June 30, 1997

LICENSEE: IES Utilities Inc.

FACILITY: Duane Arnold Energy Center

SUBJECT: SUMMARY OF JUNE 18, 1997, MEETING ON LOOP SELECT LOGIC
(TAC NO. M97157)

On June 18, 1997, a public meeting was held between the U.S. Nuclear
Regulatory Commission staff and IES Utilities Inc. (the licensee) to discuss
the unique aspects of the Duane Arnold Energy Center's design with regard to
loop select logic[1]. Enclosure 1 is a list of attendees. The handouts
provided by the licensee in the meeting are Enclosures 2, 3, and 4.

During the meeting, the licensee discussed the residual heat removal system
design, success criteria for design basis loss-of-coolant accidents, low-
pressure coolant injection loop select logic (including time delays), and the
improved Technical Specification submittal with respect to the loop select
logic.

Original signed by:

Glenn B. Kelly, Sr. Project Manager
Project Directorate III-3
Division of Reactor Projects III/IV
Office of Nuclear Reactor Regulation

Docket No. 50-331

Enclosures: As stated

cc w/encls: See next page

| OFFICE | LA:PDIII-3 | N | PM:PDIII-3 | N |
|--------|-----------|---|-----------|---|
| NAME | CBoyle | | GKelly | |
| DATE | 6/23/97 | | 6/ /97 | |

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[1] Loop select logic - logic that chooses the loop of the recirculation
system (1 of 2) into which to pump ECCS water from the residual heat removal
system in such a manner that it does not bypass cooling the core.

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**UNITED STATES**
**NUCLEAR REGULATORY COMMISSION**
WASHINGTON, D.C. 20555-0001

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Duane Arnold Energy Center
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# RESIDUAL HEAT REMOVAL

- **DESIGN BASIS / MODES**

  - In conjunction with other ECCS
    Systems to cool the core (**LPCI**)

  - Cool the Containment:
    - » **Containment Spray**
    - » **Torus Cooling**

  - Provide **Shutdown Cooling** to
    remove shutdown decay heat

  - Provide Reactor and Torus **draining**

  - Supplement **Fuel Pool Cooling**
    System

# RESIDUAL HEAT REMOVAL

- **Major Components**

    - Two divisions (loops)
        » Note: One division alone cannot fulfill the LPCI function due to pump capacity
        » Two logics, each of which can fulfill the LPCI function
    - Per loop:
        » Two Pumps
        » One Heat Exchanger
        » One inject line to Rx
    - Crosstie line to connect the two loops to allow sufficient flow for LPCI (i.e. 3 of 4 pumps required)
    - Special Power distribution to the valves which are necessary for proper LPCI function:
        » **LPCI Inject Valves** and
        » **Recirc Pump Discharge Valves**
    - Lots of valves

# RESIDUAL HEAT REMOVAL

- **LPCI**
    - Suction from Torus
    - Initiation Signals:
        - » Drywell Pressure High, or
        - » Rx Water Level Lo-Lo-Lo
    - Requires 3 of 4 pumps, so:
        - » **LPCI Loop Select** to determine which loop is broken and to inject into the non-broken loop
        - » **LPCI Swing Bus** to ensure that when one division is without power, power is provided to the *LPCI Inject Valves,* and *Recirc Pump Discharge Valves* from the electrical division which has power
    - **LPCI Inject Valves** open when Rx Pressure < 450 psig
    - **LPCI Inject Valves** have timers to ensure that they accomplish their functions
        - » 5-Minute timer
        - » 10-Minute timer
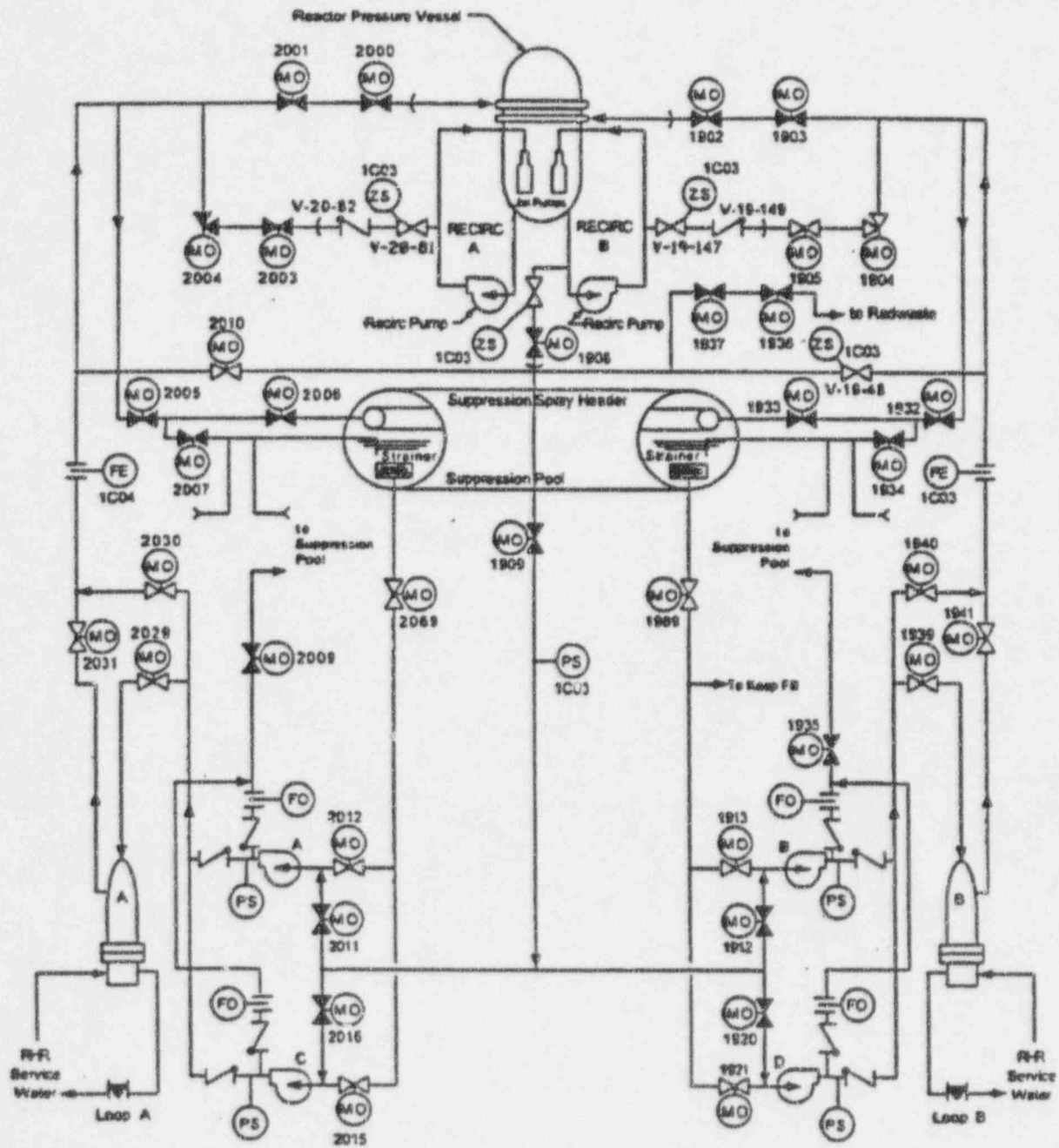
Figure 2. LPCI Mode of RHR System

# LPCI LOOP SELECT
## (BREAK DETECTION)

- **DESIGN BASIS**

    - The *minimum* break size for which Loop Selection Logic is able to detect an unbroken Recirc Loop is approximately 0.5 ft$^2$

        » Any **smaller** break would not require LPCI

        » Any **larger** break is more easily detectable

    - Logic defaults to inject into the "B" Recirc Loop if it does not detect which loop is broken

# LPCI LOOP SELECT

- **LPCI LOOP SELECT DESIRED ACTIONS**

  - Determine which Recirc Loop is Broken and:

    » Close **Non-Selected LPCI Loop's** Inject Valves

      • Prevents injection into broken Recirc loop

    » Open **Selected LPCI Loop's** Inject Valves

      • Allows injection into intact Recirc loop

    » Close **Selected Recirc Loop's** Pump Discharge Valve

      • Prevents bypass of water backwards through Recirc pump, into the core shroud? and out of the break

  - Ensure that the LPCI function continues to completion

# LPCI LOOP SELECT

- **Major Inputs**

    - **Initiation Signals:**

        » Drywell Pressure High (2 psig)
        » Rx Water Level Low-Low (119")
        » One-out-of-two twice logic

    - **Selection Logic Inputs:**

        » Recirc Pump Running
        » Recirc Loop Riser Pressure
        » Rx Pressure

# LPCI LOOP SELECT

- **INITIATION**

    - **Drywell Pressure High (2 PSIG)**

        » LOCA Indicator
        » One-out-of-two twice logic

    - **Rx Water Level Low-Low (119")**

        » LOCA indicator
        » 119" is above the 64" LPCI
          Initiation Rx Water Level
        » One-out-of-two twice logic

# LPCI LOOP SELECT

- **Selection Logic**

    - **Recirc Pump Running**
        - » Necessary to trip a recirc pump if only one recirc pump is running
        - » Necessary to avoid confusing logic due to a running recirc pump affecting Recirc Loop Riser Pressure
        - » One-out-of-two twice logic

    - **Recirc Loop Riser Pressure**
        - » Necessary to determine which recirc loop is broken (i.e. the pressure in the intact loop will be higher than the pressure in the broken loop by > 1 psid)
        - » One-out-of-two twice logic

# LPCI LOOP SELECT

- **Selection Logic**

    - **Reactor Pressure < 900 psig**
        - » Necessary to allow a Recirc Pump to coast down (which reduces reactor pressure) if only one was initially running
        - » Necessary to avoid confusing logic due to a single pump running affecting Recirc Loop Riser Pressure
        - » One-out-of-two twice logic

    - **Reactor Pressure < 450 psig**
        - » Necessary to wait until Rx pressure is reduced below pressure rating of LPCI Inject Piping
        - » One-out-of-two twice logic

# LPCI LOOP SELECT

- **Selection Logic**

    - **TIME DELAY RELAYS:**

        » **1/2 Sec (#1):**
            - Delays tripping a Recirc Pump (when only one is initially running) less than 1/2 sec after initiation signal
            - Necessary because it gives the logic a little more time to sense that both recirc pumps are running because you don't want to trip recirc pumps if you don't have to

        » **1/2 Sec (#2):**
            - Delays signal to close Non-selected Loop's LPCI Inject Valves and to close Selected Loop's Recirc Pump Discharge Valves
            - Necessary to give the logic a little more time to ensure that the Recirc Riser Pressures do detect a break

        » **2 Sec:**
            - Delays looking at Recirc Riser dP and initiating above 1/2 sec time delay
            - Necessary to allow initial perturbations and momentum effects to settle

# LPCI LOOP SELECT

- **Selection Logic**

  - **TIME DELAY RELAYS (Cont.):**

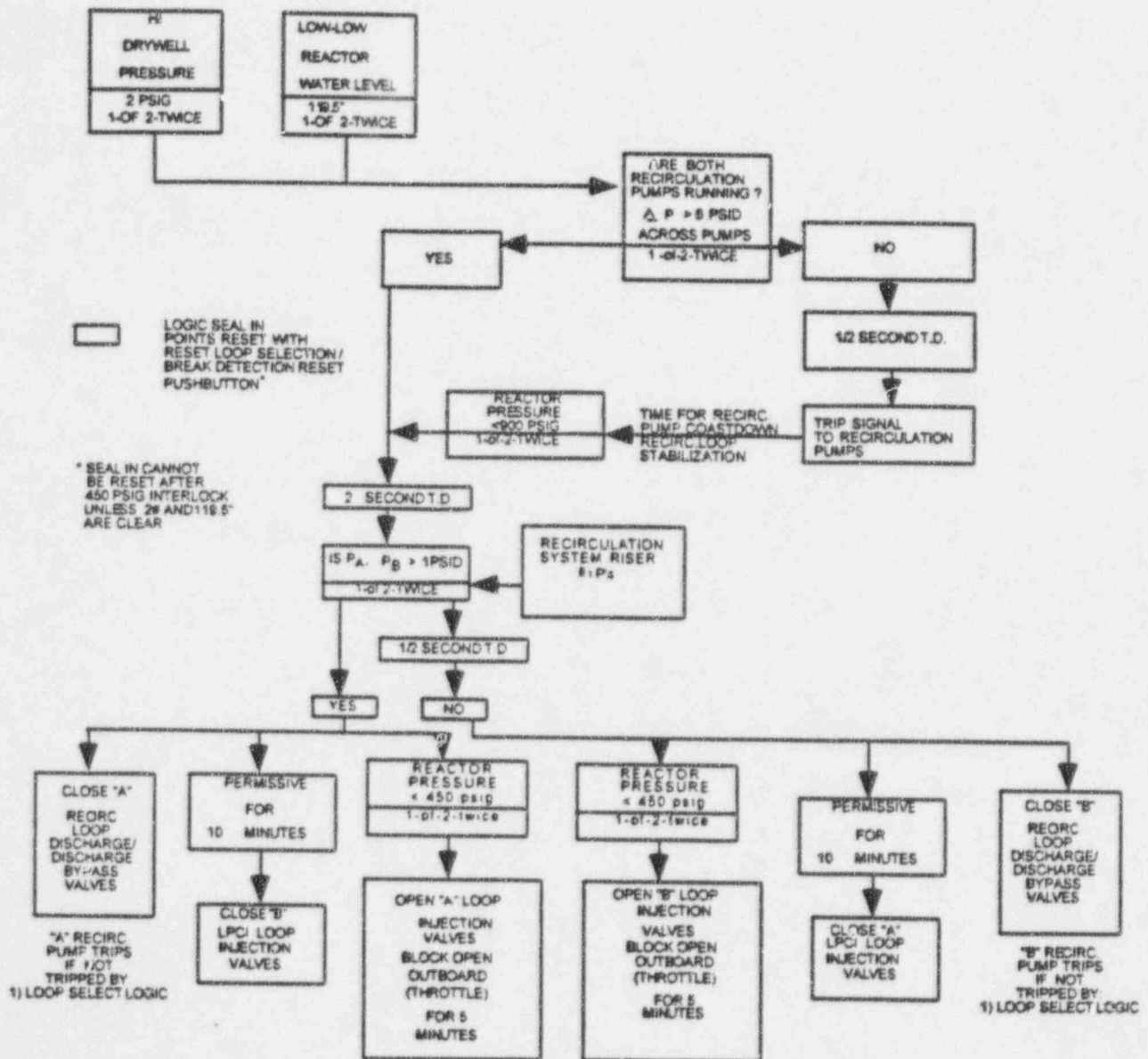    - » **5 Min:**
      - Keeps **Selected Loop's** Outboard LPCI Inject Valve from being manually closed for 5 minutes (Note: there is an override handswitch to bypass this timer)
      - Necessary to ensure that Rx is flooded

    - » **10 Min:**
      - Keeps **Non-selected Loop's** Inboard and Outboard Inject Valves from being manually opened for 10 minutes
      - Necessary to ensure Rx is flooded

# APPENDIX 1

## LPCI LOOP SELECT LOGIC



HI DRYWELL PRESSURE
2 PSIG
1-OF 2-TWICE

LOW-LOW REACTOR WATER LEVEL
119.5"
1-OF 2-TWICE

ARE BOTH RECIRCULATION PUMPS RUNNING ?
ΔP > 6 PSID ACROSS PUMPS
1-of-2-TWICE

YES          NO

LOGIC SEAL IN POINTS RESET WITH "RESET LOOP SELECTION / BREAK DETECTION RESET PUSHBUTTON"

1/2 SECOND T.D.

REACTOR PRESSURE <900 PSIG
1-of-2-TWICE

TIME FOR RECIRC. PUMP COASTDOWN RECIRC LOOP STABILIZATION

TRIP SIGNAL TO RECIRCULATION PUMPS

* SEAL IN CANNOT BE RESET AFTER 450 PSIG INTERLOCK UNLESS 2# AND 119.5" ARE CLEAR

2 SECOND T.D

IS $P_A - P_B > 1 PSID$
1-of-2-TWICE

RECIRCULATION SYSTEM RISER ΔPs

1/2 SECOND T.D

YES          NO

CLOSE "A" RECIRC LOOP DISCHARGE/ DISCHARGE BYPASS VALVES

"A" RECIRC PUMP TRIPS IF NOT TRIPPED BY 1) LOOP SELECT LOGIC

PERMISSIVE FOR 10 MINUTES

CLOSE "B" LPCI LOOP INJECTION VALVES

REACTOR PRESSURE < 450 psig
1-of-2-Twice

OPEN "A" LOOP INJECTION VALVES BLOCK OPEN OUTBOARD (THROTTLE) FOR 5 MINUTES

REACTOR PRESSURE < 450 psig
1-of-2-Twice

OPEN "B" LOOP INJECTION VALVES BLOCK OPEN OUTBOARD (THROTTLE) FOR 5 MINUTES

PERMISSIVE FOR 10 MINUTES

CLOSE "A" LPCI LOOP INJECTION VALVES

CLOSE "B" RECIRC LOOP DISCHARGE/ DISCHARGE BYPASS VALVES

"B" RECIRC PUMP TRIPS IF NOT TRIPPED BY 1) LOOP SELECT LOGIC

# DUANE ARNOLD ENERGY CENTER

# IMPROVED TECHNICAL SPECIFICATIONS

## LPCI Loop Select Logic

## Changes to NUREG-1433

1

# OVERVIEW

♦ ECCS Instrumentation (ITS 3.3.5.1)

♦ Recirculation Loops Operating (ITS 3.4.1)

♦ ECCS - Operating (ITS 3.5.1)

♦ Distribution Systems - Operating (ITS 3.8.7)

2

## ECCS Instrumentation (ITS 3.3.5.1)

- Add Loop Select Logic Instruments to Table 3.3.5.1-1

- Add Required Action C.2 to ACTIONS for Loss of Loop Select Capability

- Revise Required Actions and Completion Times for Conditions C.1 and E.1 to reflect "triad" of low pressure ECCS subsystems in Loop Select design

RAB
6/18/97

## Recirculation Loops Operating (ITS 3.4.1)

- Revise LCO from "matched flow" to "matched pump speeds"

- Add Condition C to ACTIONS for pump speeds not matched

- Revise SR 3.4.1.1 to reflect pump speed mismatch criteria

## ECCS - Operating (ITS 3.5.1)

- Revise Conditions to account for Loop Select design basis:

  * LPCI only needs 3-out-of-4 RHR pumps

  * Low Pressure ECCS is CS "A", CS "B" & LPCI

- Add Condition C for loss of one CS and one or two RHR pumps (loss of room coolers)

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## ECCS - Operating (ITS 3.5.1) - cont.

- Include LPCI "Swing Bus" and Reactor Recirculation valves in ITS SR 3.5.1.7 for the Simulated Automatic Actuation test

- Delete NUREG SRs 3.5.1.4 and 5 - not for Loop Select design (Cross-tie valve is Open & no LPCI Inverters) and SR 3.5.1.6 - included in ITS SR 3.5.1.7 and IST Program

## Distribution Systems - Operating (ITS 3.8.7)

- Add SR 3.8.7.2 to verify LPCI "Swing Bus" breaker coordination

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Table 3.3.5.1-1 (page 2 of 5)
Emergency Core Cooling System Instrumentation

| FUNCTION | APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS | REQUIRED CHANNELS PER FUNCTION | CONDITIONS REFERENCED FROM REQUIRED ACTION A.1 | SURVEILLANCE REQUIREMENTS | ALLOWABLE VALUE |
|---|---|---|---|---|---|
| 2. LPCI System (continued) | | | | | |
| c. Reactor Steam Dome Pressure - Low (Injection Permissive) | 1,2,3 | 4 | C | SR 3.3.5.1.3 SR 3.3.5.1.8 SR 3.3.5.1.9 | ≥ 363.3 psig and ≤ 485.1 psig |
| | 4(a), 5(a) | 4 | B | SR 3.3.5.1.3 SR 3.3.5.1.8 SR 3.3.5.1.9 | ≥ 363.3 psig and ≤ 485.1 psig |
| d. Reactor Vessel Shroud Level - Low | 1,2,3 | 4 | B | SR 3.3.5.1.1 SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.9 | ≥ -40.89 inches |
| e. Low Pressure Coolant Injection Pump Start - Time Delay Relay | 1,2,3, 4(a), 5(a) | 1 per pump | C | SR 3.3.5.1.8 SR 3.3.5.1.9 | |
| Pumps A & B | | | | | ≥ 8.8 seconds and ≤ 11.2 seconds |
| Pumps C & D | | | | | ≥ 13.8 seconds and ≤ 33.5 seconds |
| f. Low Pressure Coolant Injection Pump Discharge Flow - Low (Bypass) | 1,2,3, 4(a), 5(a) | 2 | E | SR 3.3.5.1.3 SR 3.3.5.1.8 SR 3.3.5.1.9 | ≥ 471.8 gpm and ≤ 3770.2 gpm |
| g. LPCI Loop Select - Reactor Vessel Water Level-Low-Low | 1,2,3 | 4 | C | SR 3.3.5.1.1 SR 3.3.5.1.2 SR 3.3.5.1.6 SR 3.3.5.1.9 | ≥ 112.65 inches |
| h. LPCI Loop Select - Reactor Steam Dome Pressure - Low | 1,2,3 | 4 | C | SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.9 | ≥ 887 psig |

(continued)

(a) When associated subsystem(s) are required to be OPERABLE.

Table 3.3.5.1-1 (page 3 of 5)
Emergency Core Cooling System Instrumentation

| FUNCTION | APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS | REQUIRED CHANNELS PER FUNCTION | CONDITIONS REFERENCED FROM REQUIRED ACTION A.1 | SURVEILLANCE REQUIREMENTS | ALLOWABLE VALUE |
|---|---|---|---|---|---|
| **2. LPCI System (continued)** | | | | | |
| i. LPCI Loop Select - Recirculation Pump Differential Pressure | 1,2,3 | 4 per pump | C | SR 3.3.5.1.1 SR 3.3.5.1.2 SR 3.3.5.1.8 SR 3.3.5.1.9 | ≤ 7.8 psid |
| j. LPCI Loop Select - Recirculation Riser Differential Pressure | 1,2,3 | 4 | C | SR 3.3.5.1.1 SR 3.3.5.1.2 SR 3.3.5.1.4 SR 3.3.5.1.9 | ≥ 0.5 psid and ≤ 2.0 psid |
| k. 4.16 kV Emergency Bus Sequential Loading Relay | 1,2,3 | 2 | F | SR 3.3.5.1.5 SR 3.3.5.1.6 SR 3.3.5.1.9 | ≤ 3500 V |
|  | 4(a), 5(a) | 1 | F | SR 3.3.5.1.5 SR 3.3.5.1.6 SR 3.3.5.1.9 | ≤ 3500 V |
| **3. High Pressure Coolant Injection (HPCI) System** | | | | | |
| a. Reactor Vessel Water Level - Low Low | 1, 2(c), 3(c) | 4 | B | SR 3.3.5.1.1 SR 3.3.5.1.3 SR 3.3.5.1.6 SR 3.3.5.1.9 | ≥ 112.65 inches |
| b. Drywell Pressure - High | 1, 2(c), 3(c) | 4 | B | SR 3.3.5.1.3 SR 3.3.5.1.8 SR 3.3.5.1.9 | ≤ 2.19 psig |
| c. Reactor Vessel Water Level - High | 1, 2(c), 3(c) | 2 | C | SR 3.3.5.1.1 SR 3.3.5.1.3 SR 3.3.5.1.6 SR 3.3.5.1.9 | ≤ 214.8 inches |
| d. Condensate Storage Tank Level - Low | 1, 2(c), 3(c) | 2 | D | SR 3.3.5.1.3 SR 3.3.5.1.8 SR 3.3.5.1.9 | ≥ 11.6 inches |

(continued)

(a)  When the associated subsystem(s) are required to be OPERABLE.

(c)  With reactor steam dome pressure > 150 psig.

ACTIONS (continued)

| CONDITION | | REQUIRED ACTION | COMPLETION TIME |
|-----------|---|-----------------|-----------------|
| C. As required by Required Action A.1 and referenced in Table 3.3.5.1-1. | C.1 | --------NOTES--------<br>1. Only applicable in MODES 1. 2. and 3.<br><br>2. Only applicable for Functions 1.c. 1.e. 2.c and 2.e.<br>----------------------<br><br>Declare supported feature(s) inoperable. | 1 hour from discovery of loss of initiation capability for two or more low pressure ECCS subsystems |
| | AND | | |
| | C.2 | --------NOTES---------<br>1. Only applicable in Modes 1. 2. and 3.<br><br>2. Only applicable for Functions 2.g. 2.h. 2.i. and 2.j.<br>----------------------<br><br>Declare Low Pressure Coolant Injection (LPCI) subsystem inoperable. | 1 hour from discovery of loss of Loop Selection capability |
| | AND | | |
| | C.3 | Restore channel to OPERABLE status. | 24 hours |

(continued)

ACTIONS (continued)

| CONDITION | | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|---|
| E. As required by Required Action A.1 and referenced in Table 3.3.5.1-1. | E.1 | --------NOTES--------<br>1. Only applicable in MODES 1. 2. and 3.<br><br>2. Only applicable for Functions 1.d and 2.f.<br>----------------------<br><br>Declare supported feature(s) inoperable. | 1 hour from discovery of loss of initiation capability for two or more minimum flow valves in the low pressure ECCS subsystems |
| | AND | | |
| | E.2 | Restore channel to OPERABLE status. | 7 days |
| F. As required by Required Action A.1 and referenced in Table 3.3.5.1-1. | F.1 | Restore channel to OPERABLE status. | 1 hour |

(continued)

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.1 Recirculation Loops Operating

LCO 3.4.1    Two recirculation loops with matched pump speeds shall be in operation with core flow as a function of THERMAL POWER outside the Exclusion Region specified in the COLR.

OR

One recirculation loop may be in operation with core flow as a function of THERMAL POWER outside the Exclusion Region specified in the COLR and with the following limits applied when the associated LCO is applicable:

a.    LCO 3.2.1, "AVERAGE PLANAR LINEAR HEAT GENERATION RATE (APLHGR)." single loop operation limits specified in the COLR:

b.    LCO 3.2.2. "MINIMUM CRITICAL POWER RATIO (MCPR)." single loop operation limits specified in the COLR: and

c.    LCO 3.3.1.1. "Reactor Protection System (RPS) Instrumentation." Function 2.b (Average Power Range Monitors Flow Biased High Scram). Allowable Value of Table 3.3.1.1-1 is reset for single loop operation.

APPLICABILITY:    MODES 1 and 2.

ACTIONS

| CONDITION | | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|---|
| A. No recirculation loops in operation. | A.1 | Place the reactor mode switch in the Shutdown position. | Immediately |

(continued)

| CONDITION | | REQUIRED ACTION | | COMPLETION TIME |
|---|---|---|---|---|
| B. | One or two recirculation loops in operation in the Exclusion Region of the power/flow map described in the Core Operating Limits Report. | B.1 | Initiate action to exit the Exclusion Region. | Immediately |
| C. | Recirculation pump speed mismatch not within limits. | C.1 | Trip one recirculation pump. | 2 hours |
| D. | Requirements of the LCO not met for reasons other than Conditions A. B or C. | D.1 | Satisfy requirements of the LCO. | 24 hours |
| E. | Required Action and associated Completion Time of Condition C or D not met. | E.1 | Be in MODE 3. | 12 hours |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | FREQUENCY |
|---|---|
| SR 3.4.1.1       --------------------NOTE--------------------<br>Not required to be performed until 24 hours after both recirculation loops are in operation.<br>-------------------------------------------------<br><br>Verify recirculation pump speed mismatch with both recirculation pumps at steady state operation is as follows:<br><br>a.   The speed of the faster pump shall be $\leq 135\%$ of the speed of the slower pump when operating at < 80% RTP.<br><br>b.   The speed of the faster pump shall be $\leq 122\%$ of the speed of the slower pump when operating at $\geq$ 80% RTP. | 24 hours |
| SR 3.4.1.2      Verify core flow as a function of core THERMAL POWER is outside the Exclusion Region shown in the COLR. | 24 hours |

3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS) AND REACTOR CORE ISOLATION COOLING (RCIC) SYSTEM

3.5.1 ECCS—Operating

LCO 3.5.1       Each ECCS injection/spray subsystem and the Automatic Depressurization System (ADS) function of four safety/relief valves shall be OPERABLE.

APPLICABILITY:   MODE 1.
                 MODES 2 and 3, except High Pressure Coolant Injection (HPCI) is not required to be OPERABLE with reactor steam dome pressure ≤ 150 psig and ADS valves are not required to be OPERABLE with reactor steam dome pressure ≤ 100 psig.

ACTIONS

| CONDITION | | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|---|
| A. One Residual Heat Removal (RHR) pump inoperable. | A.1 | Restore RHR pump to OPERABLE status. | 30 Days |
| B. One low pressure ECCS subsystem inoperable for reasons other than Condition A. | B.1 | Restore low pressure ECCS subsystem to OPERABLE status. | 7 days |
| C. One Core Spray subsystem inoperable. AND One or two RHR pump(s) inoperable. | C.1 | Restore Core Spray subsystem to OPERABLE status. OR | 72 hours |
| | C.2 | Restore RHR pump(s) to OPERABLE status. | 72 hours |
| D. Both Core Spray subsystems inoperable. | D.1 | Restore one Core Spray subsystem to OPERABLE status. | 72 hours |

(continued)

ACTIONS (continued)

| CONDITION | | REQUIRED ACTION | | COMPLETION TIME |
|---|---|---|---|---|
| E. | Required Action and associated Completion Time of Condition A. B. C. or D not met. | E.1 | Be in MODE 3. | 12 hours |
| | | AND | | |
| | | E.2 | Be in MODE 4. | 36 hours |
| F. | HPCI System inoperable. | F.1 | Verify by administrative means RCIC System is OPERABLE. | Immediately |
| | | AND | | |
| | | F.2 | Restore HPCI System to OPERABLE status. | 14 days |
| G. | HPCI System inoperable. | G.1 | Restore HPCI System to OPERABLE status. | 7 days |
| | AND | OR | | |
| | One RHR pump inoperable. | G.2 | Restore RHR pump to OPERABLE status. | 7 days |
| H. | HPCI System inoperable. | H.1 | Restore HPCI System to OPERABLE status. | 72 hours |
| | AND | OR | | |
| | One low pressure ECCS subsystem is inoperable for reasons other than Condition A. | H.2 | Restore low pressure ECCS subsystem to OPERABLE status. | 72 hours |
| I. | HPCI System inoperable. | I.1 | Restore HPCI System to OPERABLE status. | 72 hours |
| | AND | OR | | |
| | One ADS valve inoperable. | I.2 | Restore ADS valve to OPERABLE status. | 72 hours |

(continued)

ACTIONS (continued)

| CONDITION | | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|---|
| J. Required Action and associated Completion Time of Condition F, G, H, or I not met. | J.1 <br><br> AND <br><br> J.2 | Be in Mode 3. <br><br><br><br> Reduce reactor steam dome pressure to ≤ 150 psig. | 12 hours <br><br><br><br> 36 hours |
| K. One ADS valve inoperable. | K.1 | Restore ADS valve to OPERABLE status. | 30 days |
| L. One ADS valve inoperable. <br><br> AND <br><br> One low pressure ECCS subsystem inoperable for reasons other than Condition A. | L.1 <br><br> OR <br><br> L.2 | Restore ADS valve to OPERABLE status. <br><br><br><br> Restore low pressure ECCS subsystem to OPERABLE status. | 72 hours <br><br><br><br> 72 hours |
| M. Two or more ADS valves inoperable. <br><br> OR <br><br> Required Action and associated Completion Time of Condition K or L not met. | M.1 <br><br> AND <br><br> M.2 | Be in MODE 3. <br><br><br><br> Reduce reactor steam dome pressure to ≤ 100 psig. | 12 hours <br><br><br><br> 36 hours |

(continued)

ACTIONS (continued)

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|-----------|-----------------|-----------------|
| N. Two or more low pressure ECCS subsystems inoperable for reasons other than Condition C or D.<br><br>OR<br><br>HPCI System and two or more ADS valves inoperable.<br><br>OR<br><br>HPCI System and two or more low pressure ECCS subsystems inoperable.<br><br>OR<br><br>One ADS valve and two or more low pressure ECCS subsystems inoperable.<br><br>OR<br><br>One ADS valve and HPCI System and one low pressure ECCS subsystem inoperable. | N.1   Enter LCO 3.0.3. | Immediately |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | FREQUENCY |
|--------------|-----------|
| SR  3.5.1.1   Verify, for each ECCS injection/spray subsystem, the piping is filled with water from the pump discharge valve to the injection valve. | 31 days |

(continued)

SURVEILLANCE REQUIREMENTS (continued)

| SURVEILLANCE | FREQUENCY |
|---|---|
| SR 3.5.1.7     --------------------NOTE--------------------<br>1.  Vessel injection/spray may be excluded.<br><br>2.  When an ECCS System/subsystem or Diesel Generator (DG) is placed in an inoperable status solely for the performance of this Surveillance, entry into associated Conditions and Required Actions may be delayed for up to 4 hours for CS System testing and 6 hours for LPCI and HPCI System testing, provided the remaining ECCS, the RCIC System if the HPCI System is being tested and the remaining AC Sources if CS is being tested, are OPERABLE.<br>------------------------------------------ | |
| Verify each ECCS injection/spray subsystem actuates on an actual or simulated automatic initiation signal. | 24 months |
| SR 3.5.1.8     --------------------NOTE--------------------<br>Valve actuation may be excluded.<br>------------------------------------------ | |
| Verify the ADS actuates on an actual or simulated automatic initiation signal. | 24 months |
| SR 3.5.1.9     --------------------NOTE--------------------<br>Not required to be performed until 12 hours after reactor steam pressure and flow are adequate to perform the test.<br>------------------------------------------ | |
| Verify each ADS valve opens when manually actuated | 24 months |

BASES

SURVEILLANCE
REQUIREMENTS

SR 3.5.1.7 (continued)

LPCI will cause the systems or subsystems to operate as designed, including actuation of the system throughout its emergency operating sequence, automatic pump startup and actuation of all automatic valves to their required positions. As part of this SR for the LPCI subsystem, a verification of the "power-seeking" logic for the LPCI "Swing Bus" (1B34A and 1B44A), i.e., the ability to transfer power sources from either AC Essential Bus upon loss of power (either AC or 125 VDC), is included. This verification, when coupled with the verification of the "break-before-make" coordination of the breakers in SR 3.8.7.2, demonstrate the ability of the Swing Bus to perform its intended safety function in support of the Loop Select design of the LPCI subsystem without compromising the independence of the AC Distribution System (Reference 16). This SR also ensures that the HPCI System will automatically restart on an RPV low water level signal received subsequent to an RPV high water level trip and that the suction is automatically transferred from the CST to the suppression pool on a CST Low Water Level Signal or Torus High Water Level Signal. The LOGIC SYSTEM FUNCTIONAL TEST performed in LCO 3.3.5.1 overlaps this Surveillance to provide complete testing of the assumed safety function.

Operating experience has shown that these components usually pass the SR when performed at the 24 month Frequency, which is based on the refueling cycle. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.

This SR is modified by two Notes. The first Note excludes vessel injection/spray during the Surveillance. Since all active components are testable and full flow can be demonstrated by recirculation through the test line, coolant injection into the RPV is not required during the Surveillance. The second Note allows delaying the entry into associated Conditions and Required Actions for up to six hours. This note is necessary because the various subsystems are prevented from injecting or initiating, making the subsystems inoperable. The HPCI injection valve is deenergized in the closed position to prevent injection into the RPV. The LPCI subsystem logic is overridden to prevent RHR pump starts, LPCI Loop Select Logic from closing the Recirculation System Discharge valves and the LPCI inject

(continued)

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | | FREQUENCY |
|---|---|---|
| SR 3.8.7.1 | Verify correct breaker alignments and indicated power availability to required AC and DC electrical power distribution subsystems. | 7 days |
| SR 3.8.7.2 | Verify proper coordination of the LPCI Swing Bus circuit breakers. | 24 months |

BASES (continued)

| SURVEILLANCE REQUIREMENTS | SR 3.8.7.2 |
|---|---|

SR 3.8.7.2

This Surveillance verifies the "break-before-make" coordination of the circuit breakers for the LPCI Swing Bus (1B34A and 1B44A). This SR, when coupled with SR 3.5.1.7, demonstrates the ability of the LPCI Swing Bus to perform its intended safety function in support of the LPCI Loop Select design without compromising the independence of the AC Electrical Power Distribution System (Reference 3). Consequently, failure to satisfy this SR requires that both 1B34 and 1B44 buses be declared inoperable, and Condition G be entered until either 1B34 or 1B44 can be isolated from the Swing Bus, as a loss of all low pressure ECCS has potentially occurred. If the Swing Bus can be isolated from 1B34 or 1B44, then this SR is met, and the AC electrical power distribution subsystems are not inoperable. However, this will result in a failure to meet SR 3.5.1.7 (and Condition B of LCO 3.5.1 will be required to be entered since the LPCI system will be inoperable).

REFERENCES

1. UFSAR, Chapter 6.

2. UFSAR, Chapter 15.

3. J. Hall (NRC) to L. Liu (IELP), "LPCI Swing Bus Design Modification (TAC No. 69556)," dated January 19, 1989