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September 2, 2008

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

Subject: Duke Energy Carolinas, LLC
Oconee Nuclear Site, Units 1, 2, and 3
Docket Numbers 50-269, 50-270, and 50-287
Request for Additional Information associated with the License Amendment Request (LAR) for Low Pressure Service Water Reactor Building Waterhammer Prevention System Modification
LAR No. 2006-05

In accordance with 10 CFR 50.90, Duke Energy Carolinas, LLC (Duke) proposes to amend Renewed Facility Operating Licenses Nos. DPR-38, DPR-47, and DPR-55. A LAR was submitted on October 16, 2007 to the Nuclear Regulatory Commission (NRC) seeking review and approval of a plant modification that 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 in the LPSW return header, and associated circuitry 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.

Duke met with the NRC on January 24, 2008, to discuss the submittal. In an email dated March 12, 2008, Duke received requests for additional information (RAIs). The RAI response was submitted in a letter dated May 7, 2008. In an email dated June 12, 2008 and a conference call on July 22, 2008, Duke was asked to clarify information associated with valve leakage and to address the accumulators. Enclosure 2 contains Duke's responses to those RAIs. Attachments 1 and 2 contain TS that are required as a result of addressing the RAI associated with the accumulators and other components associated with the LPSW Waterhammer Prevention System.

A001
NRR

The NRC also requested the Updated Final Safety Analysis Report (UFSAR) revision associated with this LAR be provided. It is included in attachment 3.

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 Chairman and Nuclear Safety Review Board Director. Additionally, a copy of this response 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 September 30, 2008, and be effective upon issuance. Modification implementation will 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. 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,

Dave Baxter, Vice President
Oconee Nuclear Site

Enclosures:
1. Notarized Affidavit
2. Requests For Additional Information

Attachments:
1. Technical Specifications – Mark Up
2. Technical Specifications – Reprinted Page
3. Updated Final Safety Analysis Report Revision

bc w/enclosures and attachments:

Mr. Luis Reyes, Regional Administrator
U. S. Nuclear Regulatory Commission - Region II
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Oconee Nuclear Site

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Infectious and Radioactive Waste Management Section
Department of Health & Environmental Control
2600 Bull Street
Columbia, SC 29201

ENCLOSURE 1

NOTARIZED AFFIDAVIT

AFFIDAVIT

Dave Baxter, being duly sworn, states that he is Vice President, Oconee Nuclear Site, 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.

Dave Baxter, Vice President
Oconee Nuclear Site

Subscribed and sworn to before me this 2nd day of September 2008

Notary Public

My Commission Expires:

6-12-2013
Date

SEAL

ENCLOSURE 2

REQUESTS FOR ADDITIONAL INFORMATION

Enclosure 2 – Evaluation of Proposed Change
License Amendment Request No. 2006-05
September 2, 2008

1.0 REQUESTS FOR ADDITIONAL INFORMATION

RAI #1

Should the accumulators discussed in your 5/7/08 RAI response be included in technical specifications (TS)? If not, please explain.

ANSWER:

The accumulators, as well as other components that support maintaining LPSW piping integrity are being included in the technical specifications. A Limiting Condition for Operation (LCO) is being added to state that the Low Pressure Service Water (LPSW) Waterhammer Prevention System (WPS) shall be OPERABLE on Units where the LPSW WPS modification is installed. A condition is being added for an inoperable LPSW WPS requiring action be taken immediately to restore the LPSW WPS to OPERABLE status. No shutdown requirements are being added due to analysis that shows for the waterhammer event, piping integrity is maintained, although code allowable stresses could be exceeded. Due to the low probability of these types of events, this completion time is acceptable to allow for repairs. Three surveillance requirements (SRs) will be added to TS 3.7.7, Low Pressure Service Water (LPSW) System. SR 3.7.7.1 is added to verify every 12 hours that level is maintained within limits for the accumulator. An 18 month Functional Test to ensure flow from the accumulator into the LPSW System is added as SR 3.7.7.5. An 18 month verification to ensure that boundary valve leakage is within limits is being added. The other SRs are renumbered to accommodate this change.

The bases are revised to reflect the above changes and also define what's necessary to support LPSW WPS OPERABILITY.

Attachments 1 and 2 contain the mark-up and reprinted copies of these changes, respectively.

RAI #2

The May 7, 2008, response to RAI #2 says that the accumulators will supply 25 gpm for one minute. However, you don't indicate what amount of leakage could occur. For example, is it possible that over time the leakage could amount to more than 25-gallon capacity of the accumulators?

ANSWER:

An analysis was performed to ensure that waterhammers are eliminated during actuation and reset of the LPSW Reactor Building (RB) Waterhammer Prevention System (WPS). Based on

the analysis, allowed boundary valve leakage for cases without heat input from containment (e.g., Loss Of Offsite Power (LOOP) only) is very low. In order to allow a larger leakage rate, a "leakage accumulator" is provided. The accumulator "floats" on the LPSW supply header and has an air tank to drive water into the isolated portion of LPSW whenever the LPSW RB WPS actuates and valve leakage drops the pressure in this region. Making up any leakage will maintain the pressure in the system above vapor pressure which will prevent voiding.

A target allowed maximum leakage rate of 25 gpm was arbitrarily chosen because a) the leakage accumulator is not needed for a Large Break Loss Of Coolant Accident (LOCA) since that value is less than that allowed for a Large Break LOCA, and b) this is a reasonable leakage rate for the aggregate leakage of four large valves in a raw water system (i.e., notably larger leakage rates could be indicative of a legitimate valve problem). The accumulator must provide for the leakage for at least one minute. The maximum amount of time that the LPSW pumps would be expected to be off following a LOOP is about 33 seconds. Thus, a one minute mission time is acceptable. Leakage beyond that time frame is considered a Station Blackout (SBO) and a supply from High Pressure Service Water is available that will automatically begin supplying water when the pressure falls below the regulator setpoint.

The LPSW Leakage Accumulator is designed to allow up to 25 gpm of aggregate leakage for one minute. The aggregate leakage includes boundary valve seat leakage and miscellaneous leakage. Miscellaneous leakage is typically difficult to quantify, but is small, dripping type leaks (e.g. packing leaks).

RAI #3:

Submit the Updated Final Safety Analysis Report (UFSAR) Revision.

ANSWER:

Attachment 3 contains the UFSAR revision which describes the new system.

ATTACHMENT 1

TECHNICAL SPECIFICATION - RETYPE

3.7 PLANT SYSTEMS

3.7.7 Low Pressure Service Water (LPSW) System

LCO 3.7.7 For Unit 1 or Unit 2, three LPSW pumps and one flow path shall be OPERABLE.

For Unit 3, two LPSW pumps and one flow path shall be OPERABLE.

The LPSW Waterhammer Prevention System (WPS) shall be OPERABLE on Units where the LPSW RB Waterhammer modification is installed.

----------NOTE----------
With either Unit 1 or Unit 2 defueled and appropriate LPSW loads secured on the defueled Unit, such that one LPSW pump is capable of mitigating the consequences of a design basis accident on the remaining Unit, only two LPSW pumps for Unit 1 or Unit 2 are required.

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

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One required LPSW pump inoperable.	A.1	Restore required LPSW pump to OPERABLE status.	72 hours
B. Required Action and associated Completion Time of Condition A not met.	B.1	Be in MODE 3.	12 hours
	AND		
	B.2	Be in MODE 5.	60 hours
C. LPSW WPS inoperable on Units with LPSW RB Waterhammer modification installed.	C.1	Take actions to restore LPSW WPS to OPERABLE status.	Immediately

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.7.7.1	Verify LPSW leakage accumulator level is within limits for Units with LPSW RB Waterhammer modification installed.	12 hours
SR 3.7.7.2	----------NOTE---------- Isolation of LPSW flow to individual components does not render the LPSW System inoperable. ---------- Verify each LPSW manual, and non-automatic power operated valve in the flow path servicing safety related equipment, that is not locked, sealed, or otherwise secured in position, is in the correct position.	31 days
SR 3.7.7.3	Verify each LPSW automatic valve in the flow path that is not locked, sealed, or otherwise secured in position, actuates to the correct position on an actual or simulated actuation signal.	18 months
SR 3.7.7.4	Verify each LPSW pump starts automatically on an actual or simulated actuation signal.	18 months
SR 3.7.7.5	Verify LPSW leakage accumulator is able to provide makeup flow lost due to boundary valve leakage on Units with LPSW RB Waterhammer modification installed.	18 months
SR 3.7.7.6	Verify LPSW WPS boundary valve leakage is within limits for Units with LPSW RB Waterhammer modification installed.	18 months

B 3.7 PLANT SYSTEMS

B 3.7.7 Low Pressure Service Water (LPSW) System

BASES

BACKGROUND

The LPSW System provides a heat sink for the removal of process and operating heat from safety related components during a transient or accident. During normal operation and normal shutdown, the LPSW System also provides this function for various safety related and nonsafety related components.

The LPSW system for Unit 1 and Unit 2 is shared and consists of three LPSW pumps which can supply multiple combinations of path ways to supply required components. The LPSW system for Unit 3 consists of two LPSW pumps which can supply multiple combinations of path ways to supply required components. Although multiple combinations of path ways exist, only one flow path is necessary, since no single failure of an active component can prevent the LPSW system from supplying necessary components. The pumps and valves are remote manually aligned, except in the unlikely event of a loss of coolant accident (LOCA) or other accidents. The pumps are automatically started upon receipt of an Engineered Safeguards actuation signal, and automatic valves are aligned to their post accident positions. The LPSW System also provides cooling directly to the Reactor Building Cooling Units (RBCU) and Low Pressure Injection coolers, turbine driven EFW pump, HPI pump motor coolers, and the motor driven EFW pumps.

GL 96-06 required consideration of waterhammer inside containment during a LOCA or MSLB combined with a loss of offsite power (LOOP) event. As a result, the LPSW Reactor Building (RB) Waterhammer Prevention System (WPS) was added to maintain LPSW piping water solid inside containment during any event that causes a loss of LPSW system pressure. The WPS is fully automatic. Other functions of the WPS are addressed by LCO 3.3.27 and LCO 3.6.5.

Additional information about the design and operation of the LPSW System, along with a list of the components served, is presented in the UFSAR, Section 9.2.2 (Ref. 1).

APPLICABLE SAFETY ANALYSES

The primary safety function of the LPSW is, in conjunction with a 100% capacity reactor building cooling system, (a combination of the reactor building spray and reactor building air coolers) to remove core decay heat following a design basis LOCA, as discussed in the UFSAR,

BASES

APPLICABLE SAFETY ANALYSES (continued)

Section 6.3 (Ref. 2). This provides for a gradual reduction in the temperature of the fluid, as it is supplied to the Reactor Coolant System (RCS) by the High Pressure and Low Pressure Injection pumps.

The LPSW System is designed to perform its function with a single active failure of any component, assuming loss of offsite power

The LPSW System also cools the unit from Decay Heat Removal (DHR) System entry conditions, to MODE 5 during normal and post accident operation. The time required for this evolution is a function of the number of DHR System trains that are operating. One LPSW pump per unit and a flowpath is sufficient to remove decay heat during subsequent operations in MODES 5 and 6. This assumes a maximum LPSW System temperature of 90°F occurring simultaneously with maximum heat loads on the system.

The LPSW satisfies Criterion 3 of 10 CFR 50.36 (Ref. 2).

LCO

For the LPSW system shared by Units 1 and 2, three LPSW pumps are required to be OPERABLE to provide the required redundancy to ensure that the system functions to remove post accident heat loads, assuming the worst case single active failure occurs coincident with the loss of offsite power. The LCO is modified by a Note which requires only two LPSW pumps to be OPERABLE for Units 1 or 2 if either Unit is defueled and one LPSW pump is capable of mitigating the DBA on the fueled Unit. The Units 1 and 2 LPSW System requires only two pumps to meet the single failure criterion provided that one of the units has been defueled and the following LPSW System loads on the defueled unit are isolated: Reactor Building Cooling Units (RBCU), Reactor Building Auxiliary Coolers, Component Cooling, main turbine oil tank, reactor coolant (RC) pumps, and Low Pressure Injection (LPI) coolers.

For the LPSW system for Unit 3, two LPSW pumps are required to be OPERABLE to provide the required redundancy to ensure that the system functions to remove post accident heat loads, assuming the worst case single active failure occurs coincident with the loss of offsite power.

An LPSW flow path is considered OPERABLE when the associated piping, valves, heat exchangers, and instrumentation and controls required to perform the safety related function are OPERABLE. Any combination of path ways to supply the required components is acceptable, provided there is no single active failure which can prevent supplying necessary loads and applicable design criteria (e.g., seismic qualification) are satisfied.

BASES

LCO (continued)

The LPSW WPS is considered OPERABLE when the associated leakage accumulator, relief valves, seat leakage for check valves and pneumatic discharge isolation valves, closure capability of pneumatic discharge isolation valves, opening capability of the controllable vacuum breaker valves, and instrumentation and controls required to control WPS functions are OPERABLE.

APPLICABILITY

In MODES 1, 2, 3, and 4, the LPSW System is a normally operating system that is required to support the OPERABILITY of the equipment serviced by the LPSW System. Therefore, the LPSW System is required to be OPERABLE in these MODES

In MODES 5 and 6, the OPERABILITY requirements of the LPSW System are determined by the systems it supports.

ACTIONS

A.1

If one required LPSW pump is inoperable, action must be taken to restore the required LPSW pump to OPERABLE status within 72 hours. In this Condition, the remaining OPERABLE LPSW pump(s) are adequate to perform the heat removal function. However, the overall reliability is reduced because a single failure in the OPERABLE LPSW pump(s) could result in loss of LPSW system function. The 72 hour Completion Time is based on the redundant capabilities afforded by the OPERABLE pump, and the low probability of a DBA occurring during this period.

B.1 and B.2

If the LPSW pump cannot be restored to OPERABLE status within the associated Completion Time, the unit must be placed in a MODE in which the LCO does not apply. To achieve this status, the unit must be placed in at least MODE 3 within 12 hours, and in MODE 5 within 60 hours.

The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems. The extended interval to reach MODE 5 provides additional time to restore the required LPSW pump and is reasonable considering that the potential for an accident or transient is reduced in MODE 3.

BASES

ACTIONS (continued)

C.1

If the LPSW WPS is inoperable, action shall be taken to restore the required LPSW WPS components to OPERABLE status immediately for Units with the LPSW RB Waterhammer modification installed. The allowed Completion Time is based on analysis that shows that LPSW System piping integrity is maintained following a LOOP induced waterhammer even though code allowable stresses could be exceeded. The allowed Completion Time is considered reasonable based on the low probability of a DBA occurring during the period of maintenance.

SURVEILLANCE REQUIREMENTS

SR 3.7.7.1

For Units with LPSW RB Waterhammer Prevention System installed, verifying the correct level in the leakage accumulator will provide assurance that in the event of boundary valve leakage during a LOOP event, there is sufficient water to keep the LPSW piping filled.

The 12 hour Frequency is based on engineering judgment and considered sufficient to ensure the appropriate amount of water is available in the accumulator.

SR 3.7.7.2

Verifying the correct alignment for manual, and power operated valves in the LPSW System flow path provides assurance that the proper flow paths exist for LPSW 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 31 day Frequency is based on engineering judgment, is consistent with the procedural controls governing valve operation, and ensures correct valve positions.

This SR is modified by a Note indicating that the isolation of components or systems supported by the LPSW System does not affect the OPERABILITY of the LPSW System.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.7.7.3

The SR verifies proper automatic operation of the LPSW System valves. The LPSW System is a normally operating system that cannot be fully actuated as part of the normal testing. 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 this Surveillance under the conditions that apply during a unit outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown that these components usually pass the Surveillance when performed at the 18 month Frequency. Therefore, the Frequency is acceptable from a reliability standpoint.

SR 3.7.7.4

The SR verifies proper automatic operation of the LPSW System pumps on an actual or simulated actuation signal. The LPSW System is a normally operating system that cannot be fully actuated as part of normal testing during normal operation. The 18 month Frequency is consistent with the Inservice Testing Program. Operating experience has shown that these components usually pass the Surveillance when performed at an 18 month Frequency. Therefore, the Frequency is acceptable from a reliability standpoint.

SR 3.7.7.5

For Units with LPSW RB Waterhammer Prevention System installed, the SR verifies proper operation of the LPSW RB Waterhammer Prevention System leakage accumulator. Verifying adequate flow from the accumulator will provide assurance that in the event of boundary valve leakage during a LOOP event, there is sufficient water to keep LPSW piping filled.

The 18 month Frequency is based on engineering judgment and operating experience.

SR 3.7.7.6

For Units with LPSW RB Waterhammer Prevention System installed, the SR verifies that LPSW WPS boundary valve leakage is within limits. Verifying boundary valve leakage is within limits will ensure that in the event of a LOOP, a waterhammer will not occur, because the LPSW leakage accumulator will be able to maintain the LPSW piping water solid.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.7.7.6 (continued)

The 18 month Frequency is based on engineering judgment and operating experience.

REFERENCES

1. UFSAR, Section 9.2.2.
2. UFSAR, Section 6.3.
3. 10 CFR 50.36.

ATTACHMENT 2

TECHNICAL SPECIFICATIONS – MARK UP

3.7 PLANT SYSTEMS

3.7.7 Low Pressure Service Water (LPSW) System

LCO 3.7.7 For Unit 1 or Unit 2, three LPSW pumps and one flow path shall be OPERABLE.

For Unit 3, two LPSW pumps and one flow path shall be OPERABLE.

---NOTE---
With either Unit 1 or Unit 2 defueled and appropriate LPSW loads secured on the defueled Unit, such that one LPSW pump is capable of mitigating the consequences of a design basis accident on the remaining Unit, only two LPSW pumps for Unit 1 or Unit 2 are required.

The LPSW Waterhammer Prevention System (WPS) shall be OPERABLE on Units where the LPSW RB Waterhammer modification is installed.

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

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One required LPSW pump inoperable.	A.1 Restore required LPSW pump to OPERABLE status.	72 hours
B. Required Action and associated Completion Time of Condition A not met.	B.1 Be in MODE 3. AND B.2 Be in MODE 5.	12 hours 60 hours
C. LPSW WPS inoperable on Units with LPSW RB Waterhammer modification installed.	C.1 Take actions to restore LPSW WPS to OPERABLE status	Immediately

SR 3.7.7.1 Verify LPSW leakage accumulator level is within limits for Units with LPSW RB Waterhammer ~~WPS~~ modification installed. 12 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.7.7.2 ----------NOTE---------- Isolation of LPSW flow to individual components does not render the LPSW System inoperable. ---------- Verify each LPSW manual, and non-automatic power operated valve in the flow path servicing safety related equipment, that is not locked, sealed, or otherwise secured in position, is in the correct position.	31 days
SR 3.7.7.3 Verify each LPSW automatic valve in the flow path that is not locked, sealed, or otherwise secured in position, actuates to the correct position on an actual or simulated actuation signal.	18 months
SR 3.7.7.4 Verify each LPSW pump starts automatically on an actual or simulated actuation signal.	18 months
SR 3.7.7.5 Verify LPSW leakage accumulator is able to provide makeup flow lost due to boundary valve leakage on Units with LPSW RB Waterhammer modification installed.	18 months
SR 3.7.7.6 Verify LPSW WPS boundary valve leakage is within limits for Units with LPSW RB Waterhammer modification installed.	18 months

B 3.7 PLANT SYSTEMS

B 3.7.7 Low Pressure Service Water (LPSW) System

BASES

BACKGROUND

The LPSW System provides a heat sink for the removal of process and operating heat from safety related components during a transient or accident. During normal operation and normal shutdown, the LPSW System also provides this function for various safety related and nonsafety related components.

The LPSW system for Unit 1 and Unit 2 is shared and consists of three LPSW pumps which can supply multiple combinations of path ways to supply required components. The LPSW system for Unit 3 consists of two LPSW pumps which can supply multiple combinations of path ways to supply required components. Although multiple combinations of path ways exist, only one flow path is necessary, since no single failure of an active component can prevent the LPSW system from supplying necessary components. The pumps and valves are remote manually aligned, except in the unlikely event of a loss of coolant accident (LOCA) or other accidents. The pumps are automatically started upon receipt of an Engineered Safeguards actuation signal, and automatic valves are aligned to their post accident positions. The LPSW System also provides cooling directly to the Reactor Building Cooling Units (RBCU) and Low Pressure Injection coolers, turbine driven EFW pump, HPI pump motor coolers, and the motor driven EFW pumps.

Add Insert #1 per attached sheet →

Additional information about the design and operation of the LPSW System, along with a list of the components served, is presented in the UFSAR, Section 9.2.2 (Ref. 1).

APPLICABLE SAFETY ANALYSES

The primary safety function of the LPSW is, in conjunction with a 100% capacity reactor building cooling system, (a combination of the reactor building spray and reactor building air coolers) to remove core decay heat following a design basis LOCA, as discussed in the UFSAR, Section 6.3 (Ref. 2). This provides for a gradual reduction in the temperature of the fluid, as it is supplied to the Reactor Coolant System (RCS) by the High Pressure and Low Pressure Injection pumps.

The LPSW System is designed to perform its function with a single active failure of any component, assuming loss of offsite power.

BASES

APPLICABLE SAFETY ANALYSES (continued)

The LPSW System also cools the unit from Decay Heat Removal (DHR) System entry conditions, to MODE 5 during normal and post accident operation. The time required for this evolution is a function of the number of DHR System trains that are operating. One LPSW pump per unit and a flowpath is sufficient to remove decay heat during subsequent operations in MODES 5 and 6. This assumes a maximum LPSW System temperature of 90°F occurring simultaneously with maximum heat loads on the system.

The LPSW satisfies Criterion 3 of 10 CFR 50.36 (Ref. 2).

LCO

For the LPSW system shared by Units 1 and 2, three LPSW pumps are required to be OPERABLE to provide the required redundancy to ensure that the system functions to remove post accident heat loads, assuming the worst case single active failure occurs coincident with the loss of offsite power. The LCO is modified by a Note which requires only two LPSW pumps to be OPERABLE for Units 1 or 2 if either Unit is defueled and one LPSW pump is capable of mitigating the DBA on the fueled Unit. The Units 1 and 2 LPSW System requires only two pumps to meet the single failure criterion provided that one of the units has been defueled and the following LPSW System loads on the defueled unit are isolated: Reactor Building Cooling Units (RBCU), Reactor Building Auxiliary Coolers, Component Cooling, main turbine oil tank, reactor coolant (RC) pumps, and Low Pressure Injection (LPI) coolers.

For the LPSW system for Unit 3, two LPSW pumps are required to be OPERABLE to provide the required redundancy to ensure that the system functions to remove post accident heat loads, assuming the worst case single active failure occurs coincident with the loss of offsite power.

An LPSW flow path is considered OPERABLE when the associated piping, valves, heat exchangers, and instrumentation and controls required to perform the safety related function are OPERABLE. Any combination of path ways to supply the required components is acceptable, provided there is no single active failure which can prevent supplying necessary loads and applicable design criteria (e.g., seismic qualification) are satisfied.

Add Insert #2 per attached →

APPLICABILITY

In MODES 1, 2, 3, and 4, the LPSW System is a normally operating system that is required to support the OPERABILITY of the equipment serviced by the LPSW System. Therefore, the LPSW System is required to be OPERABLE in these MODES.

BASES

APPLICABILITY (continued)

In MODES 5 and 6, the OPERABILITY requirements of the LPSW System are determined by the systems it supports.

ACTIONS

A.1

If one required LPSW pump is inoperable, action must be taken to restore the required LPSW pump to OPERABLE status within 72 hours. In this Condition, the remaining OPERABLE LPSW pump(s) are adequate to perform the heat removal function. However, the overall reliability is reduced because a single failure in the OPERABLE LPSW pump(s) could result in loss of LPSW system function. The 72 hour Completion Time is based on the redundant capabilities afforded by the OPERABLE pump, and the low probability of a DBA occurring during this period.

B.1 and B.2

If the LPSW pump cannot be restored to OPERABLE status within the associated Completion Time, the unit must be placed in a MODE in which the LCO does not apply. To achieve this status, the unit must be placed in at least MODE 3 within 12 hours, and in MODE 5 within 60 hours.

The allowed Completion Times are reasonable, based on operating experience, to reach the required unit conditions from full power conditions in an orderly manner and without challenging unit systems. The extended interval to reach MODE 5 provides additional time to restore the required LPSW pump and is reasonable considering that the potential for an accident or transient is reduced in MODE 3.

Add Insert #3 per attached →

SURVEILLANCE REQUIREMENTS

SR 3.7.7.~~1~~ 2

Verifying the correct alignment for manual, and power operated valves in the LPSW System flow path provides assurance that the proper flow paths exist for LPSW 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.

Add Insert #4 per attached

BASES

SURVEILLANCE REQUIREMENTS

SR 3.7.7.~~1~~ 2 (continued)

The 31 day Frequency is based on engineering judgment, is consistent with the procedural controls governing valve operation, and ensures correct valve positions.

This SR is modified by a Note indicating that the isolation of components or systems supported by the LPSW System does not affect the OPERABILITY of the LPSW System.

SR 3.7.7.~~2~~ 3

The SR verifies proper automatic operation of the LPSW System valves. The LPSW System is a normally operating system that cannot be fully actuated as part of the normal testing. 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 this Surveillance under the conditions that apply during a unit outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Operating experience has shown that these components usually pass the Surveillance when performed at the 18 month Frequency. Therefore, the Frequency is acceptable from a reliability standpoint.

SR 3.7.7.~~3~~ 4

The SR verifies proper automatic operation of the LPSW System pumps on an actual or simulated actuation signal. The LPSW System is a normally operating system that cannot be fully actuated as part of normal testing during normal operation. The 18 month Frequency is consistent with the Inservice Testing Program. Operating experience has shown that these components usually pass the Surveillance when performed at an 18 month Frequency. Therefore, the Frequency is acceptable from a reliability standpoint.

Add Insert #5 per attached ↳

REFERENCES

1. UFSAR, Section 9.2.2.
2. UFSAR, Section 6.3.
3. 10 CFR 50.36.

Insert #1

GL 96-06 required consideration of waterhammer inside containment during a LOCA or MSLB combined with a loss of offsite power (LOOP) event. As a result, the LPSW Reactor Building (RB) Waterhammer Prevention System (WPS) was added to maintain LPSW piping water solid inside containment during any event that causes a loss of LPSW system pressure. The WPS is fully automatic. Other functions of the WPS are addressed by LCO 3.3.27 and LCO 3.6.5.

Insert #2

The LPSW WPS is considered OPERABLE when the associated leakage accumulator, relief valves, seat leakage for check valves and pneumatic discharge isolation valves, closure capability of pneumatic discharge isolation valves, opening capability of the controllable vacuum breaker valves, and instrumentation and controls required to control WPS functions are OPERABLE.

Insert #3

C.1

If the LPSW WPS is inoperable, action shall be taken to restore the required LPSW WPS components to OPERABLE status immediately for Units with the LPSW RB Waterhammer modification installed. The allowed Completion Time is based on analysis that shows that LPSW System piping integrity is maintained following a LOOP induced waterhammer even though code allowable stresses could be exceeded. The allowed Completion Time is considered reasonable based on the low probability of a DBA occurring during the period of maintenance.

Insert #4

SR 3.7.7.1

For Units with LPSW RB Waterhammer Prevention System installed, verifying the correct level in the leakage accumulator will provide assurance that in the event of boundary valve leakage during a LOOP event, there is sufficient water to keep the LPSW piping filled.

The 12 hour Frequency is based on engineering judgment and considered sufficient to ensure the appropriate amount of water is available in the accumulator.

Insert #5

SR 3.7.7.5

For Units with LPSW RB Waterhammer Prevention System installed, the SR verifies proper operation of the LPSW RB Waterhammer Prevention System leakage accumulator. Verifying adequate flow from the accumulator will provide assurance that in the event of boundary valve leakage during a LOOP event, there is sufficient water to keep LPSW piping filled.

The 18 month Frequency is based on engineering judgment and operating experience.

SR 3.7.7.6

For Units with LPSW RB Waterhammer Prevention System installed, the SR verifies that LPSW WPS boundary valve leakage is within limits. Verifying boundary valve leakage is within limits will ensure that in the event of a LOOP, a waterhammer will not occur, because the LPSW leakage accumulator will be able to maintain the LPSW piping water solid.

The 18 month Frequency is based on engineering judgment and operating experience.

ATTACHMENT 3

UPDATED FINAL SAFETY ANALYSIS REPORT REVISION

UFSAR Mark-ups NSM ON-x3117
LPSW RB Waterhammer Prevention System Description

Insert into UFSAR 9.2.2.2.3 at end

Unit 2

Generic Letter 96-06 required consideration of effects inside containment due to the change in environment during a Loss of Coolant Accident (LOCA). This consideration identified the potential for waterhammers in cooling water systems serving containment following a Loss of Offsite Power (LOOP) concurrent with a LOCA or Main Steam Line Break (MSLB). Analysis and system testing in response to GL 96-06 concluded that waterhammers could occur in the Low Pressure Service Water (LPSW) system during all LOOP events (e.g., LOCA/LOOP, MSLB/LOOP). The LPSW piping supplies the Reactor Building Cooling Units (RBCU), the Reactor Building Auxiliary Coolers (RBAC), and the Reactor Coolant Pump Motor Coolers (RCPMC). During Loss of Offsite Power (LOOP) events or Loss of Coolant Accident (LOCA) events coupled with a LOOP it was possible to create a Column Closure Waterhammer (CCWH) or Condensation Induced Waterhammer (CIWH) in the LPSW piping and components inside containment. CCWH could have occurred when the LPSW pumps restart following a LOOP and rapidly close vapor voids within the system. CIWH could have occurred when heated steam voids interact with sub-cooled water in long horizontal piping sections.

The LPSW RB Waterhammer Prevention System (WPS) was designed to maintain the LPSW piping inside containment water solid during events which cause a loss of LPSW such a LOOP, LOCA/LOOP, or MSLB/LOOP. The system's major components consist of check valves in the supply headers (LPSW-1111, 1116), pneumatic discharge isolation valves (LPSW-1121, 1122, 1123, 1124), pneumatic vent valves (a.k.a., controllable vacuum breakers) (LPSW-1150, 1151), and associated actuation circuitry. The discharge header from containment is a common header. The header splits into two parallel headers each of which contain two of the pneumatic discharge isolation valves. The controllable vacuum breakers are located on the common header downstream of the pneumatic discharge isolation valves. See Figure 9-12. The actuation circuitry consists of four pressure measurement loops along with necessary components to cause the pneumatic discharge isolation valves to close and the controllable vacuum breakers to open on low LPSW supply header pressure. The circuitry resets and causes a) the pneumatic discharge isolation valves to reopen and b) the controllable vacuum breakers to reclose on increasing LPSW supply header pressure. The circuitry is designed to be single failure proof to open and close the valves. Failure of the pneumatic discharge isolation valves to reopen following system actuation will prevent flow through the Reactor Building Cooling Units as well as other containment loads such as the Reactor Building Auxiliary Coolers and the Reactor Coolant Pump Motor coolers. Provisions to manually fail open the valves are provided. The failure of the controllable vacuum breakers to reclose is inconsequential (i.e., containment heat removal can be accomplished with the valves in the open position). Each pneumatic valve is provided

with an air accumulator to provide a source of air to move the valve and maintain the desired end state for a short period of time. Only for the case of a Station Blackout (SBO) could the air in the accumulator be insufficient to maintain closure of the pneumatic discharge isolation valves for the duration of the SBO. In this case, reliance on the Supplemental Diesel Air Compressors is needed to provide air to make-up any leakage to maintain closure.

The system includes a "leakage accumulator" to allow a reasonable amount of boundary valve leakage while the piping inside containment is being maintained water solid. The leakage accumulator consists of a quantity of water with an air overpressure. The air overpressure will force water into the isolated portion of LPSW should the pressure decrease due to leakage in order to prevent voiding. The leakage accumulator is a passive device and is normally kept charged by LPSW. During an SBO, a HPSW connection to the accumulator provides extended make-up for leakage. During times when the WPS is out of service, piping code allowable stresses may be exceeded, but pipe rupture is not expected, if an event occurs that produces a waterhammer.

Insert into 3.1.1.1

16. The LPSW RB Waterhammer Prevention System (Unit 2)

Insert into 6.2.2.2.1
(As last part of next to the last paragraph).

(Unit 2) The LPSW return header will be isolated during a LOOP by the LPSW RB Waterhammer Prevention System (See Section 9.2.2.2.3). Flow is restored once emergency power is available, which is well before the point in time when the RBCU fans restart.

Section 9.2.2.1

Insert the italicized portion into the last sentence of the High Pressure Service Water (HPSW) System paragraph of Section 9.2.2.1

> "For loss of A.C. power, HPSW … Oil Cooler *and the LPSW Leakage Accumulator (Unit 2)* for all Units."

New Sections 7.4.4 and 7.5.2.62

7.4.4 REACTOR BUILDING LPSW LOW PRESSURE INSTRUMENTATION CIRCUITRY

Unit 2

The Reactor Building LPSW Low Pressure Instrumentation Circuitry consists of four (4) analog channels each powered from a separate safety related battery backed power panel board and two (2) digital actuation channels each powered from a separate safety related battery backed power panel board. Portions of the analog and digital channels are shared with the RBAC LPSW Low Pressure Instrumentation Circuitry which isolates the LPSW supply and return flow to the Reactor Building Auxiliary Coolers (RBAC). The design function of the instrumentation circuitry is to close the pneumatic discharge isolation valves (LPSW-1121, 1122, 1123, and 1124) and open controllable vacuum breakers (LPSW-1150 and LPSW-1151) any time a low pressure condition occurs in the LPSW supply header. Closure of LPSW-1121, 1122, 1123, and 1124 and the opening of controllable vacuum breakers LPSW-1150 and LPSW-1151 on low LPSW pressure will maintain the LPSW piping inside the Reactor Building water solid thereby avoiding water hammers in the RBCU LPSW piping.

A pressure transmitter for each of the four (4) analog channels monitors LPSW supply header pressure and provides an input signal to a current switch that in turn provides permissive contacts to actuate a separate low pressure OAC alarm relay, a low pressure trip relay, a normal pressure OAC alarm relay, and a normal pressure reset relay for each respective channel. When pressure decreases to the design setpoint as sensed by a particular channel, a trip relay and alarm relay are actuated for each of the respective channels that sensed the low pressure condition. The output contacts from each of the four (4) analog channel low pressure relays provide inputs to the two redundant 2 out of 4 trip logic paths for each of the two (2) digital logic trip channels. Contacts off of the two redundant digital logic trip channel relays each provide a close command signal to the solenoid valves for pneumatic discharge isolation valves LPSW-1121, 1122, 1123, and 1124. The two redundant digital logic trip channel relays also provide a trip open command signal to the solenoid valves for controllable vacuum breakers LPSW-1150 and LPSW-1151 when a low LPSW pressure condition occurs.

The inputs from each of the four analog channels are arranged in such a way as to provide different paths within each of the two redundant 2 out of 4 logic circuits. This assures the Reactor Building LPSW flow does not terminate flow to the Reactor Building due to a single failure of one of the other analog channels during an analog channel test.

The Reactor Building LPSW low pressure analog and digital trip channels are an "Energize to Trip and De-energize to Reset" design (i.e., when the analog and digital channel trip relays are energized, relay contacts from the trip relays change state). The change of state of these relay contacts in turn removes power from solenoid valves LPSSV1121, 1122, 1123, and

1124 to cause each of the normally open pneumatic discharge isolation valves LPSW-1121, 1122, 1123, and 1124 to "Trip" (i.e., go to the closed position).

Other contacts off of the above mentioned trip relays simultaneously apply power to solenoid valves LPSSV-1150 and LPSSV-1151 which in turn cause the normally closed controllable vacuum breakers LPSW-1150 and LPSW -1151 to "Trip" (i.e., go to the open position).

Controllable vacuum breakers LPSW-1150 and LPSW-1151 will "Reset" (i.e., go to the closed position) if both low pressure trip relays have returned to their normal de-energized shelf state. If one of the two trip relays mentioned above should fail to reset the controllable vacuum breaker for a particular train, then, the controllable vacuum breakers for that train will still reset when the normal pressure reset logic for that train has been satisfied as described below.

The low pressure LPSW trip relays reset to provide a permissive for the resetting of the Waterhammer Protection System (WPS) and the controllable vacuum breakers following the return to normal LPSW system pressure. The Reactor Building LPSW normal pressure analog and digital reset channels are designed to "Energize to Reset and De-energize to prevent Reset" (i.e., when the LPSW supply pressure returns to its normal operating pressure, the current switch contacts for the reset logic in each of the analog channels close thereby energizing the normal pressure relays in the analog channel). Contacts off of these normal pressure relays in the analog channels in turn form the logic to energize the normal pressure digital reset channel relays. Contacts from the digital reset channel relays provide a permissive for reset of train A and train B pneumatic discharge isolation valves. However, as stated above, pneumatic discharge isolation valves for a particular train will not actually re-open (Reset) until the low pressure trip relay for that particular train has also been de-energized (Reset), which should have already occurred by the time that the normal pressure reset logic circuit has been actuated.

Therefore, when the LPSW supply pressure is restored to a value greater than its normal set point value as sensed on two of the four analog input channels, then, power will be re-applied to the solenoid valves that control the pneumatic discharge isolation valves LPSW-1121, 1122, 1123, and 1124 resulting in the re-opening of these valves. Simultaneously, the power path will be interrupted to the solenoid valves that control the controllable vacuum breakers LPSW-1150 and 1151 resulting in the re-closing of these valves, if they have not already done so by the removal of the two trip signals from the digital trip logic relays.

As stated above, portions of the pneumatic discharge isolation valves instrumentation circuitry are shared with the RBAC LPSW Low Pressure Instrumentation Circuitry. After the LPSW supply pressure is restored, LPSW Valves LPSW-1054, 1055, 1061, and 1062 will remain closed until the control room operator resets the circuitry by depressing the respective channel reset pushbutton on the control room vertical board and initiates a slow ramp open circuit to restore flow back to the RBAC units.

The pneumatic discharge isolation valves LPSW-1121, 1122, 1123, and 1124 are spring loaded to open and require air to close. The controllable vacuum breakers LPSW-1150 and LPSW-1151 are spring loaded to close and require air to open. The pneumatic discharge isolation valves and the controllable vacuum breakers all fail closed on loss of electrical power to their respective control solenoid valves.

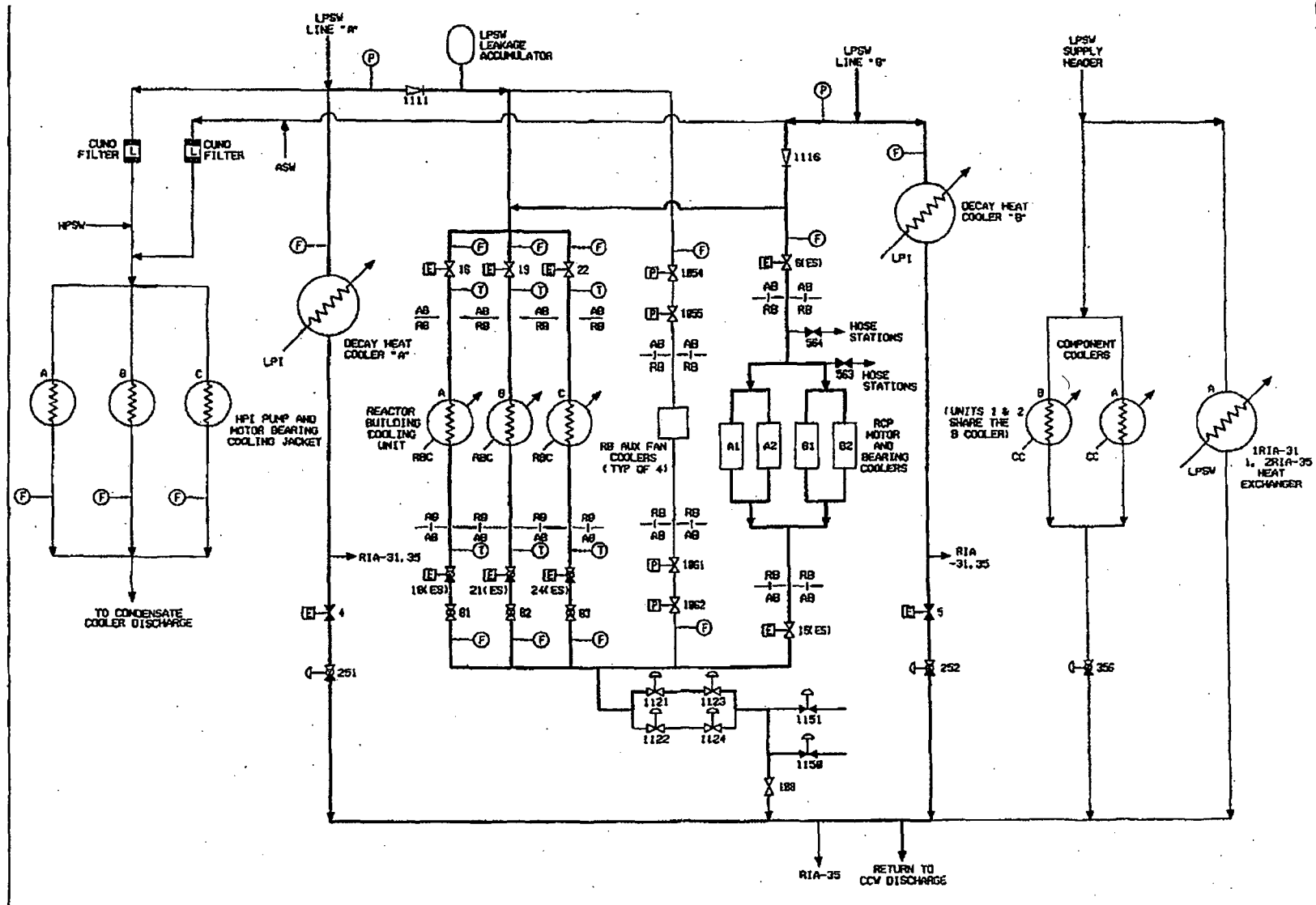
7.4.5 References

7.5.2.62 REACTOR BUILDING LPSW LOW PRESSURE DISPLAY INSTRUMENTATION

Unit 2

REG GUIDE 1.97

The position indications for pneumatic discharge isolation valves LPSW-1121, 1122, 1123 and 1124 are Reg. Guide 1.97 Type D category 3 variables. The basic function for the position indication for these valves is to provide valve position status (i.e. open/closed indication). Position indication is provided by QA Condition 1 indicating lamps at the normal valve control switches on the control board for the four pneumatic discharge isolation valves (LPSW-1121, 1122, 1123 and 1124). Power for the valve position indication for these valves is provided from QA Condition 1 panel board power sources which are battery backed.



LEGEND

- SHUTOFF VALVE
- FLOW CONTROL VALVE
- CHECK VALVE (ALL TYPES)
- RELIEF VALVE
- NORMALLY OPEN
- NORMALLY CLOSED
- NORMALLY THROTTLED
- STOP CHECK VALVE
- NC - NORMALLY CLOSED
- F-FLOW, L-LEVEL, P-PRESSURE, T-TEMPERATURE
- E-ELECTRIC, H-HYDRAULIC, P-PISTON (PNEUMATIC), S-SOLENOID
- DIAPHRAGM (PNEUMATIC)
- (ES)-RECEIVES ENGINEERED SAFEGUARD SIGNAL

THIS DRAWING WAS CREATED FROM SUMMARY FLOW DIAGRAM OFD-124-1. FOR COMPLETE SYSTEM DESIGN INFORMATION REFER TO THE FOLLOWING FLOW DIAGRAMS.

OFD-124B-1.1, -2.1	DECAY HEAT COOLERS, HPI PUMP COOLERS, COMPONENT COOLERS
OFD-124B-1.2, -2.2	REACTOR BUILDING COOLING UNITS
OFD-124B-1.3, -2.3	REACTOR BUILDING AUXILIARY FAN COOLERS
OFD-124B-1.4, -2.4	RC PUMP MOTOR AND BEARING COOLERS
OFD-124B-1.5	RIA HEAT EXCHANGERS
OFD-124B-1.6	LPSW - AUXILIARY BUILDING AIR HANDLING UNITS

THIS DRAWING SHOWS UNITS 1 & 2
ALL VALVES "LPSW" EXCEPT AS NOTED

Unit 2 only

UFSAR Figure 9-12 (Unit 1 & 2)
Low Pressure Service Water System

Figure 9-12 (Sheet 1 of 2
Low Pressure Service Water Syster