A. PURPOSE

The purpose of this guideline is to attempt to restore emergency coolant recirculation capability, to delay depletion of the RWST by adding makeup fluid and reducing outflow, and to depressurize the RCS to minimize break flow.

B. SYMPTOMS

Following are symptoms of loss of emergency coolant recirculation capability:

1. Loss of both sump recirculation isolation valves

2. Loss of both low-head SI pumps

3. Inadequate sump fluid inventory

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

Caution

- *When minimum acceptable emergency coolant recirculation capability, which is the ability to inject fluid from the sump to the RCS from one low-head SI pump, is restored, return to guideline in effect.*
- *Stop SI and spray pumps if suction source is lost.*

1	**Continue Attempts to Restore Emergency Coolant Recirculation Equipment**	
2	**Add Makeup to RWST:**	
	a. [Enter plant specific means.]	
3	**Compare RCS and Steam Generator Pressures:**	
	a. RCS pressure - GREATER THAN OR EQUAL TO STEAM GENERATOR PRESSURES	a. IF RCS pressure less than steam generator pressures, THEN go to Step 5.
4	**Maintain RCS Heat Removal:**	
	a. Dump steam to condenser 1) [Enter plant specific steps.]	a. IF condenser NOT available, THEN use steam generator PORVs.
5	**Verify Containment Fan Coolers Running:**	
	a. Fan cooler indicator lights - LIT	a. Manually start fan coolers.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
6	**Check RWST Level:**	
	a. RWST level - GREATER THAN (1)	a. IF RWST level is less than (1), THEN go to Step 21.
7	**Reset Containment Spray Signal**	
8	**Check Containment Spray System:**	
	a. Spray pumps - RUNNING	a. IF pumps NOT running, THEN go to Step 10.
	b. Containment pressure - LESS THAN (2) PSIA	b. IF pressure high, THEN go to Step 9.
	c. Stop all spray pumps and place in standby [Enter plant specific steps.]	
	d. Go to Step 10	
9	**Establish Containment Heat Removal Using Fan Coolers:**	
	a. All fan coolers - RUNNING	a. IF at least (3) fan coolers running, THEN maintain one spray pump operating. IF less than (3) fan coolers running, THEN maintain two spray pumps operating. Go to Step 10.
	b. Stop all spray pumps and place in standby [Enter plant specific steps.]	

(1) Enter plant specific value corresponding to RWST empty alarm in plant specific units.
(2) Enter plant specific Hi-3 pressure setpoint.
(3) Enter number of fan coolers corresponding to the heat removal capability of one containment spray pump for the plant design basis.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
10	**Reset SI**	
11	**Check RWST Level:**	
	a. RWST level - LESS THAN (1)	a. IF RWST level greater than (1), THEN go to Step 14.
12	**Verify No Backflow from RWST to Sump:**	
	a. Sump recirculation valves - OPEN	a. IF sump recirculation valves closed, THEN go to Step 13.
	b. Valves from RWST to low - head SI pumps - CLOSED	b. Manually close valves.
13	**Establish SI Flow to Match Decay Heat:** **[RWST Level Less Than (1)]**	
	a. Suction of one high-head SI and one charging/SI pump - ALIGNED TO RWST	a. Align suction of one high - head SI and one charging/SI pump to RWST.
	b. Operate SI pumps to establish minimum SI flow (2)	
	c. Go to Step 15.	

(1) Enter plant specific value corresponding to RWST switchover alarm in plant specific units.
(2) Enter plant specific value corresponding to flow obtained from background document.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
14	**Establish One Train of SI Flow:** **[RWST Level Greater than (1)]**	
	a. One charging/SI pump - RUNNING	a. Operate charging/SI pumps as necessary.
	b. One high-head SI pump - RUNNING	b. Operate high-head SI pumps as necessary.
	c. RCS pressure - EQUAL TO OR LESS THAN (2) PSIG	c. IF RCS pressure high, THEN stop low-head SI pumps and go to Step 15.
	d. One low-head SI pump - RUNNING	d. Operate low-head SI pumps as necessary.
15	**Verify SI Flow Increase NOT Required:**	
	a. RVLIS narrow range indication - GREATER THAN (3)	a. Increase SI flow to maintain RVLIS narrow range indication greater than (3).
	b. Core exit TCs - STABLE OR DECREASING	b. Increase SI flow to maintain TCs stable or decreasing.

(1) Enter plant specific value corresponding to RWST switchover alarm in plant specific units.
(2) Enter plant specific shutoff head pressure of low-head SI pumps.
(3) Enter plant specific value which is top of core plus instrument uncertainties.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
16	**Check Containment Spray System:**	
	a. Spray pumps - RUNNING	a. IF pumps NOT running, THEN go to Step 20.
	b. Containment pressure - LESS THAN (1) PSIA	b. IF pressure high, THEN go to Step 17.
	c. Stop spray pumps and place in standby	
	d. Go to Step 20	
17	**Check Alternate Spray Source:**	
	a. Alternate spray source - AVAILABLE	a. IF alternate spray source NOT available, THEN go to Step 18.
	1) [Enter plant specific means]	
	b. Align/maintain alternate spray source	
	c. Go to Step 20	
18	**Check RWST Level:**	
	A. RWST level - LESS THAN (2)	a. If RWST level greater than (2), THEN perform actions of any other guideline in effect until (2) is reached, THEN return to Step 12.

(1) Enter plant specific Hi-3 pressure setpoint.
(2) Enter plant specific value corresponding to RWST switchover alarm in plant specific units.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
19	**Check Containment Spray System:**	
	a. Containment Pressure - LESS THAN (1) PSIA	a. Operate spray pumps to maintain pressure less than (1) psia and go to Step 20.
	b. At least (2) fan cooler indicator lights - LIT	b. Operate one spray pump and go to Step 20.
	c. Stop all spray pumps and place in standby [Enter plant specific steps]	
20	**Check RWST Level:**	
	a. RWST level - LESS THAN (3)	a. IF RWST level greater than (3), THEN continue with attempts to restore emergency coolant recirculation and return to Step 11.
21	**Stop Pumps Taking Suction from RWST and Place in Standby:**	
	a. Low-head SI pumps	
	b. High-head SI pumps	
	c. Charging/SI pumps	
	d. Containment spray pumps	

(1) Enter plant specific containment design pressure.
(2) Enter number of fan coolers required to maintain pressure below containment design pressure.
(3) Enter plant specific value corresponding to RWST empty alarm in plant specific units.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
22	**Add Makeup to RCS from Alternate Source:**	
	a. [Enter plant specific means.]	
23	**Decrease Steam Generator Pressure to (1) PSIG:**	
	a. Maintain cooldown rate - LESS THAN 100°F/HR	
	b. Dump steam to condenser	b. Dump steam with steam generator PORVs. IF steam generator PORVs NOT available, THEN dump steam by [other plant specific means].
	1) [Enter plant specific steps]	
24	**Slowly Decrease Steam Generator Pressure to (2) PSIG:**	
	a. Dump steam to condenser	a. Dump steam with steam generator PORVs. IF steam generator PORVs NOT available, THEN dump steam by [other plant specific means].
	1) [Enter plant specific steps.]	

(1) Enter plant specific value slightly above normal accumulator pressure.
(2) Enter plant specific value which is 200 PSIG plus instrument uncertainties.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
25	**Isolate All Accumulators:**	
	a. Close all accumulator isolation valves	a. Vent all unisolated accumulators to (1) psig. DO NOT proceed until the venting is completed.
26	**Check If RCPs Must Be Stopped:**	
	a. At least one RCP-RUNNING	a. IF no RCPs running, THEN go to Step 27.
	b. No. 1 seal differential pressure - LESS THAN (2) PSIG - OR- No. 1 seal leak-off flow - LESS THAN (2) GPM	b. Do not stop RCPs Go to Step 27.
	c. Stop all RCPs	
27	**Initiate Depressurization of Steam Generators to Atmospheric Pressure:**	
	a. Maintain cooldown rate - LESS THAN 100°F/HR	
	b. Dump steam to condenser	b. Dump steam with steam generator PORVs. IF steam generator PORVs NOT available, THEN dump steam by [other plant specific means].
	1) [Enter plant specific steps]	

(1) Enter value such that injection of accumulator water from this pressure will not result in nitrogen injection at low RCS pressure.
(2) Enter plant specific minimum value for continued RCP operation.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
28	**Check RHR System Availability:**	
	a. [Enter plant specific list]	a. IF RHR System NOT available, THEN continue attempts to restore emergency coolant recirculation and go to Step 30.
29	**Check if RHR System Should Be Placed in Service:**	
	a. RCS hot leg temperature - LESS THAN 350°F	a. IF greater than 350°F, THEN return to Step 27.
	b. RCS pressure - LESS THAN 400 PSIG	b. IF greater than 400 psig, THEN return to Step 27.
	c. Place one train of RHR System in service per [Enter plant specific procedure.]	
30	**Maintain RCS Heat Removal:**	
	a. Continue RHR system operation - OR-	
	b. Dump steam to condenser	b. Dump steam with steam generator PORVs. IF steam generator PORVs NOT available, THEN dump steam by [other plant specific means].
	1) [Enter plant specific steps]	
31	**Maintain Makeup to RCS from Alternate Source:**	
	a. [Enter plant specific means]	
32	**Consult TSC for Further Actions**	

— END —

BACKGROUND INFORMATION

FOR

WESTINGHOUSE

EMERGENCY RESPONSE GUIDELINES

ECA-5

LOSS OF EMERGENCY COOLANT RECIRCULATION

REVISION: HP-BASIC

November 1, 1982

I. INTRODUCTION

The "Loss of Emergency Coolant Recirculation (ECR) guideline", ECA-5 has been developed as an Emergency Contingency Action (ECA), and it provides procedural guidance when emergency coolant recirculation capability is lost. Loss of emergency recirculation capability is defined as the loss of the ability to provide the recirculation function following a LOCA; i.e., the loss of the ability to inject fluid from the sump to the RCS from one low-head SI pump.

The objective of the loss of ECR guideline 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.

As noted in Volume I, Tab 7, the Emergency Response Guidelines are written to the greatest extent possible to be generic and applicable to all Westinghouse-designed plants. However, when certain areas of guidelines require a more precise definition of specific features of a plant design, the Westinghouse standard 4 loop, 3425 MWt plant design is used. A brief description of the relevant systems comprising this reference design are contained in Volume I, Tab 7.

For the Loss of Emergency Coolant Recirculation guideline, the following specific design features of the reference plant design are important to note since certain steps in this guideline have been written based upon these design features:

- The reference design uses <u>both</u> containment sprary pumps and containment fan coolers for containment heat removal subsequent to an accident. The design basis containment heat removal capability is accomplished by certain combinations of spray pumps and fan coolers, which is described in the affected steps.

- In the SIS of the reference plant design, the sump recirculation isolation valves open automatically upon a coincident low level (switchover setpoint) in the RWST and an "S" signal.

- Also, in the SIS design of the reference plant, separate and distinct piping and valving exist between the containment sump and the suction of the containment spray pumps. This piping and valving is completely separate from that which connects the containment sump to the suction of the residual heat removal pumps.

These design features of the reference plant design are discussed in detail under the specific steps in Section IV, "Discussion of Specific Guideline Steps, Notes and Cautions".

II. EVENT DESCRIPTION

Loss of emergency loss recirculation capability is defined as the loss of the ability to inject fluid from the sump to the RCS from one low-head SI pump. The Loss of ECR guideline can be entered at three distinct times subsequent to a LOCA. First, during the injection phase of the LOCA before the RWST switchover alarm setpoint is reached. Second, during the actual switchover from the injection phase to the cold leg recirculation phase when the RWST level is below the switchover alarm setpoint but above the empty alarm setpoint. Third, when the plant is already in the cold or hot recirculation phase and the RWST is empty. The determination of loss of the emergency coolant recirculation capability and thus entry to this guideline is most probable to occur during the actual switchover from the injection phase to cold leg recirculation phase. At this time, the operator would be most likely to detect a loss of recirculation capability.

The following symptoms or indications of loss of emergency coolant recirculation capability, which could occur during any one of the three above described periods, are:

1. Loss of both sump recirculation isolation valves

2. Loss of both low-head SI pumps, or

3. Inadequate sump fluid inventory

Explicit transitions to the Loss of ECR guideline will be included in E-1, "Loss of Reactor Coolant", ES-1.3, "Transfer to Cold Leg Recirculation Following Loss of Reactor Coolant", and ES-2.2, "Transfer to Cold Leg Recirculation Following Loss of Secondary Coolant".

III. RECOVERY DESCRIPTION

This guideline presents procedural steps to be performed upon the loss of emergency coolant recirculation capability. A high level summary of the actions taken in this guideline are:

1. Continue attempts to restore ECR

2. Add makeup to RWST

3. Start all fan coolers

4. Reduce to minimum containment heat removal (pressure < Hi-3)

5. Reduce SI flow to one train (RWST level < switchover)

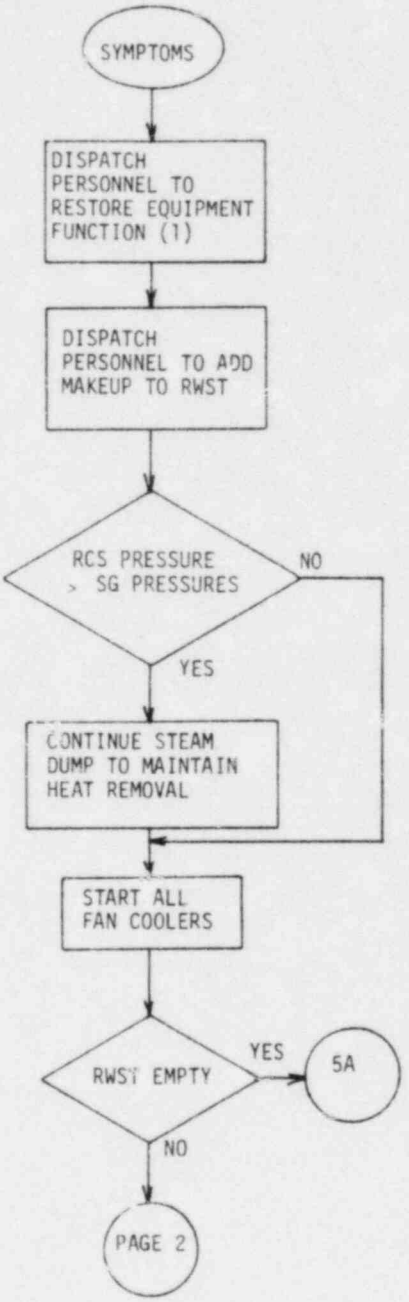
6. Reduce SI flow to match decay heat (RWST level < switchover)

7. Reduce to minimum containment heat removal (pressure < design and RWST level < switchover)

8. When RWST is empty

    a. Add makeup to RCS
    b. Inject accumulators
    c. RHRS operation
    d. Depressurize RCS to atmospheric
    e. Maintain makeup to RCS

The following block diagram provides the logic for this guidelines.



(1) EXAMPLES: CLOSE BREAKERS, LOCAL VALVE OPERATION, ETC.

FIGURE 1
(PAGE 2 OF 6)

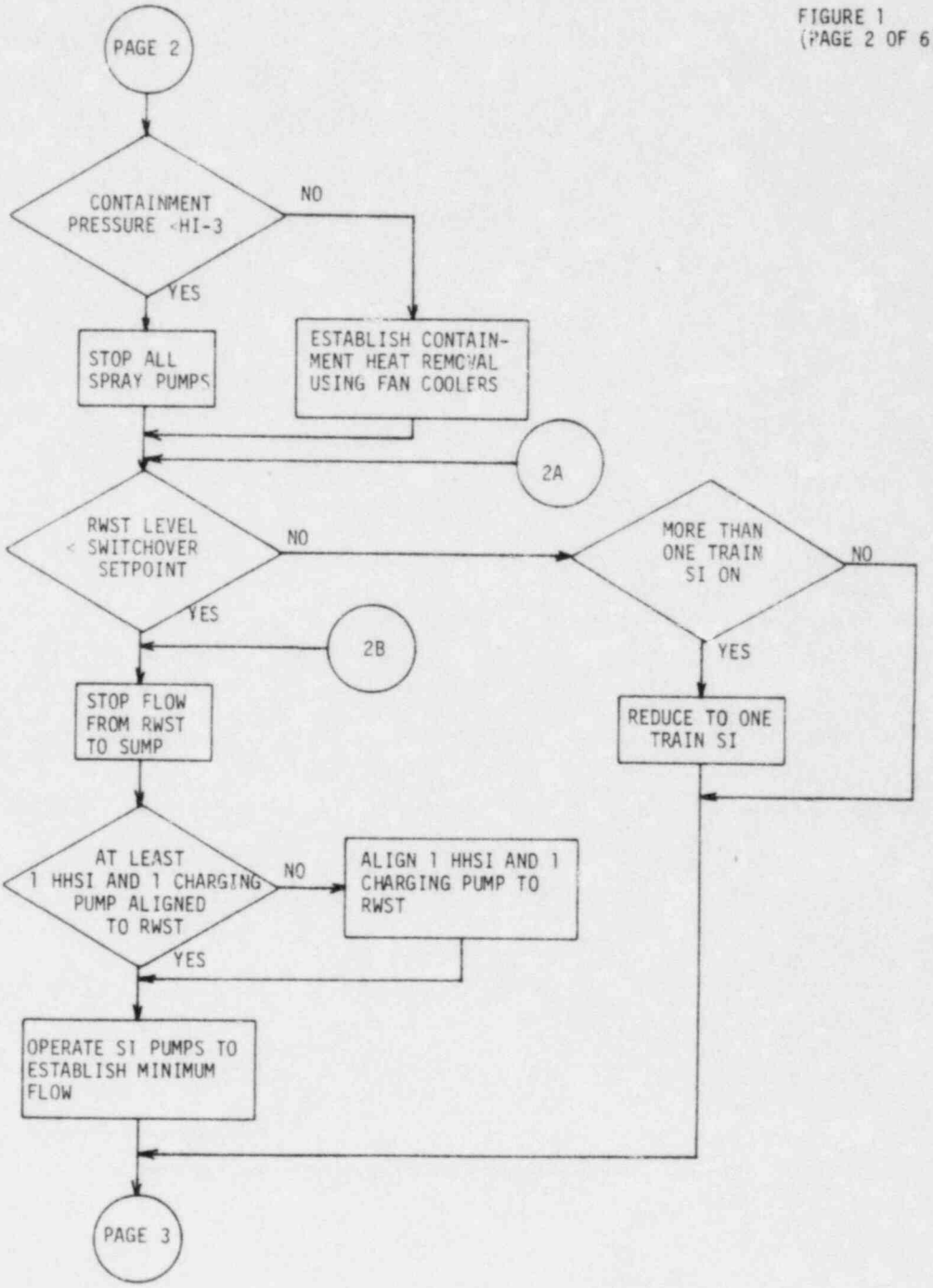
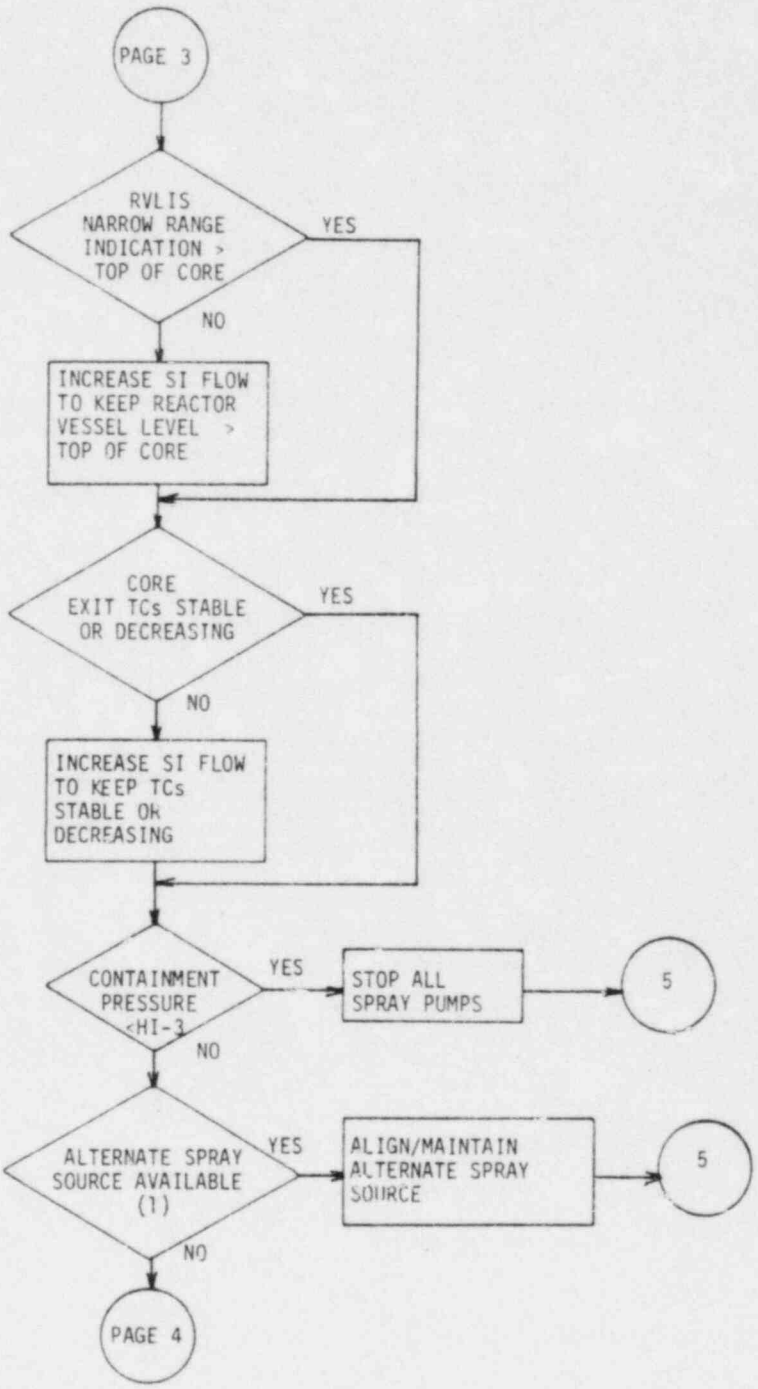
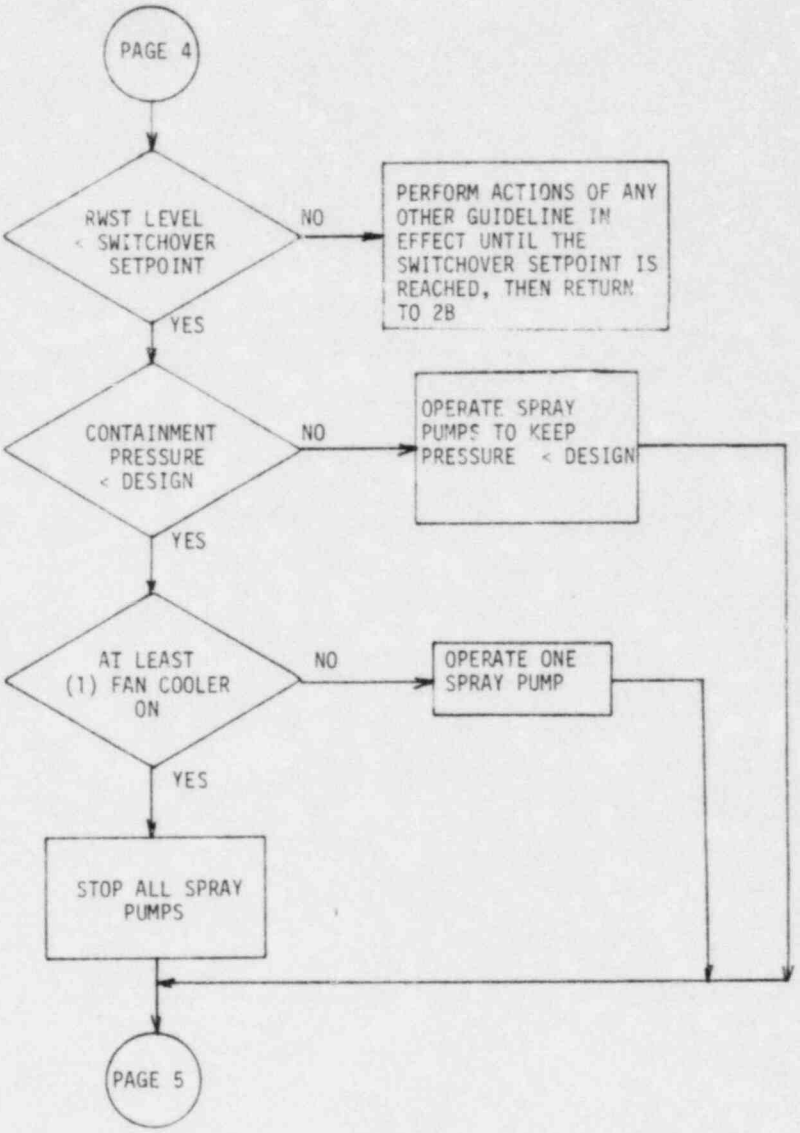


FIGURE 1
(PAGE 3 OF 6)



(1) SUBCOOLED WATER IN SUMP, VALVES OPERABLE, ETC.

FIGURE 1
(PAGE 4 OF 6)



(1) NUMBER OF FAN COOLERS REQUIRED TO MAINTAIN PRESSURE BELOW CONTAINMENT DESIGN PRESSURE.

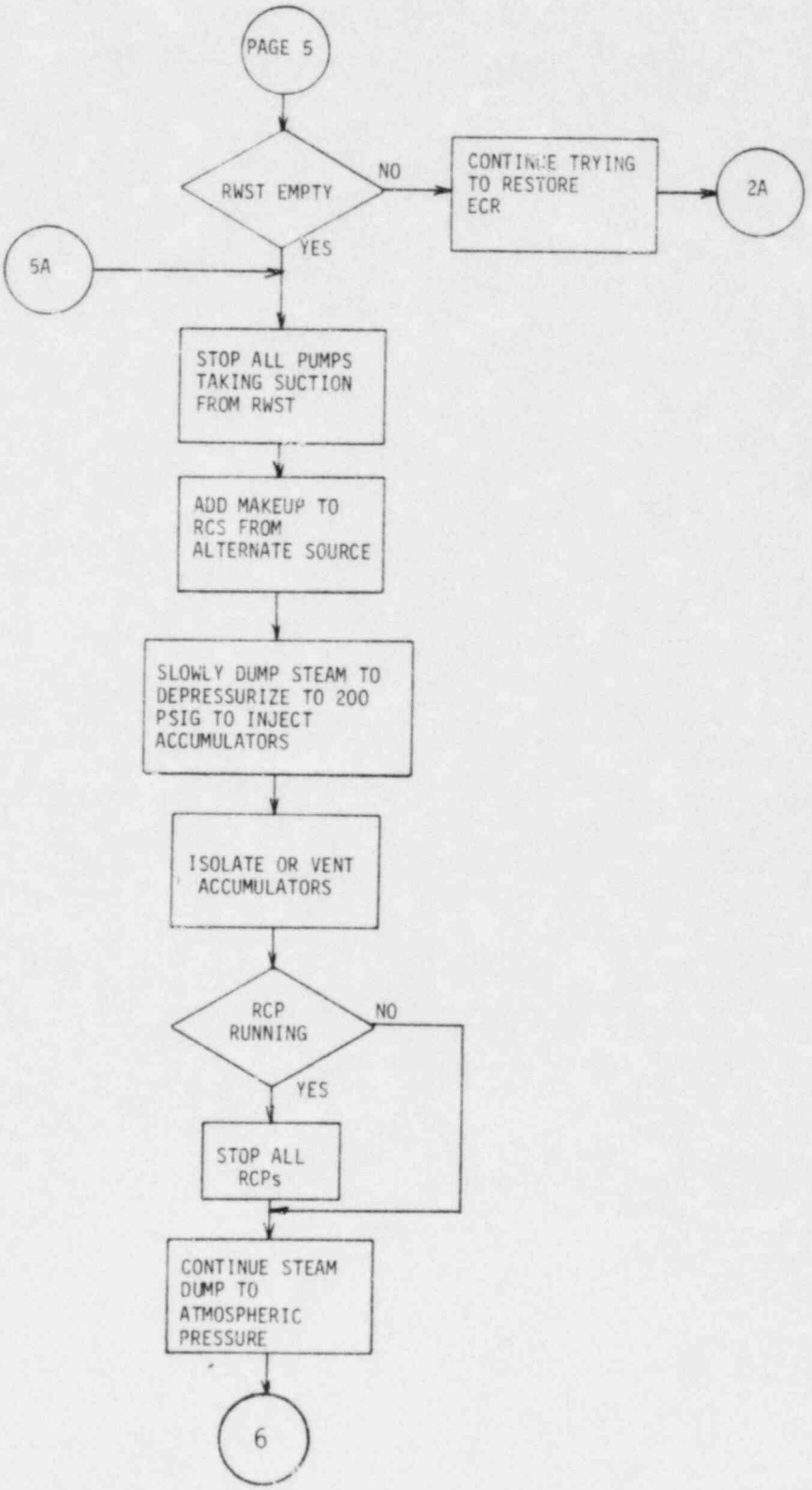
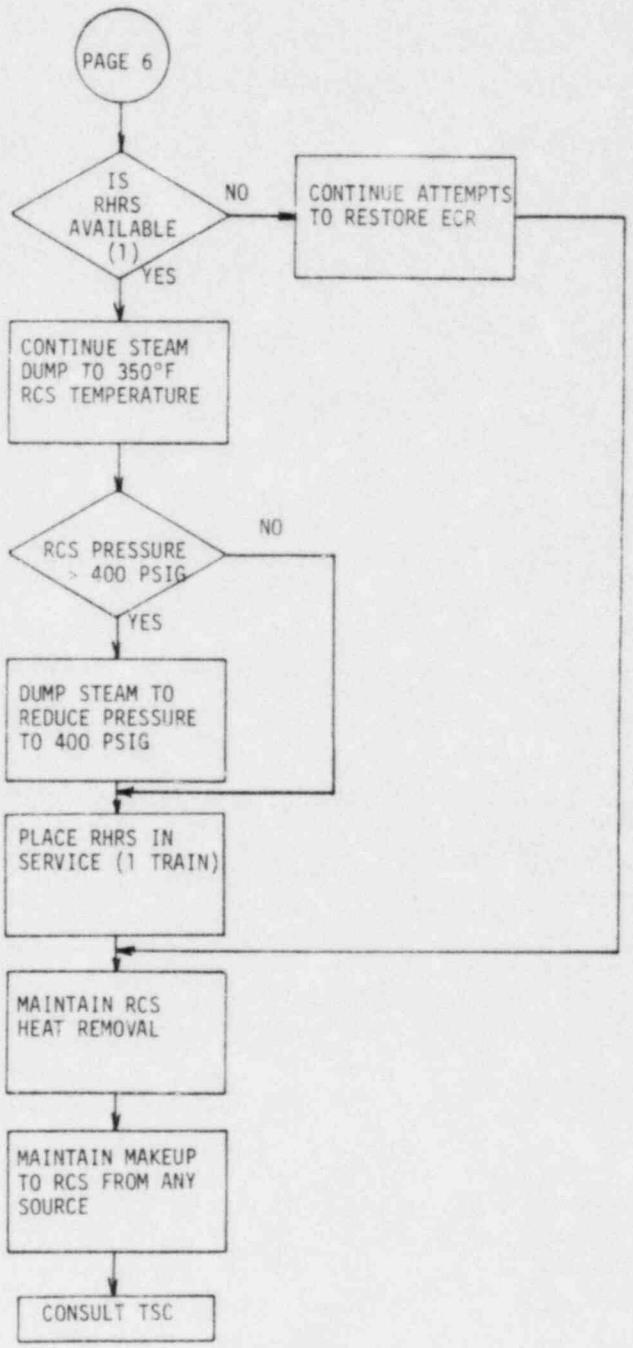

PAGE 5
RWST EMPTY
NO
CONTINUE TRYING TO RESTORE ECR
2A
YES
5A
STOP ALL PUMPS TAKING SUCTION FROM RWST
ADD MAKEUP TO RCS FROM ALTERNATE SOURCE
SLOWLY DUMP STEAM TO DEPRESSURIZE TO 200 PSIG TO INJECT ACCUMULATORS
ISOLATE OR VENT ACCUMULATORS
RCP RUNNING
NO
YES
STOP ALL RCPs
CONTINUE STEAM DUMP TO ATMOSPHERIC PRESSURE
6

FIGURE 1
(PAGE 6 OF 6)



(1) INCLUDES CONSIDERATION OF EQUIPMENT AVAILABILITY, RCS INVENTORY, RHR VALVES OPERABLE, ETC.

First Caution Preceding Step 1

This caution instructs the operator to return to the guideline in effect when minimum acceptable emergency coolant recirculation capability is restored. Minimum acceptable emergency coolant recirculation capability is defined as the ability to inject fluid from the sump to the RCS from at least one low-head SI pump.

Second Caution Preceding Step 1

This caution warns the operator to stop all SI pumps and spray pumps if their suction source is lost to prevent damage to the pumps. Subsequent guideline 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 should the RWST empty to prevent pump damage.

STEP 1

This step instructs the operator to continue attempts to restore equipment needed for emergency coolant recirculation. Equipment can be restored by various methods, such as inserting pump breakers, local operation of valves or equipment repair.

STEP 2

This step instructs the operator to add makeup to the RWST. Makeup is added to the RWST to extend the time the SI pumps and containment spray pumps (if operating) can take suction from the RWST and provide core cooling to the RCS. The means of adding makeup fluid to the RWST depends on the plant specific design. Typical methods could include the use of the Reactor Makeup Water Control System or the Spent Fuel Pit Cooling System.

STEPS 3 and 4

These steps instruct the operator to compare the RCS and steam generator pressures and to dump steam to the condenser to maintain RCS heat removal if required. RCS heat removal is only required when the RCS pressure is greater than the steam generator pressures, since in this case which is a small LOCA the break itself may be too small to remove all of the decay heat. Therefore, the decay heat removal from the break is supplemented by dumping steam to the condenser. If the condenser is not available, the steam generator PORVs should be used. If RCS pressure is less than the steam generator pressures RCS heat removal is not required and the operator is instructed to go to step 5.

STEP 5

This step instructs the operator to verify that all containment fan coolers are operating. If the containment fan coolers are not running, the operator should manually start the fan coolers. This step applies to both normal and emergency fan coolers; i.e., those used during normal plant operation and those designed to function after a LOCA. The intent of this step is to provide containment heat removal capability using containment fan coolers and therefore containment spray pumps can be stopped in future steps.

STEP 6

This step instructs the operator to check RWST level to determine if the RWST is empty. If the RWST is not empty, the operator proceeds. However, if the RWST is empty, the operator is instructed to skip to step 21. Steps 7 through 20 are concerned with minimizing the RWST outflow, and therefore extending the time that fluid for core cooling is provided by the RWST. This is accomplished by stopping the containment spray pumps and decreasing the SI pump flowrate.

STEP 7

This step instructs the operator to reset the containment spray signal so that the automatic actuation signal for containment spray is blocked. This allows the containment spray pumps to be stopped in subsequent steps if required.

STEP 8

This step instructs the operator to stop the containment spray pumps (if they are running) if the containment pressure is less than the Hi-3 pressure setpoint. The purpose of the step is to stop the spray pumps from depleting the RWST by stopping the pumps.

STEP 9

This step instructs the operator to establish containment heat removal using the fan coolers. This is only required if the containment pressure is above the Hi-3 pressure setpoint as determined by the previous step. This step applies to those plants in which the design uses both emergency fan coolers and containment spray pumps for heat removal under accident conditions (reference plant design). The intent of this step is to establish containment heat removal with the emergency fan coolers thereby allowing the containment spray pumps to be stopped. For the reference plant design, any one of the following combinations of emergency fan coolers and spray pumps provides the design basis heat removal capability:

1) 4 fan coolers and 0 spray pumps,
2) 2 fan coolers and 1 spray pump, or
3) 0 fan coolers and 2 spray pumps

Therefore, depending upon the number of emergency fan coolers operating, the spray pumps can be stopped, and thus the depletion of the RWST by the spray pumps is eliminated.

STEP 10

This step instructs the operator to reset SI so that the automatic SI actuation signal is blocked. This action allows the operator to stop SI pumps in future steps.

STEP 11

This step instructs the operator to check RWST level to determine if level is less than the switchover alarm setpoint. The RWST level is quite important in the loss of ECR guideline since different subsequent actions are taken depending on the RWST level. The RWST level corresponding to the switchover alarm setpoint is used in the Loss of ECR guideline as a reference point. The design basis values for the SI flow and the containment heat removal (via containment fan coolers and containment spray pumps) are maintained when the RWST level is above the RWST switchover volume. However, in the Loss of ECR guideline, the operator is directly to decrease SI flow and containment heat removal below design basis values when the RWST level falls below the switchover alarm setpoint. The operator proceeds to Step 12 (RWST level < switchover setpoint and to Step 14 (RWST level > switchover setpoint).

STEP 12

This step instructs the operator to verify that no backflow exists from the RWST to the sump. On the RWST low level (switchover setpoint volume) coincident with a "S" signal, the sump recirculation valves automatically open (reference plant design). At this point the valves from the RWST to the low-head SI pums and the sump recirculation valves are simultaneously open and backflow from the RWST to the sump may exist depending on the relative elevations. The operator is instructed to close the valves from the RWST to the low-head SI pumps as part of the switchover procedure to cold leg recirculation. This step therefore instructs the operator to verify the proper valve positions to ensure no backflow.

STEP 13

This step instructs the operator to establish the SI flow needed to match decay heat. This amount of SI flow is established when the RWST level is below the switchover alarm setpoint. This is done by aligning (if necessary) and operating the appropriate charging/high-head SI pumps such that the flow required to match decay heat is established. The SI flow needed to match decay heat is a function of time and is obtained from Figure 2. Note that no throttling capability is provided for the charging or high-head SI pumps, therefore, the flow obtained from starting/stopping the charging/high-head SI pumps will match or probably exceed the decay heat flow required. The purpose of this step is to decrease SI pump flow to delay RWST depletion.

STEP 14

This step instructs the operator to establish one train of SI flow, which is one charging/SI, one high-head SI and one low-head SI pump for the standard Westinghouse 412 ECCS system design (reference plant design). This amount of SI flow is established by this step when the RWST level is above the switchover alarm setpoint and thus the design basis SI flow to the RCS is maintained. The purpose of this step is to reduce SI pump flow (if needed) to delay RWST depletion.

The quantified benefit of reducing SI flow in steps 13 and 14 is illustrated below in terms of time available for RWST switchover. These times are typical and are computed for the reference 4-loop plant.

- 12 minutes - Based on maximum safeguards flow
- 17 minutes - Based on minimum safeguards flow
- 150 minutes - Based on decay heat flow

STEP 15

This step instructs the operator to verify a SI flow increase is not required by verifying proper reactor vessel level (top of the core) and core exit TCs are stable or decreasing. The purpose of the step is to assure that the SI flow reduction performed in the two prior steps was done properly; i.e., if the SI flow is now inadequate, it will be detected in this step.

When entering the Loss of ECR guideline, the RCPs may or may not be running. However, it is much more likely that they are not operating. If the RCPs are running this step will not be very useful in detecting inadequate SI flow, based upon the parameters being used (reactor vessel level and core exit temperatures). However, for the expected case (RCPs not running), this step will be useful in detecting potential inadequate SI flow.

STEP 16

This step instructs the operator to stop the containment spray pumps (if they are running) if the containment pressure is less than the Hi-3 pressure setpoint. Again, the purpose of this step is to stop the containment spray pumps from depleting the RWST by stopping the pumps.

STEP 17

This step instructs the operator to align the containment spray pumps to an alternate source. The primary alternate source would be alignment of the spray pumps to the sump by one of two typical flow paths: 1) a separate line from the sump directly to the suction of the spray pumps (reference plant design), or 2) a common line from the sump to the suction of the spray pumps and low-head SI pumps, which assumes this flow path via the sump recirculation valves is available (plant designs other than the reference plant design). Again, the purpose of this step is to stop the containment spray pumps from depleting the RWST.

STEP 18

This step checks the RWST level to determine if the level is below the switchover alarm setpoint. If the RWST level is below the switchover alarm setpoint, the operator performs the next step which deals with stopping the containing spray pumps. If the RWST level is above the switchover alarm setpoint, the operator is instructed to return to Step 12 when the RWST switchover alarm setpoint is reached. The purpose of returning to step 12 is to reduce SI flow to match decay heat when the switchover alarm setpoint is reached.

STEP 19

This step instructs the operator to check the containment spray system to determine if the containment spray pumps can be stopped using a best estimate instead of design basis containment heat removal criteria. As noted previously, this non-design basis criteria applies in this step since the RWST level is below the switchover alarm setpoint. This criteria deviates from the design basis containment heat removal criteria in two ways. First, the pressure now used is the containment design pressure instead of the Hi-3 pressure setpoint (design basis). Second, a "best estimate" calculation was used to determine the required containment heat removal capability. For the reference plant design, based upon this best estimate calculation either three fan coolers or one spray pump will maintain pressure below the containment design pressure.

STEP 20

This step istructs the operator to check the RWST level to determine if the RWST is empty. When the RWST is empty, the operator proceeds to the next step to stop all pumps taking suction from the RWST. If the RWST is not empty, the operator is instructed to continue with attempts to restore ECR and return to Step 11.

STEP 21

In this step all pumps still taking suction from the RWST are stopped since the RWST is now empty.

STEP 22

This step instructs the operator to add makeup to the RCS from an alternate souce. At this point in the Loss of ECR guideline, no SI flow is being delivered to the RCS since the RWST is now empty and the emergency coolant recirculation capability is lost. Under these conditions the decay heat generated in the core will convert the liquid into steam which will exit the break in the RCS. Therefore, the operator should provide makeup from any alternate source, which depends on the plant specific design. A typical alternate source of makeup would be providing fluid from the Reactor Makeup Water Control System using the centrifugal charging pumps and the normal charging line.

STEPS 23, 24 and 25

These steps instruct the operator to decrease the steam generator pressures (and therefore RCS pressure) to inject the accumulator fluid and then isolate or vent the accumulators after they have been emptied. The RCS is first depressurized at the maximum allowable cooldown rate ($100^{o}F/HR$) to a pressure slightly above the normal accumulator pressure. Then, the RCS pressure is decreased slowly to 200 psig so that the accumulators will inject slowly into the RCS. Finally, either the accumulator discharge isolation valves are closed or the accumulators are vented to prevent the injection of nitrogen gas to the RCS.

Pressure is decreased by dumping steam to the condenser or by using the PORVs. If the condenser and PORVs are <u>not</u> available, the operator is instructed to use any plant specific means of removing water or steam from the steam generators. This could include opening the blowdown lines or allowing the steam driven AFW pump to run at maximum speed.

STEP 26

This step instructs the operator to check if RCPs (if running) must be stopped. As mentioned previously, it is very unlikely that the RCPs will be running when entering the Loss of ECR guideline. However, if the pumps are running, this step provides crtieria (No. 1 seal ΔP and leakoff flow) to check to determine if the RCPs must be stopped. Since the RCS was depressurized to 200 psig in the previous step, the RCPs will probably be required to be stopped in this step.

STEP 27

This step instructs the operator to initiate decreasing steam generator pressures (and therefore RCS pressure) to atmospheric pressure. Decreasing steam generator pressures will result in also decreasing the RCS pressure and temperature. The purpose of this step is twofold. First, RCS pressure and temperature are decreased to RHR system conditions. Second, steam generator pressures (and thus RCS pressure) is decreased to atmospheric pressure to decrease break flow. At this time in the guideline with no SI flow to the RCS and assuming the LOCA is a stuck open PORV (break is at a high RCS elevation), calculations show that the time to core uncovery is increased to one day or more by depressurizing the RCS to atmospheric pressure. For lower elevation RCS breaks (e.g., cold leg break), the time to core uncovery is also increased by depressurizing the RCS to atmospheric pressure.

STEPS 28 and 29

These steps instruct the operator to check on RHRS availability and place one train of the RHRS in operation when the RCS pressure and temperature are 400 psig and 350^{o}F, respectively. Only one train of RHR is placed in service to preserve the second train of RHR equipment. RHR system availability includes equipment needed for RHR operation (RHR suction valves, RHR pumps, etc.) and adequate liquid inventory in the RCS to preclude steam entering the RHR pump suction.

STEP 30

This step instructs the operator to maintain RCS heat removal either by continued RHR system operation (if available) or by dumping steam, since at this time no SI flow is being provided to the RCS.

STEP 31

This step instructs the operator to maintain makeup to the RCS from an alternate source. This step is a continuation and reinforcement of Step 22.

STEP 32

This step instructs the operator to consult the Technical Support Center for further actions since at this time no other appropriate guideline can be provided.

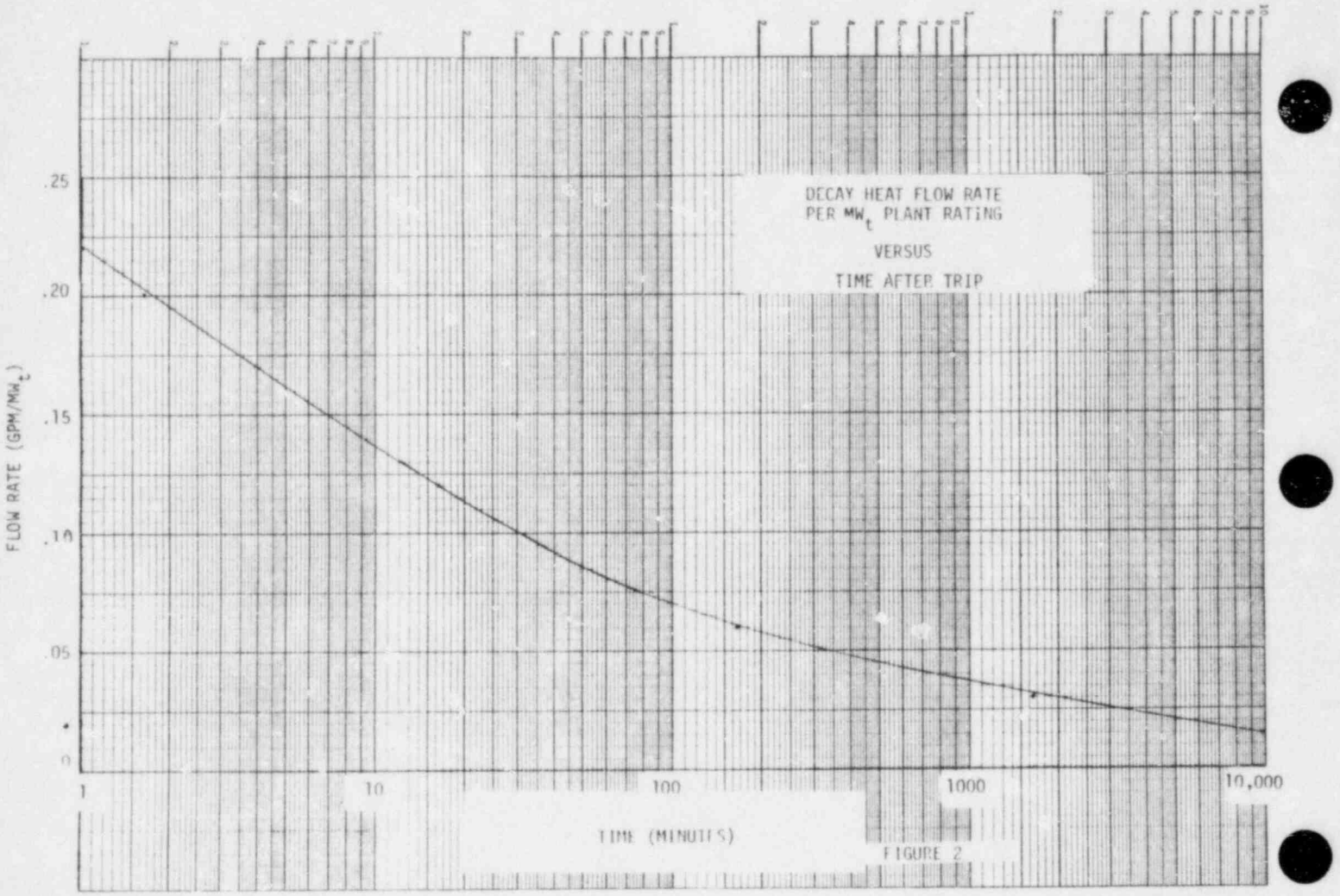

DECAY HEAT FLOW RATE
PER MW$_t$ PLANT RATING
VERSUS
TIME AFTER TRIP
FLOW RATE (GPM/MW$_t$)
.25
.20
.15
.10
.05
0
1
10
100
1000
10,000
TIME (MINUTES)

FIGURE 2

WESTINGHOUSE OWNERS GROUP
EMERGENCY RESPONSE GUIDELINES
CONFIGURATION CONTROL SHEET

GUIDELINE DESIGNATOR: ECA-5

GUIDELINE TITLE: Loss of Emergency Coolant Recirculation

REVISION: HP-Basic DATE: November 1, 1982

The guideline described above has been reviewed and approved for implementation by the Westinghouse Owners Group Procedures Subcommittee and the Westinghouse Nuclear Technology Division.

NOTICE: THIS EMERGENCY RESPONSE GUIDELINE SET REVISION (HP-BASIC) IS THE ORIGINAL ISSUE OF GENERIC GUIDANCE ON ITS SUBJECT MATTER FOR PLANTS WITH HIGH-PRESSURE SI SYSTEMS AND SUPERSEDES ANY GENERIC GUIDANCE ON THIS SUBJECT BEARING AN ISSUE DATE EARLIER THAN NOVEMBER 1, 1982

File this sheet with the approved version of this guideline in your Emergency Response Guideline set.

Roger A. Newton
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