Level SRO Tier 1 Group 1 K/A# E11 EA2.1 Imp. RO 3.5 Imp. SRO 4.2

7. Following a LOCA, low head recirculation flow was established on both RHR trains. Several hours later, debris blocks the suction lines from Containment Sump B to both trains of RHR and both RHR pumps are cavitating. The RO suggests making a transition to procedure ECA-1.1, "Loss of Emergency Coolant Recirculation"

   SHOULD a transition be made to ECA-1.1 and **WHY**?

a. No, ECA-1.1 strategies would NOT provide a success path for these conditions.
b. Yes, ECA-1.1 would still be effective in restoring long-term cooling.
c. Yes, ECA-1.1 would provide temporary core cooling until the containment is flooded.
d. No, instead start the SI pumps and return to E-1, "Loss of Reactor or Secondary Coolant."

ANSWER: A

Explanation:

a **Correct. Rules of usage do not allow entry to ECA-1.1 after a successful completion of the transfer to recirculation and actions in ECA-1.1 will not be effective with the RWST empty.**

b. **Plausible based on the title but not true because ECA-1.1 does not have actions to correct a suction problem.**

c **Plausible because the statement is true without condition. However, the procedure would not be used under the conditions given.**

d **Plausible because this action is on the information page of ES-1.1, Post-LOCA Cooldown and Depressurization if subcooling is lost but it is not appropriate because the SI pumps have no suction source.**

Technical References: **ECA-1.1**

Objective: **P8197L-012**

KA Statement: **Ability to determine and interpret the following as they apply to Loss of Emergency Coolant Recirculation: Facility conditions and selection of appropriate procedures during abnormal and emergency operations.**

Cog. Level: **HIGH** 10CFR55.41: 10CFR55.43: **YES** New Question: **YES**

Bank: Ques. ID: Modified: Last NRC Exam:

Recommend key be modified to accept B or C vice A for SRO Question 7.

ECA-1.1, "Loss of Emergency Coolant Recirculation," has several strategies which would be beneficial in the situation proposed in the question stem.

1. In step 10, one RHR pump would be stopped. This would reduce the pressure loss due to the blockage and increase the NPSH for the running RHR pump. This could restore both long-term and short-term core cooling.
2. In step 13-RNO, the total injection flow could be reduced to the minimum for decay heat removal which would reduce the pressure loss due to the blockage and increase the NPSH for the running RHR pump. This could restore both long-term and short-term core cooling.
3. In step 13-RNO b.2), charging is used to establish minimum injection flow.
4. In step 2, actions are performed to start filling the RWST. Combined with step 10, which starts an SI pump, these two steps would restore short-term cooling.

This makes either choice B or C correct.

Choice A is NOT correct for the reasons stated above. As stated in the answer key, there are no explicit EOP transitions into ECA-1.1 after placing the unit in recirculation. However, implementing ECA-1.1 is warranted and the transition is supported by procedure ES-0.0, "Rediagnosis", step 3 which may be entered using ES-0.0 entry conditions. In addition, E-1, "Loss of Reactor or Secondary Coolant," step 30 says, "Evaluate Long Term Plant Status" which would be a prudent transition to ECA-1.1 under the direction of the Technical Support Center staff. At this time of the event, all emergency response organizations would be operational.

This is further justified as step 23 of ES-1.2, "Transfer to Recirculation" would have been completed and the basis (in "Background Information for . . . Transfer to Recirculation") describes that if such degradation were detected then appropriate actions . . . should be developed. These actions are developed in ECA-1.1 as described above.

Choice D is NOT correct, without making assumptions, for the reasons stated on the key.

Ref: 1ES-0.0, "Rediagnosis", Pages 1-4
Information Page for ES-0.0 Procedure
Background Information for 1ES-0.0, "Rediagnosis", Page 1
1ECA-1.1, "Loss of Emergency Coolant Recirculation", Pages 3,4,7,9,&19
Background Information for 1ECA-1.1, Pages 1, 3, and 4
1E-1, "Unit 1, Loss of Reactor or Secondary Coolant", Page 14
1ES-1.2, "Unit 1, Transfer to Recirculation", Page 12
1ES-1.2, "Unit 1, Background Information for 1ES-1.2, Transfer to Recirculation", Page 7

UNIT 1
REDIAGNOSIS

LEVEL OF USE

CONTINUOUS USE
• Continuous use of procedure required. • Read each step prior to performing. • Mark off steps as they are completed. • Procedure **SHALL** be at the work location.

O.C. REVIEW DATE		
4/17/00	REVIEWED BY: D Smith	DATE: 10/19/01
	APPROVED BY: P Valtakis	DATE: 10/22/01

REDIAGNOSIS

A. PURPOSE

This procedure provides a mechanism to allow the operator to determine or confirm the most appropriate post accident recovery procedure.

B. ENTRY CONDITIONS

1. This procedure is entered based on operator judgement when the following conditions are met:

   - Safety injection is in service or is required
   - 1E-0, Reactor Trip Or Safety Injection has been performed and a transition has been made to another E, ES, or ECA (except ECA-0) procedure

C. ATTACHMENTS:

NONE

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
	NOTE *This procedure SHALL only be used if SI has actuated or is required.*	
1	Check If Any SG Not Faulted - ANY SG PRESSURE STABLE OR INCREASING	IF a controlled cooldown is in progress, THEN go to Step 2. IF NOT, THEN perform the following: • IF main steamlines NOT isolated, THEN go to 1E-2, FAULTED STEAM GENERATOR ISOLATION, Step 1. -OR- • IF main steamlines isolated, THEN go to 1ECA-2.1, UNCONTROLLED DEPRESSURIZATION OF BOTH STEAM GENERATORS, Step 1.
2	Check If Both SGs Are Not Faulted:	
	a. Check SG pressures: • NO SG DEPRESSURIZING IN AN UNCONTROLLED MANNER • NO SG HAS COMPLETELY DEPRESSURIZED	a. Verify faulted SG isolated: • Steamlines • Feedlines IF NOT, THEN go to 1E-2, FAULTED STEAM GENERATOR ISOLATION, Step 1.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
3	Check For Ruptured SG(s): • ANY SG LEVEL INCREASING IN AN UNCONTROLLED MANNER -OR- • ANY SG WITH HIGH RADIATION	You should be in an 1E-1 or 1ECA-1 series procedure.
4	You Should Be In An 1E-3 Or 1ECA-3 Series Procedure	

-END-

INFORMATION PAGE FOR ES-0.0 PROCEDURE*

1. RCP TRIP CRITERIA
   Trip both RCPs if ALL conditions listed below occur:
   a. Injection flow exists to RCS:
      - AT LEAST ONE SI PUMP RUNNING AND FLOW INDICATED
      -OR-
      - AT LEAST ONE RHR PUMP RUNNING AND FLOW INDICATED
   b. RCS Pressure - LESS THAN 1250 PSIG [1575 PSIG]
   c. An operator controlled cooldown has NOT been initiated

2. RED PATH SUMMARY
   a. SUBCRITICALITY - Nuclear power - GREATER THAN 5%
   b. CORE COOLING - Core exit TCs - GREATER THAN 1200°F
      -OR-
      Core exit TCs - GREATER THAN 700°F
      AND
      RVLIS full range - LESS THAN 40%
      WITH NO RCPS RUNNING
   c. HEAT SINK - Wide range level in both SGs - LESS THAN 50%
      AND
      Total feedwater flow - LESS THAN 200 GPM
   d. INTEGRITY - Cold leg temperature decrease - GREATER THAN 100°F
      IN LAST 60 MINUTES
      AND
      RCS cold leg temperature - LESS THAN 250°F
   e. CONTAINMENT - Containment pressure - GREATER THAN 46 PSIG

*Adverse containment conditions are defined as a containment pressure greater than 5 psig or containment radiation level greater than 1E4 R/Hr.

BACKGROUND INFORMATION FOR

1ES-0.0, REDIAGNOSIS

SUMMARY FOR 1ES-0.0

The Rediagnosis Procedure is entered based on operator judgement when there is doubt that he is in the correct procedure. The applicability of the procedure is limited to those cases when SI has actuated or is required and 1E-0 has been executed and transitioned out of. This procedure does not apply to function restoration procedures. These cover the cases where the operator has not necessarily regained control of the plant and may question the diagnostic capabilities of 1E-1. Upon completion of the Rediagnosis Procedure, the operator either confirms he is in the correct series of procedures or is directed to the appropriate procedure.

BASIS FOR ACTIONS IN 1ES-0.0

Note Procedure Steps, Step 1

The sequence of steps in this procedure is based on the assumption that SI has actuated or is required. Therefore, this procedure should be used only if SI is in service or is required and 1E-0, REACTOR TRIP OR SAFETY INJECTION, has been completed.

Procedure Steps, Step 1

If both SGs are faulted and the main steamlines are isolated, then the appropriate procedure is 1ECA-2.1, UNCONTROLLED DEPRESSURIZATION OF BOTH STEAM GENERATORS, since that procedure deals with controlling feed to faulted steam generators to stabilize and then cool down the plant. If the main steamlines are not isolated, then the appropriate transition is to 1E-2, FAULTED STEAM GENERATOR ISOLATION, which will isolate the steamlines and then check for a non-faulted steam generator.

Procedure Steps, Step 2

Pressure decreasing in an uncontrolled manner or a completely depressurized SG (near containment or atmospheric pressure) indicates failure of the secondary pressure boundary. If not already complete, isolation is to be done using 1E-2, FAULTED STEAM GENERATOR ISOLATION.

Procedure Steps, Step 3

Level increasing in an uncontrolled manner in either SG or high radiation in either SG indicates a failure of the primary to secondary pressure boundary. If no SG tubes are ruptured, then the appropriate procedure is either an 1E-1 or 1ECA-1 series procedure.

Procedure Steps, Step 4

In order to reach Step 4, a ruptured SG had to have been identified in Step 3. Thus, if any SG is ruptured, the appropriate procedure is an 1E-3 or 1ECA-3 series procedure.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

Caution

- *IF emergency coolant recirculation capability is restored, THEN further recovery actions should continue by returning to procedure and step in effect.*
- *IF suction source is lost to any SI, RHR, or containment spray pump, THEN the pump(s) should be stopped.*

1	**Check If Emergency Coolant Recirculation Equipment - AVAILABLE** • Safeguard systems power supply • Safeguard systems valve alignment	Attempt to restore at least one train.
2	**Add Makeup To RWST, As Necessary:** • Boric acid blender through SI-17-1 (located 715, near 11 VCT room) AND VC-11-59 (located in 11 VCT room) per C12.5, CVCS BORON CONCENTRATION CONTROL -OR-	Consult plant engineering staff for other sources of makeup to RWST.

This Step continued on the next page.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

(Step 2 continued from previous page)

- Spent fuel pit filter by performing the following line-up:

  a. Open SI-17-2 (located 755, near 11 RWST)

  b. Open SF-14-20 (located near Gas Analyzer)

  c. Close SF-14-6 (located in 121 SFP HX Room)

-OR-

- RCDT filter discharge by performing the following line-up:

  a. Open SI-23-1 (located 755, near 11 RWST)

  b. Open WL-27-2 (located in CVCS valve gallery)

  c. Close WL-27-1 (located in CVCS valve gallery)

  d. Close WL-27-3 (located in CVCS valve gallery)

-OR-

- Purification pump X-fer between units Per C16, SPENT FUEL COOLING SYSTEM

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
8	**Check Safeguard Pump Status:** • SI pumps - ANY RUNNING -OR- • RHR pumps - ANY RUNNING IN SI MODE	Go to Step 18
	Caution *IF offsite power is lost after SI reset, THEN manual action may be required to restart safeguard equipment.*	
9	**Reset SI**	
10	**Establish One Train Of SI Flow:**	
	a. SI pump - ONLY ONE RUNNING	a. Start or stop SI pumps to establish only one pump running.
	b. RCS pressure - LESS THAN 250 PSIG [550 PSIG]	b. Stop RHR pumps. Go to Step 11.
	c. RHR pump - ONLY ONE RUNNING	c. Start or stop RHR pumps to establish only one pump running.
11	**Verify No Backflow From RWST To Sump:**	
	a. Sump B valves - ANY OPEN	a. IF both Sump B valves closed, THEN go to Step 12.
	b. Valve from RWST to RHR pump in same train - CLOSED	b. Close valves.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
13	**Check If SI Can Be Terminated:**	
	a. Check RVLIS indication: • Full range - GREATER THAN 63% IF NO RCP RUNNING -OR- • Dynamic head range - GREATER THAN 42% IF ONE RCP RUNNING	a. Go to Step 18.
	b. RCS subcooling based on core exit T/Cs - GREATER THAN 70°F [85°F]	b. Establish minimum injection flow to remove decay heat. Perform the following: 1) Determine minimum injection flow required from Figure ECA11-1. 2) Establish minimum injection flow using SI, RHR, or charging pumps as necessary. 3) Go to Step 18.
14	**Reset Containment Isolation**	
15	**Establish Instrument Air To Containment**	
16	**Stop Safeguard Pumps:** • RHR pumps • SI pumps	

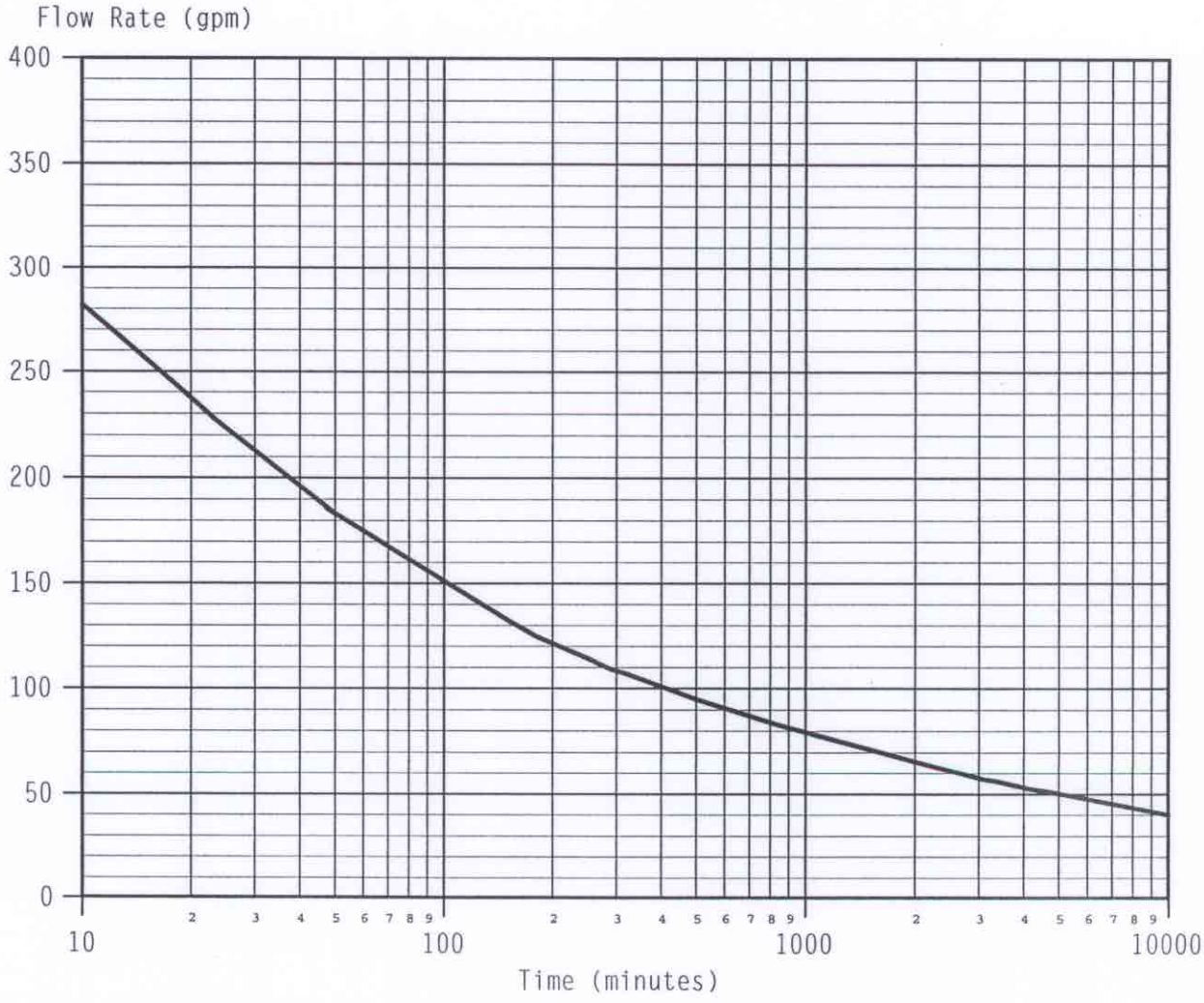

FIGURE ECA11-1. MINIMUM INJECTION FLOW RATE VERSUS TIME AFTER TRIP

BACKGROUND INFORMATION FOR

1ECA-1.1, LOSS OF EMERGENCY COOLANT RECIRCULATION

SUMMARY FOR 1ECA-1.1

The objective of this procedure is threefold: 1) to continue attempts to restore emergency coolant recirculation capability, 2) to delay depletion of the RWST by adding makeup fluid and reducing outflow, and 3) to depressurize the RCS to minimize break flow and cause SI accumulator injection.

BASIS FOR ACTIONS IN 1ECA-1.1

1st Caution Procedure Steps, Step 1

This caution instructs the operator to continue with procedure and step in effect for further recovery action if ECR capability is restored during the 1ECA-1.1 procedure.

2nd Caution Procedure Steps, Step 1

This caution warns the operator to stop any SI, RHR or spray pump if their suction source is lost to prevent damage to the pumps. Subsequent procedure steps attempt to delay depletion of the RWST volume and thus extend the time the pumps can use the RWST as their suction source. However, the operator should always be ready to stop operating pumps to prevent pump damage should the RWST empty.

Procedure Steps, Step 1

Failures or unavailability of RHR pumps and Sump B isolation valves are the most common reason for loss of ECR capability. This step instructs the operator to attempt to restore the equipment needed for emergency coolant recirculation. Equipment can be restored by various methods, such as pump breakers, local operation of valves or equipment repair.

Procedure Steps, Step 2

Makeup is added to the RWST to extend the time the RHR, SI and containment spray pumps (if operating) can take suction from the RWST and provide core cooling to the RCS. Typical methods are specified.

Caution Procedure Steps, Step 3

If CST level decreases below 10,000 gallons, inadequate suction pressure may result in AFW pump trip. An alternate suction source should be provided.

Procedure Steps, Step 3

In most cases, feed flow will exceed steam flow from the intact SG resulting in an accumulation of water in the SG. This excess feed flow will also result in a cooldown of the RCS at a rate dependent upon the feed flow rate and heat generation rate in the primary system. Consequently, feed flow must be adjusted to control SG level and RCS temperature. The minimum feed flow requirement satisfies the requirement of the Heat Sink Status Tree until level in at least one SG is restored.

Procedure Steps, Step 9

In order to realign safeguard equipment, a deliberate action must be taken to reset the SI signal. This deliberate action will extend to the subsequent stopping and/or realigning of equipment in future steps.

Procedure Steps, Step 10

This step instructs the operator to establish one train of injection flow which is one SI pump and one RHR pump, in order to delay RWST depletion.

Procedure Steps, Step 11

This step instructs the operator to verify that no backflow exists from the RWST to the sump. The operator is instructed to close the valves from the RWST to the RHR pumps as part of the switchover procedure to recirculation. This step therefore instructs the operators to verify the proper valve positions to ensure no backflow.

Caution Procedure Steps, Step 12

The potential for degradation in RCP seal performance and seal life increases with increasing temperature above 300°F. Hence, if seal cooling is lost for a significant period of time, seal or bearing damage may occur. The potential non-uniform sealing surfaces and seal crud blockage that may exist prior to RCP start can aggravate bearing and seal damage if the RCP is started. Following restoration of seal cooling, the RCP should not be started prior to a complete RCP status evaluation in order to minimize potential RCP damage on restart.

Procedure Steps, Step 12

Forced coolant flow is the preferred mode of operation to allow for normal RCS cooldown and provide PRZR spray. If RCPs had not been tripped, all but one are now stopped to minimize heat input to the RCS. The RCP started or left running will be used to provide normal PRZR spray. If no RCP is running, conditions stated in 1C3 AOP1, POST ACCIDENT START OF A RCP, are required before starting an RCP.

If all seal cooling has been lost long enough that the maximum RCP seal parameters identified in the RCP Vendor Manual have been exceeded, seal injection and CCW thermal barrier cooling should not be established to the affected RCP(s). Both of these methods of seal cooling could have unintended consequences that result in additional pump damage or the failure of plant safety systems. Seal cooling should instead be restored by cooling the RCS, which will reduce the temperature of the water flowing through the pump seals.

Depressurization of the RCS may generate a steam bubble in the upper head region of the reactor vessel if no RCP is running. This upper head void could rapidly condense during RCP startup, drawing liquid from the PRZR and reducing RCS subcooling. In addition, local flashing of reactor coolant could occur if RCS subcooling is not adequate.

RCP restart should be permitted if an RCS leak path is certain since the leak ensures that there will not be a significant pressure surge when the RCP is started.

Procedure Steps, Step 13

Following the reduction to one train of SI, RCS conditions may be within acceptable limits for SI termination to be allowed. The combination of a minimum subcooling and sufficient liquid level in the vessel to cover the core represents less restrictive SI termination criteria in this procedure because SI flow may prevent a subsequent reduction in RCS pressure and cause considerable depletion of the RWST.

The subcooling criterion will ensure subcooled conditions and the RVLIS indication ensures the existence of an adequate vessel inventory such that core cooling is ensured.

If the SI termination criteria are not satisfied, then SI is required to ensure core cooling and SI should not be terminated. If RVLIS indication is adequate but subcooling is not, the operator is then instructed to establish the minimum injection flow needed to match decay heat in order to further decrease injection flow and delay RWST depletion. This is done by aligning (if necessary) and operating RHR, SI or charging pumps such that the flow required to match decay heat is established. The injection flow needed to match decay heat is a function of time and is obtained from Figure ECA11-1.

Because flow through SI lines cannot be throttled and the exact flow rate per Figure ECA11-1 cannot be established, flow should be established equal to or greater than the requirement of Figure ECA11-1. It should be noted that Figure ECA11-1 is based on the 1979 ANS decay heat standard with no uncertainties, and assumes that the water reaching the core is saturated.

Procedure Steps, Step 14

This part of the automatic logic requires a deliberate operator action to remove the "close" signal. No valve will reposition upon actuation of the resets, but subsequent control actions will open the valves. These valves should remain closed, unless necessary process streams are being established, until the cause of the SI is determined or corrected.

Procedure Steps, Step 15

Instrument air to containment may have been isolated in the course of events. If so, this step restores instrument air to containment in preparation for operating air-operated valves in containment.

Procedure Steps, Step 16

Satisfaction of conditions for SI termination implies that control can be maintained by the operator without all of the ECCS pumps running. In this step RHR and SI pumps are stopped.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
28	**Depressurize Intact SG(s) To RCS Pressure:**	
	a. RCS pressure - LESS THAN INTACT SG(s) PRESSURE	a. Go to Step 29.
	b. Sample both SGs for radioactivity levels	
	c. Request a dose projection for steaming SGs from plant engineering staff	
	d. Dose projection for each SG - ACCEPTABLE	d. Do NOT dump steam from a SG with an unacceptable dose projection.
	e. Check one condensate pump - RUNNING	e. Start one condensate pump.
	f. Dump steam to condenser from intact SG(s) until SG pressure less than RCS pressure	f. Dump steam using intact SG(s) PORV until SG pressure less than RCS pressure.
29	**Determine If Reactor Vessel Head Should Be Vented - CONSULT PLANT ENGINEERING STAFF**	
30	**Evaluate Long Term Plant Status**	

-END-

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
22	Check Loop A And Loop B Cooling Water Pressures - GREATER THAN 65 PSIG	Initiate C35 AOP1, LOSS OF PUMPING CAPACITY OR SUPPLY HEADER WITH SI. Continue with Step 23.
23	Notify TSC To Monitor Long Term RHR Operation	
24	Return To Procedure And Step In Effect	

-END-

Procedure Steps, Step 23

Recirculation flow to the RCS must be maintained at all times. This step establishes long term monitoring by TSC personnel. RHR system parameters such as RHR pump suction pressure, discharge pressure, motor current, vibration, and flow should be monitored for any indication of flow degradation. Flow degradation could occur over a long time period due to debris accumulating in Sump B or the RHR heat exchanger. If degradation is detected, then appropriate actions, such as flow reductions or swapping ECCS trains, should be developed.

Procedure Steps, Step 24

The operator is directed to return to the procedure in effect following the completion of this procedure.