Emergency Condenser Circulating Water Upgrade

Oconee Nuclear Station

December 28, 1995

(This document does not contain any new regulatory commitments or commitment changes beyond those set forth in previously docketed correspondence to the NRC.)

Table of Contents

1.0 Executive Summary

Several issues were identified as a result of Duke audits and NRC inspections of Oconee Nuclear Station's (ONS) service water systems. Duke has addressed many of these issues through modifications, process improvements, procedural and documentation upgrades, and training. In addition, Duke Power management has met with NRC management on two occasions to communicate the efforts in progress to resolve these items.

In a November 1, 1995, meeting between Duke and the NRC, Duke provided the NRC with updated information on a series of plant modifications known as the Emergency Condenser Circulating Water (ECCW) System upgrade. Duke believes the ECCW System upgrade will resolve a majority of the remaining open items related to the ECCW System. The open items identified in the 1993-1994 service water inspections include three major service water issues:

1) The High Pressure Service Water (HPSW) System is relied upon to support the safety-related functions of the Condenser Circulating Water (CCW) and Low Pressure Service Water (LPSW) Systems. However, the HPSW piping that supports these functions is non QA Condition 1 (QA-1) and has not been seismically qualified.

2) Following a loss of coolant accident coincident with a loss of offsite power (LOCA/LOOP), with a single failure and a loss of instrument air, the LPSW pumps may have inadequate Net Positive Suction Head (NPSH) available for as long as 30 minutes into the event.

3) Quality standards for the CCW System are not commensurate with the system's importance to safety. The CCW pumps and other equipment relied upon after a LOCA/LOOP are non QA-1.

The objectives of the ECCW System upgrade are to:

1) Eliminate dependence on the HPSW System for mitigating a LOCA/LOOP.

2) Ensure adequate NPSH for the LPSW pumps during all design basis conditions.

3) Upgrade the systems, structures, and components (SSCs) necessary for supplying suction to the LPSW pumps following a LOCA/LOOP to QA-1.

After a detailed engineering and Oconee site management review of a number of potential options to achieve these objectives, Oconee management selected the modifications presented in this submittal. Duke has committed to implement these modifications beginning with the Unit 3 End of Cycle 16 refueling outage in late 1996 with final completion for all three units by the end of 1997.

Duke believes this ECCW System upgrade will resolve the major outstanding NRC open items. This report identifies the specific open items and describes how they will be addressed by the ECCW System upgrade. This description of the ECCW System upgrade supersedes previous descriptions provided to the NRC in a February 24, 1995, meeting and documented in meeting summaries by Duke and NRC dated March 9, 1995, and April 5, 1995, respectively.

2.0 Description of Existing CCW/ECCW Systems

The ECCW System is a siphon system that can be divided into two distinct parts: (1) the first siphon, and, (2) the second siphon. The ECCW System is a subset of the CCW System and does not include the LPSW or HPSW Systems.

2.1 CCW System General Physical Description

The CCW System takes its suction from the Little River arm of Lake Keowee. As illustrated in Figure 1, the suction of the CCW pumps extends below the maximum drawdown of the lake. As shown in Figure 2, each ONS unit has four CCW pumps supplying water via two 11 ft conduits into a common condenser intake header. An inter-unit crossover header is also provided upstream of the condensers. The LPSW System for each unit takes suction from the crossover header in order to supply decay heat removal loads. These loads include the Low Pressure Injection (LPI) coolers and the Reactor Building Cooling Units. The LPSW System is shared for Units 1 and 2, and independent for Unit 3. During normal operation, the CCW crossover header is aligned to all three ONS units and CCW pumps provide adequate flow to the suctions of the LPSW Systems for all three units.

2.2 CCW System Major Functions

The Oconee Nuclear Station (ONS) Condenser Circulating Water (CCW) System performs four major functions:

1) Supplies water to the LPSW System which serves as the heat sink for decay heat removal during shutdown conditions and for certain postulated accidents including LOCA/LOOP.

2) Provides for cooling of the condensers during normal operation of the ONS units.

3) Provides a backup source of decay heat removal via the condensers during emergency operation of the ONS units.

4) The embedded CCW piping is capable of retaining a supply of cooling water which is used to mitigate several postulated events such as tornado, loss of lake, station blackout, fire, and sabotage.

The ECCW upgrade addresses the first major function of CCW above. The second major function of CCW identified above is not essential for accident mitigation at ONS. The third major function described above was addressed in Technical Specification 3.4 prior to 1994. This backup mode for decay heat removal is not credited in the mitigation of any of the design basis accidents in the ONS FSAR. Technical Specification Amendment 207/207/204 deleted the third major function of CCW from the Technical Specifications as documented in Reference 13.

Since no outstanding issues exist with the second and third major functions, they are not affected by the ECCW System upgrade. Therefore, they are not further addressed in this submittal. The capability to perform the fourth major function is not affected by the ECCW System upgrade.

2.3 Current ECCW System Operation

To meet the requirements of Technical Specification 3.3.7, the ECCW System must be capable of supplying suction to the LPSW pumps in the event of a LOCA/LOOP. The LOCA/LOOP is the bounding accident for operation of the ECCW System. In addition, the ECCW supply to LPSW must be capable of withstanding a single active failure.

The CCW pumps are load shed during a LOCA/LOOP. Therefore, the ECCW System is designed to supply suction to the LPSW pumps using an unassisted siphon. To maintain siphon flow capability, the ECCW piping must be relatively air-free and leak-tight. To help maintain ECCW siphon flow capability, HPSW supplies seal water to the CCW pump shafts to minimize air in-leakage that may degrade the siphon. The Elevated Water Storage Tank (EWST) provides flow through the HPSW System as necessary to provide sealing to the CCW pumps immediately following a LOCA/LOOP. Above a specified lake level, gravity flow can supply suction to the LPSW pumps without relying on the siphon.

Operability of the siphon supply to the LPSW pumps is controlled by a combination of lake level and CCW System alignment as dictated by ONS Selected Licensee Commitment (SLC) 16.9.7 and associated station procedures. The duration of gravity or siphon flow operation during a LOCA/LOOP is currently credited for 1.5 hours until a CCW pump can be restarted to supply LPSW suction for the affected unit(s). CCW pump forced flow is reestablished manually by the operators during recovery from the LOCA/LOOP event. In addition, HPSW cooling water flow must be available in order to restart CCW pumps for the LOCA/LOOP. Availability of HPSW cooling water flow is controlled by SLC 16.9.8 and associated station procedures.

2.4 Current ECCW System Design

The CCW intake structure, CCW pumps, CCW pump motors, CCW intake piping to the LPSW pumps, CCW piping through the condenser, emergency CCW discharge piping, and normal CCW discharge piping are seismically qualified (Reference 2).

The ECCW System is not designed to withstand a tornado or resulting tornado missile. Exposed CCW piping near the CCW intake is vulnerable to tornado damage. However, the embedded CCW piping below elevation 791 ft is protected from damage due to a tornado (Reference 2). The ECCW System is not required to meet environmental qualification (EQ) criteria as required by 10CFR50.49 because the equipment is located in mild environments.

The first siphon portion of the ECCW System is designed to withstand a single active failure.

The first siphon portion of the ECCW System licensing basis does not credit the supporting use of the existing vacuum priming system.

The CCW pump motors are powered off IEEE Class 1E designed power supplies. However, power and control cabling and other equipment which route power from these Class 1E power supplies to the CCW pump motors are not designated as IEEE Class 1E. The CCW pump discharge valves are powered via IEEE Class 1E designed switchgear. However, power and control cabling and other equipment which route power from these Class 1E power supplies to the CCW pump discharge valves are not designated as IEEE Class 1E.

The CCW pump motor power and control cabling does not meet cable separation design criteria. However, the CCW pump motor power and control cabling is armored.

As described in Reference 24, 10CFR50 Appendix B Quality Assurance program requirements were not applied to portions of the CCW System due to certain features of its design. These features were: 1) redundancy and diversity, 2) passive mitigation functions, 3) seismic design, and 4) constant use of these systems in normal operation of the plant. As a result, 10CFR50 Appendix B Quality Assurance requirements have not been applied to some of the service water system SSCs such as the CCW pump motors, CCW pump discharge valve control circuitry, and HPSW cooling water to the CCW pump motors. An effort is underway to upgrade maintenance, testing, and operating procedures for the first siphon portion of the ECCW System to meet applicable 10CFR50 Appendix B QA criteria.

3.0 Historical Perspective of ECCW System

To assist in the review of Duke's ECCW System upgrade, the following description provides an historical perspective of the development of the ECCW upgrade project. The historical perspective includes information beginning with NRC Inspection Report (IR) 93-13 since this report contains the earliest service water issues which remain open.

NRC Inspection Report 93-13, dated May 24, 1993, identified unresolved items (URIs) concerning lack of seismic qualifications of portions of the CCW/ECCW Systems and support systems as well as LPSW/ECCW testing and design concerns.

Duke had identified some of these concerns prior to the May 24, 1993 NRC inspection. A Duke design study (ONDS-0327 dated 12/31/92) provided recommendations for the resolution of some of these concerns. Some items were resolved administratively by use of operational guidance via SLCs. These SLCs were written to control lake level, CCW System configuration, and HPSW System configuration in order to maintain ECCW System operability. The Continuous Vacuum Priming (CVP) System connections to the CCW inlet piping were isolated to preserve the seismic boundary and single-failure design of the ECCW System. Once the CVP System was isolated, increased focus was placed on the availability of conclusive testing to ensure that the ECCW System could function in a LOCA/LOOP. As a result, there was also increased attention on crediting the HPSW System to perform a safety-related supporting function. NRC IR 93-30, dated December 22, 1993, describes concerns resulting from the isolation of the CVP System.

NRC Service Water System Operational Performance Inspection (SWSOPI) IRs 93-25, 94-31, and 94-39 identified several additional, related issues with the ONS ECCW System. Duke has pursued closure of these open items through modifications, process improvements, procedural and documentation upgrades, and training. In addition, Duke has conducted two follow-up meetings with the NRC to describe progress on these open service water issues. These meetings were held on February 24, 1995 and November 1, 1995. In the most recent service water status meeting dated November 1, 1995, Duke described its plan to resolve many of the remaining open service water issues with the ECCW System upgrade.

4.0 Detailed ECCW System Upgrade Description

The objectives of the ECCW System upgrade are:

1) Eliminate dependence on the HPSW System for mitigating a LOCA/LOOP.

2) Ensure adequate NPSH for the LPSW pumps during all design basis conditions.

3) Upgrade the systems, structures, and components (SSCs) necessary for supplying suction to the LPSW pumps following a LOCA/LOOP to QA-1.

Duke believes these objectives will resolve the major remaining NRC open items.

4.1 NRC Open Items to be Addressed by Upgrade

As noted previously, there were several issues raised by the NRC and Duke on design, testing, and operation of the ONS ECCW System. Some of these issues remain open. In the February 24, 1995 meeting, Duke reviewed the status of all ECCW System open items with the NRC and stated that the major open items would be addressed by an ECCW System upgrade. In the meeting on November 1, 1995, Duke described changes in the specific details of the ECCW System upgrade although the overall objectives remained the same. The NRC open items are listed below. Included in this list is a brief description of each open item's origin and how the open item is covered by the ECCW System upgrade objectives:

1) Unresolved Item 93-13-03, "ECCW System Design and Testing Issues" - This URI identifies several concerns related to CCW System QA classification and design criteria. Some examples of concerns under this item are CCW pump motor and power supplies, cooling water from HPSW to CCW pumps, and CCW pump discharge valve control logic QA classifications, as well as continuous vacuum priming seismic qualification and QA classification. This open item is very comprehensive. Therefore, all three objectives of the ECCW System upgrade must be met to address this open item.

2) Violation 93-25-03, Example A, "Inadequate NPSH for LPSW Pumps" - This violation identifies concerns regarding insufficient documented testing to justify adequate LPSW pump NPSH during the first 30 minutes of a LOCA/LOOP.

This open item will be addressed by the objective to ensure adequate NPSH exists for the LPSW pumps during all design basis conditions.

3) Inspection Report 93-25, Finding #7, "HPSW not designed or maintained commensurate with its importance to safety" - This finding identifies concerns that the HPSW System provides sealing and cooling water to the CCW pumps. HPSW sealing and cooling water is necessary to maintain siphon flow and to support restart of the CCW pumps within 1.5 hours following the LOCA/LOOP event. The concern is that HPSW is a non QA-1 system which is required for LOCA/LOOP mitigation. The objective to eliminate dependence on the HPSW System for mitigating a LOCA/LOOP will address this issue.

4) Violation 94-31-08, "LPSW-53 not tested per IST requirements" - This violation identifies concerns with crediting operation of non safety-related valves LPSW-51 or LPSW-53 for isolation of LPSW loads to maintain LPSW pump NPSH during a LOCA/LOOP. In a LOCA/LOOP on one unit, LPSW-51 or LPSW-53 are used to isolate the main turbine oil tank (MTOT) on the LOCA unit while maintaining LPSW flow to the non-LOCA unit MTOT. This open item will be addressed by the objective to ensure adequate NPSH exists for the LPSW pumps during all design basis conditions.

5) Deviation 93-25-01, Part a, "Inadequate Generic Letter (GL) 89-13 response on HPSW" - This deviation states that commitments made in GL 89-13 to address safety-related service water systems at Oconee did not adequately cover the HPSW System. This issue stems from the fact that the HPSW System falls outside Oconee's quality assurance program per 10CFR50 Appendix B although it is credited for LOCA/LOOP mitigation. This open item will be addressed by the objective to eliminate dependence on the HPSW System for mitigating a LOCA/LOOP.

6) LER 94-04, "LPSW System Inoperability", corrective actions on HPSW - This LER identified LPSW System inoperability as a result of unavailability of certain HPSW System SSCs required for CCW pump restart in a LOCA/LOOP. This open item will also be addressed by the objective to eliminate dependence on the HPSW System for mitigating a LOCA/LOOP.

Resolution of each of these NRC open items will be addressed specifically in the detailed descriptions of the ECCW Modification tasks described in Section 4.3.

4.2 Solution to NRC open Items - ECCW Upgrade Modifications

The ECCW upgrade modifications will address the open items by satisfying the three major objectives. These modifications are divided as follows:

1) Addition of new QA-1 seal water to the Emergency Siphon Vacuum (ESV) System pumps and seal/cooling water supply to the CCW pumps and motors from the LPSW System.

2) LPSW System changes to ensure adequate NPSH. These changes involve:

   (a) reducing LPSW System flow demands,

   (b) providing the capability to isolate LPSW non-essential loads with QA-1 equipment, and

   (c) providing LPSW pump minimum flow protection due to reduction in system flow demands.

3) Addition of a new QA-1 ESV System to increase the reliability and duration of the ECCW System first siphon supply to LPSW, and to remove any requirements to restart CCW pumps following a LOOP event.

4) Reclassification of all existing SSCs required to maintain the ECCW System first siphon supply to LPSW to QA-1.

4.3 Detailed Modification Descriptions

For each of these plant modifications, which constitute the ECCW System upgrade, a physical description of changes, design criteria, testing, and operations considerations are described below.

4.3.1 Seal and Cooling Water Supply to CCW Pumps and Motors

This part of the ECCW System upgrade will support elimination of the CCW System's dependence on the non-seismic HPSW piping for seal and cooling water supply. This will assist in resolving the following open items:

* Inspection Report 93-25, Finding #7 "HPSW not designed or maintained commensurate with its importance to safety"

* Deviation 93-25-01, Part a, "Inadequate Generic Letter (GL) 89-13 response on HPSW"

* LER 94-04, "LPSW System Inoperability"

A seal water supply for the new ESV pumps will also be provided with this modification. New QA-1 piping from LPSW will become the normal supply source for seal and cooling water to the CCW pumps and motors and the new ESV pumps.

The function for this portion of the ECCW System upgrade is to supply seal water for the ESV pumps. The ESV pumps are sized such that worst-case air in-leakage at the CCW pump shaft will not defeat the siphon during design basis conditions, including loss of seal water to the CCW pump shafts.

LPSW supply to the CCW pump motor oil cooler and shaft seal cooling are not safety-related functions. The LPSW supply to the CCW pumps will be seismically qualified in order to maintain the pressure boundary to LPSW SSCs which perform a safety-related function. These cooling water supplies to the CCW pump and motor are necessary for CCW pump restart and operation. However, CCW pump restart and operation will not be credited during any design basis accident. Long-term performance of the siphon will be further discussed in Section 4.3.3.

Physical Description:

Two CCW seal supply headers will be routed from the LPSW System in the turbine building to the CCW intake structure, as shown in Figure 3. One header will tap off the Units 1 and 2 LPSW System, and the other will tap off Unit 3 LPSW System. Both taps will be downstream of LPSW pump cross-connects. An HPSW supply line will be connected to each of the CCW seal supply headers in the turbine building to provide a means for flushing the lines.

The CCW seal supply headers will be routed to the intake structure. Duplex strainers will filter LPSW to a value acceptable for the CCW pump shaft seal and bearings and the ESV pump seal. Two ESV pump seal supply headers, one from each CCW seal supply header, will be provided for the nine ESV pumps. These ESV pump seal supply headers will be cross-connected to accommodate maintenance.

At the CCW intake structure, each CCW seal supply header will be routed across the bridge and span east and west across the length of the intake structure. These headers will be cross-connected at each of the twelve CCW pumps to facilitate continuous supply during header flushing and maintenance. From the header cross-connects, the new LPSW piping to each CCW pump and motor will follow a path similar to the existing HPSW supply path.

All piping is being constructed of material such as stainless steel in order to minimize the effects of corrosion and biofouling. Freeze protection will be applied appropriately where the new cooling piping is not buried to an adequate depth or will be exposed to outside temperatures.

Local flow indication will be provided for flow through each of the CCW seal supply headers in the turbine building. Local indication will be provided for pressure drop across each duplex strainer. Rotameters will continue to provide local flow indication for flow to the CCW pumps. Control room alarms indicating low flow to a CCW pump will continue to be provided.

Design Criteria:

Upon completion, SSCs installed by this modification will have the same design criteria as all other portions of the LPSW System which are required to perform a safety-related function.

This portion of the upgrade will be designed such that a single, active failure will not prevent the system's safety-related function from being accomplished.

This portion of the upgrade will be designed to withstand Oconee's Maximum Hypothetical Earthquake.

All new piping will be QA-1, seismically qualified, and designed to meet or exceed Power Piping Code ANSI B31.1.0.

The CCW seal water supply duplex strainers will be ASME Code Section III or they will be designed and constructed to appropriate commercial standards and dedicated by Duke as a basic component to meet QA-1 requirements.

After an Appendix R fire, the CCW pumps seal water supply will be required to function for restart of a CCW pump. Restart of a CCW pump is required as part of the fire damage repairs necessary to achieve cold shutdown. However, there will be no NEW electrically-operated components necessary for the seal water supply to perform its function after a fire. Therefore, the new CCW pumps seal water supply modification will not involve any design requirements associated with the 10CFR50 Appendix R design criteria.

As described in the ONS FSAR Section 3.2.2, the Oconee design basis for mitigation of a tornado takes credit for water trapped in the embedded CCW piping below 791 feet as a source of water for the Auxiliary Service Water (ASW) Pump. Therefore, tornado wind loads and missiles will not be considered during the design of the new LPSW SSCs installed by this modification.

Regulatory Guide 1.97 requirements will be reviewed for applicability to the new instrumentation.

Testing:

To verify adequate LPSW System pressure and flow to CCW pumps shaft seal and ESV pumps, a one-time post modification functional test will be performed prior to placing the addition in service. The acceptance criteria will verify adequate LPSW System pressure and flow under worst case conditions.

Active QA-1 components installed by this modification which perform a safety-related function will be included in the ASME Section XI testing program. This will include the requirement to perform a quarterly test on each ESV pump to verify adequate LPSW cooling water flow during accident conditions.

Operational Considerations:

Each CCW seal supply header can operate independently from the other. This will allow for header maintenance without interrupting CCW pump and motor and ESV pump seal supply.

To ensure adequate pressure will be available to the CCW pumps and motors, strainer pressure drop will be periodically monitored using local indication. The strainers will be cleaned when a specified pressure drop is reached.

CCW seal and cooling water supply to each pump and motor is currently monitored every shift by operations. They will continue to be periodically monitored.

4.3.2 LPSW System Changes to Ensure Adequate NPSH

Several LPSW System changes will be made to ensure adequate Net Positive Suction Head (NPSH) is available at the LPSW pumps during all design basis conditions. This part of the ECCW System upgrade will address the following open items:

* Violation 93-25-03, Example A, "Inadequate NPSH for LPSW Pumps"

* Violation 94-31-08, "LPSW-53 not tested per IST requirements"

Currently, adequate NPSH for the LPSW pumps cannot be assured during the first 30 minutes of a LOCA/LOOP when accounting for a single active failure and assuming worst-case system loads. Adequate NPSH is achieved by establishing administrative limits on lake level and relying on operator action to isolate loads during an accident. However, operator action to throttle LPSW flow to the LPI coolers and isolate the MTOT during this event is not credited for 20 to 30 minutes after event initiation. The pump manufacturer has indicated that the LPSW pumps would still be capable of performing their safety-related function following operation for up to 30 minutes with inadequate NPSH. However, LPSW System changes will be made to ensure the pumps operate with adequate NPSH during all phases of a LOCA/LOOP. Additionally, all LPSW components relied upon to ensure proper LPSW operation during a design basis accident will be QA-1.

Physical Description:

A number of physical changes will be made to the LPSW System to address NPSH concerns. Changes will be made to: (1) Reduce LPSW System flow demands, (2) Provide capability to isolate non-essential loads with QA-1 components, and (3) Provide LPSW pump minimum flow protection due to reduction in system demands.

Currently, the LPSW System demands during the initial phase of a LOCA/LOOP can be very high. This is due to the potential for a large non-essential load demand coupled with a high LPSW demand to the LPI coolers due to a loss of instrument air. LPSW-4 and -5 (LPSW to LPI cooler isolation valves) currently receive an ES signal to fully open at the beginning of a LOCA. In addition, the LPSW to LPI cooler air-operated throttle valves are assumed to fail full-open due to a loss of instrument air. To reduce the LPSW flow demand during the first thirty minutes of a LOCA/LOOP, Duke is proposing to remove the ES signal that automatically opens LPSW-4 and -5 after a LOCA.

During the initial phase of a LOCA, the LPI pumps are operating in the injection mode which involves pumping water from the Borated Water Storage Tank (BWST) to the Reactor Coolant System (RCS) (see Figure 6). This mode does not require heat removal from the LPI coolers by LPSW. LPSW flow to the LPI coolers is only required after the operators establish the Reactor Building Emergency Sump recirculation mode (at the earliest approximately 30 minutes after a large break LOCA; longer for smaller LOCAs). Therefore, the initial demands on the LPSW System can be reduced without affecting its safety-related function.

Operator action will be relied upon to open LPSW-4 and -5 when realigning to the Reactor Building Emergency Sump recirculation mode. Duke believes that deletion of the ES signal to LPSW-4 and -5 will not significantly impact operator burden during a LOCA. A separate submittal will be provided to request a change to the Technical Specifications regarding removal of the ES signals from LPSW-4 and -5. This Technical Specification amendment submittal will contain the appropriate justification for removal of the ES signal to LPSW-4 and -5, along with an evaluation of any impacts on operator burden during a LOCA.

The modification will also enhance the isolation of the LPSW non-essential header for the LOCA unit. Currently, the LPSW non-essential headers for both Units 1 and 2 are isolated by closing LPSW-139. The Unit 3 non-essential header is isolated by closing 3LPSW-45. For Units 1 and 2, if the LOOP affects only the LOCA unit, this would require that the non-LOCA unit be tripped to avoid damaging the turbine due to loss of cooling water to the MTOT. Since it is not desirable to trip an unaffected unit during a LOCA/LOOP, the capability to independently isolate each unit's non-essential header will be provided.

Therefore, a new QA-1 MOV (2LPSW-139) is being installed to allow isolation of the Unit 2 non-essential header with its control switch in the Unit 2 control room. The control switch for 1LPSW-139 (Unit 1 non-essential header isolation valve) will be relocated to the Unit 1 control room. A simplified diagram of this portion of the LPSW System is provided in Figure 4. On Unit 3, the control switch for 3LPSW-45 will be moved to the Unit 3 control room.

Each valve will be powered from its own unit's Class 1E power supply. Only one QA-1 MOV is needed to isolate each unit's non-essential header since the LPSW pumps would have adequate NPSH assuming a single active failure of one of these valves to close during a LOCA/LOOP with no pipe breaks. If one of these MOVs is taken as the single failure during a LOCA/LOOP, all LPSW pumps would be available to compensate for this additional flow demand. Class 1E power is provided to these valves such that no single active failure can result in failure of both a non-essential header isolation valve and an LPSW pump.

By using 1LPSW-139 and 2LPSW-139 for isolating the non-essential headers, non QA-1 valves LPSW-51 and 53 (MTOT isolation and bypass valves) will no longer be relied upon to perform a safety-related function. This addresses the example identified in Violation 94-31-08 regarding inclusion of LPSW-53 in the ONS ASME Section XI testing program. LPSW-53 will no longer be considered for inclusion into the ASME Section XI testing program since it does not perform a safety-related function.

The Control Room Ventilation Chillers A and B take their cooling water supply from the Unit 2 LPSW non-essential header. Modifications will be made that allow isolation of the LPSW non-essential header following a LOCA. In order to maintain cooling water supply to the chillers following a LOCA/LOOP on Unit 2, the cooling water supply will be relocated to the CCW crossover header.

By reducing the LPSW flow demands to the LPI coolers during the initial phase of a design basis accident, the potential exists for the LPSW pumps to be operated below the manufacturer's recommended minimum continuous flow rate of 4250 gpm. Also, in the event that all LPSW pumps successfully start and operate during the event, the potential exists for a stronger pump to deadhead a weaker one. NRC Generic Letter 88-04 describes concerns related to low flow conditions and dead-heading of pumps operating in parallel. Duke's response to GL 88-04 will be revised to address this minimum flow concern.

To avoid damaging a pump due to minimum flow concerns, installation of minimum flow piping for each LPSW pump will be provided. Each minimum flow line will require local flow rate indication for testing. To avoid having to install heat exchangers on the minimum flow piping, the discharge from each pump will not be returned to its own suction supply. Currently, the manufacturer recommends a minimum flow of 4250 gpm for long term continuous operation. If minimum flow piping is designed for this flow rate, the LPSW NPSH requirements will be unreasonably high. The pump manufacturer has indicated that a flow rate of approximately 500 gpm should be an adequate pump minimum flow for short-term operation up to 24 hours. This minimum flow requirement will be confirmed by documented pump testing at the manufacturer's testing facilities.

Design Criteria:

Upon completion, SSCs installed by this modification will have the same design criteria as all other portions of the LPSW System which are required to perform a safety-related function.

This portion of the upgrade will be designed such that a single, active failure will not prevent the system's safety-related function from being accomplished.

This portion of the upgrade will be designed to withstand Oconee's Maximum Hypothetical Earthquake.

All new piping will be QA-1, seismically qualified, and designed to meet or exceed Power Piping Code USAS B31.1.0.

Generic Letter 89-10 commitments will be changed to include any new motor-operated valves (MOVs) required to perform a safety-related function.

Testing:

All QA-1 active components will be tested in accordance with the existing ASME Section XI testing program.

LPSW System flow testing will continue to be performed on a refueling basis. This testing verifies adequate flow can be provided to all QA-1 components while accounting for worst-case system configuration. This testing will also verify the minimum flow capability of the new pump minimum flow lines.

The LPSW pump manufacturer will perform minimum flow testing on an LPSW pump. This testing will be performed at the manufacturer's testing facilities and witnessed by Duke personnel.

Technical Specifications 4.5.1.1.2.a.(2) requires a periodic test to verify the ES function for LPSW supply to the LPI coolers by verifying that LPSW-4 and -5 open on ES actuation signal. This surveillance requirement will be revised prior to implementation of this change since valves LPSW-4 and -5 will not be required to open automatically following an ES signal. Valves LPSW-4 and -5 will be required to be remotely-operated from the control room and will be tested in accordance with the existing ASME Section XI testing program. A separate submittal requesting NRC approval of this change to the Technical Specifications will be made in early 1996.

As part of the post-modification testing, a fully integrated ECCW/LPSW System test will be performed on each unit. This test will demonstrate that ECCW siphon flow from each unit can adequately supply the LPSW Systems while aligned for worst-case LOCA/LOOP loads. This test will also verify that adequate NPSH is available to the LPSW pumps under achievable worst-case conditions.

Operational Considerations:

In addition to the current manual actions required to establish Reactor Building Emergency Sump recirculation, the operators will be required to isolate the LPSW non-essential header on the LOCA unit (closing valve 1,2LPSW-139 for Units 1 or 2 and 3LPSW-45 for Unit 3), and initiate flow to the LPI coolers by opening LPSW-4 and -5 on the LOCA unit. These new actions will be coordinated with the existing EOP steps for establishing the sump recirculation mode. All three of these valves will be operated from their respective control rooms. These changes are not expected to significantly impact operator burden during a LOCA.

In the event that all LPSW pumps start and operate during a LOCA, the potential exists for a stronger pump to deadhead a weaker one. This condition could exist until LPSW is aligned to the LPI coolers on the LOCA unit. The LPI coolers will be aligned during the establishment of Reactor Building Emergency Sump recirculation. While these actions can occur as soon as 30 minutes following a large break LOCA, it will occur at a much later time for smaller break LOCAs. A minimum flow line will be provided for each LPSW pump to avoid pump damage during short term operation in this condition. LPSW operation in this low flow condition will be limited to less than 24 hours. Therefore, guidance will be provided to the operators in the Emergency Operating Procedure (EOP) to ensure the short-term minimum flow limits will not be exceeded.

4.3.3 Emergency Siphon Vacuum System

This modification will upgrade the siphon and remove reliance on manually restarting the CCW pumps by installing a QA-1, seismically qualified Emergency Siphon Vacuum (ESV) System. Accordingly, this will assist in resolving the following open items:

* Inspection Report 93-25, Finding #7 "HPSW not designed or maintained commensurate with its importance to safety"

* Deviation 93-25-01, Part a, "Inadequate Generic Letter (GL) 89-13 response on HPSW"

* LER 94-04, "LPSW System Inoperability"

The ESV System will be designed to remove any air in-leakage or air accumulation in the CCW inlet headers following a LOCA/LOOP event.

Physical Description:

The new ESV System will consist of three 100% capacity vacuum pumps per unit. Each unit will have its own independent ESV System with the exception of the LPSW sealing water, which will be provided from shared LPSW headers. A simplified flow diagram of the ESV System for a single unit is provided in Figure 5. One continuously operating vacuum pump will normally be aligned to each 11 ft. CCW inlet header (ECCW siphon header). The vacuum piping will be connected to the top of the ECCW siphon header and will contain a float valve to prevent water from entering the system during normal operation. Piping from each header will go to a small receiver tank. This will allow for the collection and drainage of any entrained liquids as well as add some system capacitance. The tank will also provide a more suitable location for installation of instrumentation and pump capacity testing components.

The ESV System vacuum pumps and tanks will be located on a seismically qualified pad in the plant yard just north of the CCW intake dike. A pre-engineered building for enclosure of the ESV System vacuum pumps and other components, designed to appropriate seismic codes, will be evaluated. This evaluation will determine if construction of this building is cost effective.

The ESV System vacuum pumps will be powered by Class 1E power. Power from independent strings will be supplied to each pump on a per unit basis. An engineering review will be conducted to determine if the vacuum pumps can be loaded simultaneously with all other emergency loads immediately following a LOCA/LOOP or if they must be started subsequent to the initial loading. Since the CCW inlet piping will be normally full of water, delaying the vacuum pumps' start for several minutes will not affect siphon reliability.

The ESV System tie-ins to the ECCW siphon header will consist of an isolation valve, an automatic float valve (an air release valve that allows air to pass but not water), and a test vent valve to allow testing of the float valve and pumps.

Instrumentation will be provided for control room operators to verify that the ESV System is operating properly. This will include the following control room indications and alarms:

- vacuum tank pressure
- low vacuum alarm
- vacuum pump operating status (ON/OFF)

A concrete trench will be necessary to route the ESV System piping across the CCW intake dike. A permit from the Federal Energy Regulatory Commission (FERC) will be required to perform the trench construction. This trench will run north-south across the dike and then east-west along the dike to carry the vacuum lines to the individual CCW inlet headers. LPSW lines carrying cooling water to the CCW pumps, motors, and necessary instrumentation cabling will also be routed in this trench. Piping and cabling which are not placed in the trench will be buried.

ESV System Vacuum Pumps

A total of nine vacuum pumps will be provided (three per unit). Each vacuum pump will be sized to handle the maximum expected air in-leakage associated with one ECCW siphon header.

Each unit has 2 ECCW siphon headers. Two 8 ft CCW pump discharge pipes feed each 11 ft ECCW siphon header. Normally, only one 8 ft CCW pump discharge pipe is needed to feed an ECCW siphon header during siphon operations. One ESV System vacuum pump will be aligned to each of the 6 ECCW siphon headers. One vacuum pump per unit will be treated as an installed spare capable of being aligned to either of the two CCW inlet headers for its unit.

Testing was performed during the recent Unit 1 end-of-cycle 16 outage to obtain data for sizing the ESV System vacuum pumps. Based on past operating experience, the pump shaft is the major air in-leakage path for the ECCW siphon header. Two CCW pumps were recently tested with no packing or seal water in order to evaluate the amount of air in-leakage in this degraded condition. During these test conditions, the water leakage out the shaft was excessive while the pumps were operating. This leakage was observed spraying out the shaft assembly and flooding the top of pump foundation on the intake structure in a matter of minutes. A siphon flow test was then performed on the degraded ECCW siphon header for 1.5 hours to determine the rate of air in-leakage. The results from this test were extrapolated to reflect worst-case lake levels. The ESV System vacuum pumps will be sized to handle the air in-leakage associated with these test results plus a factor of approximately two safety margin to account for other potential leakage paths and potential air degassing. Preliminary results indicate that the pumps will be sized to operate at 21 in. Hg vacuum with a 300 cfm air flow rate.

The ESV System vacuum pumps will be of a liquid ring design. They will be an open design with the sealing water being discharged from the pump. This sealing water will be provided from LPSW. Since a 10 CFR Part 50 Appendix B supplier for vacuum pumps does not exist, the pumps will be procured as commercial grade items and dedicated by Duke as a basic component in order to meet QA-1 requirements.

ESV System Vacuum Tanks

Six vacuum tanks, one for each ECCW siphon header, will be provided. The tanks will provide some system capacitance for transient conditions. In addition, the tanks provide a place to remove some entrained liquid. Testing orifices and system instrumentation will be included on the vacuum tanks.

Float Valve/CCW Tie-in

A float valve will be provided as near to the CCW header connection as possible to prevent water from entering the vacuum lines. In addition, an isolation valve and a test vent valve will be added between the isolation valve and the float valve as shown in Figure 5. The test vent valve will allow air to be induced into the system to demonstrate the ability of the ESV System to remove it.

Monitoring, Alarms, and Controls

The ESV System vacuum pumps will be driven by Class 1E electric motors. The power to the motors for each unit will be from independent, Class 1E power strings. START/STOP controls will be located in each respective unit's control room. Local START/STOP capability will be available for testing and maintenance purposes. Control room indication will also be provided for receiver tank vacuum and pump operating status (ON/OFF).

A vacuum transmitter will be provided to indicate vacuum in the system. This transmitter will provide control room annunciation on low vacuum and indication of current vacuum level. Local vacuum indication will be provided by either displaying transmitter output or by a local vacuum gauge.

A calibrated orifice will be provided on the tank to allow for capacity testing (flow versus vacuum pressure) of the ESV System vacuum pumps.

Heat tracing/freeze protection will be provided for all lines, equipment, and instrumentation containing moisture except for those items contained within heated structures or buried below the frost line.

Design Criteria:

All ESV piping will be QA-1, seismically qualified, and designed to meet or exceed Power Piping Code ANSI B31.1.0 (7/67 ed. for Units 1 and 2, 8/69 ed. for Unit 3). ESV System equipment will be ASME Code Section III or it will be designed and constructed to appropriate commercial standards and dedicated as a basic component by Duke in order to meet QA-1 requirements.

If a building is used to house portions of the ESV System, it will meet Duke's Class II structure criteria but will be qualified for an MHE as described in FSAR Section 3.8.5.

Cable separation will be in accordance with FSAR Section 8.3.1.4.6.2. Power to the vacuum pumps on the same unit will be from independent IEEE Class 1E power sources.

This portion of the upgrade will be designed such that a single, active failure will not prevent the system's safety-related function from being accomplished.

This portion of the upgrade will be designed to withstand Oconee's Maximum Hypothetical Earthquake.

Generic Letter 89-10 commitments will be changed to include any new motor-operated valves (MOVs) required to perform a safety-related function.

The CCW seal water supply duplex strainers will be ASME Code Section III if available. Otherwise, they will be designed and constructed to appropriate commercial standards and dedicated by Duke as a basic component to meet QA-1 requirements.

After an Appendix R fire, the CCW pumps seal water supply will be required to function for restart of a CCW pump. Restart of a CCW pump is required as part of the fire damage repairs necessary to achieve cold shutdown. However, there will be no electrically-operated components necessary for the seal water supply to perform its function after a fire. Therefore, the new CCW pumps seal water supply modification will not involve any design requirements associated with the 10CFR50 Appendix R design criteria.

As described in the ONS FSAR Section 3.2.2, the Oconee design basis for mitigation of a tornado takes credit for water trapped in the embedded CCW piping below 791 feet as a source of water for the Auxiliary Service Water (ASW) Pump. Therefore, tornado wind loads and missiles will not be considered during the design of the new LPSW SSCs installed by this modification.

Regulatory Guide 1.97 requirements will be reviewed for applicability to the new instrumentation.

Upon completion, SSCs installed by this modification will have the same design criteria as all other portions of the LPSW system which are required to perform a safety-related function.

Testing:

Listed below is a summary of proposed tests and inspections that will demonstrate the new ESV System can perform its intended safety-related function.

Equipment Testing

The new ESV System vacuum pumps will be tested quarterly to determine operational readiness. While the ASME code for inservice testing of QA-1 pumps does not specifically address vacuum pumps, manufacturer's test methods coupled with the ASME standard (OM-6) requirements for testing methodology will be used as a guide for quarterly vacuum pump testing. As a minimum, this test will record pressure (vacuum), flowrate, and vibration at a baseline point on the performance curve in order to evaluate for pump degradation.

The ESV System vacuum pump control circuitry will be tested each refueling outage to verify that the pumps will restart following a LOOP event.

System Testing

The ESV System float valves and vacuum breakers will be tested on a refueling basis or as necessary to comply with IST requirements to verify these check valves can cycle properly. These valves will be required to cycle during a LOOP event. One potential way to perform this test is to isolate the vacuum line at the connection to the ECCW siphon header (See Figure 5). With the ESV System vacuum pump operating in this alignment, the vacuum tank pressure should decrease until the vacuum breaker opens. Once the vacuum breaker is open, the test line upstream of the float valve will be opened to initiate air in-leakage.

On a refueling outage basis, a test will be performed to verify that the ECCW air in-leakage is within the bounds of the ESV System design. The acceptance criteria will verify that the air in-leakage extrapolated to design basis conditions of lake level, flow, and temperature is within the ESV System design capacity. During siphon operation, air can be introduced into the CCW inlet header by two mechanisms: air in-leakage and degassing. Air in-leakage is primarily a function of lake level-induced vacuum and equivalent hole size. Degassing is primarily a function of lake level, flow rate and water temperature. Past testing experience indicates that air in-leakage is the dominant factor.

These refueling tests will be performed near the end of the outage to demonstrate system function prior to the next operating cycle. Accordingly, these tests may not reflect "as-found" conditions at the end of the operating cycle. However, performance of the refueling siphon flow tests prior to an operating cycle and the periodic tests and inspections during the operating cycle, along with the ability to credit siphon flow paths from other units, provides a high level of confidence that a siphon flow path will be available in the event of a LOOP.

Inspections to Verify ECCW Siphon Header Integrity

Operating procedures will include provisions to observe accessible portions of the ECCW siphon headers once per shift for obvious signs of water leakage or air in-leakage. Any observed leakage on the CCW inlet header, with the exception of the CCW pump shafts, would be considered abnormal and reported for evaluation. Operating procedures will also include a method to verify proper operation of the ESV System by monitoring vacuum pressure in the receiver tank and ESV System pump parameters.

Quarterly, a more rigorous inspection of accessible potential leakage paths will be performed while running all operable CCW pumps. These potential leakage locations include vent lines, instrument line isolation valves, manway covers, expansion joints, and the CCW pump flange when exposed. Running all operable pumps will increase the potential for visible water leakage.

Post Modification Testing

A detailed post modification testing program will be developed to verify the ESV System and ECCW System can perform their intended safety-related function(s). As a minimum, a post modification test will be performed equivalent to each of the equipment and system tests described above. Additionally, a one-time endurance test will be performed on each unit at the first available refueling outage. The ESV System may be declared operable based on system and equipment testing described above. This endurance test may be combined with the ECCW/LPSW integrated test.

A one-time endurance test will be performed on each unit. This endurance test will establish siphon flow conditions with the ESV System operating and ECCW siphon flow supplying the LPSW System for a minimum of 8 hours. During this test, air in-leakage will be introduced into the ECCW siphon header to demonstrate long-term operation of the ESV System.

Operational Considerations:

After a LOOP or LOCA/LOOP, operators may restart CCW pumps per emergency operating procedure guidance if adequate electrical capacity is available on the emergency power supplies. However, CCW pump restart is not required. CCW pump restart may be delayed until off-site power is restored.

The ESV System will operate during normal unit operation to keep the CCW inlet piping free of air. Therefore, the current SLC requirements (Reference 11) to operate a minimum number of CCW pumps during normal operation to keep the piping free of air can be eliminated.

Technical Specifications (TS) will be developed to cover the ESV System. ESV System and ECCW Siphon header operability will be required to support the LPSW System safety-related function. Based on preliminary LPSW NPSH analysis, the following TS will be developed to assure LPSW System operability: Whenever Unit 1/2 LPSW operability is required (Figure 3), a TS will require a minimum of 2 siphon flow paths, with associated ESV trains, from either Unit 1 or Unit 2 to be operable (any 2 of 4 available siphon flow paths if the crossover isolation valves are open). Likewise, whenever Unit 3 LPSW System operability is required, a TS will require 2 siphon flow paths, with associated ESV trains, from either Unit 2 or 3 to be operable (any 2 of 4 available siphon flow paths if the crossover isolation valves are open). This proposed TS amendment to address the ESV System will be submitted following completion of the LPSW NPSH analysis. This analysis will incorporate the LPSW System changes described in other sections of this submittal.

New equipment associated with the ESV System will be monitored once per shift during operator rounds. Accumulated water will be drained from the receiver tanks as necessary.

4.3.4 Upgrade Existing SSCs to QA-1

Existing systems, structures, and components (SSCs) that will be required to function to maintain the ECCW siphon to the LPSW pumps suction will be reclassified to QA-1. These SSCs will also be upgraded as necessary to meet seismic qualification criteria.

Reclassification will involve changing design documents to indicate that the SSCs are QA-1, even though they were not originally designed, procured, or constructed to meet QA-1 criteria. This will ensure that activities affecting these SSCs in the future will be performed using QA-1 programs and procedures, including the use of QA-1 replacement parts. Reclassification does not imply backfitting to meet all of the usual nuclear safety-related design criteria, procurement criteria and material traceability.

The reclassification of existing SSCs to QA-1 will resolve some of the issues in Unresolved Item 93-13-03, "ECCW System Design and Testing".

Physical Description:

The following SSCs will be reclassified to QA-1:

1. CCW pumps (pressure boundary only).
2. CCW piping from the CCW pumps to the CCW crossover header and to the LPSW pumps suction.
3. CCW pump discharge valves, 1,2,3CCW-10 through 13.
4. CCW crossover valves 1CCW-40, 2CCW-41, 3CCW-42 and 3CCW-94.

The CCW pumps are vertical, single-stage, centrifugal pumps. The suction bell of each pump extends below the maximum drawdown of the intake canal. Each pump discharges into a horizontal section of 8 ft. diameter pipe which has its centerline at elevation 800.5 ft. Each 8 ft. section connects with the discharge piping from another pump to form an 11 ft. diameter condenser inlet header with its centerline at elevation 799 ft. Each condenser inlet header is above ground for about 100 feet before becoming embedded. The condenser inlet header continues underground until it emerges from the turbine building floor at an elevation of 775.5 ft. near the condenser inlet waterboxes.

The CCW pump discharge valves are electric motor-operated valves located in the 8 ft. diameter pipe sections downstream of the CCW pumps. Each CCW pump discharge valve is normally open whenever its respective CCW pump is operating. Normal unit operation requires from two to four CCW pumps operating per unit for optimum power generation, depending upon CCW inlet temperature. Therefore, each unit normally has at least two CCW pump discharge valves open during unit operation. If power to the valves is lost and later restored, the open valves must remain open to provide a flowpath for the ECCW siphon. The control function that maintains the valves open will be a safety-related function, and the controls will be reclassified to QA-1 accordingly. The controls will be modified to provide isolation between the QA-1 and non-QA portions so that a failure in the non-QA controls cannot prevent the successful performance of the safety-related function.

The CCW crossover valves are manual valves located in the CCW crossover header in trenches under the turbine building basement floor. The valves are normally open and are not required to change position during an accident. They can be closed to isolate a single unit's condenser inlet piping from the CCW crossover header to perform maintenance or testing. The LPSW pumps take suction from the CCW crossover header. Administrative controls ensure that suction to the LPSW pumps will be adequate for normal conditions and for postulated emergencies whenever any CCW crossover valve is closed.

<u>Design Criteria:</u>

The SSCs mentioned above will be upgraded as necessary to qualify them to meet seismic qualification criteria. The CCW pumps and the CCW piping from the CCW pumps to the LPSW pumps are capable of withstanding the Maximum Hypothetical Earthquake (Reference 2). The large diameter, embedded CCW piping was designed as a Class II structure that meets Class I structure seismic loads. The valves located in this section of piping (1,2,3CCW-10 through -13, 1CCW-40, 2CCW-41, 3CCW-42, and 3CCW-94) will be reviewed to verify that they are capable of meeting seismic qualification criteria. The controls for the CCW pump discharge valves will be evaluated, and if necessary, they will be modified to meet seismic qualification criteria.

Since the CCW System was not originally QA-1 (References 4, 24), several branch connections to the CCW piping have seismic/non-seismic boundaries that do not meet the FSAR section 3.7.3.9 criteria for seismic boundaries. This is expected to require one or more of the following: (1) analyses to demonstrate that a seismically induced failure of the piping would not cause loss of function, (2) analyses and/or modifications to seismically qualify additional piping to an acceptable seismic boundary, or (3) modifications to install valves that meet the seismic boundary criteria.

Oconee's design basis for mitigation of a tornado event takes credit for the water trapped in the embedded CCW piping as a source of water used by the Auxiliary Service Water (ASW) pump (Reference 2). The embedded CCW piping is protected from damage due to a tornado. The non-embedded condenser inlet header piping, the CCW pumps, and the CCW pump discharge valves are not designed for tornado protection, because no credit is taken for water in the piping above elevation 791 ft. for mitigating a tornado event.

All SSCs required for the ECCW siphon supply to LPSW pumps will be designed so that no single active failure would prevent the performance of the safety-related function required to mitigate a LOCA/LOOP. The siphon pressure boundary does not perform an active function.

Power and control cables for the CCW pump discharge valves will not be required to meet separation criteria as described in FSAR 8.3.1.4.6.2 since these cables are armored. Documented Duke testing has demonstrated that faults do not propagate from one armored cable to another.

The SSCs being reclassified are located in mild environments, so environmental qualification requirements do not apply.

Oconee's licensing basis for Appendix R fire protection is not affected by the reclassification of certain SSCs to QA-1. Design features needed to mitigate a fire are not required to be QA-1.

Testing:

At least once per refueling, the CCW pump discharge valves will be tested to ensure that they will remain open after power is lost and then restored.

Any new motor-operated valves (MOVs) that may be required to meet seismic boundary criteria will be treated consistent with existing MOVs which perform this function. Currently, MOVs required to meet seismic boundary criteria are included in the In-Service Testing (IST) Program and Duke's valve testing program associated with NRC Generic Letter 89-10.

Operational Considerations:

Exposed CCW piping near the CCW intake structure and the CCW pump pressure boundary will be periodically inspected for leaks at pre-selected locations. Details are described in Section 4.3.3 on the Emergency Siphon Vacuum System.

In a meeting with the NRC on February 24, 1995 (Reference 5), Duke Power committed that procedures associated with the CCW pumps would be upgraded to "A" (QA-1) procedures no later than December, 1996. At the time of this commitment, the ECCW System Upgrade was expected to involve upgrading the CCW pumps, motors, pump discharge valve actuators, etc. to QA-1. Subsequently, the scope of the ECCW System upgrade was changed as discussed in the November 1, 1995 meeting and as described in this letter. Accordingly, the scope of this commitment is hereby changed such that the procedures will be upgraded to "A" procedures only for the existing SSCs being reclassified to QA-1 as described in this letter. Any procedures not associated with the ECCW siphon supply to the LPSW pumps are not required to be upgraded. The original commitment date of December, 1996 will be met for the affected procedure upgrades.

4.4 Implementation Schedule

Duke Power intends to meet the implementation schedule originally proposed during the February, 24, 1995, NRC/Duke meeting. To ensure completion, Duke has established a dedicated project team and allocated funding for this upgrade as a special project.

Much of the work can be performed during an innage period with unit tie-ins being made during unit outages. Unit tie-ins should begin by the Unit 3 End of cycle 16 refueling outage scheduled for the fourth quarter of 1996. The ECCW System upgrade is scheduled for final completion on all three units by the end of 1997. Some post-modification testing such as the ECCW and LPSW System integrated tests may not be completed until the respective unit refueling outages following modification completion.

The new piping from LPSW to the CCW pumps and motors cannot be made operational until the ES signal is removed for LPSW-4 and -5 to ensure adequate LPSW pressure is available for cooling supply to the CCW pumps and motors. Removal of the ES signal from valves LPSW-4 and -5 cannot be implemented until: (1) minimum flow piping for LPSW pumps is operational, (2) capability for the control room to isolate the LPSW non-essential headers individually is provided, (3) an alternate water supply for the control room chillers is provided, and (4) NRC approval of the Technical Specification submittal to remove the ES signal from valves LPSW-4 and -5.

There is no prerequisite for installing the alternate water supply for the control room chillers and adding the new MOVs to allow individual isolation of the non-essential headers. Also, the ESV System may be made operational at any time before or after the changes to LPSW. Upgrading existing SSCs to QA-1 by changing design documents may be done prior to the other portions of the modification, if appropriate.

A new trench will be required to route the LPSW and vacuum piping across the intake dike. A permit from the Federal Energy Regulatory Commission (FERC) is required before installation.

4.5 Technical Specifications Summary

Technical Specification 3.3.7 currently establishes requirements for LPSW pump operability. Technical Specification Table 4.1-2 establishes a surveillance requirement to demonstrate ECCW System capability to supply suction to the LPSW pumps. SLCs 16.9.7 and 16.9.8 provide additional conditions to support operability of the ECCW System supply to the LPSW pumps. Technical Specification 4.5.2.1.2.a (2) currently specifies surveillance requirements for valves LPSW-4 and -5 in support of LPI cooler operability.

Duke expects to submit new Technical Specifications to address operability and surveillance requirements for the ESV System and the ECCW siphon flowpaths. As a result of these new Technical Specification changes, SLCs 16.9.7 and 16.9.8 will be significantly modified or deleted. As previously described, a Technical Specification amendment to revise the surveillance requirements for valves LPSW-4 and -5 will be submitted.

Per the November 1, 1995 meeting, Duke agreed to submit the LPSW-4 and -5 Technical Specification change as soon as possible, no later than April 1, 1996, with NRC approval by October 1, 1996. In addition, Duke agreed that new Technical Specifications for the ESV System and ECCW siphon will be submitted no later than the end of 1996, with NRC approval by the end of 1997.

5.0 Conclusions

By performing the ECCW System upgrade, Duke is improving the siphon reliability and removing any reliance on CCW pump restart for a LOCA/LOOP. The ECCW System upgrade reinforces the existing ECCW siphon concept by installation of a QA-1, seismically qualified ESV System which will maintain ECCW System operability under the most limiting design conditions during a LOCA/LOOP. The ECCW System upgrade will ensure consistency with the ONS licensing basis for application of 10CFR50 Appendix B, design criteria, and other regulatory requirements. The non QA-1 CCW pumps will be available to be restarted following a LOCA/LOOP at operator discretion to provide additional defense-in-depth. Enhancements in integrated testing are under development which will more closely simulate conditions during a LOCA/LOOP. This enhanced integrated testing will provide additional assurance that the upgraded ECCW System can perform its intended safety-related functions during a LOCA/LOOP. In addition, new Technical Specifications will be proposed to address operability and surveillance requirements associated with the ESV System and the ECCW siphon headers.

Duke believes these significant improvements in the ONS ECCW System will will enhance the reliability of this system and address the major outstanding NRC open items and concerns.

6.0 Definitions of Terms used in this Report

Active Accident Mitigation - Accident mitigation function performed by an active component.

Active component - Any component that is required to change position or state in order to accomplish a safety-related function that is credited in the Oconee licensing basis.

Active failure - The failure of a component that is externally powered such as a piece of mechanical equipment, a component of the electrical supply system, or an instrumentation and control component to perform work on demand to perform its design function. Manual valves can result in active failures if they fail to move to their desired position.

Cable Separation Criterion - A nuclear safety-related design criterion. For ONS, this criterion is applied per ONS FSAR Section 8.3.1.4.6.2. This criterion requires cabling for mutually redundant IEEE Class 1E cables to be in separate trays.

CCW Forced flow - The mode of CCW flow in which CCW pumps take suction from Lake Keowee and supply water to various systems and components.

Class 1E Electrical Design - Class 1E is an IEEE Code designation which implies application of certain nuclear safety-related design criteria. The IEEE definition is function-oriented: "The safety classification of the electric equipment and systems that are essential to emergency reactor shutdown, containment isolation, reactor core cooling, and containment and reactor heat removal, or otherwise are essential in preventing significant release of radioactive material to the environment". For ONS, this criterion is applied per ONS FSAR Section 3.1 Design Criterion 24. Class 1E requires the application of certain nuclear safety-related design criteria such as seismic design or single failure-proof design.

Class I Structure - The ONS structures which are designed as described in ONS FSAR Sections 3.8.1 through 3.8.4.

Class II Structure - The ONS structures which are designed as described in ONS FSAR Section 3.8.5.

ECCW gravity flow - The mode of CCW flow in which no CCW pumps are running, no leak tightness in the CCW intake piping is required, and flow through the CCW System is driven by open-channel flow principles to supply the CCW loads from Lake Keowee.

ECCW siphon flow - The mode of CCW flow in which no CCW pumps are running, gravity alone is not sufficient to drive flow through the CCW System, leak tightness is required in the CCW intake piping, and flow through the CCW System is driven by a siphon effect. The siphon effect requires a vacuum in the high point of the CCW inlet piping so that water at a lower elevation in the intake canal can be raised to the elevation necessary to provide adequate flow in the CCW inlet piping.

ECCW System - As described in FSAR Section 9.2.2.2.1, the ECCW System is a siphon system that can be divided into two distinct parts: (1) the first siphon, and, (2) the second siphon. The ECCW System is a subset of the CCW System and does not include the LPSW or HPSW Systems.

External environmental considerations - A design criterion. For ONS, this criterion is applied per ONS FSAR Section 3.1, Design criterion 2. This design criterion requires evaluation of SSCs required to protect the public to ensure they are designed for all credible external environmental conditions such as humidity, temperature, winds, ice, water, and other weather phenomena.

Environmentally Qualified (EQ) - A design criterion. For ONS, this criterion is applied per ONS FSAR Section 3.11, 10CFR50.49, and numerous other guidance documents as specified in ONS DBDs. This criterion requires an SSC to be designed to withstand adverse environmental conditions during the event they are credited to mitigate without loss of safety function.

First siphon - The first siphon is that portion of the ECCW System that takes suction from the CCW intake canal and supplies flow to the CCW crossover header in the turbine building basement, where the LPSW System takes its suction.

Passive Accident Mitigation - Accident mitigation function performed by a passive component.

Passive component - Any component that is required to maintain a position in order to accomplish a safety-related function that is credited in the Oconee licensing basis.

Passive failure - Any failure that is not an active failure.

Postulated accidents - The accidents in the ONS licensing basis.

QA Condition 1 (QA-1) - A quality assurance program applied to SSCs fully in accordance with 10CFR50 Appendix B. At ONS, application of this program to an SSC does not imply application of all design criteria to that SSC.

Safe shutdown - At ONS, this is the hot shutdown condition as defined in the ONS Technical Specifications.

Safety-related function - A function of an SSC which is necessary to ensure any of the following: 1) the integrity of the reactor coolant pressure boundary, 2) the capability to shut down the reactor and maintain it in a safe shutdown condition, or, 3) the capability to prevent or mitigate the consequences of postulated accidents that could result in potential offsite exposure comparable to the 10CFR100 guidelines.

Safety-Related - At Oconee, the term safety-related has been applied to SSCs to mean any combination of the following:

1) that these SSCs fall under the scope of 10 CFR 50 Appendix B Quality Assurance requirements (i.e., the SSC is QA Condition 1).

2) that the SSC was designed to meet some or all of the various nuclear safety related design criteria.

3) that the SSC performs a safety-related function.

Therefore, to minimize confusion, use of this term is avoided in this submittal.

Second siphon - The second siphon is that portion of the CCW System that takes suction from the condenser inlet piping, supplies flow through the condenser, and discharges to the Keowee Hydro tailrace. A loss of function of the second siphon does not affect the capability of the first siphon to perform its function.

Seismically Qualified - A nuclear safety-related design criterion. For ONS, this criterion is applied per ONS FSAR Section 3.1 Design Criterion 2. This criterion requires certain SSCs to withstand a Maximum Hypothetical Earthquake without loss of capability to protect the public.

Single Failure-Proof - A nuclear safety-related design criterion. For ONS, this criterion is applied per ONS FSAR Section 3.1 Design Criteria 19, 20, 21, 22, 38, 39, 41, 42, and 53. A single failure is an occurrence, not necessarily mechanistic, which results in the loss of capability of an SSC to protect the public. Failure of multiple components which may result from a single occurrence is considered a single failure. Single failures can be further categorized as active or passive failures.

Tornado-proof - A design criterion. For ONS, this criterion is applied per ONS FSAR Section 3.1 Design Criterion 2. This design criterion includes consideration of the ability to withstand tornado wind loadings and tornado missiles without loss of the capability to protect the public.

7.0 References

1) Oconee Nuclear Station Final Safety Analysis Report (FSAR), through Revision 37 of 6/3/76, Section 9.6.2.

2) Oconee Nuclear Station Final Safety Analysis Report (FSAR), through the 1994 Revision dated 6/30/95, Sections 3.1, 3.2.1, 3.2.2, 3.3.2, 3.7.3.9, 3.8, and 9.2.2.2.1.

3) Draft IEEE 279, 8/68 ed., "Criteria for Nuclear Power Plant Protection Systems"

4) Letter dated 4/12/95 from J. W. Hampton (DPC) to NRC regarding Oconee QA-1 Licensing Basis and Generic Letter 83-28, Section 2.2.1, Subpart 1 Supplemental Response.

5) NRC Safety Evaluation Report for "Environmental Qualification of Safety-Related Electrical Equipment at Oconee Nuclear Station", dated 5/22/81.

6) Code of Federal Regulations, Title 10, Part 50, Appendices B and R, 01/01/95 ed.

7) Letter dated 4/5/95 from A. F. Gibson (NRC) to J. W. Hampton (DPC) regarding 2/24/95 Service Water Open Issues NRC/DPC Management Meeting Summary.

8) NRC Bulletin 88-04, "Potential Safety-Related Pump Loss", dated 5/5/88.

9) Letter dated 1/7/93 from J. W. Hampton (DPC) to NRC regarding revised response to NRC Bulletin 88-04.

10) Letter dated 3/9/95, from J. W. Hampton (DPC) to NRC regarding Commitments from 2/24/95 Service Water Open Issues Management Meeting

11) ONS Selected Licensee Commitments Manual, updated through 10/5/95, Sections 16.9.7, 16.9.8.

12) USAEC Safety Evaluation for ONS FSAR, Unit 1, dated December 29, 1970, Section 10.4.

13) NRC Safety Evaluation Report for ONS Units 1,2, and 3 regarding changes to Technical Specification 3.4 to delete operability requirements for the ECCW System, dated 10/31/94. Technical Specification Amendments 207/207/204.

14) NRC Inspection Report 93-13, Monthly Resident Inspection, dated 5/24/93, from E. W. Merschoff (NRC) to J. W. Hampton (DPC).

15) NRC Inspection Report 93-25, Service Water Systems Operational Performance Inspection (SWSOPI), dated 2/11/94, from A. F. Gibson (NRC) to J. W. Hampton (DPC).

16) NRC Inspection Report 93-30, Monthly Resident Inspection, dated 12/22/93, from A. R. Herdt (NRC) to J. W. Hampton (DPC)

17) NRC Inspection Report 94-31, SWSOPI Followup Inspection, dated 12/19/94, from A. F. Gibson (NRC) to J. W. Hampton (DPC).

18) NRC Inspection Report 94-39, SWSOPI Followup Inspection, dated 1/6/95, from A. F. Gibson (NRC) to J. W. Hampton (DPC).

19) Letter dated 4/20/94 from J. W. Hampton (DPC) to A. F. Gibson (NRC) regarding SWSOPI Violations/Deviations.

20) Letter dated 5/12/94 from J. W. Hampton (DPC) to A. F. Gibson (NRC) regarding SWSOPI findings.

21) Letter dated 8/2/93 from J. W. Hampton (DPC) to NRC regarding response to ECCW System Unresolved Items in NRC Inspection Report 93-13.

22) ONS Licensee Event Report 269/94-04, Revision 1, "Post Accident Core Cooling Technically Inoperable due to Design Deficiency", dated 3/30/95.

23) ONS Technical Specifications, through Amendments 210/210/207 of 8/15/95.

24) NRC Safety Evaluation Report for Units 1, 2, and 3 regarding Supplemental Response to Generic Letter 83-28 Section 2.2.1 Subpart 1, dated 8/3/95.

8.0 Figures

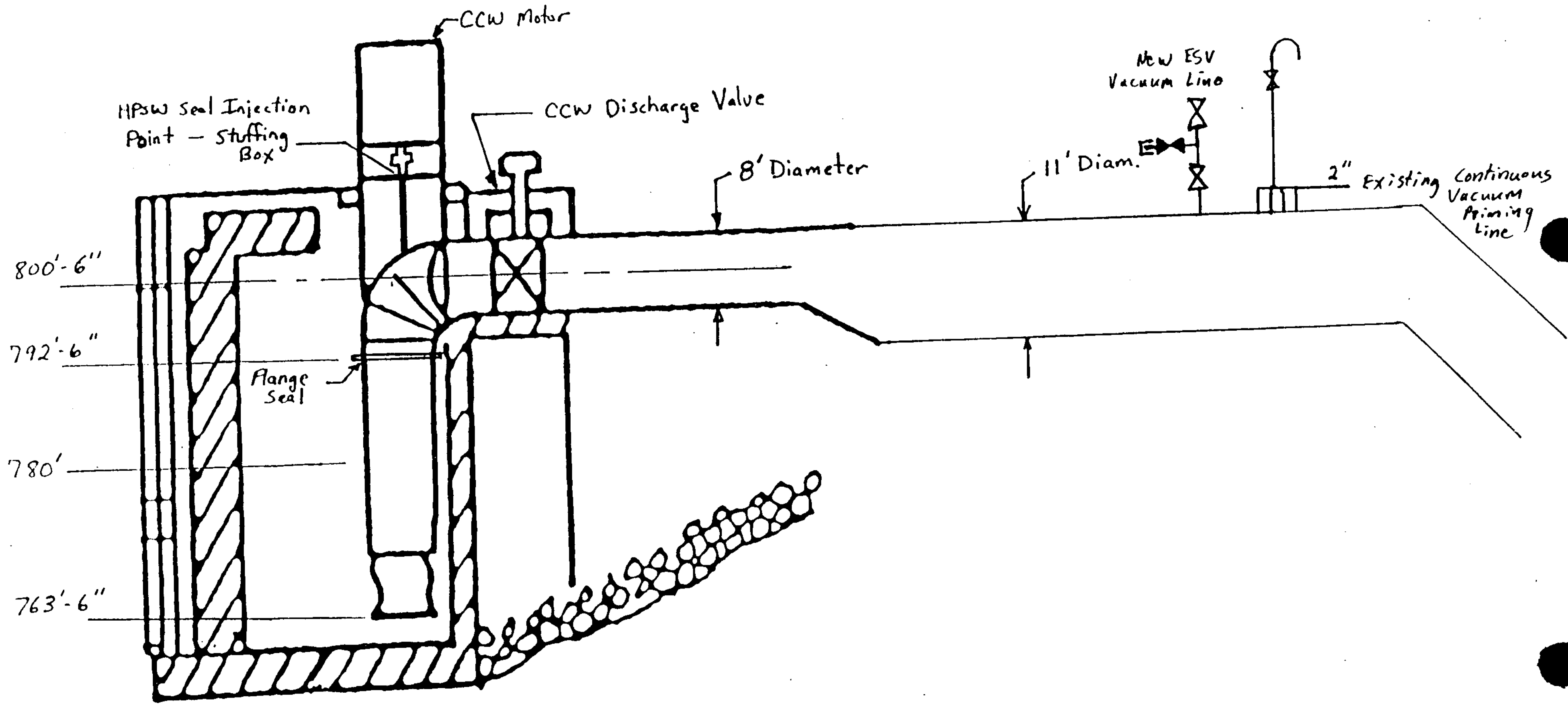


FIGURE 1 - CCW INTAKE STRUCTURE

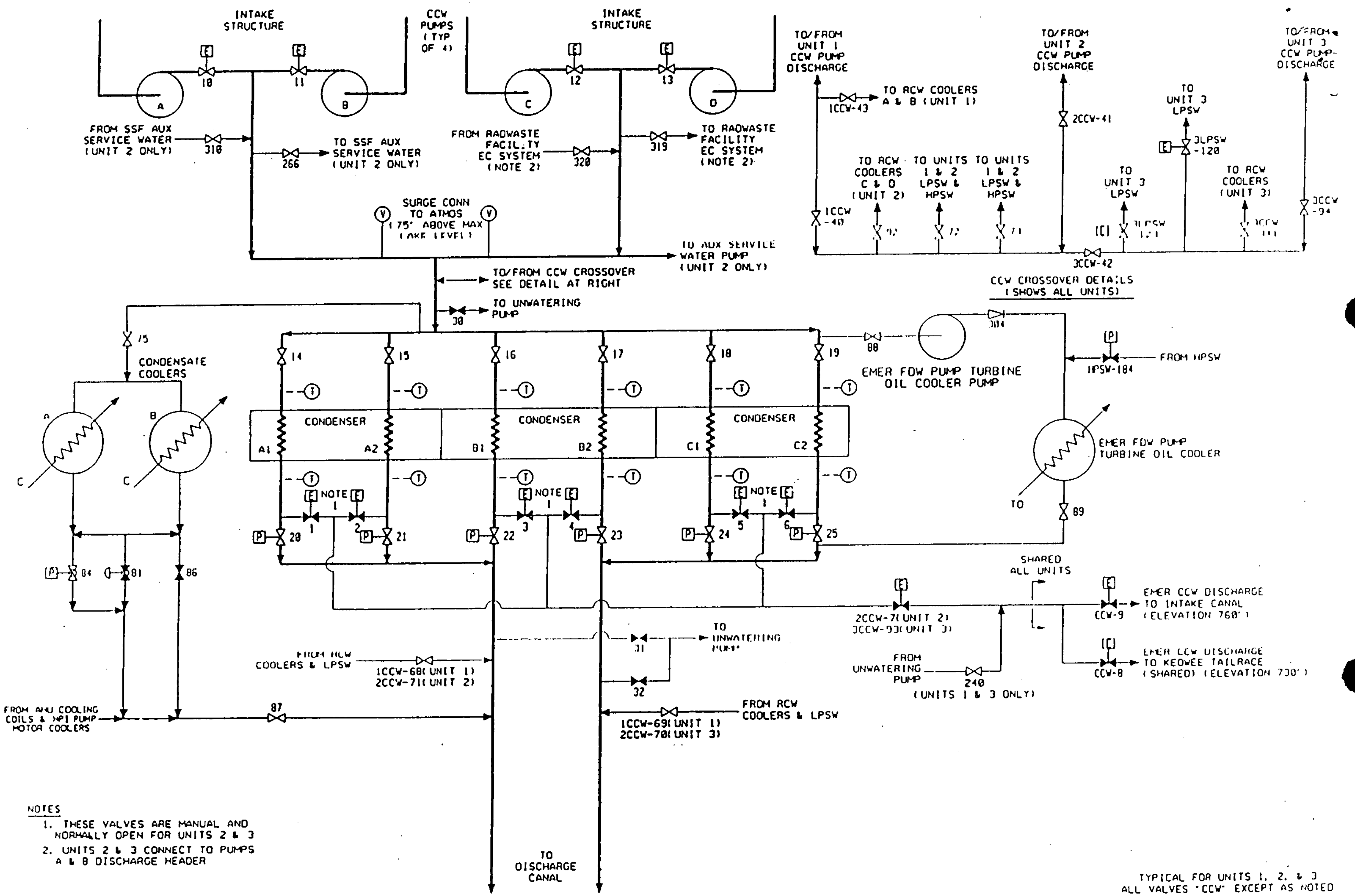


FIGURE 2 - CCW SYSTEM

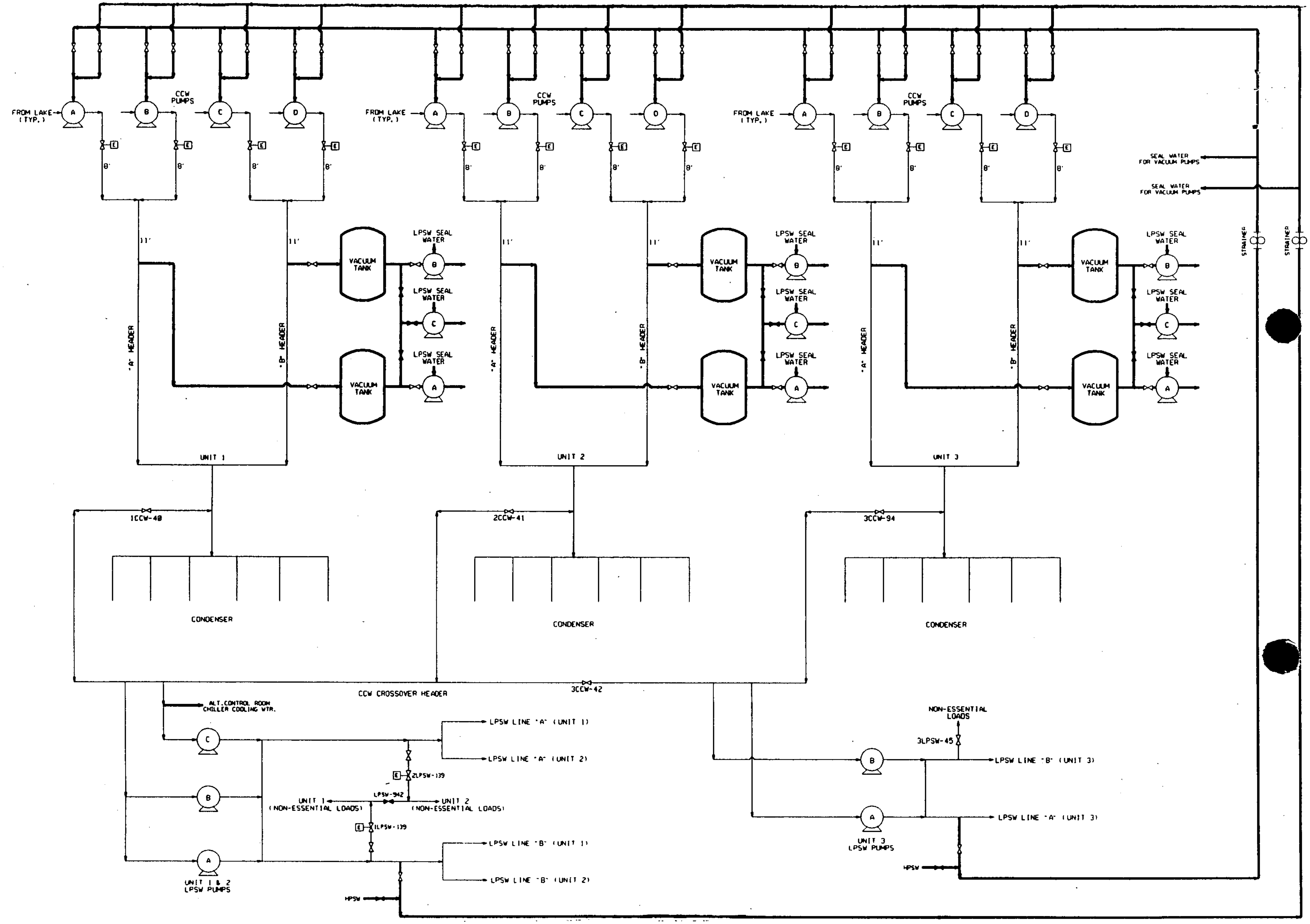


FIGURE 3 - CCW PUMP SEAL WATER SYSTEM

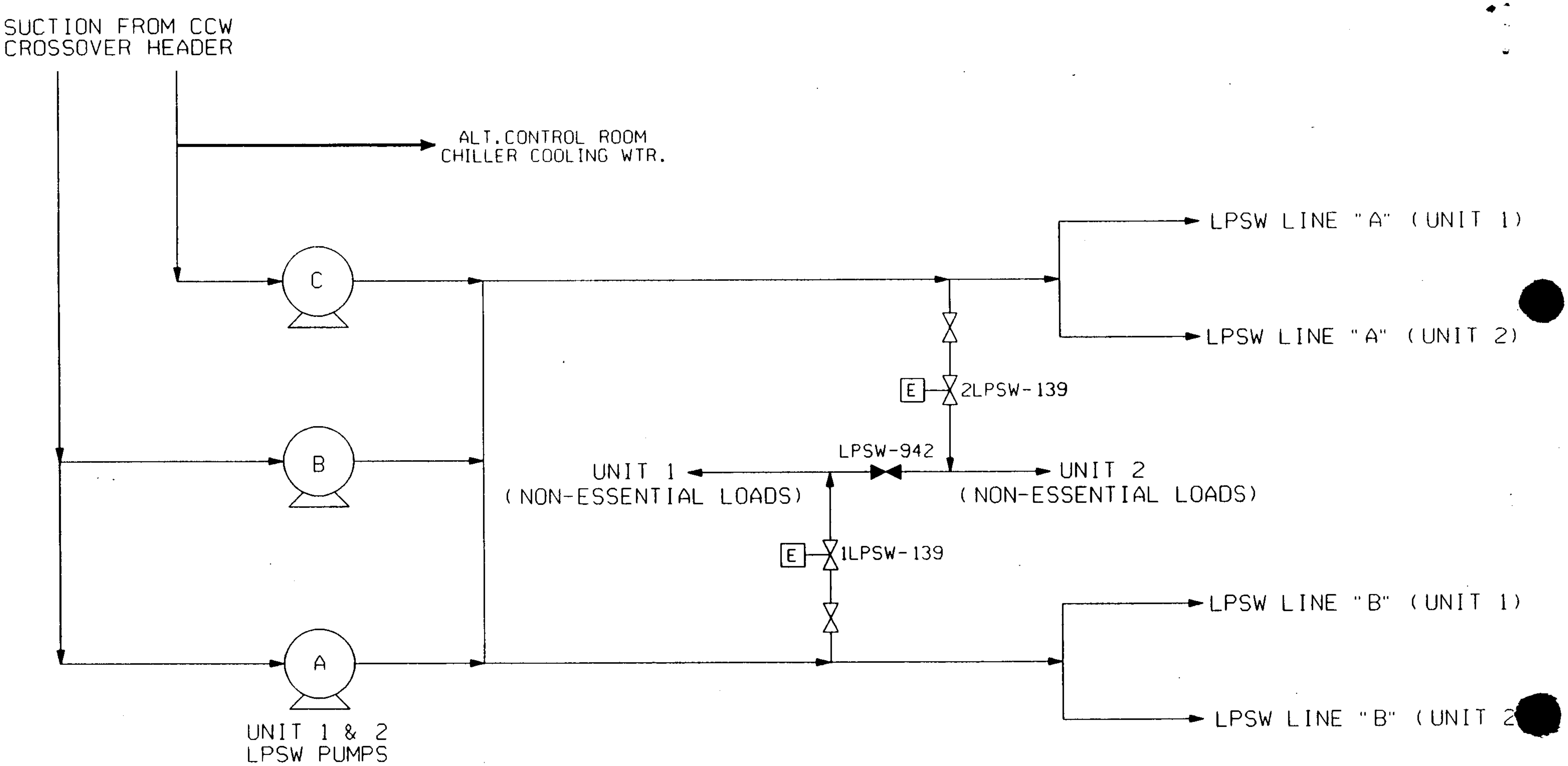
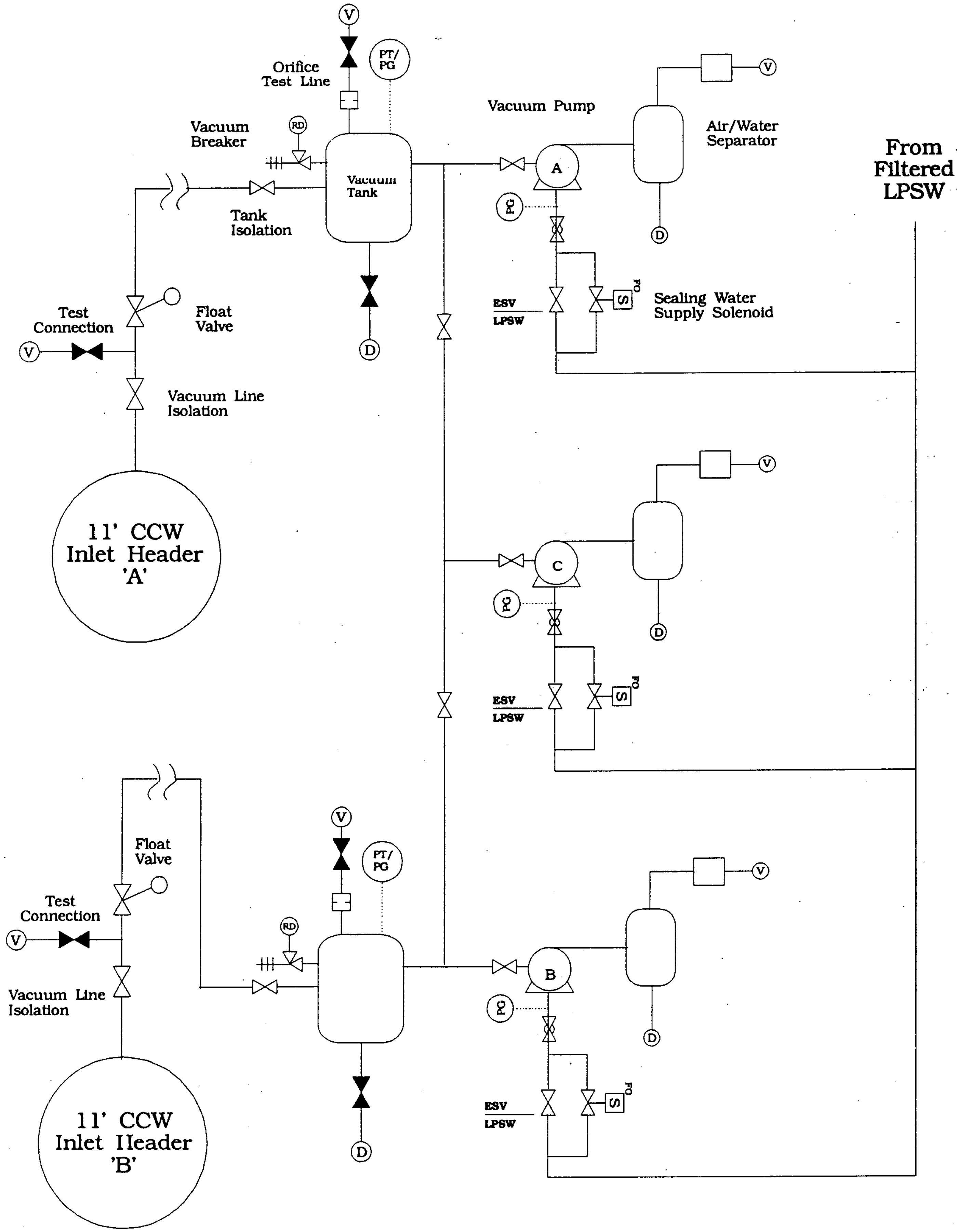


FIGURE 4 - NON-ESSENTIAL LPSW LOADS

FIGURE 5 - ESV SYSTEM



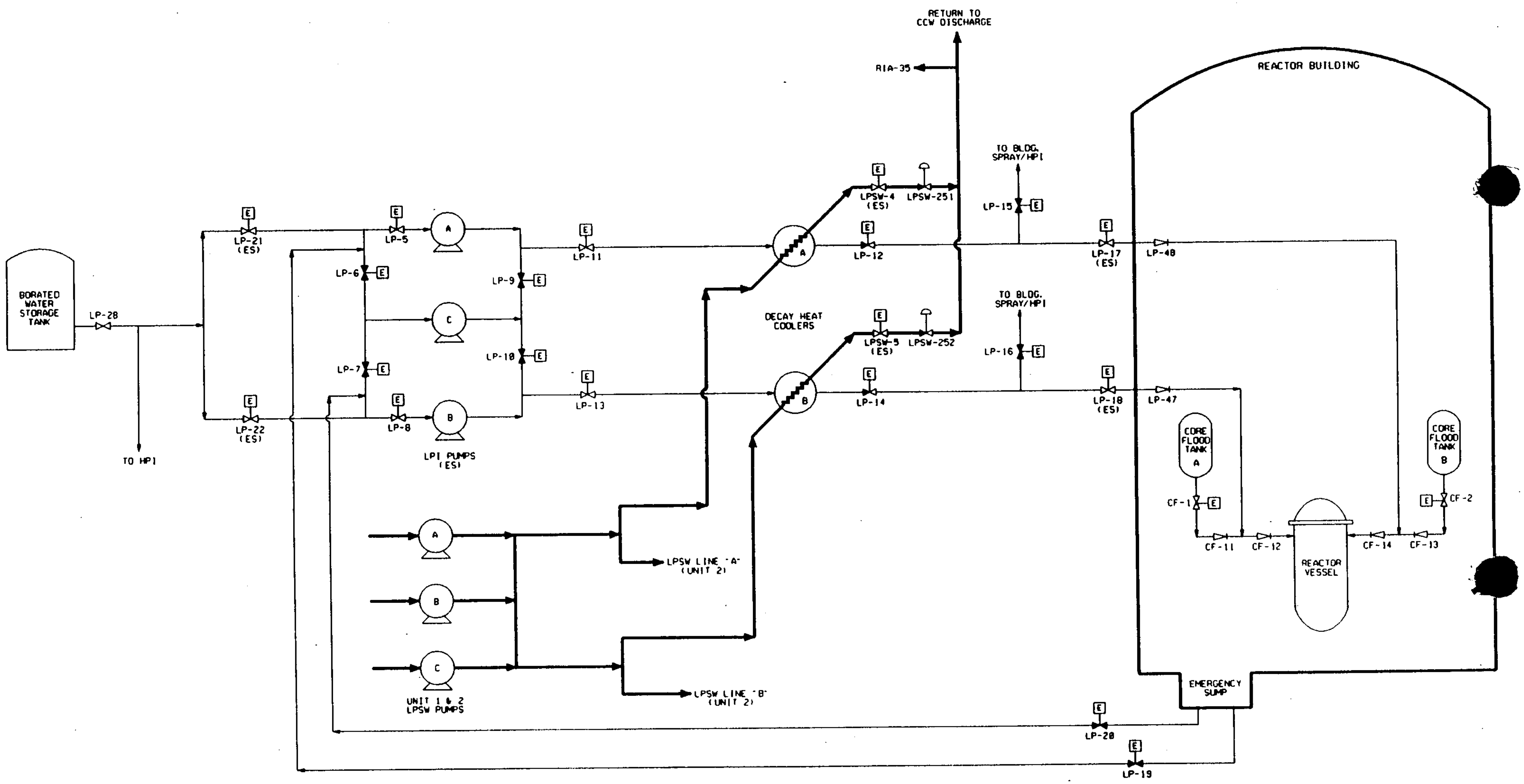


FIGURE 6 - LPI/LPSW SYSTEMS