the proposed surveillances will ensure that the chilled water system functions properly and that its failure will not prevent the safety related SW from performing its intended function, as required, in response to accidents at Salem Unit 1. The 4 hours required to restore the SW accumulator to operable status are justified based on the GL 96-06 discussion above and to allow for reasonable time for Operations staff to investigate the cause of the inoperability and restore the accumulator to operable status without inducing unnecessary plant transients. In addition, the proposed modification is removing the fast-acting discharge valves currently installed at the accumulator discharge thus eliminating any active component failures that could prevent the accumulator discharge to the SW piping into the CFCUs.

CH NOT AVAILABLE DURING NORMAL OPERATIONS

The CH system has been designed with substantial redundancy and reliability including four 400 ton air cooled chillers which provide a combined chiller capacity of approximately 150% of required cooling, four 50% capacity chilled water pumps, an oversized head tank, sidestream filter and demineralizer, redundancy in flow path active components (allowing the isolation valves to be tested and removed from service during operation), and digital controls, instruments, and computer diagnostic capabilities. Once the CH system is installed and operating, there is high expectation that raw water (SW) will not be required for CFCU cooling unless called upon under post-accident conditions or other emergency conditions.

The CFCU chilled water system is not safety related and may become unavailable (e.g. after severe natural phenomena or significant failures of non-vital power sources). CFCU SW cooling during normal operation is retained to address these failures and to prevent unnecessary containment transients and immediate, unplanned forced outages.

Reference 7.2 provides the basis for usage of SW for containment cooling during normal operations with the limitations listed below. The basis for these limitations is to limit long-term corrosion of the CFCUs while, at the same time, not to preclude the use of SW during power operation as an abnormal line-up.

1. Operation with SW is permitted for a period not to exceed 30 consecutive days unless an engineering evaluation is performed. The engineering evaluation must address the GL 89-13 requirements.

2. As part of the implementation of this amendment, procedures will be developed to guide the restoration of normal chilled water supply to the CFCUs.

SW PUMP DESTAGING

The present design requires a three stage SW pump to satisfy the CFCU SW flow requirements of 2500 gpm/CFCU. During normal operation, this has required excess throttling in the CFCU branch lines and in other SW lines. Also, it has resulted in a supply header operating pressure as high as 150 psig.

A significant benefit of reducing the CFCU SW accident flow from 2500 gpm to 1200 gpm is that it eliminates the CFCU as the dominant loop in determining the required SW pump's head requirements. The hydraulic models have confirmed that the SW flow rates for all modes of operation to all SW cooled components can be met with only the first two stages of the present three stage SW pumps. As part of the proposed modification, the last stage on the SW pumps will be removed.

A key benefit of destaging SW pumps is the reduction of the supply header operating pressure to approximately 100 psig providing greater margin to the design pressure and reducing throttling and cavitation. In addition, it will lower the required SW pump motor horsepower by approximately one-third. This lowers the emergency diesel loading. In addition, since the SW pumps are presently the highest single load placed on the emergency diesels, it reduces the diesel loading/unloading transient.

The detailed design will address changes to pressure instrumentation, pressure setpoints, and existing orifices and flow control valves.

4.3 Environmental Qualification Assessment

Design Basis Accident (DBA) Profiles postulated by the Westinghouse CFCU analysis indicates that the new profile exceeds the current Salem EQ composite DBA Temperature Profile at certain times as described below:

Based on initial proposed design assumptions, the delay time for the CFCU actuation (allowing the automatic swap from the chillers to Service Water and accounting for appropriate delays including a loss of offsite power) was 100 seconds. The accident analysis supporting the containment response to mass and energy release events was subsequently based on this 100 seconds delay time. From the standpoint of containment temperature and pressure response profiles, this is bounding for safeguards system actuation for any time periods up to 100 seconds. The revised containment DBA analysis assumes CFCU SW cooling commences in 100 seconds from the start of the DBA. However, the design ensures that full SW flow is initiated within the present 60 seconds Technical Specification requirement.

From 100 to 300 seconds into the accident the new temperature profile exceeds the current EQ profile. From 1000 seconds (approximately 16 minutes) to 8000 seconds (approximately 2.22 hours) the new profile exceeds the current EQ profile by less than 10°F. The maximum temperature at 1000 seconds is 265°F, going down to 225°F at 8000 seconds. Although the current EQ Profile temperature boundaries are exceeded by the new Westinghouse analysis for brief time periods, it has been determined by this review that the equipment qualification status will not be compromised. This has been determined as follows.

A review of the qualification binders for all of the EQ equipment located inside containment has determined that the Vendor test profiles will envelope the new postulated DBA temperature profile in most cases. In the isolated cases where this doesn't occur, the revised DBA temperature profile will only exceed the test profiles for small periods of time. In these cases an equivalency evaluation will document that the equipment qualification is not affected.

The EQ Program's Post Accident Operability Calculations that are used to demonstrate operability to 120 days post-DBA do not take credit for temperature margin during the first 24 hours of accident testing. Therefore, the changes occurring during the first 24-hours in the new Westinghouse profile will not affect the equipment's Post Accident Operability Calculations.

For containment pressure, the new Westinghouse profile stayed below the existing EQ profile, except towards the end of the profile, where pressure slightly exceeds the current EQ profile. However, since the new Westinghouse DBA pressure profile is enveloped by the current EQ profile for the peak pressure, the difference at the end of the profile at the lower pressure limits will not affect the qualification of the equipment.

As part of the implementation of the design change package, EQ Binders for EQ equipment located inside containment at Salem will be updated to document the analysis performed.

Conclusion:

Once chilled water is installed, three CFCUs are capable of maintaining containment temperature at approximately 90°F during normal operations. Furthermore, only two CFCUs are required for post-accident cooling, however, since the present dose calculation credits the equivalent of three CFCUs for DBA containment air mixing and iodine scrubbing, and a single active component failure (SACF) may disable two CFCUs, the Containment Cooling System Technical Specifications will retain the requirements to maintain five CFCUs operable. Following submittal and approval of the full scope Alternate Source Term (AST), the analysis will support a licensing change to reduce the number of required operable CFCUs.

The reliability of the modified system will be improved through greatly reduced tube fouling, substantial reductions in CFCU piping erosion, corrosion, and silting, reduced SW flow rates (allowing for continuous strainer backwash), reduced EDG load requirements, and fewer required maintenance activities. Also, lower operating containment temperatures will improve the reliability of equipment and components within the containment.

Under accident conditions, the system automatically transfers to SW cooling. Post-accident containment accident pressures and temperatures remain within limits, and all requirements of NRC Generic Letter 96-06 are satisfied.

5.0 REGULATORY SAFETY ANALYSIS

5.1 Basis for proposed no significant hazards consideration determination

As required by 10 CFR 50.91(a), PSEG provides its analysis of the no significant hazards consideration. According to 10 CFR 50.92(c), a proposed amendment to an operating license involves no significant hazards consideration if operation of the facility in accordance with the proposed amendment would not:

1. Involve a significant increase in the probability of occurrence or consequences of an accident previously evaluated;
2. Create the possibility of a new or different kind of accident from any previously analyzed; or
3. Involve a significant reduction in a margin of safety.

The determinations that the criteria set forth in 10 CFR 50.92 are met for this amendment request are indicated below:

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

   Response: No

   Containment cooling fans remove containment heat loads under both normal and accident conditions. As such, they have no impact on the probability of occurrence of any previously evaluated accidents, although they do function to mitigate accident consequences. With regard to accident consequences, revised containment response analysis has been performed with the proposed changes of this license amendment. This analysis demonstrates that containment pressure and temperature limits continue to be met as further described below.

   The addition of the non-safety related chilled water system does not represent an increase in the consequences of an accident since, at the onset of the accident, the chilled water supply is automatically isolated on the resulting safety injection signal and the safety related Service Water System supplies the cooling method to remove the containment heat loads, as presently analyzed. Analysis has been performed to evaluate any potential failures that could prevent the Containment Cooling System to perform its safety related functions. Redundancy in the chilled water system and transfer to service water during an accident are incorporated in the design. In addition, as a conservative measure, an action statement has been added to require prompt action to restore containment cooling or commence a unit shutdown in the event of an unexpected condition that results in the loss of normal containment cooling capability.

   The accidents previously evaluated that are associated with containment heat removal are design basis loss-of-coolant accident (LOCA) and main steam line break (MSLB) accident. In the case of the design basis LOCA, the revised analysis demonstrates that all cases resulted in a peak containment pressure that was less than 47 psig. In addition, all long-term cases were well below 50% of the peak value within 24 hours. Based on the results, applicable criteria for Salem Unit 1 have been met and therefore, the consequences of previously evaluated accidents are not increased.

   The proposed change to the non-conservative TS 3.6.2.3 Action b, maintains that five CFCUs remain operable to ensure that, upon a single failure, a minimum of three CFCUs will provide the required containment and air mixing which is consistent with the current Salem Dose Analysis.

Consequently, the proposed license amendment does not increase the probability of occurrence or the consequences of accidents previously evaluated for Salem.

2. Create the possibility of a new or different kind of accident from any accident previously evaluated.

   Response: No

   Containment cooling fans remove containment heat loads under both normal and accident conditions. The containment cooling fans are presently part of the plant protection equipment and have been analyzed and evaluated as to their function and effectiveness. Consequently, they cannot create the possibility of any new or different kinds of accidents from any previously evaluated. The addition of a chilled water system that is isolated on an accident condition does not create a new or different kind of accident. The accidents analyzed are the LOCA and MSLB, which are part of the Salem Design Bases.

   The proposed change to the non-conservative TS 3.6.2.3 Action b, maintains that five CFCUs remain operable to ensure that, upon a single failure, a minimum of three CFCUs will provide the required containment and air mixing which is consistent with the current Salem Dose Analysis.

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

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

   Response: No

   The margin of safety pertinent to the proposed changes is the dose consequences resulting from a design basis LOCA. Containment cooling fans affect potential dose consequences in that they assist in maintaining containment pressure and temperature within design limits. By maintaining these limits, three critical functions are performed. These are:

   a. Containment integrity is assured by maintaining pressure below the containment design limit.

   b. By maintaining pressure below 47 psig, leakage of containment atmosphere to the surrounding environment is retained within the leakage testing results of 10 CFR 50, Appendix J. In this case, the Appendix J testing procedures provide the margin of safety, as long as the limiting pressure (47 psig) is not exceeded.

   c. By maintaining containment temperature within limits, the qualification of vital electrical equipment to function in the post-accident containment environment is assured. In this case, the margin of safety is provided by the testing and evaluation procedures implemented by 10 CFR 50.49.

   In addition, as a conservative measure, an action statement has been added to require prompt action to restore containment cooling or commence a unit shutdown in the event of an unexpected condition that results in the loss of normal containment cooling capability.

   The proposed change to the non-conservative TS 3.6.2.3 Action b, maintains that five CFCUs remain operable to ensure that, upon a single failure, a minimum of three CFCUs will provide the required containment and air mixing which is consistent with the current Salem Dose Analysis.

Design Basis Accident Radiological Consequences

PSEG Nuclear has evaluated the current offsite and control room dose analyses for potential effects due to the proposed modifications. The current dose analyses are not affected by the proposed changes to the Containment Cooling System. Therefore, the proposed modification does not result in any increase in dose and remains in compliance with 10 CFR 100 and GDC 19 limits.

Therefore, the proposed changes do not involve a significant reduction in a margin of safety.

Based on this review, it is concluded that the three standards of 10 CFR 50.92(c) are satisfied. Therefore, PSEG proposes that a finding of "no significant hazards consideration" is justified.

5.2 Applicable Regulatory Requirements/Criteria

10 CFR 50, Appendix A, General Design Criterion 38, Containment Heat Removal

A system to remove heat from the reactor containment shall be provided. The safety system function shall be to reduce rapidly, consistent with the functioning of other associated systems, the containment pressure and temperature following any loss-of-coolant accident and maintain them at acceptably low levels. Suitable redundancy in components and features, and suitable interconnections, leak detection, isolation, and containment capabilities shall be provided to assure that for onsite electric power system operation (assuming offsite power is not available) and for offsite electric power system operation (assuming onsite power is not available), the safety system function can be accomplished, assuming a single failure.

Response: The heat removal during normal and accident conditions has been verified through formal calculations. This includes a revised analysis from Westinghouse of the limiting containment accident transients.

A non-safety related (NSR) chilled water system has been added to optimize the cooling during normal operation and minimize long-term corrosion. The safety related (SR) SW system is retained for accident and emergency conditions since it has greater reliability and greater heat removal. The proposed design ensures that on a failure of the NSR system, or in an accident that requires the SR SW system to provide cooling, the NSR system is isolated and the SR SW is aligned. The components that accomplish this transfer assume a single failure of an active component, and these components are designed to the higher standard of the SW system.

Normally closed, air-operated valves have been added to the CFCU SW supply and return headers to keep the SW isolated during chilled water operation. Redundant air and redundant solenoids (from separate vital DC power) is provided to minimize the potential for the headers not opening when required. A failure of one header is addressed by having two separate headers. Either header can provide the required cooling to three CFCUs.

The revised design reduces the electrical loading during accident conditions.

Leakage detection during normal chilled water operation is enhanced by reliance on a closed loop system as opposed to a once-thru raw water system. Leakage detection with the SW system in operation is unchanged from the approved design.

10 CFR 50, Appendix A, General Design Criterion 39, Inspection of Containment Heat Removal System

The containment heat removal system shall be designed to permit appropriate periodic inspection of important components, such as the torus, sumps, spray nozzles, and piping to assure the integrity and capability of the system.

Response: The design of components inside containment is unchanged. The new chilled water system allows for isolation of one of the two CFCU headers for inspections and maintenance while continuing operation on the other CFCU header.

The redundancy in chilled water headers (insofar as active components are concerned) allows one header to be removed for testing and maintenance without affecting the continued operation.
The new CFCU SW isolation valves are in-series redundant to allow testing (by opening) without introducing raw water into the demineralized system. Appropriate flush and inspection ports have been included to address GL 89-13 concerns on any dead legs.

10 CFR 50, Appendix A, General Design Criterion 40, Testing of Containment Heat Removal System

The containment heat removal system shall be designed to permit appropriate periodic pressure and functional testing to assure (1) the structural and leaktight integrity of its components, (2) the operability and performance of the active components of the system, and (3) the operability of the system as a whole, and under conditions as close to the design as practical the performance of the full operational sequence that brings the system into operation, including operation of applicable portions of the protection system, the transfer between normal and emergency power sources, and the operation of the associated cooling water system.

Response: The primary change is to add a new clean chilled water system, which will operate at pressure nominally higher than the SW pressure. Operation at this higher pressure, improved leakage capabilities inherent in a closed loop system, and less corrosion during normal operation provide higher assurances of leak tightness for accident conditions.

The design allows for periodically testing the valves that isolate normal chilled water cooling and initiate SW flow (SW flow is retained for off-normal and accident conditions). Valve testing can be done without impacting normal operation.

The present design uses flow modulating valves (3 per CFCU, 15 total for all five CFCUs), and associated instrument and control components, in the CFCU flow path to switch from normal to accident flows. Plant surveillance presently requires switching to accident flow in order to test this complex control scheme to satisfy this GDC. The proposed design eliminates all modulating valves and replaces them with a fixed resistance in each CFCU branch line. Modeling will generate a system resistance curve, which will be confirmed during initial testing first with SW and then with chilled water. Periodic verification of the system resistance curve for a fixed resistance flow path even at the lower flow provides adequate assurances that there is no change to the fixed resistance path. Testing of the open/shut SW isolation valves and testing of the SW pumps under the In-Service Testing (IST) program then provides the assurance that accident SW flow will be met.

Title 10, Code of Federal Regulations, Part 50 Section 49, Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants

10 CFR 50.49 requires equipment qualification to be based upon the time-dependent temperature and pressure at the location of the electrical equipment important to safety. Composite temperature and pressure profiles are prepared based upon the results of the containment response analysis to various accident scenarios. The profiles will be revised as necessary based upon the revised containment analysis, and any adjustments to the equipment qualification program will be implemented in accordance with current regulations and PSEG commitments.

Conclusion

Current Technical Specifications require 5 containment fan coolers to be operable in Modes 1, 2, and 3, because in a design basis accident with loss of off-site power and failure of an emergency diesel generator to start, the remaining 3 operating CFCUs provide sufficient cooling to achieve the heat removal credited in the containment response analysis. Based on the containment analysis performed by Westinghouse, 2 operating CFCUs provide sufficient cooling to achieve the heat removal credited in the containment response analysis. Both containment response analyses (pre- and post-modification) remain within the current pressure and temperature limits for the Salem Unit 1.

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 ASSESSMENT/IMPACT STATEMENT

Pursuant to 10 CFR 51.22 (b), an evaluation of this license amendment request has been performed to determine whether or not it meets the criteria for categorical exclusion set forth in 10 CFR 51.22 (c)(9) of the regulations.

PSEG has concluded that implementation of this amendment will have no adverse impact upon Salem Units 1 and 2; neither will it contribute to any significant additional quantity or type of effluent being available for adverse environmental impact or personnel exposure. The change does not introduce any new effluents or significantly increase the quantities of existing effluents. As such, the change cannot significantly affect the types or amounts of any effluents that may be released offsite. The consequences of the revised accident analysis remain below the acceptance criteria specified in 10 CFR 100 and GDC 19.

Therefore, it has been determined that there is:

1. No significant hazards consideration,
2. No significant change in the types, or significant increase in the amounts, of any effluents that may be released offsite, and
3. No significant increase in individual or cumulative occupational radiation exposures involved.

Therefore, this amendment request to the Salem Technical Specifications meets the criteria of 10 CFR 51.22 (c)(9) for categorical exclusion from an environmental impact statement.

7.0 REFERENCES

7.1 PSEG Calculation S-C-SW-MDC-1968, 0IR2, Post-Modification CFCU Accident Mitigation Heat Removal Capacity.

7.2 PSEG Calculation S-C-SW-MDC-1969, 0IR0, SWS System Requirements for Post-Accident Containment Cooling.

7.3 PSEG Calculation S-C-CH-MDC-1970, 0IR0, CFCU Chilled Water System Design Basis Parameters.

7.4 PSEG Salem Units 1 and 2, Final Safety Analysis Report.

7.5 PSEG Salem Unit 1 and 2, Technical Specifications.

7.6 S-C-SWS-MDC-1675, Revision 3, Salem CFCU Coil Heat-up for Accident Scenarios.

7.7 Standards of the Tubular Exchanger Manufacturer's Association (TEMA), Eighth Edition, 1999.

7.8 WCAP 16193, Salem Unit 1 and Unit 2, Containment Response to LOCA and MSLB for Containment Fan Cooler.

7.9 Simplified Chilled Water System Description.

Attachment 2

SALEM UNITS 1 AND 2

MARKED-UP TECHNICAL SPECIFICATIONS CHANGES

CFCU/SW ENHANCEMENT PROJECT

July 2004

TABLE 3.3-5

ENGINEERED SAFETY FEATURES RESPONSE ~~ITEMS~~TIMES

INITIATING SIGNAL AND FUNCTION			RESPONSE TIME IN SECONDS
1.	Manual		
	a.	Safety Injection (ECCS)	Not Applicable
		Feedwater Isolation	Not Applicable
		Reactor Trip (SI)	Not Applicable
		Containment Isolation-Phase "A"	Not Applicable
		Containment Ventilation Isolation	Not Applicable
		Auxiliary Feedwater Pumps	Not Applicable
		Service Water System	Not Applicable
		Containment Fan Cooler	Not Applicable
	b.	Containment Spray	Not Applicable
		Containment Isolation-Phase "B"	Not Applicable
		Containment Ventilation Isolation	Not Applicable
	c.	Containment Isolation-Phase "A"	Not Applicable
		Containment Ventilation Isolation	Not Applicable
	d.	Steam Line Isolation	Not Applicable
2.	Containment Pressure-High		
	a.	Safety Injection (ECCS)	≤ 27.0(1)
	b.	Reactor Trip (from SI)	≤ 2.0
	c.	Feedwater Isolation	≤ 10.0
	d.	Containment Isolation-Phase "A"	≤ 17.0(2)/27.0(3)
	e.	Containment Ventilation Isolation	Not Applicable
	f.	Auxiliary Feedwater Pumps	≤ 60
	g.	Service Water System	≤ 13.0(2)/45.0(3)
	h.	Containment Fan Coolers	≤ 60.0 (7)

TABLE 3.3-5 (Continued)

TABLE NOTATION

(1) Diesel generator starting and sequence loading delays included. Response time limit includes opening of valves to establish SI path and attainment of discharge pressure for centrifugal charging pumps, SI and RHR pumps.

(2) Diesel generator starting and sequence loading delays not included. Offsite power available. Response time limit includes opening of valves to establish SI path and attainment of discharge pressure for centrifugal charging pumps.

(3) Diesel generator starting and sequence loading delays included. Response time limit includes opening of valves to establish SI path and attainment of discharge pressure for centrifugal charging pumps.

(4) On 2/3 in any steam generator.

(5) On 2/3 in 2/4 steam generators.

(6) The response time is the time the isolation circuitry input reaches the isolation setpoint to the time the Isolation Valves are fully shut.

(7) The response time includes the time to automatically isolate the chilled water supply and align the service water flow to the CFCUs following an accident coincident with a loss of offsite power, it also includes the time delays associated with isolation of the Turbine Generator Area service water header.

3/4.6 CONTAINMENT SYSTEMS

3/4.6.1 PRIMARY CONTAINMENT

CONTAINMENT INTEGRITY

LIMITING CONDITION FOR OPERATION

3.6.1.1 Primary CONTAINMENT INTEGRITY shall be maintained.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

Without primary CONTAINMENT INTEGRITY, restore CONTAINMENT INTEGRITY within one hour or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.6.1.1 Primary CONTAINMENT INTEGRITY shall be demonstrated:

a1. At least once per 31 days by verifying that each containment manual valve or blind flange that is located outside containment and required to be closed during accident conditions is closed, except for containment isolation valves that are open under administrative controls. Valves and blind flanges in high radiation areas may be verified by use of administrative controls.

a2. Prior to entering Mode 4 from Mode 5 if not performed within the last 92 days by verifying that each containment manual valve or blind flange that is located inside containment and required to be closed during accident conditions is closed, except for containment isolation valves that are open under administrative controls. Valves and blind flanges in high radiation areas may be verified by use of administrative controls.

b. By verifying that each containment air lock is OPERABLE per Specification 3.6.1.3.

~~c. At least once per 12 hours by verifying that the surveillance requirements of 4.6.2.3.a are met for penetrations associated with the containment fan coil units.~~

~~d. At least once per 18 months by verifying that the surveillance requirements of 4.6.2.3.d are met for penetrations associated with the containment fan coil units.~~

3/4.6.1 PRIMARY CONTAINMENT

3/4 6.1.1 CONTAINMENT INTEGRITY

Primary CONTAINMENT INTEGRITY ensures that the release of radioactive materials from the containment atmosphere will be restricted to those leakage paths and associated leak rates assumed in the accident analyses. This restriction, in conjunction with the leakage rate limitation, will limit the site boundary radiation doses to within the limits of 10 CFR 100 during accident conditions.

The purpose of this surveillance requirement (4.6.1.1ε.) is not to perform any testing or valve manipulations, but to verify that containment isolation valves capable of being mispositioned are in their proper safety position (closed).

Physical verification (hands on verification) that these penetrations (containment isolation valves) are in the proper position is performed prior to entering Mode 4 from Mode 5 and documented in the appropriate valve line-up. Allowing the use of administrative means to verify compliance with the surveillance requirement for these valves is acceptable based on the limited access to these areas in Modes 1, 2, 3, and 4 for ALARA reasons. Therefore, the probability of misalignment of these containment isolation valves, once they have been verified in the proper position, is small.

~~The service water accumulator vessel and discharge valves function to maintain water filled, subcooled fluid conditions in the containment fan coil unit (CFCU) cooling loops during accident conditions. The service water accumulator vessel and discharge valves were installed to address the Generic Letter 96-06 issues of column separation waterhammer and two phase flow during an accident involving a loss of offsite power.~~ The operability of ~~each~~ the service water accumulator ~~vessel and discharge valve~~**as required in TS 3.6.2.3, Containment Cooling System** is required to ensure the integrity of containment penetrations associated with the containment cooling fan ~~coil~~ units during accident conditions. If ~~a~~ the service water accumulator ~~vessel~~ does not meet the ~~vessel~~ surveillance requirements **listed in TS 4.6.2.3a, the Action Statement TS 3.6.2.3d will require returning the service water accumulator to the required parameters within 4 hours or a unit shutdown will be required. These actions are designed to ensure ~~,~~that, the containment integrity requirements of the CFCU cooling loops are met.** ~~or if the discharge valve response time does not meet design acceptance criteria when tested in accordance with procedures, the containment integrity requirements of the CFCU cooling loops .exclusively supplied by the inoperable accumulator vessel or discharge valve are not met. Limiting Condition for Operation 3.6.1.1 is applicable, and the cooling loops for the two CFCU's exclusively supplied by the inoperable accumulator are to be removed from service and isolated to maintain containment integrity.~~

3/4.6.1.2 CONTAINMENT LEAKAGE

The limitations on containment leakage rates ensure that the total containment leakage volume will not exceed the value assumed in the accident analyses at the peak accident pressure P_a. As an added conservatism, the measured overall integrated leakage rate (Type A test) is further limited to less than or equal to 0.75 L_a or less than or equal to 0.75 L_t, as applicable, during performance of the periodic test to account for possible degradation of the containment leakage barriers between leakage tests.

The surveillance testing for measuring leakage rates are consistent with the Containment Leakage Rate Testing Program.

3/4.6.1.3 CONTAINMENT AIR LOCKS

Containment air locks form part of the containment pressure boundary and provide a means for personnel access during all MODES of operation. Each air lock is nominally a right circular cylinder, 10 feet in diameter, with a door at each end. The doors are interlocked during normal operation to prevent simultaneous opening.

LIMITING CONDITION FOR OPERATION

3.6.2.3 Five containment cooling fans shall be OPERABLE.

APPLICABILITY: MODES 1, 2 and 3

ACTION:

a. With one or two of the above required containment cooling fans inoperable, restore the inoperable cooling fan(s) to OPERABLE status within 7 days or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

b. With three or more of the above required containment cooling fans inoperable~~, and both containment spray systems OPERABLE~~, restore at least three cooling fans to OPERABLE status within ~~72~~ 1 hours or be in at least HOT STANDBY WITHIN the next 6 hours and in COLD SHUTDOWN within the following 30 hours. Restore the remaining inoperable cooling fans to OPERABLE status within 7 days of initial loss or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

c. Operation with Emergency Containment Cooling Water System (service water) shall be limited to 30 continuous days[1] or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours. The provisions of Specification 3.0.4 are not applicable.

d. With the service water accumulator inoperable, restore the accumulator to OPERABLE status within 4 hours or be in at least HOT STANDBY WITHIN the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

e. While operating on the Normal Containment Cooling System (Chilled Water), and upon a loss of the chilled water system capability, within 1 hour either re-establish containment cooling (normal or emergency) or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

[1] Operation beyond 30 days, while using Service Water, may be allowed based on an engineering evaluation that takes into consideration the requirements of NRC Generic Letter 89-13, Service Water Problems Affecting Safety-Related Equipment.

4.6.2.3 Each containment cooling fan shall be demonstrated OPERABLE:

a. At least once per 12 hours by:

1. Verifying the water level in ~~each~~ the service water accumulator ~~vessel~~ is greater than or equal to ~~226~~ 204 inches and less than or equal to ~~262~~ 300 inches.

2. Verifying the temperature in ~~each~~ the service water accumulator ~~vessel~~ is greater than or equal to 55°F and less than or equal to 95°F.

3. Verifying the nitrogen cover pressure in ~~each~~ the service water accumulator ~~vessel~~ is greater than or equal to ~~135~~ 61 psig.~~ and less than or equal to 160 psig~~.

b. At least once per 31 days by:

1. Starting (unless already operating) each fan from the control room in low speed.

2. Verifying that each fan operates for at least 15 minutes in low speed.

3. **Verifying the fixed resistance corresponding to greater than or equal to 1200 gpm SW flow to each CFCU by testing with chilled water[1].**

c. At least once per 92 days by:

1. **Stroking each valve that functions to isolate normal cooling water during accident conditions.**
2. **Stroking each valve that functions to initiate emergency containment cooling water during accident conditions.**

~~c.~~ **d.** At least once per 18 months by verifying that on a safety injection test signal:

1. Each fan starts automatically in low speed.

2. The automatic valves ~~and dampers actuate to their correctpositions~~ **that isolate normal containment cooling water and initiate emergency containment cooling water to the containment cooling fans receive the required actuation signals.**

~~d. At least once per 18 months by verifying that on a loss of offsite power test signal, each service water accumulator vessel discharge valve response time is within limits.~~

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[1] **If chilled water is isolated, by testing with service water.**

CONTAINMENT SYSTEMS

CONTAINMENT COOLING SYSTEM

LIMITING CONDITION FOR OPERATION

3.6.2.3 Five containment cooling fans shall be OPERABLE.

APPLICABILITY: MODES 1, 2 and 3.

ACTION:

a. With one or two of the above required containment cooling fans inoperable, restore the inoperable cooling fan(s) to OPERABLE status within 7 days or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

b. With three or more of the above required containment cooling fans inoperable ~~, and both containment spray systems OPERABLE,~~ restore at least three cooling fans to OPERABLE status within ~~72~~ 1 hour~~s~~ or be in at least HOT STANDBY WITHIN the next 6 hours and in COLD SHUTDOWN within the following 30 hours. Restore the remaining inoperable cooling fans to OPERABLE status within 7 days of initial loss or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.6.2.3 Each containment cooling fan shall be demonstrated OPERABLE:

CONTAINMENT SYSTEMS

AIR TEMPERATURE

LIMITING CONDITION FOR OPERATION

3.6.1.5 Primary containment average air temperature shall not exceed 120°F.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

With the containment average air temperature > 120°F, reduce the average air temperature to within the limit within 8 hours, or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.6.1.5 Verify the Containment Average Air Temperature is within limit at least once per twenty four hours.

NO CHANGES TO THIS PAGE
FOR ILLUSTRATION ONLY

3/4.7.4 SERVICE WATER SYSTEM

LIMITING CONDITION FOR OPERATION

3.7.4.1 At least two independent service water loops shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

With only one service water loop OPERABLE, restore at least two loops to OPERABLE status within 72 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.7.4.1 At least two service water loops shall be demonstrated OPERABLE:

a. At least once per 31 days by verifying that each valve (manual, power operated or automatic) servicing safety related equipment that is not locked, sealed, or otherwise secured in position, is in its correct position.

b. At least once per 18 months during shutdown, by verifying that each automatic valve servicing safety related equipment actuates to its correct position on Safeguards Initiation signal, **except as noted in Surveillance Requirement 4.6.2.3.d.2.**

3/4.6.1.4 INTERNAL PRESSURE

The limitations on containment internal pressure ensure that: 1) the containment structure is prevented from exceeding its design negative pressure differential with respect to the outside atmosphere of 3.5 psig and 2) the containment peak pressure does not exceed the design pressure of 47 psig during the limiting pipe break conditions. The pipe breaks considered are LOCA and steam line breaks.

The limit of 0.3 psig for initial positive containment pressure is consistent with the accident analyses initial conditions.

The maximum peak pressure expected to be obtained from a LOCA or steam line break event is 47 psig.

3/4.6.1.5 AIR TEMPERATURE

The limitations on containment average air temperature ensure that the overall containment average air temperature does not exceed the initial temperature condition assumed in the accident analysis for a LOCA or steam line break. In order to determine the containment average air temperature, an average is calculated using measurements taken at locations within containment selected to provide a representative sample of the overall containment atmosphere.

The OPERABILITY of the containment cooling system ensures that the containment air temperature will be maintained within limits during normal operation.

3/4.6.1.6 CONTAINMENT STRUCTURAL INTEGRITY

This limitation ensures that the structural integrity of the containment will be maintained comparable to the original design standards for the life of the facility. Structural integrity is required to ensure that the containment will withstand the design pressure. The visual inspections of the concrete and liner and the Type A leakage test both in accordance with the Containment Leakage Rate Testing Program are sufficient to demonstrate this capability.

3/4.6.2 DEPRESSURIZATION AND COOLING SYSTEMS

3/4.6.2.1 CONTAINMENT SPRAY SYSTEM

The OPERABILITY of the containment spray system ensures that containment depressurization and cooling capability will be available in the event of a LOCA. The pressure reduction and resultant lower containment leakage rate are consistent with the assumptions used in the accident analyses.

Revised Westinghouse analysis (WCAP 10193 dated March, 2004) takes credit for post-LOCA recirculation sprays to ensure that containment heat removal is sufficient to remove the maximum possible discharge of mass and energy release to containment.

Normal plant operation and maintenance practices are not expected to trigger surveillance requirement 4.6.2.1.d. Only an unanticipated circumstance would initiate this surveillance, such as inadvertent spray actuation, a major configuration change, or a loss of foreign material control when working within the affected boundary of the system. If an activity occurred that presents the potential of creating nozzle blockage, an evaluation would be performed by the engineering organization to determine if the amount of nozzle blockage would impact the required design capabilities of the containment spray system. If the evaluation determines that the containment spray system would continue to perform its design basis function, then performance of the air or smoke flow test would not be required. If the evaluation cannot conclusively determine the impact to the containment spray system, then the air or smoke flow test would be performed to determine if any nozzle blockage has occurred.

3/4.6.2.2 SPRAY ADDITIVE SYSTEM

The OPERABILITY of the spray additive system ensures that sufficient NaOH is added to the containment spray in the event of a LOCA. The limits on NaOH minimum volume and ~~concentration,~~**concentration** ensure that 1) the iodine removal efficiency of the spray water is maintained because of the increase in pH value, and 2) corrosion effects on components within containment are minimized. The contained water volume limit includes an allowance for water not usable because of tank discharge line location or other physical characteristics. These assumptions are consistent with the iodine removal efficiency assumed in the accident analyses.

3/4.6.2.3 CONTAINMENT COOLING SYSTEM

The OPERABILITY of the containment cooling system ensures that: **1) the containment air temperature and pressure will be maintained within limits 2) adequate heat removal capacity is available when operated in conjunction with the containment spray systems** during post-LOCA conditions **and 3) provides sufficient air circulation in containment post-LOCA to have adequate mixing rate between the sprayed and unsprayed regions of containment.**

NORMAL CONTAINMENT COOLING WATER SYSTEM – Chilled Water System

An independent Containment Fan Cooling Units (CFCUs) non-safety related chilled water cooling system with redundant components is supplied for Salem Unit 1. The Normal Containment Cooling Water System (NCCWS) provides chilled water for containment cooling during normal power operation, normal shutdown, and refueling. It is not relied upon for design basis accident heat removal. The system is capable of maintaining normal containment temperatures at approximately 90°F but, for conservatism and safety margin, the accident analysis, for containment response following a DBA, assumes containment temperature of 120°F at the onset of the accident.

Service Water (SW) cooling is required during any DBA that releases mass/energy into the containment, even if the CFCU NCCWS remains available, since the DBA heat load would trip out the chillers on overload. A revised Westinghouse analysis, that credits improved CFCU fouling factor and improvements in accident modeling, shows that only two CFCUs, each with a minimum of 1200 gpm SW flow, are adequate for DBA containment cooling. However, since the current source term dose calculations credits the equivalent of 3 CFCUs for DBA containment air mixing and iodine scrubbing, and a single active component failure (SACF) will disable two CFCUs, the Containment Cooling System Technical Specifications will retain the requirements to maintain five CFCUs operable.

On a safety injection signal, the CFCU flow is automatically realigned from NCCWS to ECCWS. The CFCU chilled water system is isolated and service water flow is then aligned by first opening the CFCU SW supply header isolation valves and then opening the SW return header isolation valves. However, if a LOOP occurs at the same time, the SW valve opening is delayed until after the SW pumps are restarted.

The CFCU NCCWS is the normal mode for containment cooling under all normal plant conditions, including power operations, shutdown periods, and refueling. The CFCU NCCWS has been designed with substantial redundancy and reliability such that the CFCU NCCWS is expected to be available to support plant operations. In the unlikely event that the CFCU NCCWS is unavailable to support plant operations, and to prevent unnecessary transients on the units, service water can be used for normal plant cooling under the conditions described in the Abnormal Operation section.

The surveillance requirements ensure that:

a. Each NCCWS valve actuates to the closed position to isolate the non-safety related portions of the CFCU cooling water system.

b. Each ECCWS valve actuates to the open position to automatically initiate SW cooling to the three CFCUs served by that header. The limiting single failure is addressed by having two separate CFCU SW headers each of which can cool the minimum required number of CFCUs.

c. The service water accumulator ensures the tank contains sufficient water and nitrogen to maintain water filled, subcooled fluid conditions in all five containment fan coil unit (CFCU) cooling loops in response to a loss of off-site power, without injecting nitrogen cover gas into the containment fan coil unit loops assuming the most limiting single failure.

d. Each CFCU will have a minimum SW flow of 1200 gpm.

The service water accumulator functions to maintain water filled, subcooled fluid conditions in the containment fan coil unit (CFCU) cooling loops during accident conditions. The service water accumulator was installed to address the Generic Letter 96-06 issues of column separation water-hammer and two phase flow during an accident involving a loss of offsite power. The operability of the service water accumulator is ~~required~~ intended to prevent water column separation in the CFCU headers. TS 3.6.2.3 Action statement d. applies when the service water accumulator does not meet the applicable surveillance requirements.

The MSLB and LOCA containment response analyses have been performed for Salem Unit 1. These analyses included long-term pressure and temperature profiles. All cases analyzed resulted in a peak containment pressure that was less than 47 psig.

In addition, long-term cases were well below 50% of the peak value within 24 hours. Based on the results, all applicable Standard Review Plan (SRP) criteria for Salem Unit 1 are satisfied.

The analysis and results are contained in WCAP 16193 dated March 2004.

The fixed resistance in the CFCU flow path, required for a minimum SW flow of 1200 gpm/CFCU, will be confirmed in post-installation SW flow testing. Differential pressure instrumentation between the CFCU NCCWS supply and return header and flow instrumentation will be used to periodically verify that the CFCU flow path fixed resistance has not changed.

The operation of the recirculation sprays is credited for the long term LOCA containment temperature requirements.

EMERGENCY CONTAINMENT COOLING WATER SYSTEM – Service Water Supply

Service Water (SW) cooling is required during any DBA that releases mass/energy into the containment, even if the CFCU NCCWS (chilled water) remains available, since the DBA heat load will trip out the chillers on overload. Westinghouse analysis (WCAP 16193) credits improved CFCU fouling factor and improvements in accident modeling, shows that only two CFCUs, each with a minimum of 1200 gpm SW flow, are adequate for DBA containment cooling. However, since the current source term dose calculations credits the equivalent of 3 CFCUs for DBA containment air mixing and iodine scrubbing, and a single active component failure (SACF) will disable two CFCUs, the Containment Cooling System Technical Specifications will retain the requirements to maintain five CFCUs operable.

On a safety injection signal, the CFCU flow is automatically realigned from NCCWS to ECCWS. The CFCU chilled water system is isolated and service water flow is then aligned by first opening the CFCU SW supply header isolation valves and then opening the SW return header isolation valves. However, if a LOOP occurs at the same time, the SW valve opening is delayed until after the SW pumps are restarted.

ABNORMAL OPERATION-CFCU NORMAL CONTAINMENT COOLING WATER SYSTEM UNAVAILABLE

The CFCU NCCWS is the normal mode for containment cooling under all normal plant conditions, including power operations, shutdown periods, and refueling. The CFCU NCCWS has been designed with substantial redundancy and reliability such that the CFCU NCCWS is expected to be available to support plant operations. In the unlikely event that a loss of CFCU NCCWS capability occurs, both the containment temperature and pressure will quickly rise and could exceed the initial conditions assumed in the accident analysis within a few minutes. Therefore, the action to restore normal cooling, initiate Service Water cooling or shutdown within one hour will ensure operation will not proceed in an unanalyzed condition. This action is comparable to the TS action for primary containment internal pressure (3.6.1.4), and is more restrictive than that for average air temperature (TS 3.6.1.5). However, it results in a more immediate response since the action time starts from the loss of equipment and not a measured parameter.

A loss of CFCU NCCWS capability is defined as a loss of all CH flow to the CFCUs or a loss of more than two (2) chillers, or the equivalent of two (2) chillers. Since each chiller has four (4) refrigerant circuits with a separate compressor, separate electrical circuit, refrigerant pressure boundary, and condenser cooling coil, the four (4) chillers have a total of sixteen (16) refrigerant circuits. A loss of more than eight (8) refrigerant circuits among the four chillers is equivalent to a loss of more than two chillers.

Service Water can be used for containment cooling during normal plant operations provided chilled water is restored within 30 days. Operation beyond 30 days while using Service Water may be allowed based on an engineering evaluation that takes into consideration the requirements of Generic Letter 89-13, Service Water Problems Affecting Safety-Related Equipment.

3/4.6.3 CONTAINMENT ISOLATION VALVES

The OPERABILITY of the containment isolation valves ensures that the containment atmosphere will be isolated from the outside environment in the event of a release of radioactive material to the containment atmosphere or pressurization of the containment. Containment isolation within the time limits specified ensures that the release of radioactive material to the environment will be consistent with the assumptions used in the analyses for a LOCA.

The opening of locked or sealed closed containment isolation valves (penetration flow paths) on an intermittent basis under administrative control includes the following considerations: (1) stationing a dedicated individual, who is in constant communication with the control room, at the valve controls, (2) instructing this individual to close these valves in an accident situation, and (3) assuring that environmental conditions will not preclude access to close the valves and that this action will prevent the release of radioactivity outside the containment.

The main steam isolation valves (MSIVs) fulfill their containment isolation function as remote-manual containment isolation valves. The automatic closure of the MSIVs is not required for containment isolation due to having a closed system inside containment. The remote-manual containment isolation function of the MSIVs can be accomplished through either the use of the hydraulic operator or when the MSIV has been tested in accordance with surveillance requirement 4.7.1.5 the steam assist function can be credited.

Surveillance Requirement (SR) 4.6.3.1.3 only applies to the MS7 (Main Steam Drain) valves and the MS18 (Main Steam Bypass) valves. The MS167 (Main Steam Isolation) valves are tested for main steam isolation purposes by SR 4.7.1.5. For containment isolation purposes, the MS167s are tested as remote/manual valves pursuant to Specification 4.0.5.

3/4.6.4 COMBUSTIBLE GAS CONTROL

The OPERABILITY of the equipment and systems required for the detection and control of hydrogen gas ensures that this equipment will be available to maintain the hydrogen concentration within containment below its flammable limit during post-LOCA conditions. Either recombiner unit is capable of controlling the expected hydrogen generation associated with 1) zirconium-water reactions, 2) radiolytic decomposition of water and 3) corrosion of metals within containment.

FORMAT CHANGES ONLY

3/4.7.4 SERVICE WATER SYSTEM

LIMITING CONDITION FOR OPERATION

3.7.4.1 At least two independent service water loops shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

With only one service water loop OPERABLE, restore at least two loops to OPERABLE status within 72 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.7.4.1 At least two service water loops shall be demonstrated OPERABLE:

a. At least once per 31 days by verifying that each valve (manual, power operated or automatic) servicing safety related equipment that is not locked, sealed, or otherwise secured in position, is in its correct position.

b. At least once per 18 months during shutdown, by verifying that each automatic valve servicing safety related equipment actuates to its correct position on Safeguards Initiation signal, **except as noted in Surveillance 4.6.2.3.d.2.**

~~* Operation with only the 11 service water loop OPERABLE may continue for up to 10 days. This note is applicable for one time use during Salem Unit No. 1 Cycle 15.~~

Attachment 3

SALEM UNITS 1 AND 2

CONTAINMENT RESPONSE ANALYSIS
WCAP-16193

CFCU/SW ENHANCEMENT PROJECT

April 2004

Attachment 4

SALEM UNITS 1 AND 2

SYSTEM DESCRIPTION

CFCU/SW ENHANCEMENT PROJECT

April 2004

PSEG CALCULATIONS

SALEM UNITS 1 AND 2

<u>CFCU/SW ENHANCEMENT PROJECT</u>

April 2004

(NOT TO BE INCLUDED WITH LCR SUBMITTAL)

FOR REFERENCE ONLY