December 5, 1991

Docket No. 50-206

Mr. Harold B. Ray
Senior Vice President
Southern California Edison Company
Irvine Operations Center
23 Parker Street
Irvine, California 92718

Dear Mr. Ray:

SUBJECT: NOTES AND COMMENTS RE ECCS TECHNICAL SPECIFICATION AMENDMENT, AA-188 (TAC NO. M77572)

During our telephone conference with Rick Ornelas and others of your staff on Thursday, November 21, 1991, we agreed to exchange written draft copies of our relevant notes and comments. We received a copy of your draft this morning and a copy of our notes and comments, prepared by Tom Dunning of the NRC staff, is enclosed. We hope that we can renew our discussions on this subject before the end of December.

Sincerely,
Original signed by
George Kalman, Sr. Project Manager
Project Directorate V
Division of Reactor Projects III/IV/V
Office of Nuclear Reactor Regulation

Enclosure: As stated

cc w/enclosure:
See next page

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

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Enclosure: As stated

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(9)

LCO 3.3.1 (Only those sections included for which comments are provided.)

SPECIFICATION: The following ECCS subsystems shall be OPERABLE:

A. Safety Injection System (SIS)

(1) Two SIS pump trains, with each train comprised of:

a. One safety injection (SI) pump,

b. One feedwater (FW) pump, and

c. A flow path capable of taking suction from the refueling water storage tank (RWST) via an SI and FW pump and providing flow to the SI header.

(2) Three SI loop flow paths, with each capable of providing flow from the SI header to a reactor coolant system (RCS) cold leg.

(3) Two trains of three RWST level channels having a low-low RWST level setpoint of 20% (+0%, -2%), with the capability to close each SI loop isolation valve and to trip each SI and FW pump when each valve receives a signal from each train and when each pump receives a signal for its train on 2-out-of-3 channels for each train sensing low-low level.

(4) The loop C cold leg isolation valve, with the capability of being opened by each SI train actuation signal.

B. Recirculation Systems

(1) Two Recirculation System pump trains, with each train comprised of:

a. One recirculation pump,

b. One charging pump,

c. One refueling water pump,

d. A flow path capable of taking suction from the containment sump via a recirculation pump and providing flow to the recirculation pump discharge header,

e. A flow path aligned to take suction from the charging pump suction header via a charging pump and to provide flow to the charging pump discharge header,

f. A flow path aligned to take suction from the refueling water pump suction header via a refueling water pump and to provide flow to the refueling water pump discharge header, and

g. A recirculation pump discharge valve, with a power lockout feature.

(Needed?)

h. A volume control tank (VCT) level control channel capable of transferring the charging pumps suction to the RWST from the VCT on a low-low VCT level setpoint of _____ inches and capable of tripping the charging pump on a low-low-low VCT level setpoint of _____ inches.

(2) The recirculation heat exchanger.

(3) A recirculation heat exchanger flow path aligned to provide flow from the recirculation pump discharge header via the heat exchanger to the refueling water pump suction header and the charging pump supply header.

(4) Two cold leg recirculation (CLR) supply flow paths, each capable of providing flow from the charging pump supply header to the charging pump suction header and from the charging pump discharge header to the CLR supply header.

(5) Two series valves for each diversion flow path for the charging pump suction header and for the refueling water pump suction header, with each valve capable of isolating the diversion flow path.

(6) Three CLR loop flow paths, with each capable of indicating and controlling flow from the CLR supply header to an RCS cold leg.

(7) The flow controls for each CLR loop and the loop B and C flow indication, with each OPERABLE from each of its redundant power sources.

(8) The normal hot leg recirculation (HLR) flow path, with the capability of indicating and controlling flow from the charging pump discharge header to the loop B hot leg via the pressurizer.

(9) The flow controls for the normal HLR flow path, with each OPERABLE from each of its redundant power sources.

(10) The alternate HLR flow path, with the capability for local manual control of flow from the refueling water pump discharger header, through either

residual heat removal (RHR) heat exchanger, bypassing the A RHR pump, and to the loop C hot leg.

(11) An open inlet valve for the inservice RHR heat exchanger, with the valve motor control center (MCC) power supply breaker maintained in the open position.

(11) Two secondary recirculation (SR) return flow paths, with each capable of providing flow from the containment sump via a recirculation and refueling water pump to the RWST.

(12) Two SR supply flow paths, with each capable of providing flow from the RWST via a SI and FW pump to the FW header.

(13) Three SR loop flow paths, with each capable of local manual control of flow from the FW header to a steam generator.

ACTION:

A. With one SIS pump train inoperable, restore the inoperable train to OPERABLE status within 72 hours, or be in at least HOT STANDBY within the next 6 hours, and reduce RCS pressure to less than 600 psig within the following 6 hours.

B. With one SI loop flow path inoperable or with one of the two SI train actuation signals to the loop C SI isolation valve inoperable, restore the inoperable flow path or train actuation signal to OPERABLE status within 72 hours, or be in at least HOT STANDBY within the next 6 hours, and reduce RCS pressure to less than 600 psig within the following 6 hours.

C. With one low-low RWST level channel or train actuation signal to any SI isolation valve or its SI and FW pump inoperable, restore the inoperable channel or train actuation signal to OPERABLE status within 72 hours, or be in at least HOT STANDBY within the next 6 hours, and reduce RCS pressure to less than 600 psig within the following 6 hours.

D. With one Recirculation System pump train inoperable, restore the inoperable train to OPERABLE status within 72 hours, or be in at least HOT STANDBY within the next 6 hours, and reduce RCS pressure to less than 600 psig within the following 6 hours.

E. With the recirculation heat exchanger or its flow path inoperable, be in at least HOT STANDBY within 6 hours, and reduce RCS pressure to less than 600 psig within the next 6 hours.

F. With one CLR supply flow path inoperable or with one of two valves used to isolate a diversion flow path for the CLR supply header or refueling water pump suction header inoperable, restore the inoperable flow path or diversion valve to OPERABLE status within 72 hours, or be in at least HOT STANDBY within the next 6 hours, and reduce RCS pressure to less than 600 psig within the following 6 hours.

G. With one CLR loop flow path inoperable or with any flow controller or flow indication not OPERABLE from both of its redundant power sources, restore the inoperable flow path to OPERABLE status or the capability to supply power from both of the redundant power sources within 72 hours, or be in at least HOT STANDBY within the next 6 hours, and reduce RCS pressure to less than 600 psig within the following 6 hours.

H. With either the normal or alternate HLR flow path inoperable or with one the flow controllers in the normal flow path not OPERABLE from both of its redundant power sources, restore the inoperable flow path to OPERABLE status or restore the capability to supply power from both of the redundant power sources within 72 hours, or be in at least HOT STANDBY within the next 6 hours, and reduce RCS pressure to less than 600 psig within the following 6 hours.

I. With the MCC power supply breaker for the inlet valve of the inservice RHR heat exchanger not in the open position, open the breaker within the next 72 hours, or be in at least HOT STANDBY within the next 6 hours, and reduce RCS pressure to less than 600 psig within the following 6 hours.

J. With one of the SR return, supply, or loop flow paths inoperable, restore the inoperable flow path to OPERABLE status within 72 hours, or be in at least HOT STANDBY within the next 6 hours, and reduce RCS pressure to less than 600 psig within the following 6 hours.

<u>BASES</u>: These specifications (3.3.1 through 3.3.8) establish limiting conditions for operation (LCO) that assure that sufficient ECCS subsystem or system components are operable such that each subsystem or system is capable of performing its function when degraded by a single failure. A single failure includes the failure of an active component or the failure of a support system, such as a power source, which in turn causes the failure of components that are dependent upon the availability of that support system to perform its function. Failures of passive components such as piping that may be common to redundant flow paths are not a design basis requirement for the capability to mitigate events.

When one train of an ECCS subsystem or system is inoperable, the redundant train is assumed to be available to perform its safety function. The action requirements allow continued operation for up to 72 hours to restore an inoperable subsystem, system, train, or component to operable status.

When the operability of an ECCS subsystem or system, such as SI, is dependent upon the operability of a pump and its associated flow path for that train to perform its function, both are specified as a part of the pump train operability requirements. However, the operability requirements are stated separately for pumps and flow paths when a redundant pump or flow path exists to perform an ECCS subsystem or system function, such as CLR, with inoperable components that are provided power from different train sources. This situation exists where pumps or valves share a common flow path for an ECCS subsystem or system such that ECCS function can be performed with just one operable pump in one train and with just one set of operable valves in the other train.

The allowable outage times apply independently for pumps and flow path components for the same ECCS subsystem or system when the LCO and the action requirements are stated separately for the pumps and flow paths for that subsystem. The allowable outage times also apply independently for components of different ECCS subsystems or systems so long as those components are not shared by these ECCS subsystems or systems and, thus, not subject to action requirements for both of those ECCS subsystems or systems.

The train designation for a pump in an ECCS subsystem or system is based upon the train designation of its power source. However, a flow path may not have a unique train designation based upon a power source because of the use of different power sources for the valves and instrument associated with a flow path or the use of piping that is common to redundant flow paths of a subsystem or system.

A characteristic of redundant flow paths that share a common piping system is the use of two valves in series to preclude the diversion of flow from redundant flow paths. In this situation, the capability to close either of the two series valves is sufficient to establish a boundary to assure the integrity of the system that is common to redundant flow paths. When one of these valves is inoperable, there is loss of redundancy to preclude flow diversion, however, the redundant flow paths are still capable of performing their function and are, therefore, operable on the basis that the remaining series valve is assumed to be operable.

The loss of redundancy for the series valve function that occurs when one of the two diversion valves is inoperable creates a condition that a subsequent failure could result in a common mode failure of the redundant or common flow paths. This situation is addressed by specifying that either of two series valves provided to a preclude diversion from a common flow path shall be operable. If either of these valves is closed during operation, diversion of flow from the ECCS flow path is precluded and the operability of the closed valve is not required. However, the remaining valve must be operable to assure that it could establish a boundary for a common flow path should a failure cause a closed valve to reopen, unless power is removed from the closed valve to preclude this possibility or the remaining valve is also closed.

Where a single valve is provided to preclude diversion of flow from one path of two (redundant) flow paths, that flow path is inoperable when the diversion valve is open and not capable of being closed to prevent the diversion of flow from its flow path. A failure which could causes a closed diversion valve to open in one of two (redundant) flow paths only affects that flow path. Therefore, power need not be removed from a single closed diversion valve, associated with only one flow path, since a single failure of that diversion valve would not result in the failure of redundant flow paths.

Redundant electrical sources are used to provide power for valve flow controllers or flow indication in redundant flow paths or in a single flow path so that these components can be operated from either power source. This configuration is used to assure that the loss of a single power source is not a potential common mode failure for redundant flow paths. With this provision, a controller or flow indicator is capable of performing its function, and is therefore operable, when it can be operated from either of the redundant power sources. However, when one of these power sources is unavailable and the components can be operated only from one of these power sources, this creates a condition that a subsequent power source failure could result in a common mode failure of redundant ECCS system or subsystem flow paths. Therefore, where redundant power sources are provided to preclude a common mode failure of redundant flow paths, the associated components are specified to be operable from both power sources.

For pneumatic valves, a nitrogen source is used to provide a safety grade source of instrument air when the availability of instrument air is necessary for the valve to perform its safety function. Although the safety analysis does ont rely on the availability of the normal instrument air source following an accident, it is assumed to be available during normal operation to preclude the depletion of the nitrogen system as a backup source of instrument air. While a pneumatic valve would be capable of performing its function using either the normal instrument air supply or the nitrogen backup air system, it is not operable during normal operation unless both sources are available for to assure that it will have the capability to preform its function under post-accident conditions.

Safety Injection System:

Each SIS pump train provides SI flow from the RWST via a safety injection and feedwater pump to a common SI header. During normal operation, the feedwater pumps are isolated from the SI flow path and deliver feedwater to the steam generators from the condensate system. Upon a safety injection signal, each feedwater pump is isolated from the normal flow path by closing its suction (HV-854A & B) and discharge (HV-852A & B) valve and realigned for SI by opening valves to take suction (HV-853A & B) from the discharge of its associated safety injection pump and to deliver flow (HV-581A & B) to the SI header. These valves have pneumatic/hydraulic actuators and each train is supplied backup instrument air from a separate nitrogen bottle source.

In addition, the normal minimum flow recirculation path to the condensate storage tank for each feedwater pump is isolated (CV-36 & -37) and a recirculation path to the RWST is opened (CV-875A & B) by a safety injection signal. The recirculation valves have pneumatic actuators and each train is supplied backup instrument air from a separate nitrogen bottle source. The operation of these valves prevent the diversion of RWST flow to the condenser and recovers the minimum recirculation flow by routing it back to the RWST.

Interlocks are provided for each feedwater pump to assure that the suction valve from the condensate supply is closed before opening the discharge valve to the SI header. Also, the condensate and heater drain pumps are tripped on a safety injection signal as an equipment protection measure. While the pump trips reduce the possibility of a boron dilution event, caused by failures resulting in the injection of condensate into the RCS, they are not relied upon to perform this function as an assumption of the design basis.

Three independent SI loop flow paths provide flow from the SI header to a separate RCS cold leg. Each flow path is normally isolated from the SI header by a closed valve (MOV-850A, B, & C) that is opened on a safety injection signal. Each isolation valve is provided electrical power from a separate source; electrical power trains A or B, and an uninterruptable power supply (UPS) for the loop C cold leg isolation valve.

The loop C cold leg isolation valve receives a train A and train B SI signal to open the valve to assure that a failure of either train of these signals will not impact more than one isolation valve. This arrangement of actuation signals for the loop C cold leg isolation valve precludes the failure of redundant flow paths. The loop C cold leg isolation valve would be capable of performing its function, and therefore be operable, with only one of the SI signal trains available. However, this would create a situation where a subsequent failure could result in the failure of redundant flow paths. Therefore, the loop C isolation valve is specified to be operable from each SI signal train.

Two trains of low-low RWST level signals are provided, with each train comprised of three separate sensor channels (LSL-2215, -2216, & -2217 for one train, LSL-3088, -3089, & -3090 for the other) that produce two separate output signals for each train when any two channels of that train sense low-low RWST level. A separate 2-out-of-3 logic signal is a part of the control circuit for each SI and each FW pump for each train and each is used to trip its associated SI or FW pump on low-low RWST level. The two logic signals per train are combined in a 1-out-of-2 logic in each SI pump circuit and used to close the cold leg SI isolation valves when both trains of the 1-out-of-2 logic are tripped on lwo-low RWST level. Each train of 1-out-of-2 logic produces a trip signal on the loss of control power to the logic such that a half trip for cold leg isolation valve closure is initiated on a failure of control power for the SI pump that is used for the 1-out-of-2 logic. This design provides a high degree of assuance that any single failure associated with the low-low RWST level signals and logic will not result in an inadvertent closure of any cold leg isolation valve or the failure to close any valve on low RWST level. The limits on the RWST low-low level setpoint assures that the minimum RWST inventory is available as necessary to support ECCS functions during a realignment and subsequent operation for the recirculation mode of ECCS operation.

The safety analysis for a Main Steam Line Break (MSLB) and the Loss of Coolant Accident (LOCA) is based on SI flow from two SI pump trains to one of the three cold leg flow paths. This analysis assumes the loss of flow to one SI cold leg due to an isolation valve that fails to open and the loss of flow from another cold leg SI flow path because the SI flow is supplied to the broken RCS loop for the LOCA analysis or because the cold leg isolation valve is closed due to an additional random failure for the MSLB analysis. The LOCA analysis is also valid for the condition of reduced SI flow assuming the failure of one SI pump train as well as due to the SI flow that is supplied to a broken RCS loop.

Recirculation System:

The Recirculation System provides long term post-accident cooling and provides circulation of RCS coolant to prevent boron precipitation. The recirculation system is placed in service to provide recirculation flow from the containment sump to the RCS cold or hot legs after the automatic termination of the safety injection phase of the ECCS operation.

The Recirculation System consists of two independent pump trains. Each train includes a recirculation pump and its associated flow path that provides flow from the containment sump via the recirculation pump and its normally closed discharge (containment isolation) valve (MOV-866A & B) to a common discharge header. Because the sump, recirculation pumps, and lines to the pump discharge valves are dry during normal operation, a restricted vent is provided upstream of each discharge valve and is used to purge the system of air before a discharge valve is opened by operating of its recirculation pump for 2 minutes. An inadvertent opening of a discharge valve, due to a single failure, when a recirculation pump is started could result in the admission of air or steam from the containment to the suction of the charging and refueling water pumps. To preclude this scenario, as a common mode failure of the CLR, HLR, and CS systems, each valve has a power lockout feature. The power lockout consists of an additional contactor in the power circuit for the valve that must be operated along with the normal control circuit to change the postion of each valve. This precludes the inadvertent opening of these valves due to a single failure in either the normal control or the power lockout circuit.

Each recirculation pump train includes a charging pump that provides flow for CLR and normal HLR. In addition, each recirculation pump train includes its associated refueling water pump that provides flow for the alternate HLR flow path and for the secondary recirculation (SR) return flow path.

The recirculation heat exchanger cools the recirculation pump discharge header flow which is provided to the refueling water pump suction header and to the charging pump supply header via a common flow path. Two CLR supply flow paths provide flow from the charging pump supply header via suction valves (MOV-1100B & D) to the charging pump suction header and from the charging pump discharge header via RCP seal water filter bypass valves (MOV-18 & -19) to the CLR supply header.

Because a flow path exists from the RWST to the charging pump supply header, the charging pump suction valves are also opened to provide an alternate source of makeup to the RCS on low-low VCT tank level. For low-low VCT level, as well as the recirculation mode of ECCS operation, the VCT is isolated from the charging pump suction header by the closure of two valves (MOV-1100C & E) in series. For the recirculation mode of ECCS operation, the isolation of the VCT from the charging pump suction header precludes the diversion of flow from the common flow path. Diversion of flow from the charging pump suction header is also precluded by the closure of two valves (CV-410 & -411) in series that bypass the VCT. These valves are also closed on an SI signal or by interlocks with valves that are closed on an SI signal. Diversion of flow from the discharge of the charging pumps to the charging pump suction header is precluded by closure of two valves (CV-527 & -528) in series that isolate the RCP seal water return. Finally, the isolation valve in the RWST supply to the refueling water pump suction header and the charging pump supply header is closed during the recirculation mode of ECCS operation to preclude recirculation flow being diverted to the RWST. A check valve in series with the RWST isolation valve provides a redundant means to isolate this diversion flow path. The closure of either of two series valves for each diversion path precludes a common mode failure of the CLR and HLR flow paths.

[In addition to identifying diversion valves that are automatically closed on a SI signal, any normally closed or manually closed diversion valves should be identified if their operability is necessary to assure the integrity of flow paths, consistent with the assumptions of the safety analysis.]

The three CLR loop flow paths provide the capability to indicate (FI-3114A, -2114B, & -2114C) and control CLR flow (FCV-1114D, E, & F) from the CLR supply header to each RCS cold leg. The flow controls (HC-1115D, E, & F) and the loop B and C flow transmitters (FT-1114B & C) are supplied power from redundant power sources to preclude a common mode failure of the CLR loop flow paths due to the loss of a single power source. The redundant power supplies have the capability an for an automatic transfer of the power source so that these components may be supplied power from either of two separate instrument buses. Each flow control valve has a backup instrument air supply from a separate nitrogen bottle system. Each CLR loop path also includes a normally closed isolation valve (MOV-356, -357, & -358) and each valve is powered from a separate power source; electrical train A or B, or UPS.

The normal HLR flow path provides flow from the discharge of the charging pumps via normal makeup control valve (FC-1112) and the pressurizer auxiliary spray flow control valve (CV-305). Diversion of the normal HLR flow is precluded by closing the valve for the normal makeup to loop A (CV-304), the pressurizer normal spray control valves (PCV-430C & H), and the charging sample valve (CV-2145). The normal makeup flow controller (FC-1112) and the auxiliary spray valve solenoid (HV-1304) are supplied power from redundant power sources to preclude a common mode failure of the normal HLR loop flow path due to the loss of a single power source. [The objective is to document the basis for LCO B.(9).

However it isn't clear why redundant power sources would be needed if the failure of a single power source would not cause a common mode failure of normal and alternate HLR flow paths.] Backup instrument air is provided from the nitrogen system for the flow control valves in the normal HLR flow path. The air operated diversion valves fail closed on the loss of instrument air and, therefore, do not require a backup instrument air source.

The alternate HLR flow path provides flow from the discharge of the refueling water pumps via an RHR heat exchanger (MOV-822A or B) bypassing the RHR pumps (RHR-004) to the loop C cold leg (MOV-813 & -814). The alternate hot leg recirculation flow path returns flow to the loop C hot leg via the RHR heat exchanger, in the reverse direction of flow through the exchanger in the RHR cooling mode of operation. The inlet valve for one of the heat exchangers must be open to assure the availability of flow through exchanger for the alternate HLR flow path. The inlet valves to the heat exchanger are not qualified for post accident conditions that could result in submergence of the valve operators. Because submergence of the valve operator in a post accident condition could result in an electrical short circuit which could close the valve, power must removed from the valve MCC by opening its supply breaker. This condition is stated as a requirement to preclude this failure mode and since the operability of the alternate HLR flow path is only dependent upon the open status of the valve and not whether power is connected to the valve MCC. [Note, there no associated flow indication noted for the use of the alternate HRL flow path and it is assumed that none is required!]

Secondary recirculation (SR) provides an alternate means of decay heat removal after a MSLB inside containment which could disable the RHR system. Two SR return flow paths provides flow from the containment sump via a recirculation and refueling water pump to a common return line (CRS-336) to the RWST. Two SR supply flow paths provide flow from the RWST via an SI and FW pump to the feedwater header. Three SR loop flow paths provide flow from the feedwater header via local manual control of the feedwater bypass control valves (CV-142, -143, & -144) to each steam generator.

LCO 3.3.2

APPLICABILITY: MODE 3 when RCS pressure is < 600 psig, and MODE 4

SPECIFICATION: The following ECCS subsystems shall be OPERABLE:

A. Safety Injection System

(1) A flow path from the RWST via the charging pumps to the CLR supply header.

(2) A flow path from the RWST via the refueling water pumps to the CLR supply header.

(3) One train of RWST level channels with a low-low level setpoint of 20% (+0%, -2%), with two of the three channels for that train OPERABLE.

B. Recirculation System

(1) One Recirculation System pump train as specified in LCO 3.3.1.B.(1).

(2) The recirculation heat exchanger.

(3) The recirculation heat exchanger flow path as specified in LCO 3.3.1.B.(3).

(4) One CLR supply flow path as specified in LCO 3.3.1.B.(4).

(5) One of two series valves for each diversion flow path for the charging pump suction header capable of isolating the flow path.

(6) Two CLR loop flow paths as specified in LCO 3.3.1.B.(6).

(4) Either the normal or alternate hot leg recirculation (HLR) flow path as specified in LCO 3.3.1.B.(8) and (10).

ACTION:

A. With either SI flow path from the RWST to the CLR supply header via a recirculation pump or via a charging pump inoperable, restore the inoperable flow path to OPERABLE status within 1 hour or be in COLD SHUTDOWN within the next 20 hours.

B. With neither RWST low-low level train OPERABLE or with less that two OPERABLE level channels for at least one level train OPERABLE, restore at least one train or two level channels to OPERABLE status within 1 hour or be in COLD SHUTDOWN within the next 20 hours.

C. With neither recirculation pump train OPERABLE, restore one train to OPERABLE status within 1 hour or be in COLD SHUTDOWN within the next 20 hours.

D. With the recirculation heat exchanger or its flow path inoperable, restore the heat exchanger or its flow path to OPERABLE status within 1 hour or be in COLD SHUTDOWN within the next 20 hours.

E. With neither CLR supply flow path OPERABLE, restore at least one CLR supply flow path to OPERABLE status within

1 hour or be in COLD SHUTDOWN within the next 20 hours.

F. With two CLR loop flow paths inoperable, restore at least two CLR flow paths to OPERABLE status within 1 hour or be in COLD SHUTDOWN within the next 20 hours.

G. With both the normal and alternate HLR flow paths inoperable, restore at least one HLR flow path to OPERABLE status within 1 hour or be in COLD SHUTDOWN within the next 20 hours.

BASIS: With the reactor pressure < 600 psig, one ECCS subsystem is specified to be OPERABLE without consideration for the single failure criterion on the basis of the stable reactivity condition of the reactor and limited core cooling requirements. At the lower pressure conditions of the RCS, the high pressure injection capability of the SI/feedwater pump combination is not required nor permitted when reactor pressure is < 500 psig (see LCO 3.3.3) because of the potential to overpressure the RCS at low temperatures. The refueling water pumps provide a high-volume source of RCS makeup from the RWST via a flow path from the recirculation pump discharge (MOV-880) to the CLR supply header. A low-volume source of RCS makeup from the RWST is provided by a charging pump and a flow path from the RWST to the charging pump supply header. The balance of the flow path requirements for both the high- and the low-volume makeup capability to the RCS cold legs is provided by the CLR supply and CLR loop flow paths. The Bases for LCO 3.3.1 addresses specific components that are a part of these flow paths.

During Mode 4 operation, the high-flow CLR loop flow control valves (FCV-1115D, E, & F) may be administratively maintained in the closed position to satisfy the limits on makeup capability for the overpressure analysis. When these valves are closed, the CLR loop flow path requirements are provided by the low flow capacity CLR loop flow control valves (FCV-1115A, B, & C). [Why are these valves acceptable to satisfy makeup requirements since they are not operable from a safety grade instrument air source?]

LCO 3.3.3

APPLICABILITY: MODE 3 when RCS pressure is < 500 psig, MODES 4, 5, and MODE 6 when fuel assemblies are in the reactor vessel

OBJECTIVE: To preclude the injection of feedwater/condensate into the RCS when the reactor is shutdown and to preclude the potential to overpressure the RCS during low temperature operation.

SPECIFICATION: Two positive barriers shall be provided in the piping connections between the discharge of each feedwater pump and the RCS. The following shall constitute a positive barrier when each component is tagged to note the purpose of its condition:

A. A closed motor-operated valve with its MCC power supply breaker in the open position.

B. A closed pneumatic- or hydraulic-operated valve with its pneumatic or hydraulic power supply isolated from the valve actuator by a closed block valve(s) or with the valve otherwise mechanically restrained in the closed position.

C. A closed manually operated valve.

D. A blank installed between flanges.

E. A feedwater pump with its switchgear breaker racked out or in the test position and with its suction isolated from each condensate source by at least one positive barrier.

(Suggest the relocation of requirements from LCO 3.2 as follows:)

The circuit breaker shall be removed from the power supply of one of the two centrifugal charging pump motors and tagged to note its condition when the RCS pressure is < 400 psig and the pressurizer water level is > 50 percent level. [It's implicit with these conditions that "the head is on the reactor vessel."]

ACTION: With only one positive barrier between the discharge of a feedwater pump and the RCS, verify that a remaining barrier exists and within 4 hours restore the second positive barrier.

BASIS: Two positive barriers are required between the discharge of the feedwater pumps and the RCS to assure that the feedwater pumps are not a source for injecting condensate or water from the RWST that could result in overpressurizing the reactor coolant system or in dilution of the Boron concentration in the RCS. The feedwater pump is removed as a source of overpressure when its switchgear breaker is racked out or in the test position. However, this does not provide a barrier that would preclude the injection of condensate by a condensate pump or heater drain pump. Therefore, the feedwater suction from the condensate system must be isolated if the power source is removed from the pump as means to provide a positive barrier to both overpressuring and diluting the Boron in the RCS. (This approach is only valid if the SI pumps are not otherwise isolated as a potential threat for overpressuring a water solid RCS.)

The tagging of the positive barrier is an additional administrative precaution, that is performed in accordance with procedures for tagging equipment which must not be operated. Tagging provides additional assurance that an operation or maintenance activity that is conducted during shutdown does not remove or degrade the effectiveness of the positive barrier.

(Consistent with the relocated requirements from LCO 3.2:) The removal of one of the centrifugal charging pumps from service assures that the potential for high-pressure makeup to the RCS is limited consistent with the assumptions of overpressure analysis for the RCS during low temperature operation. This analysis assumes a single failure of one PORV, operation of the overpressure mitigating system, and operator action after 10 minutes into an overpressure event.

LCO 3.3.4

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

OBJECTIVE: To ensure the availability of borated water from the RWST for safety injection, containment spray, or emergency boration during normal operation.

SPECIFICATION:

A. The RWST water level shall be at ≥ 50 feet plant elevation with a boron concentration of ≥ 3750 ppm and ≤ 4300 ppm.

B. The safety injection (SI) lines from the RWST to the SI loop supply isolation valves, excluding the lines common to the feedwater system, shall have a boron concentration of ≥ 1500 ppm and ≤ 4300 ppm when RCS pressure is > 500 psig.

C. Two trains of normal and excess letdown isolation shall be OPERABLE.

ACTION:

A. With the RWST level or boron concentration outside the specified limits, restore the level and boron concentration within its limits within 1 hour or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

B. With the boron concentration in the SI lines outside the specified limits, restore the boron concentration within its limits within 1 hour or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

C. With one train of normal or excess letdown isolation inoperable, restore the inoperable train to OPERABLE status within 72 hours, or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

BASIS: Approximately 220,000 gallons of borated water are required to provide post-accident core cooling and containment spray.[1] The RWST filled to elevation 50 feet represents in excess of 240,000 gallons and includes an allowance for water that is not usable because of the tank discharge line location.

A boron concentration of at least 3750 ppm in the RWST and 1500 ppm in the SI lines is required to meet the requirements of a postulated steam line break.[2][4] The boron concentration for the SI lines is not applicable when the RCS pressure is < 400 psig since the lines are isolated from the RCS during this condition in accordance with the requirements of LCO 3.3.3. A maximum boron concentration of 4300 ppm ensures that the post-accident containment water is maintained at a pH of between 7.0 and 7.5.[3] Boric acid is soluble up to a concentration of 4650 ppm at a temperature of 32 °F. Since sustained temperatures below 32 °F do not occur, the maximum boron concentration for the RWST and SI lines assures that boron precipitation will not occur and special provision for temperature control are not required.

Normal and excess letdown is isolated by the closure of two valves in series on an SI signal to provide a redundant means to terminate letdown and assure that sufficient water is available in the containment sump to satisfy recirculation pump NPSH requirements following the completion of the SI mode of ECCS operation. Normal letdown is isolated by the closure of the pressurizer level control valve (LCV-1112) and the parallel letdown orifice isolation valves (CV-282, -283, &-284). Excess letdown is isolated by the closure of the excess letdown heat exchanger inlet valve (CV-287), the RHR heat exchanger inlet valve (CV-413), and the RCP seal water return valve (CV-412). The letdown isolation valves do not require a safety grade instrument air source since the valves fail closed on the loss of the instrument air supply.

LCO 3.3.5

SPECIFICATION: The Containment Spray System (CSS), comprised of the following, shall be OPERABLE:

A. Two CSS pump trains, with each train comprised of:

(1) One refueling water pump,

(2) One hydrazine additive pump,

(3) A flow path, capable of providing flow from the hydrazine storage tank via a hydrazine pump to the refueling water pump discharge header,

(4) One hydrazine additive tank level channel, capable of tripping its associated additive pump when the level reaches a low level setpoint of ___ inches.

B. An RWST flow path, aligned to provide flow from the RWST to the refueling water pump suction header and with an OPERABLE RWST isolation valve power lockout feature.

C. Two CSS flow paths, with each path capable of providing flow from the refueling water pump suction header via a refueling water pump, bypassing the containment spray limiter restriction orifice, and delivering flow to the spray header.

D. Two containment spray limiter restriction orifice bypass valves, with each valve maintained in the open position.

E. A closed fire water spray header isolation valve, with an OPERABLE power lockout.

F. The hydrazine tank, with a level of ≥____ inches of water with a N_2H_4 concentration of ≥ 21 weight percent.

G. A pH control system, consisting of ≥ 5400 pounds of anhydrous trisodium phosphate in the storage racks located in the containment.

ACTION:

A. With one CSS pump train inoperable, restore the inoperable train to OPERABLE status within 72 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

B. With the RWST flow path inoperable or with the containment fire water spray header not isolated, be in at least HOT STANDBY within the 6 hours and in COLD SHUTDOWN within the next 30 hours.

C. With power lockout feature for the RWST isolation valve or the containment fire water isolation valve inoperable, restore the power lockout to OPERABLE status within 72 hours, or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

D. With one of the of the CSS flow paths inoperable, restore the inoperable flow path to OPERABLE status within 72 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

C. With one containment spray limiter restriction orifice bypass valves not open or inoperable, operation may proceed provided both refueling water pumps are OPERABLE and the inoperable valve is closed, or placed in the closed position within 1 hour, otherwise be in at least HOT STANDBY within the 6 hours and in COLD SHUTDOWN within the next 30 hours. Restore the valve to OPERABLE status in the open position within 72 hours, or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

D. With the hydrazine tank volume or N_2H_4 concentration outside its limit, restore the volume or concentration to within its limit within 1 hour or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

E. With the quantity of anhydrous trisodium phosphate in the storage racks located in the containment < 5400 pounds, restore the quantity to this limit within 72 hours or be in COLD SHUTDOWN within the following 36 hours.

BASIS:

Each refueling water pump train provides CSS flow from the RWST via a common suction line. The RWST is isolated by the closure of a motor-operated isolation valve or a check valve in the common suction line during the recirculation mode of ECCS operation. The isolation valve has a power lockout feature to assure that the flow path from the RWST to the suction of each refueling water pump is not inadvertently isolated by a single failure that results in the closure of the isolation valve. This precludes a common mode failure the common portion of the flow path to the suction of each refueling water pump.

The refueling water and the hydrazine additive pumps are started and the block valves (SV-600 & -601) at the discharge of each hydrazine additive pump are opened on a containment spray actuation signal. Upon sensing low water level (LT- & LIS-500A & B) in the hydrazine additive tank, the hydrazine additive pumps are tripped to terminate chemical addition to the CSS. The low level trip setpoint assures that the pumps will operate with sufficient net positive suction head (NPSH) until they are tripped on low level. The limit on the normal level in the tank assures that 150 gallons of water are available for chemical addition between the normal water level limit and the low level pump trip setpoint. The limits on N_2H_4 concentration and water level provides a 50 percent margin above both the volume and concentration of the chemical addition that was assumed to be available in the safety analysis.

At least one of the containment spray limiting restriction orifice bypass valves (CV-517 & -518) must be open to assure that the design flow rate for CSS operation will be provided by the operation of one refueling water pump. Each spray limiter bypass valve is maintained in the open position since instrument air is required to open the valves and they fail in the as-is position on the loss of the non-safety grade instrument air system. Each valve receives a CSS actuation signal to assure that it remains in the open position until the CSS actuation signal is reset. However, both valves are closed to limit CSS flow during the recirculation mode of operation to assure that sufficient NPSH is available to the charging pumps for CLR. Therefore, if one of the spray limiting valves is inoperable, it is maintained or placed in the closed position to assure that the NPSH requirement will be met for the recirculation mode of ECCS operation. Also, both refueling water pumps are required to be operable to permit operation to continue for the 72-hour allowable outage time to restore the spray limiting valve to operable status. [The reason for this requirement is not clear!] The restriction orifice bypass valves fail in closed position on the loss of control power regardless of the availability of instrument air.

From the outlet of the spray limiter bypass valves, CSS flow is delivered to the CSS nozzles by redundant spray header isolation valves. Each spray header isolation valve (CV-82 & -114) is opened on a containment spray actuation signal. These valve fail open on loss of the non-safety grade instrument air system.

The CSS is used to provide a source of water for the fire water spray header located inside the secondary shield in containment. The fire water spray header is isolated by a closed air-operated valve that fails closed on the loss of instrument air. A power lockout feature is provided to assure that a single failure does not result in the inadvertent opening of the isolation valve and the diversion of flow from the containment spray header.

LCO 3.3.6

SPECIFICATION: The leakage of the RCS pressure isolation valves shall not exceed the limits specified in Table 3.3.6-1.

For the footnotes in Table 3.3.6-1, delete the term "considered" so that the conditions noted are simply a statement of what is acceptable leakage.

That portion of the proposed specification that addresses the performance of a leakage test should be deleted and added to TS 4.2.1.II.D.(3) as follows:

(3) The RCS pressure isolation valves shall be tested to confirm that allowable leakage limits specified in Table 3.3.5-1 are met.

ACTION: With the leakage of any RCS pressure isolation valve in excess of its limits, within 1 hour verify that its series SI loop isolation valve is closed and restore the leakage to within its limit in the next 72 hours, or be in HOT SHUTDOWN in the following 12 hours.

BASIS: The RCS pressure isolation valves are check valves that are located in the SI lines for each RCS loop cold leg and are in series with the normally closed SI loop isolation valves. The check valves provide a redundant means for isolating the SI header from the RCS during normal operation. The check valves isolate the high pressure RCS from the lower pressure rated SIS piping upstream of the SI loop isolation valves.

LCO 3.3.7

SPECIFICATION: The following Component Cooling Water (CCW) systems shall be OPERABLE:

A. Two independent CCW pump trains, with one train in service and each train comprised of:

(1) One CCW pump, and

(2) A flow path, aligned to take suction from the CCW return header via a CCW pump and to provide flow to the CCW pump discharge header.

B. Two CCW heat exchanger trains, with one train in service and each train comprised of:

(1) One CCW heat exchanger,

(2) A CCW flow path, aligned to provide CCW flow from the CCW pump discharge header to the CCW heat exchanger and capable of providing flow from the CCW heat eachanger to the CCW supply header,

(3) One Salt Water Cooling (SWC) pump, and

(4) A SWC flow path, aligned to provide SWC flow via the SWC pump to the CCW heat exchanger and return flow to the SWC discharge structure.

The standby CCW heat exchanger train may be removed from service for up to seven days provided that (1) the SWC flow to the inservice CCW heat exchanger is > ___ gpm, [a heat exchanger Δp would be an alternative limit] (2) the CCW and SWC flow path supply and return valves for the standby CCW heat exchanger are closed, (3) the supply breakers for the CCW heat exchanger CCW return valve MCCs are placed in the open position, and (4) the SWC pump discharge cross-tie valve is placed in the open position.

C. A recirculation heat exchanger CCW supply flow path, aligned to provide flow from the CCW supply header to the recirculation heat exchanger, and two recirculation heat exchanger CCW return valves, each capable of providing flow from the heat exchanger to the CCW return header.

D. Two RHR heat exchanger CCW supply and return flow paths, each aligned to provide flow from the CCW supply header to its heat exchanger and from its heat exchanger to the CCW return header.

E. Two RHR pump CCW supply and return flow paths, each aligned to provide flow from the CCW supply header to its heat exchanger and from its heat exchanger to the CCW return header.

F. Two charging pump oil cooler CCW supply and return flow paths, each aligned to provide flow from the CCW supply header to its oil cooler and from its oil cooler to the CCW return header.

G. The spent fuel heat exchanger supply and return flow paths, aligned to provide flow from the CCW supply header to the heat exchanger and from the heat exchanger to the CCW return header.

H. The CCW surge tank, with a flow path aligned to the CCW return header and with a water level between ____ and _____ inches.

ACTION:

A. With one CCW pump train inoperable, restore the inoperable train to OPERABLE status within 72 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

B. With one CCW heat exchanger train inoperable, restore the inoperable train to OPERABLE status within 72 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

C. With neither CCW pump train or neither of the CCW heat exchanger train in service, immediately place at least one CCW pump and heat exchanger train in service or be in at least HOT STANDBY within 6 hours and in COLD SHUTDOWN within the next 30 hours.

D. With one of the conditions for removing the standby CCW heat exchanger from service not met, be in at least HOT STANDBY within 6 hours and in COLD SHUTDOWN within the next 30 hours.

E. With the recirculation heat exchanger CCW supply flow path inoperable, restore the inoperable flow path to

OPERABLE status, or be in at least HOT STANDBY within 6 hours and in COLD SHUTDOWN within the next 30 hours.

F. With one recirculation heat exchanger CCW return valve inoperable, restore the inoperable valve to OPERABLE status within 72 hours, or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

G. With the inservice RHR heat exchanger CCW supply or return flow path inoperable, place the standby RHR heat exchanger in service or restore the inoperable flow path to OPERABLE status, or be in at least HOT STANDBY within 6 hours and in COLD SHUTDOWN within the next 30 hours.

H. With the standby RHR heat exchanger CCW supply or return flow path inoperable, restore the inoperable flow path to OPERABLE status within 72 hours, or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

I. With the inservice charging pump oil cooler CCW supply or return flow path inoperable, place the standby charging pump in service or restore the inoperable flow path to OPERABLE status, or be in at least HOT STANDBY within 6 hours and in COLD SHUTDOWN within the next 30 hours.

J. With the standby charging pump oil cooler CCW supply or return flow path inoperable, restore the inoperable flow path to OPERABLE status within 72 hours, or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

K. With one RHR pump CCW supply or return flow path inoperable, restore the inoperable flow path to OPERABLE status within 72 hours, or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

L. With the spent fuel pit heat exchanger CCW supply or return flow path inoperable, restore it to OPERABLE status or implement an alternate method of spent fuel pit cooling within ____ hours.

M. With the CCW surge tank inoperable, restore the tank to OPERABLE status within 6 hours, or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

<u>BASIS</u>: The CCW system provides cooling during normal operation for potentially radioactive systems and systems located inside containment. The safety function of the system is to provide cooling for the recirculation and RHR heat exchangers

that are used by ECCS systems for accident mitigation and for residual heat removal following anticipated transients. The LCO applies for operation in Modes 1 through 4. The operability requirements for the CCW system for other modes of operation is based on the definition of operability and the applicability of LCOs for systems that the CCW system provides a necessary support function during those modes.

One of the CCW pump trains and one of the CCW heat exchanger trains are required to be in service with an operable CCW pump train and CCW heat exchanger train in standby. Although there are three CCW pumps, only pumps G-15A and -15B have the requisite independence, based upon their power sources, to satisfy the requirements of the LCO. The standby CCW heat exchanger is placed in service by starting its associated SWC pump which automatically opens the heat exchanger CCW return valve. The standby CCW and SWC pumps are started on an SI actuation signal.

When a CCW heat exchanger is removed from service for extended maintenance, greater than 72 hours as may be required to remove marine fouling, the SWC pump discharge cross-tie valve (SWC-300) is placed in the open position so that either SWC pump may provide cooling to the inservice CCW exchanger. For this mode of operation different trains of the SWC pump and the CCW heat exchanger would be in service and, therefore, the MCCs for both heat exchanger CCW return valves must de-energized locally at the MCC feeder breakers because of the interlocks with the SWC pumps.

The extended outage time for the CCW heat exchanger is conditional upon a SWC flow rate of greater than ____ gpm to the inservice CCW heat exchanger to assure that it is sufficiently free of marine growth and an adequate margin exist for subsequent fouling such that it could perform its function to achieve a cold shutdown for a post accident condition without having to return the out-of-service heat exchanger to operation. Also, having satisfied the other conditions for an extended maintenance outage, no single active failure would result in the loss of the CCW system.

The CCW supply flow path to the recirculation heat exchanger and the CCW supply and return flow paths for the RHR heat exchangers, and charging pump oil cooler are operable by the alignment of local manual valves. Therefore, an allowable outage time is not provided to restore these flow paths to operable status if they are not aligned to provide an operable flow path. However, if the status of one of these components can be changed to standby by placing its redundant counter part in service, the allowable outage time for the standby component would be available.

The operation of the CCW surge tank within the specified level limits assures that sufficient volume is available to satisfy the CCW pump NPSH requirements and for expansion under full heat load conditions.

LCO 3.3.8 EFFECTIVE LEAKAGE LIMIT OF THE RECIRCULATION LOOP LOCATED OUTSIDE CONTAINMENT.

OBJECTIVE: To establish the effective leakage limit of the recirculation loop that is located outside containment, which is an extension of the containment boundary during the recirculation mode of ECCS operation, that when combined with containment leakage will not result in the offsite dose limits of Part 100 of Title 10 to the Code of Federal Regulations being exceeded for a LOCA.

Surveillance Requirements:

4.2.1 EMERGENCY CORE COOLING SYSTEM PERIODIC TESTING

APPLICABILITY: The test requirements shall be met when the facility is in an OPERATIONAL MODE or other specified condition of operation for which an LCO applies for that system or component.