Duke Energy®

BRUCE H HAMILTON
Vice President
Oconee Nuclear Station

Duke Energy Corporation
ON01VP / 7800 Rochester Highway
Seneca, SC 29672

864 885 3487
864 885 4208 fax
bhhamilton@duke-energy.com

October 16, 2007

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

Subject: Duke Power Company LLC d/b/a Duke Energy Carolinas, LLC
Oconee Nuclear Site, Units 1, 2, and 3
Docket Numbers 50-269, 50-270, and 50-287
License Amendment Request for Low Pressure Service Water Reactor Building Waterhammer Prevention System Modification to Mitigate Waterhammers Described in Generic Letter 96-06 and Associated Technical Specifications
License Amendment Request (LAR) No. 2006-05

In accordance with 10 CFR 50.90, Duke Power Company LLC d/b/a Duke Energy Carolinas, LLC (Duke) proposes to amend Renewed Facility Operating Licenses Nos. DPR-38, DPR-47, and DPR-55. This LAR requests the Nuclear Regulatory Commission (NRC) to review and approve a plant modification that will addresses waterhammer concerns described in Generic Letter (GL) 96-06. The modification will install check valves in the Low Pressure Service Water (LPSW) supply header and automatic pneumatic discharge isolation valves, controllable vacuum breaker valves, and associated circuitry in the LPSW return header to isolate Engineered Safeguards (ES) portions of the LPSW system to mitigate waterhammers. The affected LPSW piping is located inside the containment, the turbine building, and the auxiliary building and provides cooling to the Reactor Building Cooling Units (RBCUs), Reactor Building Auxiliary Coolers (RBACs) and the Reactor Coolant Pump Motor (RCPM) Coolers. This request also proposes Technical Specifications (TS) and associated bases in support of maintaining the ES portions (Containment Heat Removal Function) of the system.

Generic Letter (GL) 96-06 required utilities to evaluate the potential for waterhammer in cooling water systems serving containment following a Loss of Offsite Power (LOOP) concurrent with a Loss of Coolant Accident (LOCA) or Main Steam Line Break (MSLB). Analysis and system testing in response to GL 96-06 concluded that waterhammers occur in the LPSW system piping during all LOOP events. The operability evaluations in response to GL 96-06 concluded that LPSW piping will not fail for the current configuration; however, piping code allowable stresses are exceeded. The Units 1, 2 and 3 LPSW Systems are currently operable, but degraded/non-conforming (OBD/NCI).

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Duke discussed this modification design with the NRC Plant Systems Branch in a conference call. The Plant Systems Branch generally agreed with the concept, but stated their review and approval would be required. Duke also discussed whether TS were required as a result of this modification with the TS Branch in a conference call on March 28, 2006. Waterhammer does not meet the TS criteria outlined in Code of Federal Regulations 10CFR 50.36. However, since the LPSW RB Waterhammer Prevention components and associated circuitry are being placed in an ES flowpath which is used to mitigate a design basis event, the reset circuitry and automatic pneumatic discharge isolation valves will become a part of the mitigating function for a design basis accident.

In accordance with Duke administrative procedures and the Quality Assurance Program Topical Report, these proposed changes have been reviewed and approved by the Plant Operations Review Committee and Nuclear Safety Review Board. Additionally, a copy of this LAR is being sent to the State of South Carolina in accordance with 10 CFR 50.91 requirements.

Implementation dates for the Waterhammer Prevention modifications were committed to in a letter to the NRC dated February 14, 2007. To support the commitment dates specified, Duke requests that this amendment be issued by October 2008, effective upon issuance, with modification implementation to start with Unit 2 startup from the fall 2008 outage and continue through the outages which follow for Units 1 and 3 in the fall and spring of 2009 respectively. Notes included in the proposed Technical Specifications control the applicability for these Units prior to the modifications being installed and can be removed or modified after the modifications have been completed on all three Oconee Units. Duke will also update applicable sections of the Oconee UFSAR and submit these changes per 10 CFR 50.71(e). There are no new commitments being made as a result of this letter.

Inquiries on this proposed amendment request should be directed to Reene' Gambrell of the Oconee Regulatory Compliance Group at (864) 885-3364.

Sincerely,

Bruce Hamilton

B. H. Hamilton, Vice President
Oconee Nuclear Site

Enclosures:
1. Notarized Affidavit
2. Evaluation of Proposed Change

Attachments:
1. Figures
2. Technical Specifications – Mark Ups
3. Technical Specifications - Reprinted Pages

bc w/enclosures and attachments:

Mr. Vic McCree, Regional Administrator
U. S. Nuclear Regulatory Commission - Region II
Atlanta Federal Center
61 Forsyth St., SW, Suite 23T85
Atlanta, Georgia 30303

Mr. L. N. Olshan, Project Manager
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Mail Stop O-8 G9A
Washington, D. C. 20555

Mr. D. W. Rich
Senior Resident Inspector
Oconee Nuclear Site

Mrs. Susan E. Jenkins, Manager
Infectious and Radioactive Waste Management Section
Department of Health & Environmental Control
2600 Bull Street
Columbia, SC 29201

bcc w/enclosures and attachments:

B. G. Davenport
R. V. Gambrell
D. J. Williams
P. J. Earnhardt
H. E. Harling
L. F. Vaughn
S. D. Capps
C. G. Abellana
J. E. Burchfield
L. T. Harbinson
R. L. Gill – NRI&IA
R. D. Hart – CNS
K. L. Ashe - MNS
NSRB, EC05N
ELL, ECO50
File - T.S. Working
ONS Document Management

ENCLOSURE 1

NOTARIZED AFFIDAVIT

AFFIDAVIT

B. H. Hamilton, being duly sworn, states that he is Vice President, Oconee Nuclear Site, Duke Power Company LLC d/b/a Duke Energy Carolinas, LLC that he is authorized on the part of said Company to sign and file with the U. S. Nuclear Regulatory Commission this revision to the Renewed Facility Operating License Nos. DPR-38, DPR-47, and DPR-55; and that all statements and matters set forth herein are true and correct to the best of his knowledge.

Bruce Hamilton

B. H. Hamilton, Vice President
Oconee Nuclear Site

Subscribed and sworn to before me this 16 day of October 2007

Notary Public

My Commission Expires:

6-12-2013
Date

SEAL

ENCLOSURE 2

EVALUATION OF PROPOSED CHANGE

Subject: License Amendment Request for Low Pressure Service Water Reactor Building Waterhammer Prevention System Modification to Mitigate Waterhammers Described in Generic Letter 96-06 and Associated Technical Specifications
License Amendment Request No. 2006-05

1.0 DESCRIPTION

This License Amendment Request (LAR) requests review and approval for a Low Pressure Service Water (LPSW) Reactor Building (RB) Waterhammer Prevention System modification. The modification is being installed to mitigate waterhammers described in Generic Letter (GL) 96-06 and resolve the operable but degraded/non-conforming (OBD/NCI) condition of the Units 1, 2, and 3 LPSW Systems. Analysis and system testing in response to GL 96-06 concluded that waterhammers can occur in the LPSW system piping during Loss of Offsite Power (LOOP) events. The operability evaluations in response to GL 96-06 concluded that LPSW piping will not fail for the current configuration; however, piping code allowable stresses are exceeded.

These design changes will modify portions of the LPSW system that serve the containment, which is an Engineered Safeguards (ES) flow path. This change will add check valves, isolation valves, controllable (either fully open or fully closed) vacuum breaker valves and associated circuitry needed to isolate/reset the LPSW piping inside containment in the event of a LOOP, Loss of Coolant Accident (LOCA)/LOOP, and Main Steam Line Break (MSLB)/LOOP. The isolation function will prevent de-pressurization of the LPSW system inside containment during these events, thus preventing the formation of voids that can lead to waterhammers described in GL 96-06. Selected Licensee Commitments (SLCs) will be issued for the LPSW RB Waterhammer Prevention Isolation Circuitry, LPSW RB Waterhammer Prevention Pneumatic Discharge Isolation Valves, and the LPSW RB Waterhammer Prevention Controllable Vacuum Breaker Valves and will address the operability and testing of these components. The SLCs will be controlled in accordance with normal station processes. The reset function will provide a means of maintaining the LPSW flowpath in support of Containment Heat Removal. This LAR proposes Technical Specifications (TS) and associated TS Bases in support of maintaining the LPSW flowpath to support the Containment Heat Removal function.

Entry into the required actions described in the proposed TS and SLCs will allow the return of the LPSW system to a condition wherein if a LOOP were to occur the system could experience a waterhammer in which pipe system integrity is maintained, but that code allowable stresses are exceeded. Approval of this concept is requested and is discussed in detail in Section 2.0.

2.0 PROPOSED CHANGE

Modification Description

The modification will install new components in the two LPSW supply headers to the reactor building containment coolers (Reactor Building Cooling Units (RBCUs), Reactor Building Auxiliary Cooling Units (RBACs), and Reactor Coolant Pump (RCP) motor coolers) and a dual path in the common cooling water return piping. This equipment will be located outside of containment (see attached Figure 1 and 2 in attachment 1).

A check valve will be installed in each of the two supply headers. Isolation valves and test connections to allow maintenance and surveillance will be installed upstream and downstream of the check valves. The check valves will prevent drainage of the supply piping to the containment coolers when power is lost to the LPSW pumps. Also, the check valve elevation is low enough relative to the lake to prevent voiding upstream of the valve when it is closed.

Outside containment, the common LPSW return header will be split into two headers with a valve arrangement to create a diverse return path. Two pneumatic discharge isolation valves will be installed in each header. The two headers are rejoined downstream of the pneumatic discharge isolation valves into a common return. Isolation valves and test connections to allow for maintenance and surveillance will also be installed upstream and downstream of the pneumatic discharge isolation valves. This design allows the pneumatic discharge isolation valve arrangement to tolerate a single failure to close on demand. This design also allows the pneumatic discharge isolation valve arrangement to tolerate a single failure to open on demand. Thermal relief valves will be installed around the pneumatic discharge isolation valve arrangement to provide overpressure protection. Controllable vacuum breaker valves are installed downstream of the pneumatic discharge isolation valves in order to precondition the system for restart by breaking the vacuum in the downstream piping.

The pneumatic discharge isolation valves will be actuated by logic circuitry that is based on system pressure. With low and decreasing LPSW system pressure due to LOOP or loss of LPSW pumps, the waterhammer prevention logic circuitry will close the pneumatic discharge isolation valves. The isolation function is performed by one of two digital channels consisting of safety related relays, which are triggered by two of four analog channels, each consisting of a pressure transmitter/current switch. The valves will re-open on increasing supply header pressure (two of four analog channels activate the digital reset channels which are a two out of two logic). The pressure transmitters used to re-open the valves tap off the system upstream of the check valves. This is to prevent thermal effects due to a LOCA from pressurizing piping and inadvertently reopening the valves.

SLC Description

The LPSW RB Waterhammer Prevention Isolation Circuitry SLC will require three LPSW RB Waterhammer Prevention Isolation analog trip channels and two digital logic trip channels to be OPERABLE. If the new circuitry were to become inoperable for some reason, the appropriate action will be to open two LPSW RB Waterhammer Prevention Pneumatic Discharge Isolation valves in the same header immediately. This would return the system to a condition wherein if a LOOP were to occur the system could experience a waterhammer in which pipe system integrity is maintained, but that code allowable stresses are exceeded. Actions would also be to immediately take action to restore the instrumentation and logic to an operable state.

The LPSW RB Waterhammer Prevention Pneumatic Discharge Isolation Valves SLC will establish requirements for the isolation function that will allow a header of the valves to be removed from service to allow test or repair. Test or repair of the valves in a single header is allowed by associated TS 3.6.5 in that opening the valves remotely or locally in the opposing header is allowed to support flowpath OPERABILITY. Test or repair of the valves in a single header will return the system to a condition wherein if a LOOP were to occur the system could experience a waterhammer in which pipe system integrity is maintained, but that code allowable stresses are exceeded.

The LPSW RB Waterhammer Prevention Controllable Vacuum Breaker Valves SLC will require both vacuum breaker valves for OPERABILITY and will specify conditions, required actions, allowed outage times, and testing.

The SLCs will be issued and controlled in accordance with normal station processes.

TS Change Description

TS 3.3.27, LPSW RB Waterhammer Prevention Reset Circuitry

Current TS 3.3.27 is titled "Not Used." This proposed TS will be revised to add new TS 3.3.27, "LPSW RB Waterhammer Prevention Reset Circuitry." This proposed TS will establish a limiting condition for operation (LCO), Actions and Surveillance Requirements (SRs) for the LPSW RB Waterhammer Prevention Reset Circuitry. This is the only portion of the circuitry that meets the criterion in 10CFR 50.36.

TS 3.3.27 LCO requires three LPSW RB Waterhammer Prevention Reset Circuitry analog reset channels and two digital logic reset channels to be OPERABLE. The LCO is modified by by a note to indicate it only applies after the implementation of the modification on each Unit.

The LPSW RB Waterhammer Prevention Reset Circuitry is required to be OPERABLE in MODES 1, 2, 3, and 4. This ensures LPSW is available to support the OPERABILITY of the equipment serviced by the LPSW system.

Three conditions address possible system operating configurations that affect Operability of the LPSW RB Waterhammer Prevention Reset Circuitry.

Condition A provides a 7 day Completion Time when the system is required OPERABLE if one of the three required analog LPSW RB Waterhammer Prevention reset channels is out of service. In this configuration, the LPSW RB Waterhammer Prevention analog reset system is vulnerable to a single failure. The 7 day Completion Time is adequate to ensure that the channel is restored in a timely manner. The Completion Time takes into account the allowed outage times of similar systems, reasonable time for repairs and the low probability of an event occurring during this period.

Condition B provides a 7 day Completion Time when the system is required OPERABLE if one of the two LPSW RB Waterhammer Prevention digital logic reset channels is out of service. In this configuration, the LPSW RB Waterhammer Prevention digital reset system is vulnerable to a single failure. The 7 day Completion Time is adequate to ensure that the channel is restored in a timely manner. The Completion Time takes into account the allowed outage times of similar systems, reasonable time for repairs and the low probability of an event occurring during this period.

Condition C applies when the Required Action and associated Completion Times of Conditions A or B are not met or two or more channels associated with the analog reset or two digital reset logic channels are not OPERABLE. If Condition C applies, Required Actions specify that two LPSW RB Waterhammer Prevention Pneumatic Discharge Isolation valves in the same header be opened immediately and that actions to restore the LPSW RB Waterhammer Prevention Reset Circuitry to OPERABLE status be taken immediately. These Completion Times take into account the allowed outage times of similar systems, reasonable time for repairs and the low probability of an event occurring during this period.

There are no defined shutdown requirements for the TS. As long as containment heat removal functions are maintained, a primary success path for accident mitigation is available. This is accomplished by opening two LPSW RB Waterhammer Prevention Pneumatic Discharge

Pneumatic Discharge Isolation valves in the same header when the circuitry is inoperable. Waterhammer is not credited as a primary success path for accident mitigation. If a waterhammer should occur, analyses demonstrate that gross pipe failure is not expected, but that code allowable stresses are exceeded. Allowing the configuration described above places the Unit in the same configuration that presently exists, i.e. currently OBD/NCI, for the time period of repair. This configuration will be controlled by SLC.

SR 3.3.27.1 specifies a channel check be performed on each channel every 12 hours. This ensures that a gross failure of instrumentation has not occurred.

SR 3.3.27.2 specifies a channel functional test be performed on each channel at a frequency of 92 days. The test frequency of 92 days provides reasonable assurance the circuitry will perform its intended safety function. The Frequency of 92 days is based on engineering judgment and operating experience with these types of circuits and equipment.

SR 3.3.27.3 specifies a performance of a channel calibration at a frequency of 18-months to verify the reset system instrument channels, including the sensors, respond to the measured parameter with the necessary range and accuracy. A channel calibration leaves the components adjusted to account for instrument drift during the 18-month interval between calibrations. The 18-month calibration interval is based on drift determination of the setpoint analysis.

TS 3.6.5, RB Spray and Cooling Systems

This LAR will revise TS 3.6.5, RB Spray and Cooling Systems. The SRs will be revised to include the RB cooling system valves.

SR 3.6.5.1 will be revised to also verify the correct alignment for manual and non-automatic power operated valves in the RB Cooling flowpath to provide assurance that the proper flow paths exist for RB Spray and Cooling system operation. This SR does not apply to valves that are locked, sealed, or otherwise secured in position, since they are verified to be in the correct position prior to locking, sealing, or securing. This SR does not require any testing or valve manipulation; rather it involves verification that those valves capable of potentially being mispositioned are in the correct position. This SR also does not apply to valves that cannot be inadvertently misaligned, such as check valves. The verification frequency of 31 days provides reasonable assurance the valves perform their safety function based on engineering judgment and operating experience with this type of equipment. The SR is modified by a note that states it is applicable for the RB Cooling system following implementation of the LPSW RB Waterhammer Prevention Modification on the respective Unit.

SR 3.6.5.5 will be revised to also verify proper automatic operation of the reactor building cooling valves in each required flow path that is not locked, sealed, or otherwise secured in position, actuates to the correct position on an actual or simulated actuation signal. The testing frequency of 18 months provides reasonable assurance the valves will perform their intended safety function. The SR is modified by a note that states it is applicable for the RB Cooling system following implementation of the LPSW RB Waterhammer Prevention Modification on the respective Unit.

TS Bases 3.3.27, LPSW RB Waterhammer Prevention Reset Circuitry

With the addition of the above described LPSW RB Waterhammer Prevention Reset Circuitry and its associated TS, TS Bases 3.3.27 is proposed which describes the reasons for the TS and its various elements.

TS Bases 3.6.5, RB Spray and Cooling Systems

With the addition of the LPSW RB Waterhammer Prevention Pneumatic Discharge Isolation Valves, TS Bases 3.6.5 LCO has been revised to describe that for Units with the LPSW Waterhammer modification installed, both headers of the LPSW RB Waterhammer Prevention Pneumatic Discharge Isolation Valves are required to support LPSW flowpath OPERABILITY or one header of LPSW RB Waterhammer Prevention Discharge Isolation Valves shall be manually opened. This ensures that the safety function can be performed. The supporting bases for SRs were revised as described above.

3.0 BACKGROUND

Generic Letter (GL) 96-06 required utilities to evaluate the potential for waterhammer in cooling water systems serving containment following a LOOP concurrent with a LOCA or MSLB. Analysis and system testing in response to GL 96-06 concluded that waterhammers occur in the LPSW system during all LOOP events. The operability evaluations in response to GL 96-06 concluded that LPSW piping will not fail for the current configuration; however, piping code allowable stresses are exceeded. The Units 1, 2 and 3 LPSW Systems are currently OBD/NCI.

This proposed LAR has various impacts on the Oconee Units' LPSW and RB cooling systems. The LPSW system provides cooling water to the two RB cooling systems, which include the safety-related RBCUs and the non-safety RBACs. The LPSW and RB cooling systems are described below.

LPSW System

The LPSW System provides cooling water for normal and emergency services throughout the station. The LPSW Systems are once-through systems that are supplied water from Lake Keowee via the Condenser Circulating Water System.

The Units 1 and 2 LPSW System shares three pumps. The Unit 3 LPSW System is separate and has two pumps. The Units 1 and 2 and the Unit 3 LPSW Systems may be cross-connected. Two LPSW pumps normally operate on the Units 1 and 2 LPSW System with the third LPSW pump in standby. For Unit 3, one LPSW pump normally operates.

For LOOP events, the LPSW System is required to support OPERABILITY of the Siphon Seal Water (SSW) System, High Pressure Injection (HPI) pump motors, and Motor Driven Emergency Feedwater (MDEFW) pump motors. For events that initiate an ES signal, the LPSW System is required to support OPERABILITY of the RBCUs, Low Pressure Injection (LPI) Coolers, SSW System, HPI pump motors, and MDEFW pump motors.

An operating LPSW pump will restart following a LOOP event unless a single failure causes the pump to fail. During the months of high lake temperature and resulting high system demand due to elevated ambient temperatures, one LPSW pump cannot supply adequate flow to two Units. Assuming one of the Units 1 and 2 LPSW pumps fails to restart following a LOOP, only one LPSW pump would remain operating. LPSW System pressure would be below the LPSW Pump Auto-start Circuitry set point and the standby LPSW pump would automatically start. The standby LPSW pump(s) will also automatically start during events involving ES actuation.

The LPSW piping to the RBACs are isolated on ES actuation by Containment Isolation Valves.

Reactor Building Cooling System

Each Unit's Reactor Building Cooling System includes:

1. Three RBCUs. These three cooling Units are Engineered Safety Systems and provide post-accident RB cooling.

2. Four RBACs. These four cooling Units are used for building cooling in normal plant operation and do not perform a safety function.

During normal plant operation, the RBCUs may operate in the high or low speed mode. These Units circulate RB air over LPSW supplied cooling coils and distribute the cool air throughout the lower portion of the RB.

On ES actuation, the RB Cooling System mode of operation changes automatically. An ES signal causes all LPSW motor operated valves at the discharge of the three RBCUs to go full open to maximize LPSW flow through the RBCUs. Additionally, the operating RBCUs will automatically trip and after a 3 minute delay, all three RBCUs begin to operate in low speed.

Figure 1 provides an overview of the LPSW system and associated cooling equipment inside the RB in its modified configuration.

4.0 Technical Analysis

The modification design ensures that the LPSW system will deliver the containment cooling water flow requirement to the RBCUs following a design basis event. The installation of check valves, controllable vacuum breaker valves, and pneumatic discharge isolation valves will provide a design that will:

- Significantly reduce and/or eliminate Condensation Induced Waterhammers (CIWH) and Column Closure Waterhammers (CCWHs) in the RBCU piping.
- Significantly reduce and/or eliminate CCWHs in the RCP Motor piping.
- Eliminate the requirement for further waterhammer analysis of the RCP and RBCU piping.

As stated previously, the longitudinal piping stresses and support/restraint qualifications in the current design could exceed specification requirements for a design basis accident (i.e. LOCA/LOOP and MSLB/LOOP). The normal design allowables for piping stresses and supports are given in design codes listed in Duke Piping Specifications. Appendix F of the ASME code was adopted to support operability. Appendix F of the ASME code is not a part of Oconee's design basis; however, it may be employed for operability analysis as allowed by GL 91-18. The proposed modification will remove the OBD/NCI condition.

The 10 CFR 50.59 process has determined that if the plant were to be modified to prevent waterhammer, the modification will require prior NRC review and approval. It is expected that the risk associated with the probability of malfunction of equipment will increase more than minimally due to installation of new components. The proposed modification will also require new TS since the LPSW Waterhammer Prevention reset function meets 10 CFR 50.36

50.36 Criterion 3. The proposed modification installs non-ES equipment into an ES flow path. These components will initially close to prevent waterhammer and reopen when the logic is satisfied. This initial closure opposes the ES function; therefore, the modification design requires NRC review and approval.

Acceptable Risk and Failure Mode:

This section evaluates the acceptability of additional components and justification of acceptable failure modes (failure modes of the air operated valves (AOVs)) on loss of air or power, the closing and reopening of the AOVs, controllable vacuum breaker valves, etc.).

The design function of the LPSW system is to provide cooling water to various safety and non-safety related components. On an ES actuation all LPSW pumps energize, all LPSW motor operated valves at the discharge of the 3 RBCUs go full open, RCP motor cooler cooling water and RBACs are isolated. The non safety loads will be secured by the operator as dictated by the emergency procedure.

The design basis function is to assure cooling water is available and provided to the equipment that are credited for event mitigation. In containment, the most critical equipment that the LPSW system provides cooling water following an event are the RBCUs. Analysis credits the RBCUs (in conjunction with RB Spray) to remove energy released in containment (following a LOCA or High Energy Line Break). Analysis does not credit RBCUs and RBS to maintain the RB below peak pressure limits. The energy is required to be removed in containment to meet the long term environmental qualification envelope and reduce building pressure to reduce potential leakage. Hence, the RBCUs are not required immediately. The RBCU fans are not energized until after 3 minutes following a LOOP.

The modification will alter the design of a portion of the LPSW system. The flow to ES components will be suspended momentarily for the time it takes the LPSW pumps to develop the head that can provide indication that the pumps have been re-powered and can be relied upon to provide continuous flow. The station emergency power switching logic has a design requirement that power to the ES loads must be regained in less than 33 seconds. Large motors like the LPSW pumps motors are expected to be at rated speed in less than 5 seconds when the adequate voltage and current is provided. The LPSW RB Waterhammer Prevention Pneumatic Discharge Isolation Valves will automatically reopen and reestablish cooling water flow to the RB cooling system prior to the need for cooling water to the RBCUs. Since RBCU fans Technical Acceptance Criteria (TAC) allows for a 3 minute delay, the effect of the delay (in seconds) to restoring cooling water to the RBCUs with regards to containment response (pressure & temperature) and environmental qualification (EQ) envelope will be inconsequential. Containment response and EQ are extended operation requirements that must extended operation requirements that must be met (in the long term). LPSW flow through the RBCUs will be established before the fans restart.

The current LPSW system flowpath through the RBCUs has minimal numbers of components, is simple, and has a collectively low potential of component failure. The LPSW system is an open loop system. It is always in use during normal operation and only portions are used during shutdown operation and event mitigation. When the effects of adding new components to a system like the LPSW system (in the sections that currently have minimal numbers of components) are considered, the risk of equipment failure will inherently increase. Hence, the 10 CFR 50.59 question "Does the proposed activity result in more than a minimal increase of likelihood of occurrence of a malfunction of an SSC important to safety previously evaluated in the UFSAR?" cannot be answered without stating that the risk increase is more than minimal.

A Failure Modes and Effect Analysis (FMEA) has been performed to ensure that the identified need for a design modification does not produce an unacceptable safety or operational condition. Additional review was performed on the effects of the modification on the vital DC power supply. Another calculation was revised to show DC power voltage and current will not be affected due to additional load on the vital battery power load (from the solenoid valves). The mechanical evaluation has addressed the postulated failures of check valves, pneumatic valves, thermal relief, and other mechanical components. Additional analysis was performed to document the acceptable leakage for the valves as well as the air supply and associated tubing. System hydraulic analysis concludes that the postulated failures, because of added components, will not affect the design function of the system.

The modification is designed to not burden the operator with any additional time critical operator actions. The system response to a design basis event will be automatic and the control logic is transparent to the operator. Hence, operator actions in the emergency procedure will not significantly change other than to verify, following a design basis event, the required flow to the containment coolers has been re-established.

Additionally, to ensure the acceptability of additional components is justified, significant design basis criteria and programs have been considered. The modification has been designed to meet the requirement(s) and the related acceptance criteria stated below:

- Generic Letter 89-04, Inservice Testing (IST)

  Guidance on developing acceptable in-service testing programs is outlined in GL 89-04. The technical areas identified in the guidance document (which are in the IST programs) will be followed to verify the installation and use of the modification to provide assurance of the operational readiness. These technical areas include, but are not limited to full flow testing of check valves, back flow testing to prevent reverse flow, and stroke time of power operated valves (specifically for rapid acting valves).

- AOV testing program

  In an event, the functions of the LPSW RB Waterhammer Prevention Pneumatic Discharge Isolation Valves are to close, contain the inventory, and re-open. The LPSW RB Waterhammer Prevention Controllable Vacuum Breakers open on low LPSW pressure and re-close when LPSW pressure is restored. Like motor operated valves, the LPSW RB Waterhammer Prevention Pneumatic Discharge Isolation Valves and Controllable Vacuum Breaker Valves analyses document the maximum differential pressure (which equates to thrust and loading, etc) expected during both the closing and opening of the valves for both normal operations and abnormal events. The testing requirements, as defined by our AOV testing program, have been incorporated into the proposed modification to assure operational readiness.

- High Energy Line Breaks (HELB)

  Equipment being installed by this modification in the Turbine Building will be located in areas remote from potential HELBs. Equipment located in the Auxiliary Building will be evaluated and protected as necessary.

- Environmental Qualifications

  The instruments and components that perform QA1 functions are qualified for their environment.

- Regulatory Guide (RG) 1.97

  Position indicators for the LPSW RB Waterhammer Prevention Pneumatic Discharge Isolation Valves are considered a Type D Category 3 variable. No other instrumentation is considered within the scope of RG 1.97.

- Maintenance rule

  Since the design adds new system functions, they will be scoped in the LPSW maintenance rule function for event mitigation.

Applicable Technical Specification Criterion

The Waterhammer Prevention System and associated isolation components and circuitry are installed in an ES flowpath that serves to provide a success path which actuates to mitigate a design bases transient. The Waterhammer Prevention reset circuitry and associated isolation components serve to maintain the Containment Heat Removal function. Thus, a Technical Specification Limiting Condition for Operation (LCO) and associated Surveillances are required per 10 CFR 50.36, §§ c(2)(ii)(C) and c(3), respectively. This requirement is addressed by the proposed technical specification additions/revisions: TS 3.3.27, LPSW RB Waterhammer Prevention Reset Circuitry; TS 3.6.5, RB Spray and Cooling Systems; along with their associated TS Bases as described in section 2.0.

5.0 REGULATORY SAFETY ANALYSIS

No Significant Hazards Consideration

Pursuant to 10 CFR 50.91, Duke has made the determination that this amendment request involves a No Significant Hazards Consideration by applying the standards established by the NRC regulations in 10 CFR 50.92. This ensures that operation of the facility in accordance with the proposed amendment would not:

1) Involve a significant increase in the probability or consequences of an accident previously evaluated.

   The requested license amendment seeks approval for the Low Pressure Service Water Reactor Building Waterhammer Prevention System that is being added to the design of the three Oconee Units and the associated revised Technical Specifications. The Low Pressure Service Water Reactor Building Waterhammer Prevention modification will provide a combination passive and automatic means to isolate the Low Pressure Service Water flow stream to the Reactor Building Cooling Units, Reactor Building Auxiliary Coolers, and Reactor Coolant Pump Motor Coolers on a loss of Low Pressure Service Water flow that can lead to a waterhammer should the Low Pressure Service Water system become depressurized.

New check valves and air operated valves are added into an Engineered Safeguards flowpath. The existing Low Pressure Service Water header that discharges from the Reactor Building Cooling Units is to be modified by separating it into two headers and then joining back into a common header. Each header will contain two air operated valves. The Waterhammer Prevention System maintains the Low Pressure Service Water System inside containment water solid during a Loss of Offsite Power such that voids, which could later collapse, cannot form. The Waterhammer Prevention System will eliminate an Operable but degraded/non-conforming condition associated with waterhammers.

The design of the proposed modification and its associated Technical Specifications will provide means to assure that the Low Pressure Service Water Reactor Building Waterhammer Prevention System operates at a performance level necessary to provide for safe operation of the Low Pressure Service Water system following installation on each of the three Units. The system is designed such that a single active failure will not prevent the system from preventing a waterhammer event if power is lost to the Low Pressure Service Water pumps (e.g., Loss of Offsite Power), nor will a single active failure prevent the Engineered Safeguards flowpath from being available if needed during a Loss of Coolant Accident or Main Steam Line Break. Evaluations have been performed to assure that the risk of adding new hardware is acceptable.

Therefore, the addition of this modification and associated Technical Specifications does not significantly increase the probability or consequences of any accident previously evaluated.

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

The proposed Low Pressure Service Water Reactor Building Waterhammer Prevention Modification and its associated Technical Specifications will provide a means to assure the mechanical and electrical components operate at a performance level necessary to provide for safe operation of the modified Low Pressure Service Water system flow to the Reactor Building Cooling Units, Reactor Building Auxiliary Coolers and Reactor Coolant Pump Motor Coolers. The change enhances the plant design by eliminating the possibility of significant waterhammers that occur on a loss of Low Pressure Service Water flow to the above components.

The modification does not add any new single active failures that would prevent the Low Pressure Service Water System from supplying cooling water to the Reactor Building

Building Cooling Units. The Reactor Building Cooling Units will be isolated briefly during an Engineered Safeguards event; however, the flow path will be restored before cooling is required following the event. Since cooling was previously not available until after power restoration following a Loss of Offsite Power, there is no change in system response regarding Low Pressure Service Water flow through the Reactor Building Cooling Units when compared to the previous design.

Therefore, the proposed modification and associated Technical Specifications will not create the possibility of a new or different kind of accident from any kind of accident previously evaluated.

3) Involve a significant reduction in a margin of safety.

The proposed change does not adversely affect any plant safety limits, setpoints, or design parameters. The change also does not adversely affect the fuel, fuel cladding, Reactor Coolant System, or Containment Operability. The Reactor Building Cooling Units will be isolated briefly during an Engineered Safeguards event; however, the flow path will be restored before cooling is required following the event.

Since cooling is currently not available until after power restoration following a Loss of Offsite Power, there is no change in system response regarding Low Pressure Service Water flow through the Reactor Building Cooling Units when compared to the previous design.

The modification mitigates significant waterhammers in the Low Pressure Service Water piping to the Reactor Building Cooling Units and Reactor Cooling Pump Motor Coolers. The change will maintain the ability to provide Low Pressure Service Water flow to safety related loads following Loss of Offsite Power events.

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

CONCLUSION

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

6.0 ENVIRONMENTAL CONSIDERATION

Duke has evaluated this license amendment request against the criteria for identification of licensing and regulatory actions requiring environmental assessment in accordance with 10 CFR 51.21. Duke has determined that this license amendment request meets the criteria for a categorical exclusion set forth in 10 CFR 51.22(c)(9). This determination is based on the fact that this change is being proposed as an amendment to a license issued pursuant to 10 CFR 50 that changes a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, or that changes an inspection or a surveillance requirement, and the amendment meets the following specific criteria.

(i) The amendment involves no significant hazards consideration.

As demonstrated in Section 5, this proposed amendment does not involve significant hazards consideration.

(ii) There is no significant change in the types or significant increase in the amounts of any effluent that may be released offsite.

The installation of this modification into the LPSW system will not impact effluents released offsite. Therefore, there will be no significant change in the types or significant increase in the amounts of any effluents released offsite.

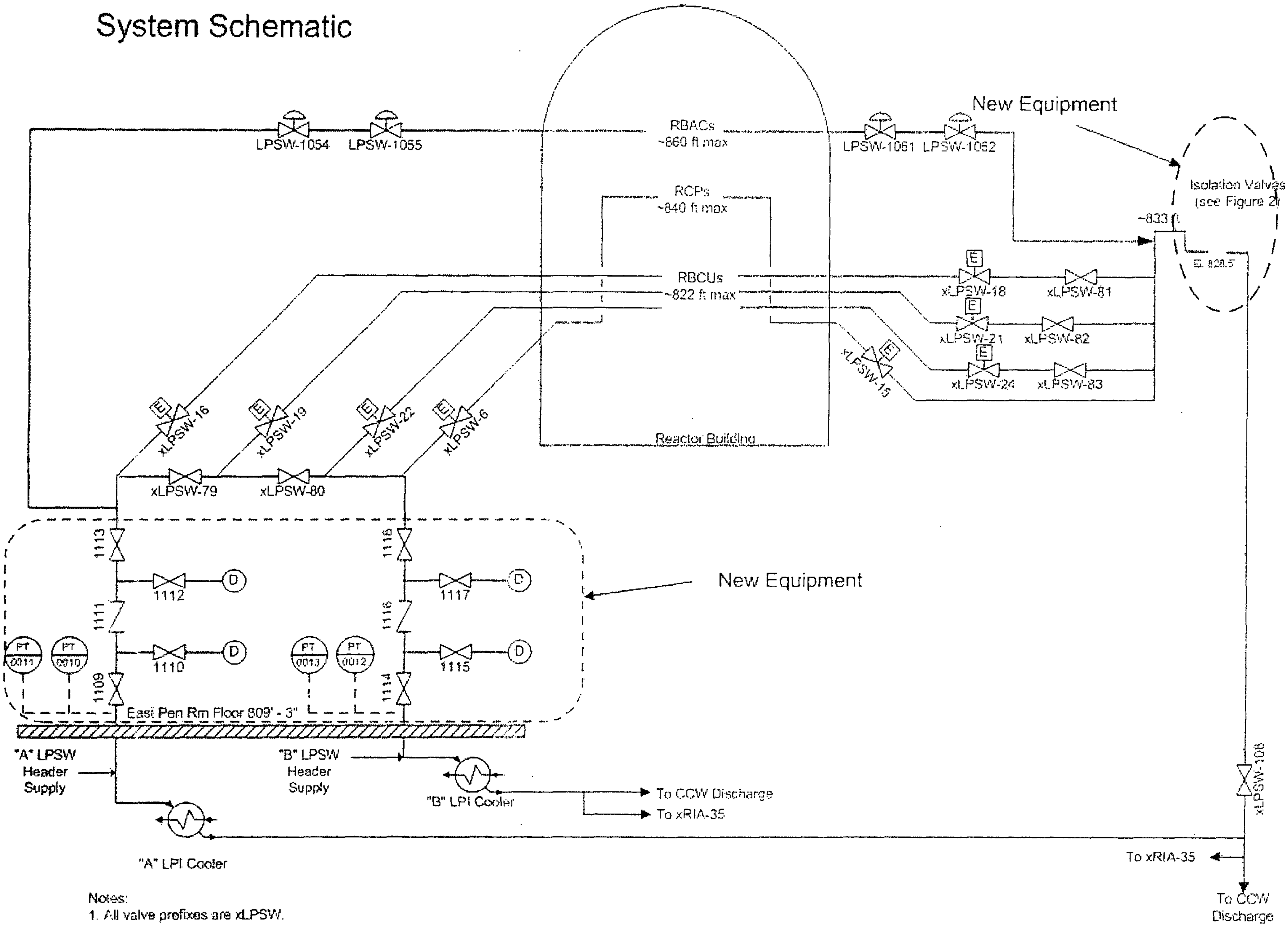
(iii) There is no significant increase in individual or cumulative occupational radiation exposure.

The installation of this modification into the LPSW system will not impact occupational radiation exposure. Therefore, there will be no significant increase in individual or cumulative occupational radiation exposure resulting from this.

ATTACHMENT 1

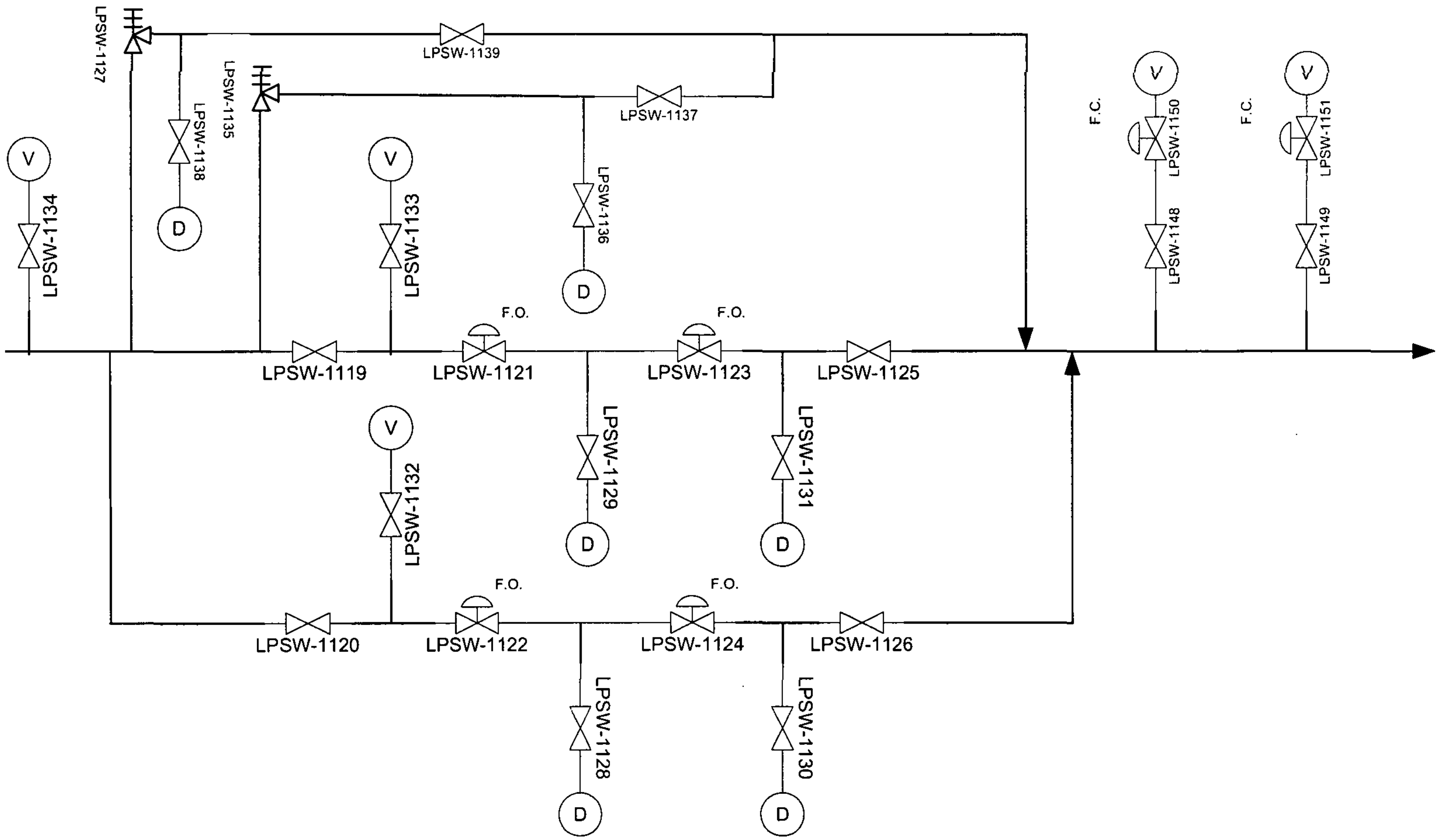
FIGURES

Figure 1

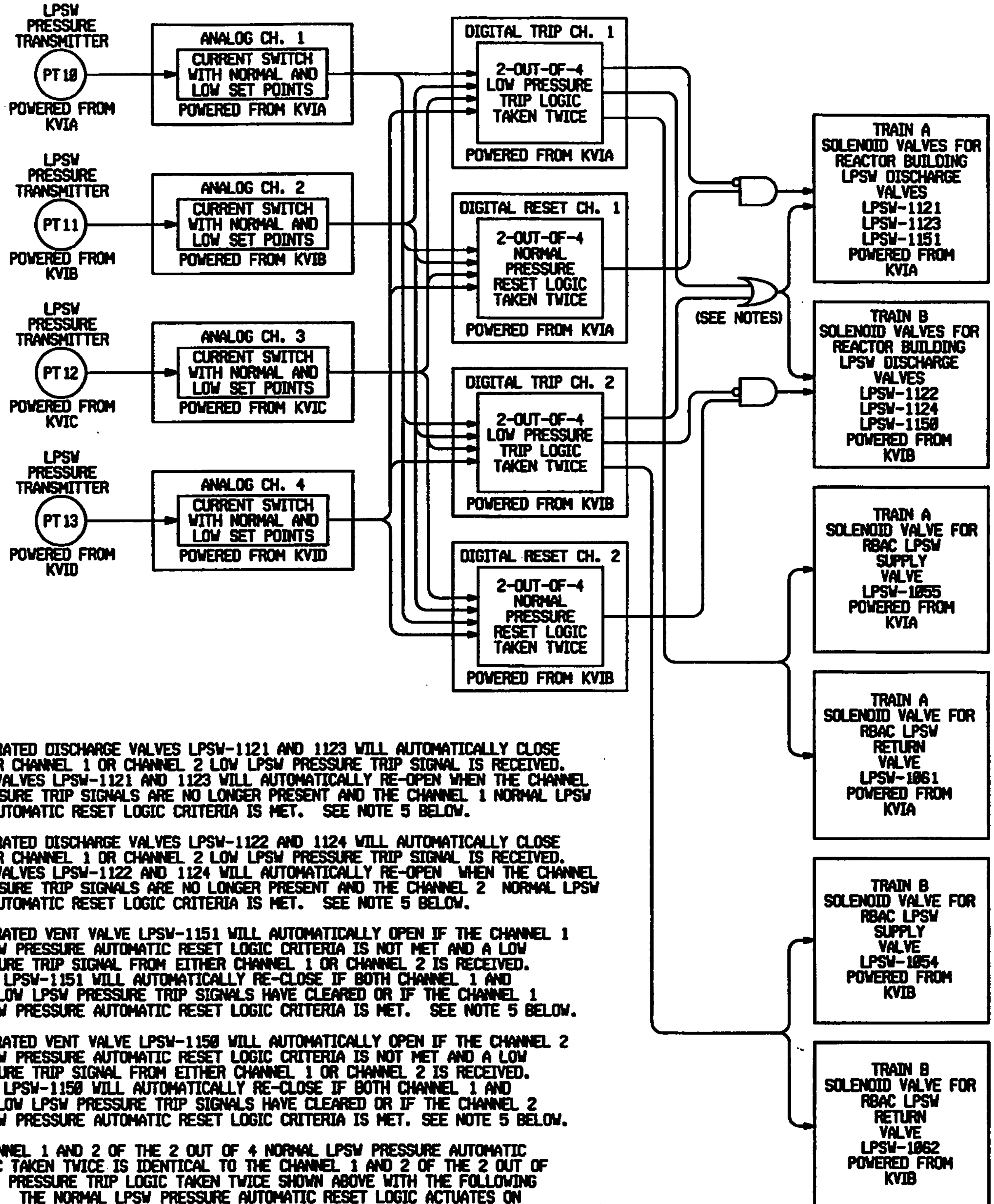


Notes:
1. All valve prefixes are xLPSW.

Figure 2
Direct RBCU/RCP Void Formation Prevention Strategy



Notes:
1. Control solenoid valves on pneumatic discharge isolation valves are energized to keep valves open. Loss of power to or failure of the solenoid valve will close the pneumatic discharge isolation valves.
2. Remote manual operation of the pneumatic discharge isolation valves from the Control Room is available to position valves as desired.
3. All pneumatic discharge isolation valves are maintained normally open to prevent a plant transient due to an on-line control solenoid valve failure.
4. Control solenoid valves for controllable vacuum breakers are energized to open.



NOTES:*

1. AIR OPERATED DISCHARGE VALVES LPSW-1121 AND 1123 WILL AUTOMATICALLY CLOSE WHEN EITHER CHANNEL 1 OR CHANNEL 2 LOW LPSW PRESSURE TRIP SIGNAL IS RECEIVED. DISCHARGE VALVES LPSW-1121 AND 1123 WILL AUTOMATICALLY RE-OPEN WHEN THE CHANNEL 1 LOW PRESSURE TRIP SIGNALS ARE NO LONGER PRESENT AND THE CHANNEL 1 NORMAL LPSW PRESSURE AUTOMATIC RESET LOGIC CRITERIA IS MET. SEE NOTE 5 BELOW.

2. AIR OPERATED DISCHARGE VALVES LPSW-1122 AND 1124 WILL AUTOMATICALLY CLOSE WHEN EITHER CHANNEL 1 OR CHANNEL 2 LOW LPSW PRESSURE TRIP SIGNAL IS RECEIVED. DISCHARGE VALVES LPSW-1122 AND 1124 WILL AUTOMATICALLY RE-OPEN WHEN THE CHANNEL 2 LOW PRESSURE TRIP SIGNALS ARE NO LONGER PRESENT AND THE CHANNEL 2 NORMAL LPSW PRESSURE AUTOMATIC RESET LOGIC CRITERIA IS MET. SEE NOTE 5 BELOW.

3. AIR OPERATED VENT VALVE LPSW-1151 WILL AUTOMATICALLY OPEN IF THE CHANNEL 1 NORMAL LPSW PRESSURE AUTOMATIC RESET LOGIC CRITERIA IS NOT MET AND A LOW LPSW PRESSURE TRIP SIGNAL FROM EITHER CHANNEL 1 OR CHANNEL 2 IS RECEIVED. VENT VALVE LPSW-1151 WILL AUTOMATICALLY RE-CLOSE IF BOTH CHANNEL 1 AND CHANNEL 2 LOW LPSW PRESSURE TRIP SIGNALS HAVE CLEARED OR IF THE CHANNEL 1 NORMAL LPSW PRESSURE AUTOMATIC RESET LOGIC CRITERIA IS MET. SEE NOTE 5 BELOW.

4. AIR OPERATED VENT VALVE LPSW-1150 WILL AUTOMATICALLY OPEN IF THE CHANNEL 2 NORMAL LPSW PRESSURE AUTOMATIC RESET LOGIC CRITERIA IS NOT MET AND A LOW LPSW PRESSURE TRIP SIGNAL FROM EITHER CHANNEL 1 OR CHANNEL 2 IS RECEIVED. VENT VALVE LPSW-1150 WILL AUTOMATICALLY RE-CLOSE IF BOTH CHANNEL 1 AND CHANNEL 2 LOW LPSW PRESSURE TRIP SIGNALS HAVE CLEARED OR IF THE CHANNEL 2 NORMAL LPSW PRESSURE AUTOMATIC RESET LOGIC CRITERIA IS MET. SEE NOTE 5 BELOW.

5. THE CHANNEL 1 AND 2 OF THE 2 OUT OF 4 NORMAL LPSW PRESSURE AUTOMATIC RESET LOGIC TAKEN TWICE IS IDENTICAL TO THE CHANNEL 1 AND 2 OF THE 2 OUT OF 4 LOW LPSW PRESSURE TRIP LOGIC TAKEN TWICE SHOWN ABOVE WITH THE FOLLOWING EXCEPTIONS: THE NORMAL LPSW PRESSURE AUTOMATIC RESET LOGIC ACTUATES ON INCREASING PRESSURE. DIGITAL RESET CHANNEL 1 RESETS LPSW-1121, 1123 AND 1151 VALVES ONLY. DIGITAL RESET CHANNEL 2 RESETS LPSW-1122, 1124 AND 1150 ONLY. ACTUATION OF EITHER DIGITAL RESET CHANNEL 1 OR DIGITAL RESET CHANNEL 2 WILL RESTORE AN ES SUCCESS FLOW PATH.

LPSW RB WATERHAMMER PREVENTION

ISOLATION CIRCUITRY SIMPLIFIED LOGIC DIAGRAM

FIGURE 3

ATTACHMENT 2

TECHNICAL SPECIFICATIONS – MARK UPS

3.3 INSTRUMENTATION

3.3.27 ~~Not Used~~ REPLACE WITH NEW ATTACHED 3.3.27

Add to TS 3.3.27

3.3 INSTRUMENTATION

3.3.27 Low Pressure Service Water (LPSW) Reactor Building (RB) Waterhammer Prevention Reset Circuitry

LCO 3.3.27 Three LPSW RB Waterhammer Prevention analog reset channels and two digital logic reset channels shall be OPERABLE.

-----NOTES-----
Applicable on each unit after completion of the LPSW RB Waterhammer Modification on the respective Unit.

APPLICABILITY: MODES 1, 2, 3, and 4

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One required LPSW RB Waterhammer Prevention analog reset channel inoperable.	A.1	Restore required LPSW RB Waterhammer Prevention analog reset channel to OPERABLE status.	7 days
B. One required LPSW RB Waterhammer Prevention ~~Isolation~~ digital logic reset channel inoperable.	B.1	Restore required LPSW RB Waterhammer Prevention ~~Isolation~~ digital logic reset channel to OPERABLE status.	7 days

(continued)

Add to TS 3.3.27

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
C. Two or more required LPSW RB Waterhammer Prevention analog reset channels inoperable. OR Two required LPSW RB Waterhammer ~~Isolation~~ Prevention digital logic reset channels inoperable. OR Required Actions and associated Completion Times of Condition A or B not met.	C.1	Open two LPSW RB Waterhammer Prevention Pneumatic Discharge Isolation valves in the same header.	Immediately
	AND		
	C.2	Take actions to restore required LPSW RB Waterhammer Prevention analog reset or digital logic reset channels to OPERABLE status.	Immediately

Add to TS 3.3.27

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.3.27.1	Perform CHANNEL CHECK.	12 hours
SR 3.3.27.2	Perform CHANNEL FUNCTIONAL TEST.	92 days
SR 3.3.27.3	Perform CHANNEL CALIBRATION.	18 months

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.6.5.1	Verify each reactor building spray and cooling manual and non-automatic power operated valve in the flow path that is not locked, sealed, or otherwise secured in position is in the correct position.	31 days
SR 3.6.5.2	Operate each required reactor building cooling train fan unit for ≥ 15 minutes.	31 days
SR 3.6.5.3	Verify each required reactor building spray pump's developed head at the flow test point is greater than or equal to the required developed head.	In accordance with the Inservice Testing Program
SR 3.6.5.4	Verify that the containment heat removal capability is sufficient to maintain post accident conditions within design limits.	18 months
SR 3.6.5.5	Verify each automatic reactor building spray and cooling valve in each required flow path that is not locked, sealed, or otherwise secured in position, actuates to the correct position on an actual or simulated actuation signal.	18 months
SR 3.6.5.6	Verify each required reactor building spray pump starts automatically on an actual or simulated actuation signal.	18 months

-----NOTE-----
Applicable for RB cooling system after the completion of the LPSW RB Waterhammer modification on the respective Unit.

(continued)

B 3.3 INSTRUMENTATION

B 3.3.27 ~~Not Used~~ REPLACE WITH NEW ATTACHED 3.3.27

ADD TO TSB 3.3.27

B 3.3 INSTRUMENTATION

B 3.3.27 Low Pressure Service Water (LPSW) Reactor Building (RB) Waterhammer Prevention Reset Circuitry

BASES

BACKGROUND

NRC Generic Letter 96-06 identified three issues of concern relative to effects of fluid in piping following postulated design basis events. One area of concern is the cooling water system piping serving the containment air coolers. The Low Pressure Service Water (LPSW) system provides cooling water to the safety related Reactor Building Cooling Units (RBCUs), non-safety related Reactor Building Auxiliary Cooling Units (RBACs) and non-safety related Reactor Coolant Pump Motor (RCPM) coolers. There is a possibility of waterhammer in the LPSW piping inside containment during either a Loss-of-Coolant Accident (LOCA) or a Main Steam Line Break (MSLB) concurrent with a loss of off-site power (LOOP) without means to prevent waterhammer.

The LPSW RB Waterhammer Prevention System (WPS) is composed of ~~passive (~~check valves~~) supply isolation valves~~, active pneumatic discharge isolation valves, and active controllable vacuum breaker valves. The LPSW RB Waterhammer Prevention Isolation Circuitry isolates LPSW to the RBCUs, RBACs and RCPM coolers any time the LPSW header pressure decreases significantly, such as during a LOOP event or LPSW pump failure during normal operations. The isolation function prevents and/or minimizes the potential waterhammers in the associated piping. The LPSW RB Waterhammer Prevention Reset Circuitry will re-establish flow to the containment air coolers following WPS actuation once the LPSW system has repressurized.

The RBCU fans and RBCU cooling water motor operated return valves are Engineered Safeguards (ES) features. On an ES actuation, these valves open. The LPSW RB Waterhammer Prevention Pneumatic Discharge Isolation Valves are designed to close on low LPSW supply header pressure and re-open when the LPSW supply header pressure is restored. The LPSW RB Waterhammer Prevention Controllable Vacuum Breaker Valves are designed to open on low LPSW pressure and re-close when LPSW pressure is restored. However, closure of the controllable vacuum breaker valves is not required to restore the ES flow path. Restoring the ES flow path via the LPSW RB Waterhammer Prevention reset function is the concern for this TS. The reset function opens the LPSW RB Waterhammer Prevention Pneumatic Discharge Isolation Valves and closes the LPSW RB Waterhammer Prevention Controllable Vacuum Breaker Valves.

The LPSW RB Waterhammer Prevention Pneumatic Discharge Isolation Valves fail open on loss of instrument air. During normal operation, a control solenoid valve in the instrument air supply to each

ADD TO TSB 3.3.27

BASES

BACKGROUND (continued)

LPSW RB Waterhammer Prevention Pneumatic Discharge Isolation Valve is energized to vent air from the actuator to maintain the isolation valves in the open position. On loss of two of four of the 120 VAC power sources for the LPSW RB Waterhammer Prevention Isolation Circuitry, the 3-way control solenoid valve is de-energized to align the air accumulator with the pneumatic operator; thereby closing the LPSW RB Waterhammer Prevention Pneumatic Discharge Isolation Valve(s). LPSW RB Waterhammer Prevention Controllable Vacuum Breaker Valves are located downstream of the pneumatic discharge isolation valves. The LPSW RB Waterhammer Prevention Controllable Vacuum Breaker Valves are normally closed. They open simultaneously with the closing of the LPSW RB Waterhammer Prevention Pneumatic Discharge Isolation Valves in order to break vacuum in the return header by energizing the control solenoid valve.

Only three analog sensor channels are required to support OPERABILITY

The LPSW RB Waterhammer Prevention Reset Circuitry contains four analog sensor channels and two digital actuation logic channels. Each analog sensor channel contains a safety grade pressure transmitter and current switch. The two digital actuation logic channels consist of safety grade relays in a ~~one~~ two-out-of-two logic configuration. The actuation of the LPSW RB Waterhammer Prevention ~~Isolation~~ reset Circuitry requires ~~an~~ two of the three required LPSW pressure signals supplied from the LPSW header pressure transmitters.

The LPSW RB Waterhammer Prevention Isolation (i.e., trip) Circuitry is being controlled in Selected Licensee Commitments.

APPLICABLE SAFETY ANALYSES

In a LOOP event, the LPSW RB Waterhammer Prevention Reset Circuitry ensures that the Containment Heat Removal function is maintained by re-establishing the LPSW flowpath to the RBCUs~~, RBACs and RCPM coolers~~.

The RBCU Fans presently have a 3 minute delay to re-start following ES activation. LPSW flow will be restored to the RBCUs prior to the RBCU fan restart. This ensures the Containment Heat Removal function is unaffected.

The LPSW RB Waterhammer Prevention Reset Circuitry satisfies Criterion 3 of 10 CFR 50.36 (Ref. 1).

Add to TSB 3.3.27

BASES (continued)

LCO

Three LPSW RB Waterhammer Prevention analog reset channels and two digital logic reset channels shall be OPERABLE. Each analog sensor channel contains a safety related pressure transmitter and current switch. The two digital logic reset channels consist of safety related relays. The LPSW RB Waterhammer Prevention Reset Circuitry design ensures that a single active failure will not prevent the circuitry and associated components from performing ~~the intended~~. safety function.

There are four analog reset channels but only three are required to support OPERABILITY. These ~~four~~ three analog reset channels are configured in a two out of three control logic scheme that will reset the LPSW RB Waterhammer Prevention ~~Isolation~~ Reset Circuitry. The LPSW RB Waterhammer Prevention ~~Isolation~~ Reset Circuitry will open the four LPSW RB Pneumatic Discharge Isolation Valves when ~~the~~ LPSW ~~analog process signal on any two channels reaches the reset point.~~ pressure returns to normal. Either digital logic reset channel will restore an ES flow path.

The actuation logic reset used for the LPSW RB Waterhammer Prevention Reset Circuitry is similar to other safety related circuitry currently being used. The LCO allowed required action and Completion Times are acceptable based on the number of channels normally available. Though one of the four analog reset channels can be out of service for an extended period, it is not a normal practice.

When one required analog reset channel is taken out of service, the two out of three analog control logic scheme is reduced to a two out of two analog control logic scheme. This control logic scheme will reset the digital channels on increasing supply header pressure.

Failure of an analog reset channel while in the two out of two control logic mode will reduce the reset control logic to a one out of two control logic scheme. This control logic is unacceptable because a failure will prevent the LPSW RB Waterhammer Prevention Reset Circuitry from resetting as required.

The two digital reset channels are triggered by two of four analog reset channels consisting of a pressure transmitter/current switch. On increasing supply header pressure, two of four analog channels will reset the digital channels. If one of the two digital reset channels is inoperable or out of service, the system is no longer single failure proof.

The LCO is modified by a note. The note states that the LCO becomes applicable on each Unit after completion of the LPSW RB Waterhammer Modification.

ADD TO TSB 3.3.27

BASES

APPLICABILITY

The LPSW RB Waterhammer Prevention Reset Circuitry is required to be OPERABLE in MODES 1, 2, 3, and 4. This ensures LPSW is available to support the OPERABILITY of the equipment serviced by the LPSW system.

ACTIONS

A.1

If one required LPSW RB Waterhammer Prevention analog reset channel is inoperable, the LPSW RB Waterhammer Prevention Reset Circuitry is no longer single failure proof and the control logic scheme is reduced to a two out of two configuration. Required Action A.1 requires the LPSW RB Waterhammer Prevention analog reset channels be restored to OPERABLE status within 7 days.

The 7 day Completion Time takes into account the allowed outage times of similar systems ~~redundant heat removal capability~~, reasonable time for repairs, and the low probability of an event occurring during this period.

B.1

If one required LPSW RB Waterhammer Prevention digital logic reset channel is inoperable, the LPSW RB Waterhammer Prevention Reset Circuitry is not single failure proof. Required Action B.1 requires the digital reset channels be restored to OPERABLE status within 7 days.

The 7 day Completion Time takes into account the allowed outage times of similar systems ~~redundant heat removal capability~~, reasonable time for repairs, and the low probability of an event occurring during this period.

In MODES 5 and 6, the probability and consequences of the events that the LPSW System supports is reduced due to the pressure and temperature limitations of these MODES. As a result, the LPSW RB Waterhammer Prevention Reset Circuitry is not required to be OPERABLE in MODES 5 and 6.

ADD to TSB 3.3.27

BASES

ACTIONS (continued)

C.1 and C.2

If two or more required LPSW RB Waterhammer Prevention analog reset channel(s) or two digital logic reset channel(s) are inoperable or the Required Actions and associated Completion Times of Condition A or B are not met, the WPS must be configured in order to assure the Containment Heat removal function is maintained. To achieve this status, actions to prevent automatic closing by manually opening (remote or local) ~~open~~ two LPSW RB Waterhammer Prevention Pneumatic Discharge Isolation valves in the same header shall be completed immediately and actions to repair the inoperable equipment shall be taken immediately.

SURVEILLANCE REQUIREMENTS

SR 3.3.27.1

Performance of the CHANNEL CHECK every 12 hours ensures that a gross failure of instrumentation has not occurred. A CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that analog instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between the two analog instrument channels could be an indication of excessive instrument drift in one of the channels or of something even more serious. CHANNEL CHECK will detect gross channel failure; therefore, it is key in verifying that the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

Agreement criteria are determined, based on a combination of the channel instrument uncertainties, including isolation, indication, and readability. If a channel is outside the criteria, it may be an indication that the transmitter or the signal processing equipment has drifted outside its limit.

The Frequency, equivalent to every shift, is based on operating experience that demonstrates channel failure is rare. Since the probability of two random failures in redundant channels in any 12 hour

ADD to TSB 3.3.27

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.27.1 (continued)

period is extremely low, the CHANNEL CHECK minimizes the chance of loss of protective function due to failure of redundant channels. The CHANNEL CHECK supplements less formal, but potentially more frequent, checks of channel operability during normal operational use of the displays associated with the LCO's required channels.

SR 3.3.27.2

A CHANNEL FUNCTIONAL TEST is performed on each channel to ensure the circuitry will perform its intended function. The Frequency of 92 days is based on engineering judgment and operating experience, with regard to channel OPERABILITY and drift, which demonstrates that failure of more than one channel in any 92 day interval is a rare event.

SR 3.3.27.3

A CHANNEL CALIBRATION is a complete check of the analog instrument channel, including the sensor. The test verifies that the channel responds to a measured parameter within the necessary range and accuracy. The CHANNEL CALIBRATION leaves the components adjusted to account for instrument drift to ensure that the circuitry remains operational between successive tests. The 18-month Frequency is justified by the assumption of an 18-month calibration interval in the setpoint analysis determination of instrument drift during that interval.

REFERENCES

1. 10 CFR 50.36.

BASES

BACKGROUND

Reactor Building Spray System (continued)

The Reactor Building Spray System provides a spray of relatively cold borated water into the upper regions of containment to reduce the containment pressure and temperature and to reduce the concentration of fission products in the containment atmosphere during an accident. In the recirculation mode of operation, heat is removed from the reactor building sump water by the decay heat removal coolers. Each train of the Reactor Building Spray System provides adequate spray coverage to meet the system design requirements for containment heat removal.

The Reactor Building Spray System is actuated automatically by a containment High-High pressure signal. An automatic actuation opens the Reactor Building Spray System pump discharge valves and starts the two Reactor Building Spray System pumps.

Reactor Building Cooling System

The Reactor Building Cooling System consists of three reactor building cooling trains. Each cooling train is equipped with cooling coils, and an axial vane flow fan driven by a two speed electric motor.

During normal unit operation, typically two reactor building cooling trains with two fans operating at low speed or high speed, serve to cool the containment atmosphere. Low speed cooling fan operation is available during periods of lower containment heat load. The third unit is usually on standby. Upon receipt of an emergency signal, the operating cooling fans running at low speed or high speed will automatically trip, then restart in low speed after a 3 minute delay, and any idle unit is energized in low speed after a 3 minute delay. The fans are operated at the lower speed during accident conditions to prevent motor overload from the higher density atmosphere.

Add

For Unit(s) with the LPSW RB Waterhammer Prevention modification installed, the common LPSW return header will split into two new headers downstream of the Reactor Building Cooling Units (RBCUs). Each header will contain two pneumatic discharge isolation valves and will be capable of full LPSW flow. The headers will be rejoined downstream of the discharge isolation valves into a common return.

APPLICABLE SAFETY ANALYSES

The Reactor Building Spray System and Reactor Building Cooling System reduce the temperature and pressure following an accident. The limiting accidents considered are the loss of coolant accident (LOCA) and the steam line break. The postulated accidents are analyzed, with regard to containment ES systems, assuming the loss of one ES bus. This is the

BASES

LCO (continued)

Each reactor building spray train shall include a spray pump, spray headers, nozzles, valves, piping, instruments, and controls to ensure an OPERABLE flow path capable of taking suction from the BWST (via the LPI System) upon an Engineered Safeguards Protective System signal and manually transferring suction to the reactor building sump. The OPERABILITY of RBS train flow instrumentation is not required for OPERABILITY of the corresponding RBS train because system resistance hydraulically maintains adequate NPSH to the RBS pumps and manual throttling of RBS flow is not required. During an event, LPI train flow must be monitored and controlled to support the RBS train pumps to ensure that the NPSH requirements for the RBS pumps are not exceeded. If the flow instrumentation or the capability to control the flow in a LPI train is unavailable then the associated RBS train's OPERABILITY is affected until such time as the LPI train is restored or the associated LPI pump is placed in a secured state to prevent actuation during an event.

or one ~~Each~~ header of LPSW RB Waterhammer Prevention Discharge Isolation Valves ~~are considered OPERABLE when they are capable of being automatically opened or they~~ shall ~~have~~ been manually opened (remote or Local)

Each reactor building cooling train shall include cooling coils, fusible dropout plates or duct openings, an axial vane flow fan, ~~instruments, valves, and controls to ensure an OPERABLE flow path~~. For Units with the LPSW RB Waterhammer modification installed, ~~only one~~ Both ~~of the two~~ headers of the LPSW RB Waterhammer Prevention Discharge Isolation Valves ~~is~~ are required to support flowpath OPERABILITY. ~~Valve LPSW-108 shall be locked open to support system OPERABILITY.~~ ADD

to prevent automatic closure

ADD

APPLICABILITY

In MODES 1, 2, 3, and 4, an accident could cause a release of radioactive material to containment and an increase in containment pressure and temperature, requiring the operation of the reactor building spray trains and reactor building cooling trains.

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

ACTIONS

The Actions are modified by a Note indicating that the provisions of LCO 3.0.4 do not apply for Unit 2 only. As a result, this allows entry into a MODE or other specified condition in the Applicability with the LCO not met after performance of a risk assessment addressing inoperable systems and components, consideration of the results, determination of the acceptability of entering the MODE or other specified condition in the Applicability, and establishment of risk management actions, if appropriate.

BASES

ACTIONS

G.1 (continued)

conditions from full power conditions in an orderly manner and without challenging unit systems.

H.1

With two reactor building spray trains, two reactor building cooling trains or any combination of three or more reactor building spray and reactor building cooling trains inoperable in MODE 1 or 2, the unit is in a condition outside the accident analysis. Therefore, LCO 3.0.3 must be entered immediately.

With any combination of two or more required reactor building spray and reactor building cooling trains inoperable in MODE 3 or 4, the unit is in a condition outside the accident analysis. Therefore, LCO 3.0.3 must be entered immediately.

SURVEILLANCE REQUIREMENTS

SR 3.6.5.1

and cooling

Verifying the correct alignment for manual and non-automatic power operated valves in the reactor building spray flow ~~path provides~~ assurance that the proper flow paths will exist for Reactor ~~Building~~ Spray System operation. This SR does not apply to ~~valves~~ that are locked, sealed, or otherwise secured in position, since these were verified to be in the correct position prior to locking, sealing, or securing. Similarly, this SR does not apply to automatic valves since automatic valves actuate to their required position upon an accident signal. This SR also does not apply to valves that cannot be inadvertently misaligned, such as check valves. This SR does not require any testing or valve ~~manipulation. Rather,~~ it involves verification, ~~through a system~~ walkdown, that those valves ~~outside containment~~ and capable of potentially being mispositioned are in the correct position.

Add same note for SR 3.6.5.1 that's contained in SR 3.6.5.5.

SR 3.6.5.2

~~Operating each required~~ reactor ~~building cooling train fan unit~~ for ≥ 15 minutes ensures that all trains are OPERABLE and that all associated controls are functioning properly. It also ensures that blockage, fan or motor failure, or excessive vibration can be detected for corrective action. The 31 day Frequency was developed considering the known reliability of the fan units and controls, the three train redundancy available, and the low

BASES

SURVEILLANCE REQUIREMENTS

SR 3.6.5.2 (continued)

probability of a significant degradation of the reactor building cooling trains occurring between surveillances and has been shown to be acceptable through operating experience.

SR 3.6.5.3

Verifying that each required Reactor Building Spray pump's developed head at the flow test point is greater than or equal to the required developed head ensures that spray pump performance has not degraded during the cycle. Flow and differential pressure are normal tests of centrifugal pump performance required by Section XI of the ASME Code (Ref. 4). Since the Reactor Building Spray System pumps cannot be tested with flow through the spray headers, they are tested on recirculation flow. This test confirms one point on the pump design curve and is indicative of overall performance. Such inservice tests confirm component OPERABILITY, trend performance, and may detect incipient failures by indicating abnormal performance. The Frequency of this SR is in accordance with the Inservice Testing Program.

SR 3.6.5.4

Verifying the containment heat removal capability provides assurance that the containment heat removal systems are capable of maintaining containment temperature below design limits following an accident. This test verifies the heat removal capability of the Low Pressure Injection (LPI) Coolers and Reactor Building Cooling Units. The 18 month Frequency was developed considering the known reliability of the low pressure service water, reactor building spray and reactor building cooling systems and other testing performed at shorter intervals that is intended to identify the possible loss of heat removal capability.

SR 3.6.5.5 and SR 3.6.5.6

These SRs require verification that each automatic reactor building spray and cooling valve actuates to its correct position and that each reactor building spray pump starts upon receipt of an actual or simulated actuation signal. The test will be considered satisfactory if visual observation and control board indication verifies that all components have responded to the actuation signal properly; ~~the appropriate pump breakers~~ have closed, and ~~all valves~~ have completed their travel. This SR is not required for valves that are

Add to SR end of SR

SR 3.6.5.5 is modified by a note that states the SR is applicable for Reactor Building Cooling system following completion of the LPSW RB Waterhammer Modification on the Respective Unit.

Amendment Nos.

ATTACHMENT 3

TECHNICAL SPECIFICATIONS– REPRINTED PAGES

Remove Page	Insert Page
TS TOC Page ii	TS TOC Page ii
3.3.27-1	3.3.27-1
----------	3.3.27-2
----------	3.3.27-3
3.6.5-4	3.6.5-4
3.6.5-5	3.6.5-5
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-----------	B 3.3.27-6
B 3.6.5-2	B 3.6.5-2
B 3.6.5-3	B 3.6.5-3
B 3.6.5-4	B 3.6.5-4
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3.3 INSTRUMENTATION

3.3.27 Low Pressure Service Water (LPSW) Reactor Building (RB) Waterhammer Prevention Reset Circuitry

LCO 3.3.27 Three LPSW RB Waterhammer Prevention analog reset channels and two digital logic reset channels shall be OPERABLE.

---NOTES---
Applicable on each unit after completion of the LPSW RB Waterhammer Modification on the respective Unit.

APPLICABILITY: MODES 1, 2, 3, and 4

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One required LPSW RB Waterhammer Prevention analog reset channel inoperable.	A.1 Restore required LPSW RB Waterhammer Prevention analog reset channel to OPERABLE status.	7 days
B. One required LPSW RB Waterhammer Prevention digital logic reset channel inoperable.	B.1 Restore required LPSW RB Waterhammer Prevention digital logic reset channel to OPERABLE status.	7 days

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
C. Two or more required LPSW RB Waterhammer Prevention analog reset channels inoperable. OR Two required LPSW RB Waterhammer Prevention digital logic reset channels inoperable. OR Required Actions and associated Completion Times of Condition A or B not met.	C.1	Open two LPSW RB Waterhammer Prevention Pneumatic Discharge Isolation valves in the same header.	Immediately
	AND		
	C.2	Take actions to restore required LPSW RB Waterhammer Prevention analog reset or digital logic reset channels to OPERABLE status.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.3.27.1	Perform CHANNEL CHECK.	12 hours
SR 3.3.27.2	Perform CHANNEL FUNCTIONAL TEST.	92 days
SR 3.3.27.3	Perform CHANNEL CALIBRATION.	18 months

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.6.5.1	-----------------------NOTE-------------------------- Applicable for RB cooling system after the completion of the LPSW RB Waterhammer Modification on the respective Unit. -- Verify each reactor building spray and cooling manual and non-automatic power operated valve in the flow path that is not locked, sealed, or otherwise secured in position is in the correct position.	31 days
SR 3.6.5.2	Operate each required reactor building cooling train fan unit for ≥ 15 minutes.	31 days
SR 3.6.5.3	Verify each required reactor building spray pump's developed head at the flow test point is greater than or equal to the required developed head.	In accordance with the Inservice Testing Program
SR 3.6.5.4	Verify that the containment heat removal capability is sufficient to maintain post accident conditions within design limits.	18 months

(continued)

SURVEILLANCE REQUIREMENTS (continued)

SURVEILLANCE		FREQUENCY
SR 3.6.5.5	----------------------NOTE--------------------------- Applicable for RB cooling system after the completion of the LPSW RB Waterhammer Modification on the respective Unit. --- Verify each automatic reactor building spray and cooling valve in each required flow path that is not locked, sealed, or otherwise secured in position, actuates to the correct position on an actual or simulated actuation signal.	18 months
SR 3.6.5.6	Verify each required reactor building spray pump starts automatically on an actual or simulated actuation signal.	18 months
SR 3.6.5.7	Verify each required reactor building cooling train starts automatically on an actual or simulated actuation signal.	18 months
SR 3.6.5.8	Verify each spray nozzle is unobstructed.	10 years

B 3.3 INSTRUMENTATION

B 3.3.27 Low Pressure Service Water (LPSW) Reactor Building (RB) Waterhammer Prevention Reset Circuitry

BASES

BACKGROUND

NRC Generic Letter 96-06 identified three issues of concern relative to effects of fluid in piping following postulated design basis events. One area of concern is the cooling water system piping serving the containment air coolers. The Low Pressure Service Water (LPSW) system provides cooling water to the safety related Reactor Building Cooling Units (RBCUs), non-safety related Reactor Building Auxiliary Cooling Units (RBACs) and non-safety related Reactor Coolant Pump Motor (RCPM) coolers. There is a possibility of waterhammer in the LPSW piping inside containment during either a Loss-of-Coolant Accident (LOCA) or a Main Steam Line Break (MSLB) concurrent with a loss of off-site power (LOOP) without means to prevent waterhammer.

The LPSW RB Waterhammer Prevention System (WPS) is composed of check valves, active pneumatic discharge isolation valves, and active controllable vacuum breaker valves. The LPSW RB Waterhammer Prevention Isolation Circuitry isolates LPSW to the RBCUs, RBACs and RCPM coolers any time the LPSW header pressure decreases significantly, such as during a LOOP event or LPSW pump failure during normal operations. The isolation function prevents and/or minimizes the potential waterhammers in the associated piping. The LPSW RB Waterhammer Prevention Reset Circuitry will re-establish flow to the containment air coolers following WPS actuation once the LPSW system has repressurized.

The RBCU fans and RBCU cooling water motor operated return valves are Engineered Safeguards (ES) features. On an ES actuation, these valves open. The LPSW RB Waterhammer Prevention Pneumatic Discharge Isolation Valves are designed to close on low LPSW supply header pressure and re-open when the LPSW supply header pressure is restored. The LPSW RB Waterhammer Prevention Controllable Vacuum Breaker Valves are designed to open on low LPSW pressure and re-close when LPSW pressure is restored. However, closure of the Controllable Vacuum Breaker valves is not required to restore the ES flow path. Restoring the ES flow path via the LPSW RB Waterhammer Prevention reset function is the concern for this TS. The reset function opens the LPSW RB Waterhammer Prevention Pneumatic Discharge Isolation Valves and closes the LPSW RB Waterhammer Prevention Controllable Vacuum Breaker Valves.

The LPSW RB Waterhammer Prevention Pneumatic Discharge Isolation Valves fail open on loss of instrument air. During normal

BASES

BACKGROUND (continued)

operation, a control solenoid valve in the instrument air supply to each LPSW RB Waterhammer Prevention Pneumatic Discharge Isolation Valve is energized to vent air from the actuator to maintain the isolation valves in the open position. On loss of two of four of the analog input signals for the LPSW RB Waterhammer Prevention Isolation Circuitry, the 3-way control solenoid valve is de-energized to align the air accumulator with the pneumatic operator; thereby closing the LPSW RB Waterhammer Prevention Pneumatic Discharge Isolation Valve(s). LPSW RB Waterhammer Prevention Controllable Vacuum Breaker Valves are located downstream of the pneumatic discharge isolation valves. The LPSW RB Waterhammer Prevention Controllable Vacuum Breaker Valves are normally closed. They open simultaneously with the closing of the LPSW RB Waterhammer Prevention Pneumatic Discharge Isolation Valves in order to break vacuum in the return header by energizing the control solenoid valve.

The LPSW RB Waterhammer Prevention Reset Circuitry contains four analog sensor channels and two digital actuation logic channels. Only three analog sensor channels are required to support OPERABILITY. Each analog sensor channel contains a safety grade pressure transmitter and current switch. The two digital actuation logic reset channels consist of safety grade relays in a two-out-of-two logic configuration. The actuation of the LPSW RB Waterhammer Prevention Reset Circuitry requires two of the three required LPSW pressure signals supplied from the LPSW header pressure transmitters.

The LPSW RB Waterhammer Prevention Isolation (i.e., trip) Circuitry is being controlled in Selected Licensee Commitments.

APPLICABLE SAFETY ANALYSES

In a LOOP event, the LPSW RB Waterhammer Prevention Reset Circuitry ensures that the Containment Heat Removal function is maintained by re-establishing the LPSW flowpath to the RBCUs.

The RBCU Fans presently have a 3 minute delay to re-start following ES activation. LPSW flow will be restored to the RBCUs prior to the RBCU fan restart. This ensures the Containment Heat Removal function is unaffected.

The LPSW RB Waterhammer Prevention Reset Circuitry satisfies Criterion 3 of 10 CFR 50.36 (Ref. 1).

BASES (continued)

LCO

Three LPSW RB Waterhammer Prevention analog reset channels and two digital logic reset channels shall be OPERABLE. Each analog sensor channel contains a safety related pressure transmitter and current switch. The two digital logic reset channels consist of safety related relays. The LPSW RB Waterhammer Prevention Reset Circuitry design ensures that a single active failure will not prevent the circuitry and associated components from performing the intended safety function.

There are four analog reset channels, but only three are required to support OPERABILITY. These three analog reset channels are configured in a two out of three control logic scheme that will reset the LPSW RB Waterhammer Prevention Reset Circuitry. The LPSW RB Waterhammer Prevention Reset Circuitry will open the four LPSW RB Pneumatic Discharge Isolation Valves when LPSW pressure returns to normal. Either digital logic reset channel will restore an ES flow path.

The actuation logic reset used for the LPSW RB Waterhammer Prevention Reset Circuitry is similar to other safety related circuitry currently being used. The LCO allowed required action and Completion Times are acceptable based on the number of channels normally available. Though one of the four analog reset channels can be out of service for an extended period, it is not a normal practice.

When one required analog reset channel is taken out of service, the two out of three analog control logic scheme is reduced to a two out of two analog control logic scheme. This control logic scheme will reset the digital channels on increasing supply header pressure.

Failure of an analog reset channel while in the two out of two control logic mode will reduce the reset control logic to a one out of two control logic scheme. This control logic is unacceptable because a failure will prevent the LPSW RB Waterhammer Prevention Reset Circuitry from resetting as required.

The two digital reset channels are triggered by two of four analog reset channels consisting of a pressure transmitter/current switch. On increasing supply header pressure, two of four analog channels will reset the digital channels. If one of the two digital reset channels is inoperable or out of service, the system is no longer single failure proof.

The LCO is modified by a note. The note states that the LCO becomes applicable on each Unit after completion of the LPSW RB Waterhammer Modification.

APPLICABILITY

The LPSW RB Waterhammer Prevention Reset Circuitry is required to be OPERABLE in MODES 1, 2, 3, and 4. This ensures LPSW is available to support the OPERABILITY of the equipment serviced by the LPSW system.

In MODES 5 and 6, the probability and consequences of the events that the LPSW System supports is reduced due to the pressure and temperature limitations of these MODES. As a result, the LPSW RB Waterhammer Prevention Reset Circuitry is not required to be OPERABLE in MODES 5 and 6.

ACTIONS

A.1

If one required LPSW RB Waterhammer Prevention analog reset channel is inoperable, the LPSW RB Waterhammer Prevention Reset Circuitry is no longer single failure proof and the control logic scheme is reduced to a two out of two configuration. Required Action A.1 requires the LPSW RB Waterhammer Prevention analog reset channels be restored to OPERABLE status within 7 days.

The 7 day Completion Time takes into account the allowed outage times of similar systems, reasonable time for repairs, and the low probability of an event occurring during this period.

B.1

If one required LPSW RB Waterhammer Prevention digital logic reset channel is inoperable, the LPSW RB Waterhammer Prevention Reset Circuitry is not single failure proof. Required Action B.1 requires the digital reset channels be restored to OPERABLE status within 7 days.

The 7 day Completion Time takes into account the allowed outage times of similar systems, reasonable time for repairs, and the low probability of an event occurring during this period.

ACTIONS (continued)

C.1 and C.2

If two or more required LPSW RB Waterhammer Prevention analog reset channel(s) or two digital logic reset channel(s) are inoperable or the Required Actions and associated Completion Times of Condition A or B are not met, the WPS must be configured in order to assure the Containment Heat removal function is maintained. To achieve this status, actions to prevent automatic closing by manually opening (remote or local) two LPSW RB Waterhammer Prevention Pneumatic Discharge Isolation valves in the same header shall be completed immediately and actions to repair the inoperable equipment shall be taken immediately.

SURVEILLANCE REQUIREMENTS

SR 3.3.27.1

Performance of the CHANNEL CHECK every 12 hours ensures that a gross failure of instrumentation has not occurred. A CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to a similar parameter on other channels. It is based on the assumption that analog instrument channels monitoring the same parameter should read approximately the same value. Significant deviations between the two analog instrument channels could be an indication of excessive instrument drift in one of the channels or of something even more serious. CHANNEL CHECK will detect gross channel failure; therefore, it is key in verifying that the instrumentation continues to operate properly between each CHANNEL CALIBRATION.

Agreement criteria are determined, based on a combination of the channel instrument uncertainties, including isolation, indication, and readability. If a channel is outside the criteria, it may be an indication that the transmitter or the signal processing equipment has drifted outside its limit.

The Frequency, equivalent to every shift, is based on operating experience that demonstrates channel failure is rare. Since the probability of two random failures in redundant channels in any 12 hour

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.27.1 (continued)

period is extremely low, the CHANNEL CHECK minimizes the chance of loss of protective function due to failure of redundant channels. The CHANNEL CHECK supplements less formal, but potentially more frequent, checks of channel operability during normal operational use of the displays associated with the LCO's required channels.

SR 3.3.27.2

A CHANNEL FUNCTIONAL TEST is performed on each channel to ensure the circuitry will perform its intended function. The Frequency of 92 days is based on engineering judgment and operating experience, with regard to channel OPERABILITY and drift, which demonstrates that failure of more than one channel in any 92 day interval is a rare event.

SR 3.3.27.3

A CHANNEL CALIBRATION is a complete check of the analog instrument channel, including the sensor. The test verifies that the channel responds to a measured parameter within the necessary range and accuracy. The CHANNEL CALIBRATION leaves the components adjusted to account for instrument drift to ensure that the circuitry remains operational between successive tests. The 18-month Frequency is justified by the assumption of an 18-month calibration interval in the setpoint analysis determination of instrument drift during that interval.

REFERENCES

1. 10 CFR 50.36.

BASES

BACKGROUND

Reactor Building Spray System (continued)

The Reactor Building Spray System provides a spray of relatively cold borated water into the upper regions of containment to reduce the containment pressure and temperature and to reduce the concentration of fission products in the containment atmosphere during an accident. In the recirculation mode of operation, heat is removed from the reactor building sump water by the decay heat removal coolers. Each train of the Reactor Building Spray System provides adequate spray coverage to meet the system design requirements for containment heat removal.

The Reactor Building Spray System is actuated automatically by a containment High-High pressure signal. An automatic actuation opens the Reactor Building Spray System pump discharge valves and starts the two Reactor Building Spray System pumps.

Reactor Building Cooling System

The Reactor Building Cooling System consists of three reactor building cooling trains. Each cooling train is equipped with cooling coils, and an axial vane flow fan driven by a two speed electric motor.

During normal unit operation, typically two reactor building cooling trains with two fans operating at low speed or high speed, serve to cool the containment atmosphere. Low speed cooling fan operation is available during periods of lower containment heat load. The third unit is usually on standby. Upon receipt of an emergency signal, the operating cooling fans running at low speed or high speed will automatically trip, then restart in low speed after a 3 minute delay, and any idle unit is energized in low speed after a 3 minute delay. The fans are operated at the lower speed during accident conditions to prevent motor overload from the higher density atmosphere.

For Unit(s) with the LPSW RB Waterhammer Prevention modification installed, the common LPSW return header will split into two new headers downstream of the Reactor Building Cooling Units (RBCUs). Each header will contain two pneumatic discharge isolation valves and will be capable of full LPSW flow. The headers will be rejoined downstream of the discharge isolation valves into a common return.

APPLICABLE SAFETY ANALYSES

The Reactor Building Spray System and Reactor Building Cooling System reduce the temperature and pressure following an accident. The limiting accidents considered are the loss of coolant accident (LOCA) and the steam line break. The postulated accidents are analyzed, with regard to containment ES systems, assuming the loss of one ES bus. This is the

BASES

APPLICABLE SAFETY ANALYSES (continued)

worst-case single active failure, resulting in one train of the Reactor Building Spray System and one train of the Reactor Building Cooling System being inoperable.

The analysis and evaluation show that, under the worst-case scenario (LOCA with worst-case single active failure), the highest peak containment pressure is 57.75 psig. The analysis shows that the peak containment temperature is 283.1°F. Both results are less than the design values. The analyses and evaluations assume a power level of 2619 MWt, one reactor building spray train and two reactor building cooling trains operating, and initial (pre-accident) conditions of 80°F and 15.9 psia. The analyses also assume a delayed initiation to provide conservative peak calculated containment pressure and temperature responses.

The Reactor Building Spray System total delay time of approximately 100 seconds includes Keowee Hydro Unit startup (for loss of offsite power), reactor building spray pump startup, and spray line filling (Ref. 2).

Reactor building cooling train performance for post accident conditions is given in Reference 2. The result of the analysis is that any combination of two trains can provide 100% of the required cooling capacity during the post accident condition. The train post accident cooling capacity under varying containment ambient conditions is also shown in Reference 2.

Reactor Building Cooling System total delay time of 3 minutes includes KHU startup (for loss of offsite power) and allows all ES equipment to start before the Reactor Building Cooling Unit on the associated train is started. This improves voltages at the 600V and 208V levels for starting loads (Ref. 2).

The Reactor Building Spray System and the Reactor Building Cooling System satisfy Criterion 3 of 10 CFR 50.36 (Ref. 3).

LCO

During an accident, a minimum of two reactor building cooling trains and one reactor building spray train are required to maintain the containment pressure and temperature following a LOCA. Additionally, one reactor building spray train is required to remove iodine from the containment atmosphere and maintain concentrations below those assumed in the safety analysis. To ensure that these requirements are met, two reactor building spray trains and three reactor building cooling trains must be OPERABLE in MODES 1 and 2. In MODES 3 or 4, one reactor building spray train and two reactor building cooling trains are required to be OPERABLE. The LCO is provided with a note that clarifies this requirement. Therefore, in the event of an accident, the minimum requirements are met, assuming the worst-case single active failure occurs.

BASES

LCO (continued)

Each reactor building spray train shall include a spray pump, spray headers, nozzles, valves, piping, instruments, and controls to ensure an OPERABLE flow path capable of taking suction from the BWST (via the LPI System) upon an Engineered Safeguards Protective System signal and manually transferring suction to the reactor building sump. The OPERABILITY of RBS train flow instrumentation is not required for OPERABILITY of the corresponding RBS train because system resistance hydraulically maintains adequate NPSH to the RBS pumps and manual throttling of RBS flow is not required. During an event, LPI train flow must be monitored and controlled to support the RBS train pumps to ensure that the NPSH requirements for the RBS pumps are not exceeded. If the flow instrumentation or the capability to control the flow in a LPI train is unavailable then the associated RBS train's OPERABILITY is affected until such time as the LPI train is restored or the associated LPI pump is placed in a secured state to prevent actuation during an event.

Each reactor building cooling train shall include cooling coils, fusible dropout plates or duct openings, an axial vane flow fan, instruments, valves, and controls to ensure an OPERABLE flow path. For Unit(s) with the LPSW RB Waterhammer modification installed, two headers of the LPSW RB Waterhammer Prevention Discharge Isolation Valves are required to support flowpath OPERABILITY or one header of LPSW RB Waterhammer Prevention Discharge Isolation Valves shall be manually opened (remote or local) to prevent automatic closure. Valve LPSW-108 shall be locked open to support system OPERABILITY.

APPLICABILITY

In MODES 1, 2, 3, and 4, an accident could cause a release of radioactive material to containment and an increase in containment pressure and temperature, requiring the operation of the reactor building spray trains and reactor building cooling trains.

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

ACTIONS

The Actions are modified by a Note indicating that the provisions of LCO 3.0.4 do not apply for Unit 2 only. As a result, this allows entry into a MODE or other specified condition in the Applicability with the LCO not met after performance of a risk assessment addressing inoperable systems and components, consideration of the results, determination of the acceptability of entering the MODE or other specified condition in the Applicability, and

BASES

ACTIONS

G.1 (continued)

conditions from full power conditions in an orderly manner and without challenging unit systems.

H.1

With two reactor building spray trains, two reactor building cooling trains or any combination of three or more reactor building spray and reactor building cooling trains inoperable in MODE 1 or 2, the unit is in a condition outside the accident analysis. Therefore, LCO 3.0.3 must be entered immediately.

With any combination of two or more required reactor building spray and reactor building cooling trains inoperable in MODE 3 or 4, the unit is in a condition outside the accident analysis. Therefore, LCO 3.0.3 must be entered immediately.

SURVEILLANCE REQUIREMENTS

SR 3.6.5.1

Verifying the correct alignment for manual and non-automatic power operated valves in the reactor building spray and cooling flow path provides assurance that the proper flow paths will exist for Reactor Building Spray and Cooling System operation. This SR does not apply to valves that are locked, sealed, or otherwise secured in position, since these were verified to be in the correct position prior to locking, sealing, or securing. Similarly, this SR does not apply to automatic valves since automatic valves actuate to their required position upon an accident signal. This SR also does not apply to valves that cannot be inadvertently misaligned, such as check valves. This SR does not require any testing or valve manipulation. Rather, it involves verification, through a system walkdown, that those valves outside containment and capable of potentially being mispositioned are in the correct position.

SR 3.6.5.1 is modified by a note that states the SR is applicable for Reactor Building Cooling system following completion of the LPSW RB Waterhammer Modification on the respective Unit.

SR 3.6.5.2

Operating each required reactor building cooling train fan unit for $\geq$ 15 minutes ensures that all trains are OPERABLE and that all associated controls are functioning properly. It also ensures that blockage, fan or motor failure, or excessive vibration can be detected for corrective action.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.6.5.2 (continued)

The 31 day Frequency was developed considering the known reliability of the fan units and controls, the three train redundancy available, and the low probability of a significant degradation of the reactor building cooling trains occurring between surveillances and has been shown to be acceptable through operating experience.

SR 3.6.5.3

Verifying that each required Reactor Building Spray pump's developed head at the flow test point is greater than or equal to the required developed head ensures that spray pump performance has not degraded during the cycle. Flow and differential pressure are normal tests of centrifugal pump performance required by Section XI of the ASME Code (Ref. 4). Since the Reactor Building Spray System pumps cannot be tested with flow through the spray headers, they are tested on recirculation flow. This test confirms one point on the pump design curve and is indicative of overall performance. Such inservice tests confirm component OPERABILITY, trend performance, and may detect incipient failures by indicating abnormal performance. The Frequency of this SR is in accordance with the Inservice Testing Program.

SR 3.6.5.4

Verifying the containment heat removal capability provides assurance that the containment heat removal systems are capable of maintaining containment temperature below design limits following an accident. This test verifies the heat removal capability of the Low Pressure Injection (LPI) Coolers and Reactor Building Cooling Units. The 18 month Frequency was developed considering the known reliability of the low pressure service water, reactor building spray and reactor building cooling systems and other testing performed at shorter intervals that is intended to identify the possible loss of heat removal capability.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.6.5.5 and 3.6.5.6

These SRs require verification that each automatic reactor building spray and cooling valve actuates to its correct position and that each reactor building spray pump starts upon receipt of an actual or simulated actuation signal. The test will be considered satisfactory if visual observation and control board indication verifies that all components have responded to the actuation signal properly; the appropriate pump breakers have closed, and all valves have completed their travel. This SR is not required for valves that are locked, sealed, or otherwise secured in position under administrative controls. The 18 month Frequency is based on the need to perform these Surveillances under the conditions that apply during a unit outage and the potential for an unplanned transient if the Surveillances were performed with the reactor at power. Operating experience has shown that these components usually pass the Surveillances when performed at the 18 month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

SR 3.6.5.5 is modified by a note that states the SR is applicable for Reactor Building Cooling system following completion of the LPSW RB Waterhammer Modification on the respective Unit.

SR 3.6.5.7

This SR requires verification that each required reactor building cooling train actuates upon receipt of an actual or simulated actuation signal. The test will be considered satisfactory if control board indication verifies that all components have responded to the actuation signal properly, the appropriate valves have completed their travel, and fans are running at half speed. The 18 month Frequency is based on engineering judgment and has been shown to be acceptable through operating experience. See SR 3.6.5.5 and SR 3.6.5.6, above, for further discussion of the basis for the 18 month Frequency.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.6.5.8

With the reactor building spray header isolated and drained of any solution, station compressed air is introduced into the spray headers to verify the availability of the headers and spray nozzles. Performance of this Surveillance demonstrates that each spray nozzle is unobstructed and provides assurance that spray coverage of the containment during an accident is not degraded. Due to the passive nature of the design of the nozzles, a test at 10 year intervals is considered adequate to detect obstruction of the spray nozzles.

REFERENCES

1. UFSAR, Section 3.1.
2. UFSAR, Section 6.2.
3. 10 CFR 50.36.
4. ASME, Boiler and Pressure Vessel Code, Section XI.