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City : CRYSTAL RIVER State: FL Postal Code: 34428-6708
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CRYSTAL RIVER UNIT 3

PLANT OPERATING MANUAL

EMERGENCY PLAN IMPLEMENTING PROCEDURE

EM-225A

POST ACCIDENT RB HYDROGEN CONTROL

REVISION 10

TABLE OF CONTENTS

1.0 PURPOSE

1. This procedure provides guidance for the Accident Assessment Team (AAT) and other emergency response personnel in developing appropriate actions to monitor and control post-accident hydrogen concentration in the Reactor Building (RB) to protect the health and safety of the general public and Crystal River Energy Complex personnel during an emergency at CR-3.
2. This procedure is an emergency plan implementing procedure. Any revisions to this procedure must be carefully considered for emergency plan impact.

2.0 REFERENCES

2.1 Developmental References

1. FSAR Chapter 14 Appendix B
2. MAR 91-05-03-01, "Hydrogen Purge Redundancy Restoration"
3. MAR 93-05-03-02, "Hydrogen Purge Redundancy Restoration, Elect. & I&C"
4. CALC M-99-0051, "Mission Dose Assessment"
5. CALC I-90-0013, "Post Accident Reactor Building Hydrogen Purge Flow Accuracy"
6. CALC M-90-0056, "Hydrogen Mini Purge Pressure Loss"
7. CALC M-99-0052, "Zone Environmental Radiation Dose for LOCA"
8. CALC N-00-0002, "Public And Control Room Dose From A LOCA Using The Alternative Source Term"
9. CALC M-85-1004, "H2 Generation Rate"
10. CALC I-90-0023, "RB Hydrogen Concentration Loop Accuracy"

2.2 Implementing References

1. EOP-14, Emergency Operating Procedure Enclosures
2. MP-815, Installation of Post Accident Hydrogen Purge Monitors
3. EM-104, Operation of the Operational Support Center

3.0 DEFINITIONS

1. **Off-shore winds:** Winds originating from NNE to ESE sectors (011° to 124°). The most common time for this to occur is midnight.

4.0 RESPONSIBILITIES

1. Emergency Coordinator (EC) or designee:
   - Approves RB purge before initiation (Enclosure 6, Purge Release Authorization Form).
   - Ensures coordination with off-site agencies before initiation of RB purges.
2. Accident Assessment Team:
   - Tracks RB conditions and predicts time for RB purge initiation.
   - Monitors the effectiveness of purge methods in hydrogen removal.
   - Informs the EC of RB conditions and the status of pre-planned releases
   - Assign a Purge Release Authorization Form number (Enclosure 6, Purge Release Authorization Form).
3. Dose Assessment Team:
   - Monitors meteorological conditions and predicts when off-shore winds should exist.
   - Projects off-site doses for proposed RB purges.
4. Procurement Representative:
   - Ensures required air compressors are delivered on-site within the required time.
   - Ensures support materials (fuel, oil, etc,) are available to support portable compressor operations.
5. Emergency Repair Team:
   - Connects temporary air compressors when delivered.
   - Installs LR-82-FE, LR-83-FE, LR-82-FI, and LR-83-FI in accordance with MP-815, Installation of Post Accident Hydrogen Purge Monitors.
6. Radiation Monitoring Team:
   - Evaluates actual plant radiological conditions and determine routes to be used (see Enclosure 9, Access Routes).
7. Operations:
   - Performs RB purge per Enclosure 7, Purging RB.

5.0 PREREQUISITES

None

6.0 PRECAUTIONS, LIMITATIONS, AND NOTES

1. All hydrogen concentration values referenced in this procedure are presented in % by volume as indicated on the hydrogen analyzers.
2. Maintain RB hydrogen concentration < 3.6% to provide adequate margin below the lower flammability limit of 4.1% for hydrogen in air.
3. Travel through radiation areas should be as shown in Enclosure 9, Access Routes, unless otherwise directed by the emergency RWP.
4. Purging should be performed under favorable meteorological conditions (off-shore winds) whenever possible.
5. RB pressure must be carefully controlled during purge evolutions to prevent ES actuations from high RB pressure.
6. The purging criteria established by this procedure is not valid during Severe Accidents.
7. Mission dose calculations credit 10 days of radioactive decay when determining the dose received for performance of local actions. Taking local actions before this time may result in excessive radiation exposure.
8. If a predictable pattern of off-shore winds is identified, consideration should be given to performing a series of intermittent releases during periods when off-shore winds are present.
9. The AAT is responsible for overall implementation of this procedure. TSC teams responsible for performing the specific actions listed in the enclosures of this procedure are denoted at the end of each step as applicable.
10. Hydrogen is a flammable and explosive gas. Care must be taken to ensure ignition source are not in the immediate area where potential for explosive hydrogen concentrations exits. This will minimize the potential for personnel injury and equipment damage.

7.0 SPECIAL TOOLS AND EQUIPMENT

1. Air Compressors (as needed)

8.0 ACCEPTANCE CRITERIA

None

9.0 INSTRUCTIONS

NOTE: Enclosure 11, Hydrogen Purge System Flow Diagram, depicts the hydrogen Purge flow paths established by this procedure. Enclosure 11, Hydrogen Purge System Flow Diagram, is provided for information only.

1. If RCS LOCA conditions exist, then monitor RB hydrogen concentration in accordance with Enclosure 1, Hydrogen Monitoring, of this procedure.
2. If at any time RB hydrogen concentration ≥ 1%, then perform the following:
   - Perform Enclosure 2, Preparations for RB Hydrogen Purge, in this procedure.
   - Notify Procurement Representative to contact Hydrogen Recombiner vendor to coordinate preliminary transportation plan and schedule for delivery of recombiner. Refer to EM-104, Operation of the Operational Support Center.
   - RMT/AAT evaluate plant conditions and equipment availability to determine if a Hydrogen Recombiner will be required. Notify Procurement Representative if recombiner is required.
3. When at any time RB purge compressors arrive on site, and radiological conditions permit, then perform Enclosure 3, Portable Compressor Installation, of this procedure.
4. When RB hydrogen concentration ≥ 3.3%, and radiological conditions permit, then perform Enclosure 4, Prerequisite Field Actions, of this procedure.
5. When RB hydrogen concentration ≥ 3.4%, then perform Enclosure 5, RB Pressurization for Hydrogen Purge, of this procedure.
6. When RB hydrogen concentration ≥ 3.5%, then begin Enclosure 6, Purge Release Authorization Form, of this procedure.
7. When any of the following conditions exist, then perform Enclosure 7, Purging RB, of this procedure:
   - RB H_2 concentration ≥ 3.5% for ≥ 24 hours
   - RB H_2 concentration ≥ 3.5% and off shore winds exist
   - RB H_2 concentration ≥ 3.6%,
8. When RB purge is stopped, then go to Step 9.0.6 or this procedure.

10.0 RECORDS

All enclosures are quality records.

HYDROGEN MONITORING

STATUS
• LOCA Conditions Exist

ACTIONS	DETAILS
1.1 ___ Ensure one H_2 analyzer is aligned and placed in service (Ops).	• ___ Ensure applicable steps of EOP-14, Enclosure 2, PPO Post Event Actions, have been completed for H_2 analyzers.
1.2 ___ Plot RB H_2 concentration on Enclosure 8, RB Hydrogen Concentration Trend of this procedure (AAT).	• Obtain H_2 concentrations from either of the following: ___ EOP-14, Enclosure 21, RB Hydrogen Monitor Log. ___ RECALL
1.3 ___ Project when RB H_2 concentration will exceed action levels of this procedure (AAT).	• ___ Use H_2 concentration plotted on Enclosure 8, RB Hydrogen Concentration Trend of this procedure. • ___ Extrapolate to estimate time when H_2 concentration will reach procedure action levels.

Action Level	Date	Time
$H_2 \geq 1\%$	____	_____
$H_2 \geq 3.3\%$	____	_____
$H_2 \geq 3.4\%$	____	_____
$H_2 \geq 3.5\%$	____	_____
$H_2 \geq 3.6\%$	____	_____

HYDROGEN MONITORING

ACTIONS	DETAILS
1.4 ___ IF at anytime H_2 concentration is ≥ an action level of this procedure, THEN immediately notify the Accident Assessment Team Coordinator (AAT).	• Action levels based on RB H_2 concentrations. Action Level / Required Action $H_2 \geq 1\%$ — See step 9.0.2 $H_2 \geq 3.3\%$ — See step 9.0.4 $H_2 \geq 3.4\%$ — See step 9.0.5 $H_2 \geq 3.5\%$ — See step 9.0.6
1.5 ___ Continue monitoring RB H_2 concentration (AAT).	___ Plot RB H_2 concentration on Enclosure 8, RB Hydrogen Concentration Trend of this procedure every 8 hours. ___ Perform Step 1.3 of this Enclosure every 8 hours.

PREPARATIONS FOR RB HYDROGEN PURGE

STATUS
• RB H_2 Concentration ≥ 1%

ACTIONS	DETAILS
1.1 ___ Notify the Procurement Representative, Radiation Controls Coordinator, Repairs Coordinator and Control Room to begin preparations for RB purge.	• Review this procedure for: ___ Procurement of tools and equipment. ___ Selection of emergency team personnel. ___ Assigning Operations support to the OSC. ___ Initiation of reentry process per EM-104. ___ Collection of radiological and meteorological data. ___ Review of dose projection process.
1.2 ___ Evaluate plant radiological conditions and determine routes to be used to perform Enclosures 2, 3, 4, 5, and 7 (RMT).	• Refer to Enclosure 9, Access Routes for locations of required actions/components and suggested routes.
1.3 ___ Notify off-site sources to obtain portable air compressors (Procurement Representative).	• Obtain 3 or more air compressors from one of the following off-site sources: ___ Compressed Air Systems, Telephone (800) 626-8177 OR (813) 626-8177 (Tampa) ___ Air Components & Equipment, Inc., Telephone (813) 621-3087 (Tampa) • ___ Obtain air compressors capable of 225 scfm minimum each for continuous purge (rated exhaust flow) and rated discharge TEMP < 150°F.
1.4 ___ Ensure all CCHE habitability breaches are sealed (ERT).	

PREPARATIONS FOR RB HYDROGEN PURGE

	ACTIONS	DETAILS
1.5	___ Monitor meteorological conditions to predict off-shore wind cycle (DAT).	• ___ Off-shore winds originate from NNE to SE sectors (011.2° to 146.3°). • ___ Most common time for off-shore winds is midnight.
1.6	___ Ensure the purge flow instrumentation cart is properly staged and equipped (ERT).	• ___ Refer to MP-815 for location of equipment. • ___ DO NOT install purge instruments until Enclosure 4, Prerequisite Field Actions is performed.
1.7	___ Ensure power is available to LR-82-FI and LR-83-FI receptacle (OPS).	• ___ RX MCC 3B2 is energized. • ___ RX MCC 3B2, BKR 8AR closed. • ___ ACDP-20, BKR 12 closed. (143 ft AB near elevator)
1.8	___ Notify the Accident Assessment Team Coordinator that Enclosure 2, Preparations for RB Hydrogen Purge is complete (AAT).	

PORTABLE COMPRESSOR INSTALLATION

STATUS
• Purge Compressors Are On Site • Hydrogen Concentration ≥ 1%

ACTIONS	DETAILS
1.1 ___ Consult Radiation Monitoring Team to determine routes and precautions to be used during compressor installation (ERT).	• Refer to Enclosure 9, Access Routes for locations of required actions/components and suggested routes.

1.2 ___ Connect portable air compressors (ERT).

- ___ DO NOT open LRVs at this time.
- ___ Indicate LRVs to which portable air compressors are connected.
- ___ Preferred - RB portable compressor connections (119 ft IB outside west wall):

___ LRV-11	___ LRV-16
___ LRV-12	___ LRV-17
___ LRV-13	___ LRV-18
___ LRV-14	___ LRV-19
___ LRV-15	___ LRV-20

- ___ Alternate - H_2 recombiner connections (119 ft IB outside west wall): (adapters in stores – CAT ID # 0001260356)

___ LRV-92 (Pen 125)
___ LRV-90 (Pen 121)
___ LRV-94 (Pen 125)
___ LRV-88 (Pen 122)

PORTABLE COMPRESSOR INSTALLATION

	ACTIONS	DETAILS
1.3	___ Ensure plant personnel are familiar with the operation of the portable compressors (OPS/ERT).	
1.4	___ Obtain support materials for portable compressors (Procurement Representative).	• ___ Determine portable compressor fuel and oil consumption rate from compressor vendor. • ___ Ensure sufficient fuel and oil supplies are available to support compressor operation.
1.5	___ Notify the Accident Assessment Team Coordinator that Enclosure 3, Portable Compressor Installation is complete (OPS/ERT).	

PREREQUISITE FIELD ACTIONS

STATUS
• RB H_2 Concentration ≥ 3.3%

ACTIONS		DETAILS
1.1	___ Consult Radiation Monitoring Team to determine routes and precautions to be used while performing RB Purge Field Actions (ERT).	• Refer to Enclosure 9, Access Routes for locations of required actions/components and suggested routes.
1.2	___ Defeat all starting interlocks on AHF-7A and 7B (OPS).	1. ___ Obtain key 92 from the Control Room. 2. Select RB exhaust fan permissive bypass switches to the "Emergency" position .(119 ft IB East Door) • ___ AHF-7A, Ventilation MCC 3A-10C • ___ AHF-7B, Ventilation MCC 3B-9C
1.3	___ Open RB exhaust dampers for emergency operation (OPS).	• ___ Select AHV-77 to the "EMERGENCY OPERATION OF AHD-95, AHD-96, AND AHD-94" position. (143 ft AB Ventilation Equipment Area, HVAC-13) • ___ Select AHV-78 to the "EMERGENCY OPERATION OF AHD-97, AHD-98, AND AHD-94" position. (143 ft AB Ventilation Equipment Area, HVAC-13)

PREREQUISITE FIELD ACTIONS

ACTIONS	DETAILS
1.4 ___ Ensure RM-A1 is in service (OPS/DAT).	• ___ Ensure RM-A1 pump is running with path to and from pump (143 ft AB). • ___ Ensure RM-A1 monitors have power aligned. • ___ Ensure the following MCB annunciator links are closed: ___ 1712 ___ 1713 ___ 1714 • ___ Adjust RM-A1 gas channel "HIGH" alarm setting potentiometer to maximum (clockwise). • ___ Ensure LMH controller associated with RM-A1 is in "AUTO".
1.5 ___ Notify Repairs Coordinator to obtain and install flow instrumentation (ERT).	• ___ CONCURRENTLY PERFORM MP-815, Installation of Post Accident H_2 Purge Flow Instruments.
1.6 ___ WHEN H_2 Purge Flow Instruments are installed THEN notify the Accident Assessment Team Coordinator that Enclosure 4, Prerequisite Field Actions is complete (OPS/ERT).	

RB PRESSURIZATION FOR HYDROGEN PURGE

STATUS

- RB H_2 Concentration $\geq$ 3.4%
- Portage Air Compressors are installed.

ACTIONS	DETAILS
1.1 ___ Consult Radiation Monitoring Team to determine routes and precautions to be used while performing RB Pressurization (ERT).	• Refer to Enclosure 9, Access Routes for locations of required actions/components and suggested routes.

1.2 ___ IF portable air compressors were connected to RB portable compressor connections, THEN start air supply to RB and establish and maintain RB PRESS at $\approx$ 2 psig (ERT/Ops).

1 ___ Start portable air compressors.

2 Open isolation valves for operating air compressors (119 ft IB west door):

___ LRV-11	___ LRV-16
___ LRV-12	___ LRV-17
___ LRV-13	___ LRV-18
___ LRV-14	___ LRV-19
___ LRV-15	___ LRV-20

3 ___ Unlock and open LRV-36 "AIR SUPPLY TO PENETRATION 121 ISO" (119 ft IB south of A MSSVs).

4 ___ Unlock and open LRV-50 "PENETRATION 121 ISO" (119 IB ft south of PZR Htr MCC 3B overhead).

5 ___ Adjust LRV-26 "LRV-24 BYPASS" (119 ft IB south of A MSSVs) to maintain RB PRESS at $\approx$ 2 psig.

RB PRESSURIZATION FOR HYDROGEN PURGE

ACTIONS	DETAILS
1.3 ___ IF portable air compressors were connected to H_2 recombiner connections, THEN start air supply to RB and establish and maintain RB PRESS at ≈ 2 psig (ERT/Ops).	1 ___ Start portable air compressors. 2 Open H_2 recombiner connection isolations for operating air compressors (119 ft IB): 3 ___ Adjust the compressor output to establish and maintain RB PRESS at ≈ 2 psig.

___ LRV-87 (unlock)	___ LRV-88 (unlock)
___ LRV-89 (unlock)	___ LRV-90 (unlock)
___ LRV-91 (unlock)	___ LRV-92 (unlock)
___ LRV-93 (unlock)	___ LRV-94 (unlock)

1.4 ___ WHEN RB PRESS is being maintained at ≈ 2 psig, THEN notify the Accident Assessment Team Coordinator that Enclosure 5, RB Pressurization for Hydrogen Purge is complete (OPS/ERT).

PURGE RELEASE AUTHORIZATION FORM

PRAF #_____

COMPLETED BY THE ACCIDENT ASSESSMENT TEAM:

1) Date/Time accident started: _____/_____

2) Projected Date/Time for purge start: _____/_____

3) Time after accident for purge start: _____ (hrs) [1 minus 2]

4) Error Corrected Flowrate based on time after accident (see Enclosure 10) _____ (scfm)

Completed By: _____ Date: _____

COMPLETED BY THE DOSE ASSESSMENT TEAM:

Containment Atmosphere Activity (μCi/cc) : _____

Meteorological Conditions used in projection:

Wind Direction _____ Wind Speed _____ Stability Class _____

Projected purge duration = 1440 minutes (1 day)

RADDOSE-IV Projected Dose (REM) based on Error Corrected Flow rate:

Site Boundary _____ 2 miles _____ 5 miles _____10 miles _____

RADDOSE-IV Projected Curies to be released: Noble Gas _____ Iodine _____

Completed By: _____ Date: _____

COMPLETED BY EMERGENCY COORDINATOR:

EOF Director notified: _____

EOF Director notified: Date/Time _____/_____

Ensure the EOF Director has coordinated with the State and local government officials before initiating purge.

EMERGENCY COORDINATOR APPROVAL _____/_____
Sign/Date

PURGING RB

STATUS
• RB Purge Is Required

	ACTIONS	DETAILS
1.1 ___	Ensure Enclosure 2, 3, 4, and 5 of this procedure have been completed (AAT).	• ___ Enclosure 2, Preparations for RB Hydrogen Purge complete • ___ Enclosure 3, Portable Compressor Installation complete • ___ Enclosure 4, Prerequisite Field Actions complete • ___ Enclosure 5, RB Pressurization for Hydrogen Purge complete
1.2 ___	Determine required purge flow rate (AAT/DAT).	• ___ IF H_2 purge has been previously performed, THEN use flows from previous purge. • ___ IF H_2 purge has NOT been previously performed, THEN refer to Enclosure 10, Continuous Purge Flow Rates after a LOCA to determine flows: ___ Required Purge Flow _____ scfm ___ Error Corrected Flow_____ scfm • ___ Record Error Corrected Flow on Enclosure 6, Purge Release Authorization Form.
1.3 ___	Consult Radiation Monitoring Team to determine routes and precautions to be used while performing RB Pressurization (ERT).	• Refer to Enclosure 9, ACCESS ROUTES for locations of required actions/components and suggested routes.
1.4 ___	WHEN Enclosure 6, Purge Release Authorization Form is complete and approved by the EC, THEN continue with this enclosure.	

PURGING RB

STATUS
• EC has approved Purge Release Authorization Form, Enclosure 6

ACTIONS		DETAILS
1.5	___ Notify the EC and the EOF Director that RB hydrogen purge is commencing (AAT).	
1.6	___ Start RB purge Exhaust fan (OPS).	• Start at least one RB Exhaust fan: ___ AHF-7A ___ AHF-7B
1.7	___ IF RB purge has previously been performed, THEN open purge isolation valves associated with the previously adjusted throttle valve (OPS).	• IF LRV-121 was previously throttled THEN Open A Train isolation valves. ___ LRV-70 ___ LRV-71 • IF LRV-123 was previously throttled THEN Open B Train isolation valves. ___ LRV-72 ___ LRV-73

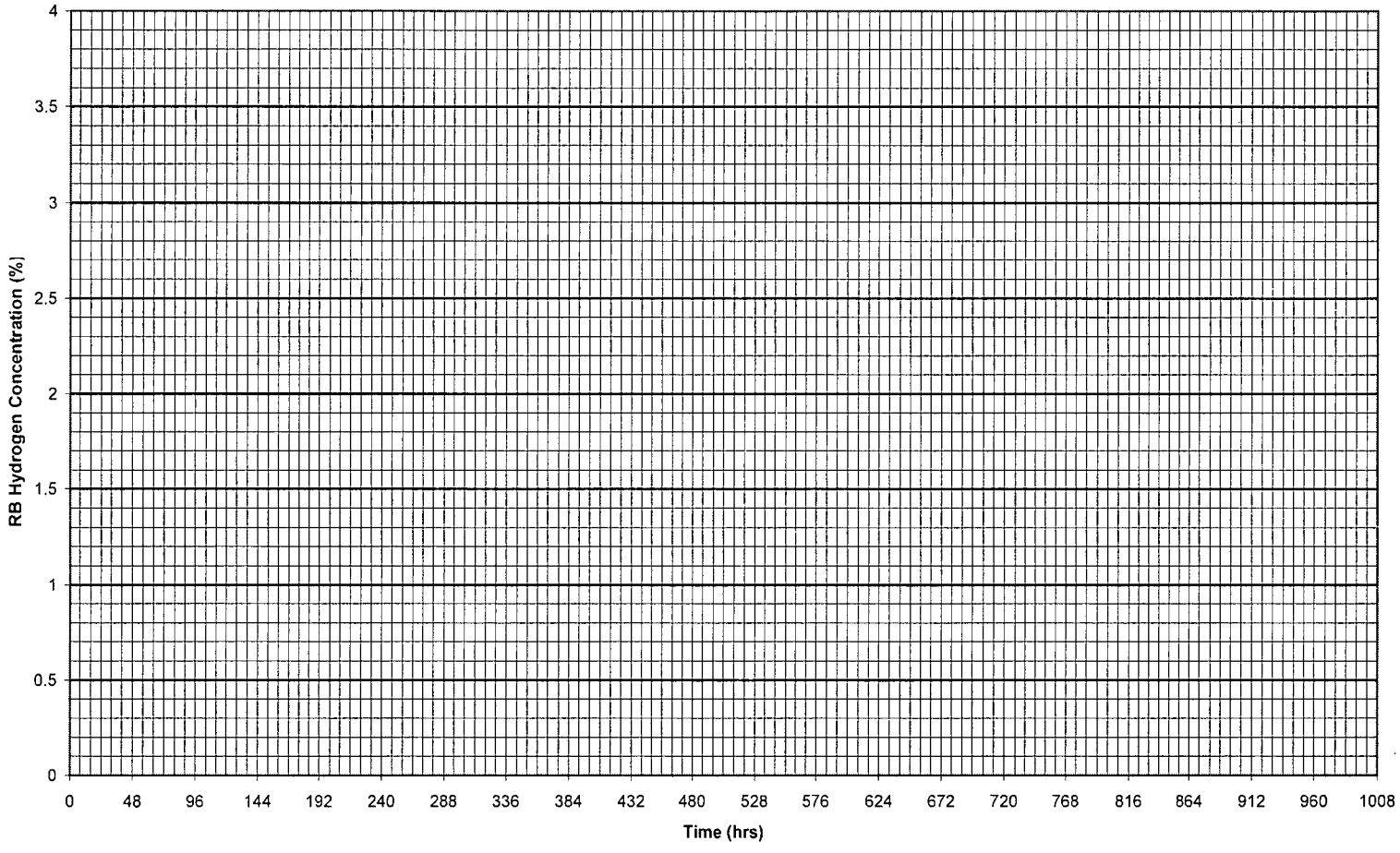
PURGING RB

ACTIONS	DETAILS
1.8 ___ IF purge has NOT previously been performed, THEN establish required RB purge flow (OPS).	1 ___ Record "Required Purge Flow" from Step 1.2 of this enclosure. • Required Purge Flow ___ scfm 2 ___ IF A Train purging is desired, THEN perform the following in order: ___ Open LRV-70 ___ Open LRV-71 ___ Throttle LRV-121 to obtain "Required Purge Flow" on flow indicator LR-82-FI (143 ft AB Ventilation Room). ___ Record reading from LR-82-FI _____ scfm 3 ___ IF B Train purging is desired, THEN perform the following in order: ___ Open LRV-72 ___ Open LRV-73 ___ Throttle LRV-123 to obtain "Required Purge Flow" on flow indicator LR-83-FI (143 ft AB Ventilation Room). ___ Record reading from LR-83-FI _____ scfm
1.9 ___ Maintain RB PRESS constant at ≈ 2 psig (OPS).	• ___ IF portable air compressors were connected to RB portable compressor connections, THEN adjust LRV-26 "AIR SUPPLY TO PENETRATION 121 CONTROL BYPASS" (119 ft IB south of A MSSVs) to maintain RB PRESS at ≈ 2 psig. • ___ IF portable air compressors were connected to H_2 recombiner connections, THEN adjust the compressor output to maintain RB PRESS at ≈ 2 psig.

PURGING RB

ACTIONS	DETAILS
1.10 ___ WHEN all of the following exist: ___ RB H_2 Concentration is ≤ 3.5% ___ EC approves termination THEN stop RB purge (OPS/ERT).	1 Ensure the following valves are closed: A Train: ___ LRV-70, ___ LRV-71 B Train: ___ LRV-72, ___ LRV-73 2 Ensure RB exhaust fans are stopped: ___ AHF-7A ___ AHF-7B 3 ___ IF portable air compressors are connected to RB portable compressor connections, THEN close the following valves: ___ LRV-50 "PENETRATION 121 ISO" (119 ft IB south of PZR Htr MCC 3B overhead) ___ LRV-36 "AIR SUPPLY TO PENETRATION 121 ISO" (119 ft IB south of A MSSVs) 4 ___ IF portable air compressors are connected to H_2 recombiner connections, THEN close the following valves: ___ LRV-87, ___ LRV-88 ___ LRV-89, ___ LRV-90 ___ LRV-91, ___ LRV-92 ___ LRV-93, ___ LRV-94 5 ___ Stop portable air compressors.
1.11 ___ Notify the Accident Assessment Team Coordinator that RB purge is secured.	

RB HYDROGEN CONCENTRATION TREND



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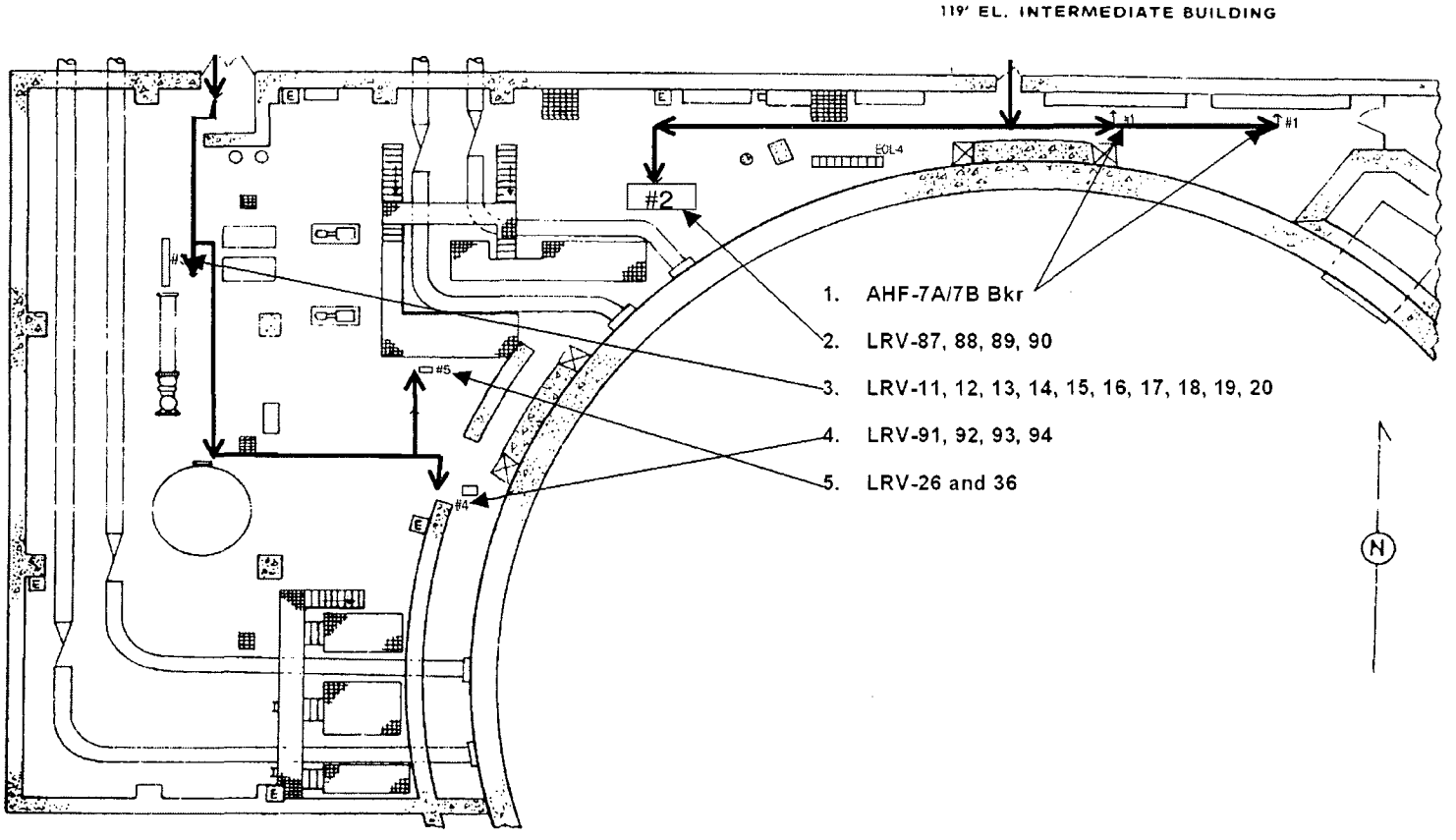

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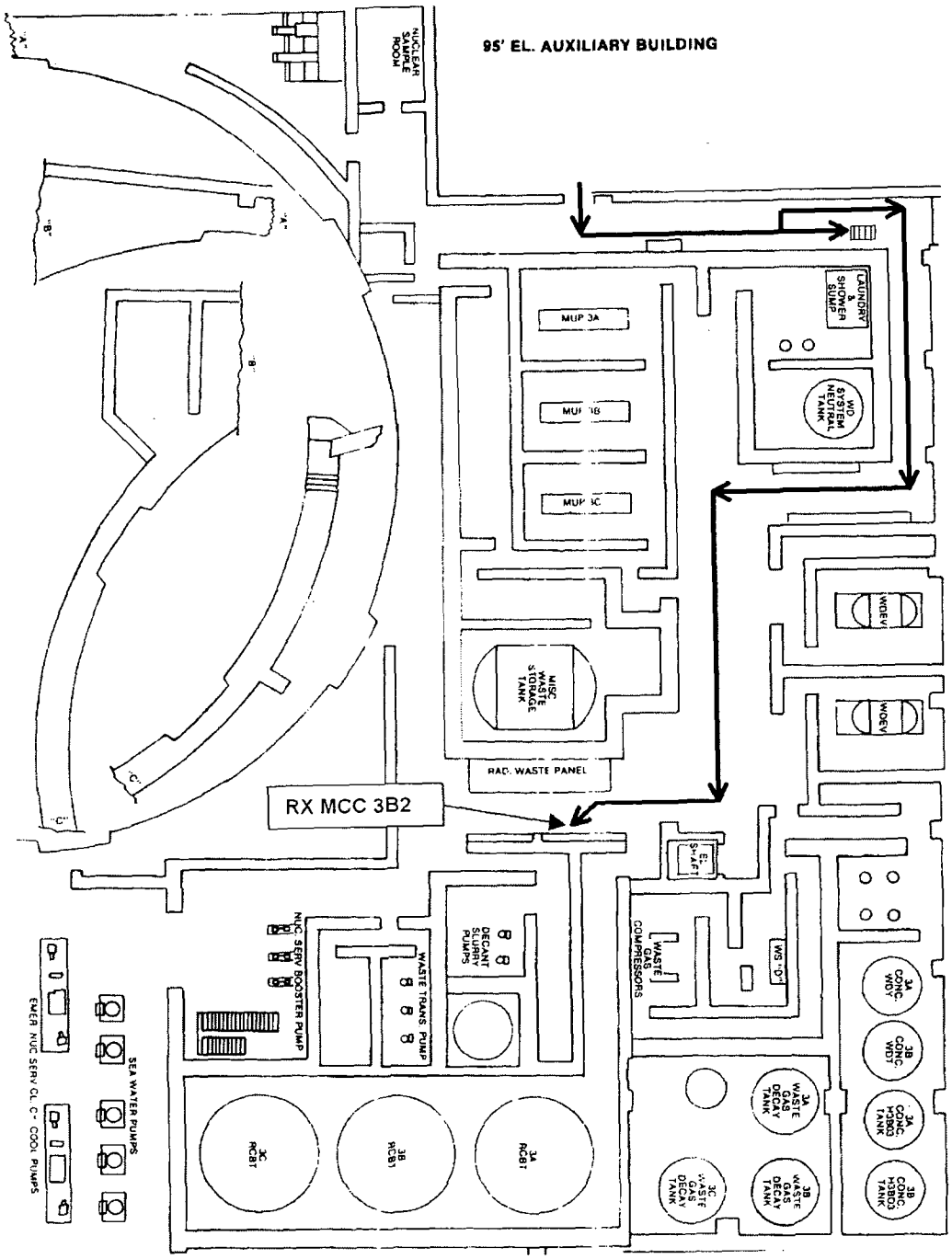

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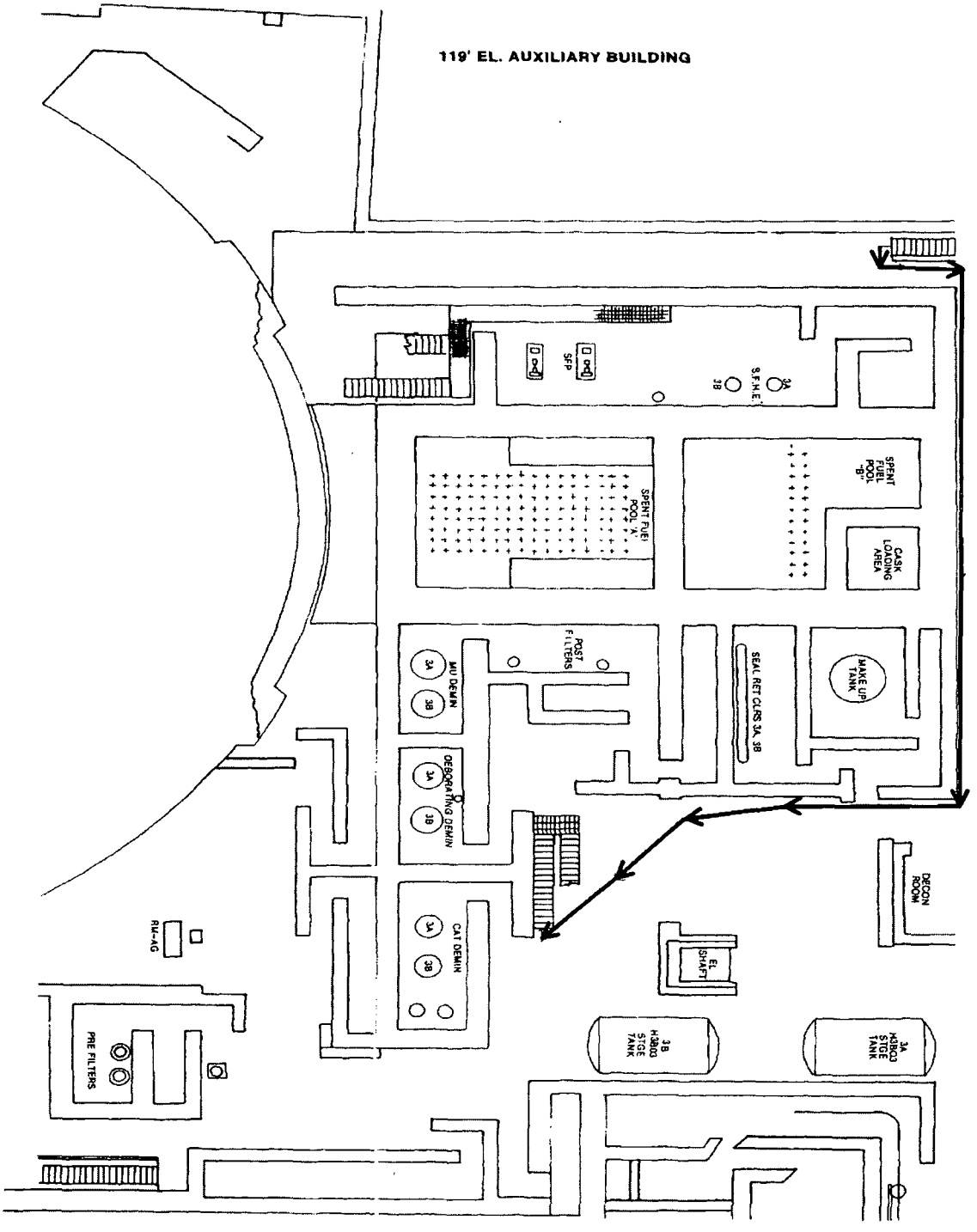

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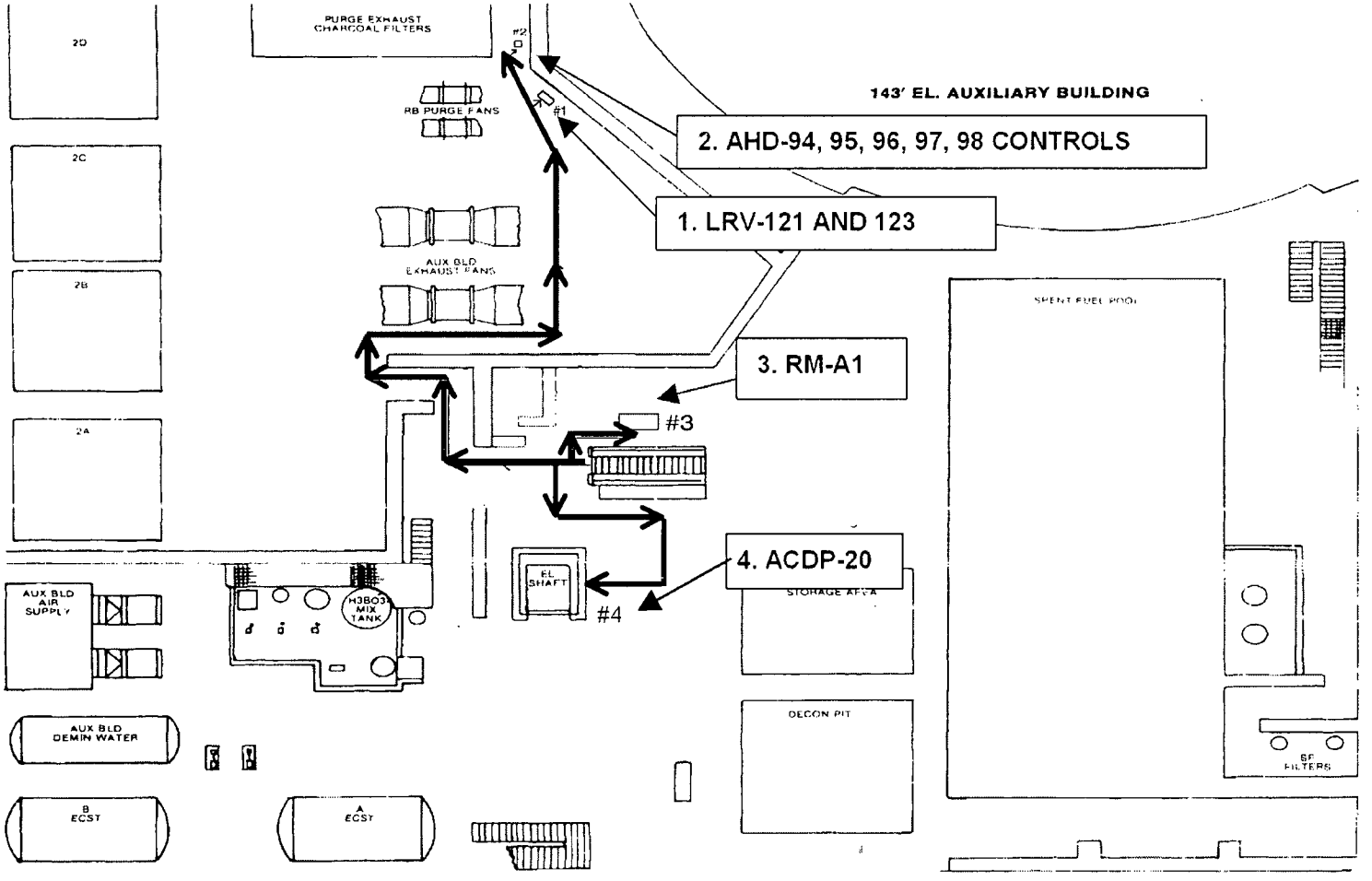
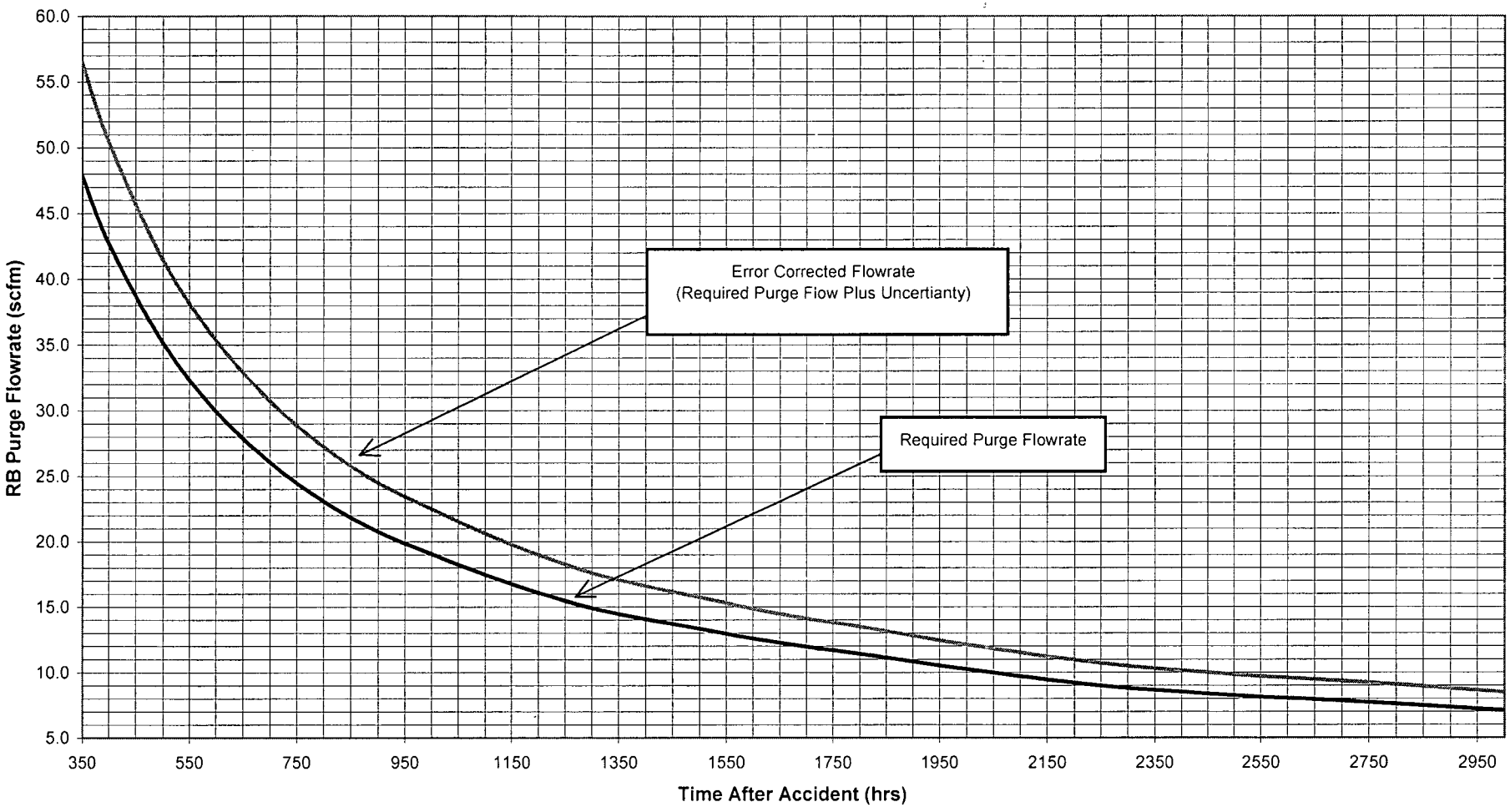
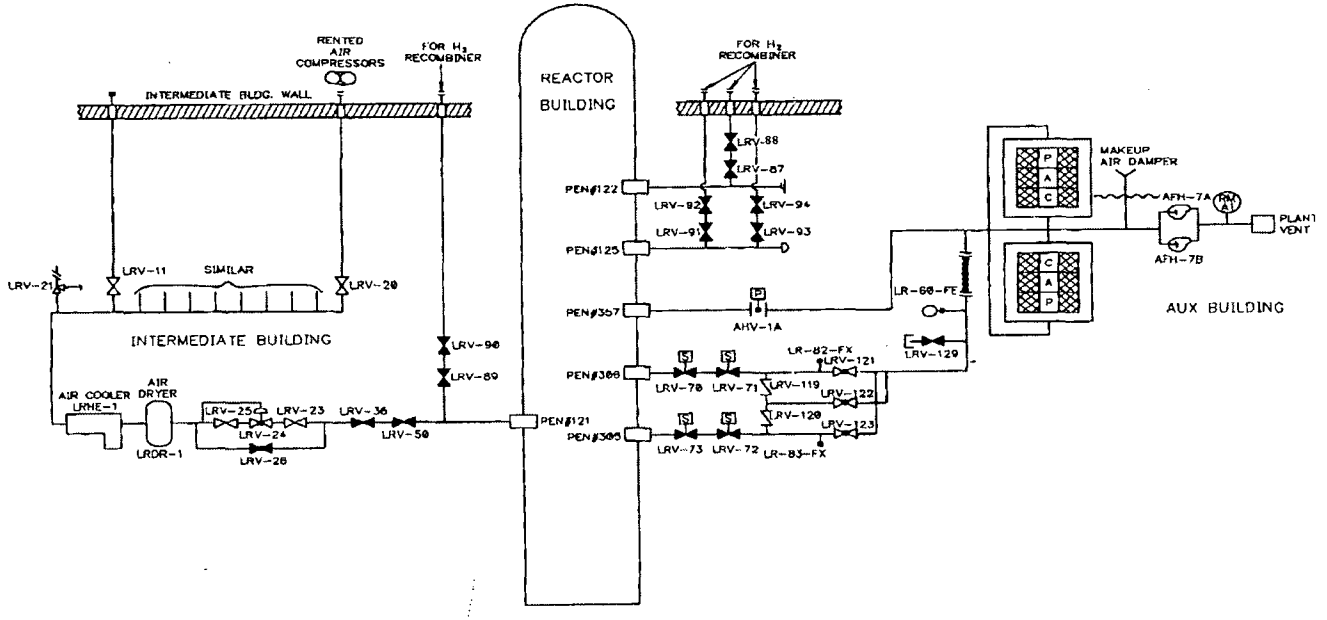


CONTINUOUS PURGE FLOW RATES AFTER A LOCA



HYDROGEN PURGE SYSTEM FLOW DIAGRAM



SUMMARY OF CHANGES
PRR # 321652

NOTES: 1. Writers and Reviewers: Ensure that any changes to this procedure that affect information contained in Emergency Response Facility posters, enclosures, briefing cards, guidelines etc. are made to those items as well.

2. Writers and Reviewers: Changes to certain parts of this procedure may impact other Emergency Preparedness Implementing Procedures. Ensure appropriate PRRs are initiated as needed.

SECTION	CHANGE
Throughout	Reformatting IAW PRO-NGGC-0201
1.0.2	New step stating "this procedure is an emergency plan implementing" procedure. Any revisions to this procedure must be carefully considered for emergency plan impact." (PRR 321652)
2.2	Added new implementing references section
3.0	Changed the definition for offshore wind direction to 11.0 t0 124.0 degrees. Wind directions from 11 to 146 degrees will transport a release to areas mostly over water. The most significant exception is that about a mile of Hwy 40 in Levy County is west of this line. The range was changed to wind from 11 to 124 degrees to compensate for this area. That would translate to wind from the NNE to ESE sectors.
6.0	Added a new L&P to caution about hydrogen explosions. Reference the Sutton Hydrogen Event PRR 455377 and NCR 454393.
7.0.1	Added special tools and equipment
9.0.2	Added title of EM-104 "Operation of the Operation Support Center"
Enclosure 2	Changed title of enclosure from "Initial Preparation for Purging" to "Preparation for RB Hydrogen Purge"
Enclosure 7	Page numbers were incorrect and fixed during reformatting. (PRR 471789)
Summary of Changes	Added two notes before Summary of Changes table (PRR 411912)

#1242

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CRYSTAL RIVER UNIT 3

PLANT OPERATING MANUAL

EMERGENCY PLAN IMPLEMENTING PROCEDURE

EM-225B

POST-ACCIDENT BORON CONCENTRATION MANAGEMENT

REVISION 12

TABLE OF CONTENTS

1.0 PURPOSE

1. The purpose of this procedure is to provide methodology for determining when post LOCA boron precipitation mitigation is required.
2. This procedure is an emergency plan implementing procedure. Any revisions to this procedure must be carefully considered for emergency plan impact.

2.0 REFERENCES

2.1 Developmental References

1. FPC Calculation M97-0120 - Sump Suction Valve Open Area
2. FPC Calculation M97-0122 - DH Dropline Backflow for Boron Dilution
3. FPC Calculation M97-0097 - Auxiliary Pressurizer Spray Flow Rate
4. FTI Letter IRS-97-4045 dated 10/10/97 Subject: Required APS Flow
5. FTI Letter IRS-97-4220 dated 10/29/97 Subject: DH Drop Line Backflow RELAP Sensitivity Evaluation
6. NOE 97-1628, Instrument Uncertainty Analysis for Boronometer (CA-56-CI)
7. NOE 97-2696, Engineering Evaluation: Incore Temperature Uncertainty
8. FPC Calculation M97-0138, "Temperature/Time Response for the Auxiliary Spray Line During Boron Precipitation Mitigation"
9. FPC Calculation M97-0139, "Temperature/Time Response for the DH Dropline with Gravity Flow Initiated for Born Precipitation"
10. FPC Calculation M97-0098, Boron Dilution by Hot-Leg Injection
11. FPC Calculation M97-0119, Post-LOCA Boron Concentration Management
12. FPC Calculation S96-0134, Fluid Velocity Analysis for RB Sump Screens
13. FPC Calculation M97-0146, Post-LOCA Boron Concentration Management for CR-3
14. FPC Calculation M04-0016, RB Sump Screen - Downstream Effects Evaluation

2.2 Implementing References

1. EM-225E, Guidelines for Long Term Cooling
2. EOP-14, Emergency Operating Procedure Enclosures

3.0 DEFINITIONS

1. **Auxiliary Pressurizer Spray (APS):** A boron precipitation mitigation method that diverts a portion of LPI flow to the pressurizer spray nozzle. Providing flow to the pressurizer builds a height of water in the core region. When an adequate height of water is developed, reverse flow through the core is initiated. This method is only effective if spray flow exceeds core boil-off and is started early enough to allow a liquid level to be established prior to reaching actual core solubility limits.
2. **Delta Boron:** The difference between Expected RB Sump Concentration and actual measured RB sump boron concentration (boronometer, grab sample) after ECCS suction transfer.
3. **Dump To Sump (DTS):** A boron precipitation mitigation method that aligns the DH drop-line to the RB sump through an idle LPI train. This alignment redirects the ECCS injection being lost though a break in the RCS cold leg through the core region. This redirection occurs because the DH drop-line connects to the hot leg at an elevation lower than the RCS cold leg piping.
4. **Expected RB Sump Concentration ($Sump_{EXP}$):** A calculated value of RB sump boron concentration assuming even mixing of the RCS, CFTs, and BWST located in the RB sump.

4.0 RESPONSIBILITIES

The TSC Accident Assessment Team is responsible for monitoring plant conditions and determining when boron precipitation mitigation is required.

5.0 PREREQUISITES

None

6.0 PRECAUTIONS, LIMITATIONS, AND NOTES

1. APS is the preferred method of boron precipitation mitigation, and should be used if acceptable plant conditions exist. This preference is due to the significant adverse impact on ECCS performance if DTS is improperly implemented, and the need to stop a train of ECCS to perform the DTS alignment.
2. If required for A Train APS effectiveness DHV-5 may be closed provided HPI has been established.
3. Grab samples should be taken from the recirculating fluid to assure correct boronometer performance, if dose limitations allow.
4. Sump sampling should continue to be used after initiation of an active method to assure the boron concentration control mechanism is working effectively.
5. The following must be used for Tincore measurements:
   - "Tincore Average Temp" on SPDS alpha page with input from at least (2) incore thermocouples.
   - The average of at least 2 incore thermocouples displayed on Chessell Recorder (If all inputs are operable the average point may be used).
6. The "Delta Boron Limit" as shown on Attachment 5, Core Boron Control Limit, includes a 25% factor of safety, and shall be used when the core has been in a saturated condition for greater than five (5) hours.
7. Boron precipitation cannot occur if adequate SCM exists.
8. Even if not warranted based on boron concentration indications, the boron precipitation mitigation method may be required to mitigate the consequence of chemical in-vessel effects.
9. Stopping an RB Spray Pump could cause RB pressure to increase.

7.0 SPECIAL TOOLS AND EQUIPMENT

None

8.0 ACCEPTANCE CRITERIA

None

9.0 INSTRUCTIONS

9.1 Contingency Actions for Establishing Auxiliary Pressurizer Spray

1. **IF** auxiliary pressurizer spray will be used and ES MCC 3AB can **NOT** be energized, **THEN** COORDINATE performance of Attachment 7, Contingency Actions for Establishing Auxiliary Pressurizer Spray, in this procedure ..... N/A ☐ ☐

9.2 Boron Precipitation Mitigation Determination

1. **IF** adequate SCM exists, **THEN** EXIT this procedure..... N/A ☐ ☐
2. **WHEN** ECCS suction transfer has been completed, **THEN** CALCULATE Expected RB Sump Concentration ($Sump_{EXP}$) using Attachment 1, Calculation of Expected RB Sump Concentration in this procedure ..... ☐
3. REQUEST the OSC Chemistry Coordinator to have RB sump boron concentration determined on a 2 hour interval ..... ☐
4. **IF** at any time RB sump sample results are received, **THEN** CALCULATE Delta Boron ($Sump_{EXP}$ - Measured Sump Boron Concentration)..... N/A ☐ ☐
5. **IF** the RB sump can be sampled, **THEN** CONCURRENTLY PERFORM Attachment 2, Mitigation Matrix with RB Sump Sampling of this procedure..... N/A ☐ ☐
6. **IF** RB sump **CANNOT** be sampled, **THEN** CONCURRENTLY PERFORM Attachment 3, Mitigation Matrix without RB Sump Sampling of this procedure..... N/A ☐ ☐
7. **WHEN** any one of the following condition exists, **THEN** IMPLEMENT Boron Precipitation per Section 9.3 and 9.4:

   - 48 hours has elapsed since the time of the event ..... ☐

     OR

   - Boron precipitation mitigation strategy is required as determined per Attachment 2, Mitigation Matrix with RB Sump Sampling ..... ☐

     OR

   - Boron precipitation mitigation strategy is required as determined per Attachment 3, Mitigation Matrix without RB Sump Sampling ..... ☐

9.3 **Boron Precipitation Mitigation Prerequisites**

1. **IF** LPI crosstie is in progress, **THEN** PRIOR TO directing performance of EOP-14, Enclosure 20, Boron Precipitation Control, ESTABLISH HPI piggyback using EM-225E, Guidelines for Long Term Cooling ..... N/A ☐ ☐

2. **IF** an HPI pump will be started using EOP-14, Enclosure 20, Boron Precipitation Control, **THEN** ENSURE HPI flow is controlled within the limits of EM-225E, Guidelines for Long Term Cooling ..... N/A ☐ ☐

9.4 **Boron Precipitation Mitigation Initiation**

1. **IF** APS will be directed, **THEN** CONSIDER the following regarding use and effectiveness: ..... N/A ☐ ☐

   - APS should cause Delta Boron to decrease in ≤ 12 hours after initiation ..... ☐
   - Indications of APS flow:
     - MONITOR APS line thermocouple indicated on AH-1003-TIR (DH-61-TE) for early indications of flow. The APS line thermocouple should be ≈ DHHE outlet temperature in ≤ 1 minute ..... ☐
     - Continued RB sump sampling, in the longer term, will provide positive verification of successful mitigation ..... ☐

2. **IF** DTS will be directed, **THEN** CONSIDER the following regarding use and effectiveness: ..... N/A ☐ ☐

   - DTS should cause Delta Boron to decrease in ≤ 10 hours after initiation ..... ☐
   - Indications of DH drop-line flow:
     - MONITOR DH drop-line thermocouple indicated on AH-1003-TIR (DH-60-TE) for early indications drop-line flow ..... ☐
     - Continued RB sump sampling, in the longer term, will provide positive verification of successful mitigation ..... ☐
   - Adequate flow in the drop line can be inferred if any of the following exist:
     - **IF** the difference between initial Tincore and average RB temperature is < 40° F, **THEN** Tincore should be 90% of average RB temperature within 13 minutes ..... N/A ☐ ☐
     - **IF** the difference between initial Tincore and average RB temperature is > 40° F, **THEN** Tincore should be 90% of average RB temperature within 26 minutes ..... N/A ☐ ☐

3. **WHEN** boron precipitation mitigation is required, **THEN** DIRECT the Control Room to perform the appropriate alignment using EOP-14, Enclosure 20, Boron Precipitation Control ..... ☐

Subsection 9.4, Boron Precipitation Mitigation Initiation (Cont'd)

4. **IF** all the following exist, **THEN** DIRECT the Control Room to close DHV-5 ..... N/A ☐ ☐

   - APS has been directed as the boron precipitation mitigation method ..... ☐
   - A Train LPI is providing APS flow ..... ☐
   - APS was aligned using EOP-14, Enclosure 20, Boron Precipitation Control ..... ☐
   - Tincore plots on Attachment 4, APS Effectiveness, indicate DHV-5 must be closed for APS effectiveness ..... ☐

9.5 **Follow-Up Actions**

1. CONTINUE RB sump monitoring and plotting of Delta Boron ..... ☐

10.0 **RECORDS**

All attachments are quality records.

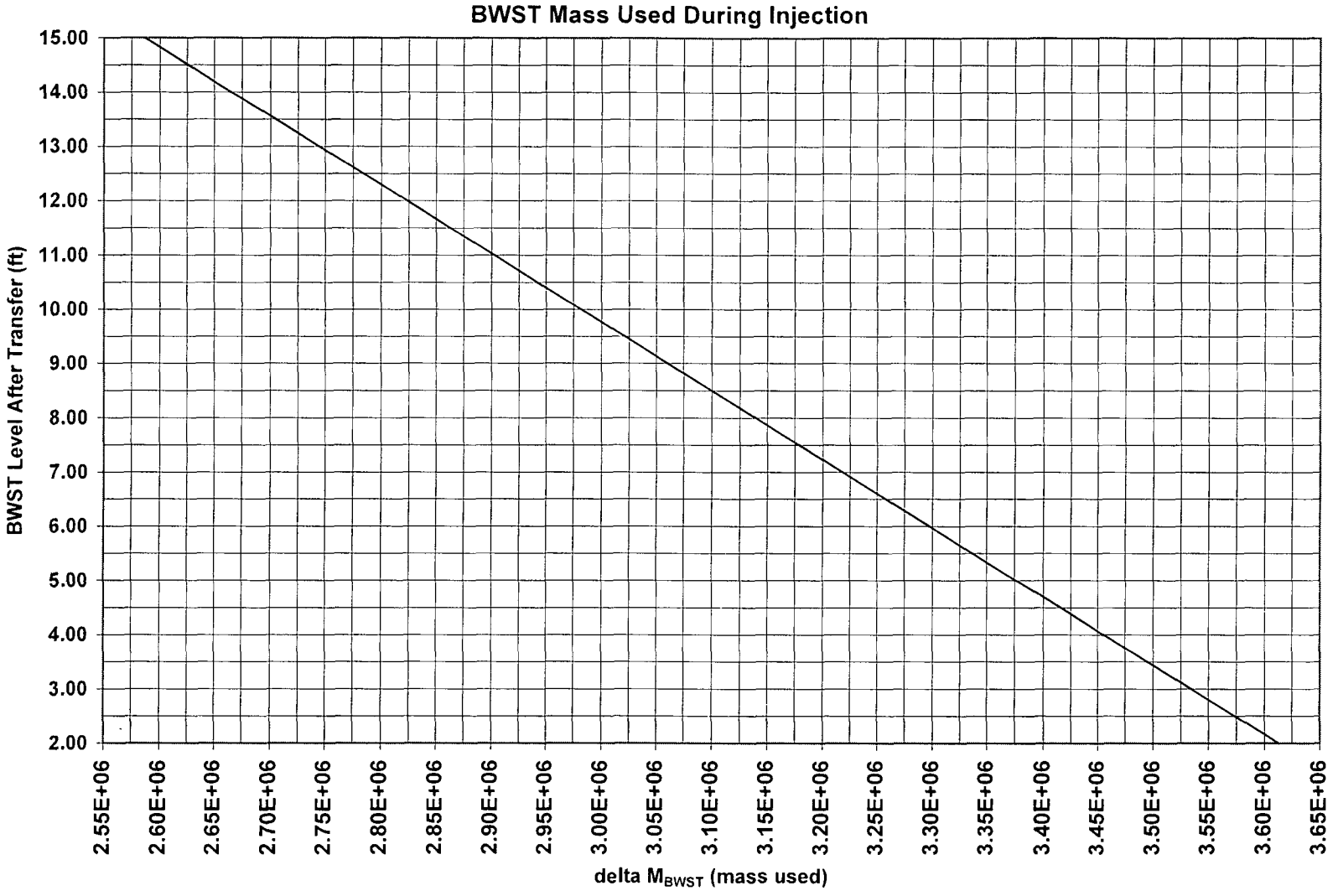
CALCULATION OF EXPECTED RB SUMP CONCENTRATION

1. OBTAIN the following data:
   - Pre-LOCA BWST Boron Concentration (C_{BWST})..... _____ ppmb
   - Pre-LOCA RCS Boron Concentration (C_{RCS})..... _____ ppmb
2. DETERMINE ΔM_{BWST} using Page 2 of this Attachment..... _____
3. CALCULATE Expected RB Sump Concentration ($Sump_{EXP}$):

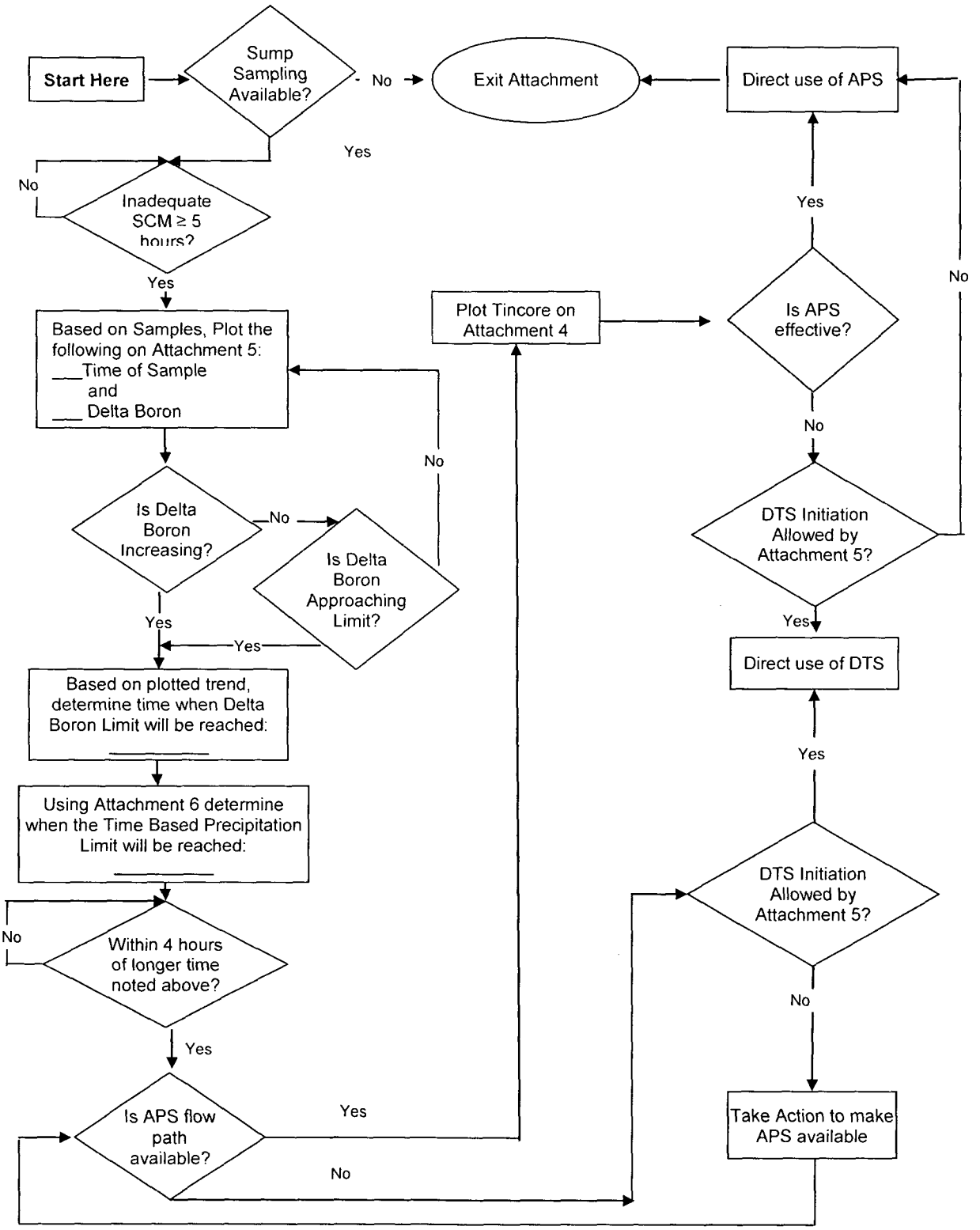
$$Sump_{EXP} = \frac{(\Delta M_{BWST} * C_{BWST}) + (M_{CFTS} * C_{CFTS}) + (M_{RCS} * C_{RCS})}{\Delta M_{BWST} + M_{CFTS} + M_{RCS}}$$

$$\_\_\_\_\_ = \frac{(\_\_\_\_\_) + (4.7\ E^8) + (5.1\ E^5 * \_\_\_\_\_)}{(\_\_\_\_\_) + (1.3\ E^5) + (5.1\ E^5)}$$

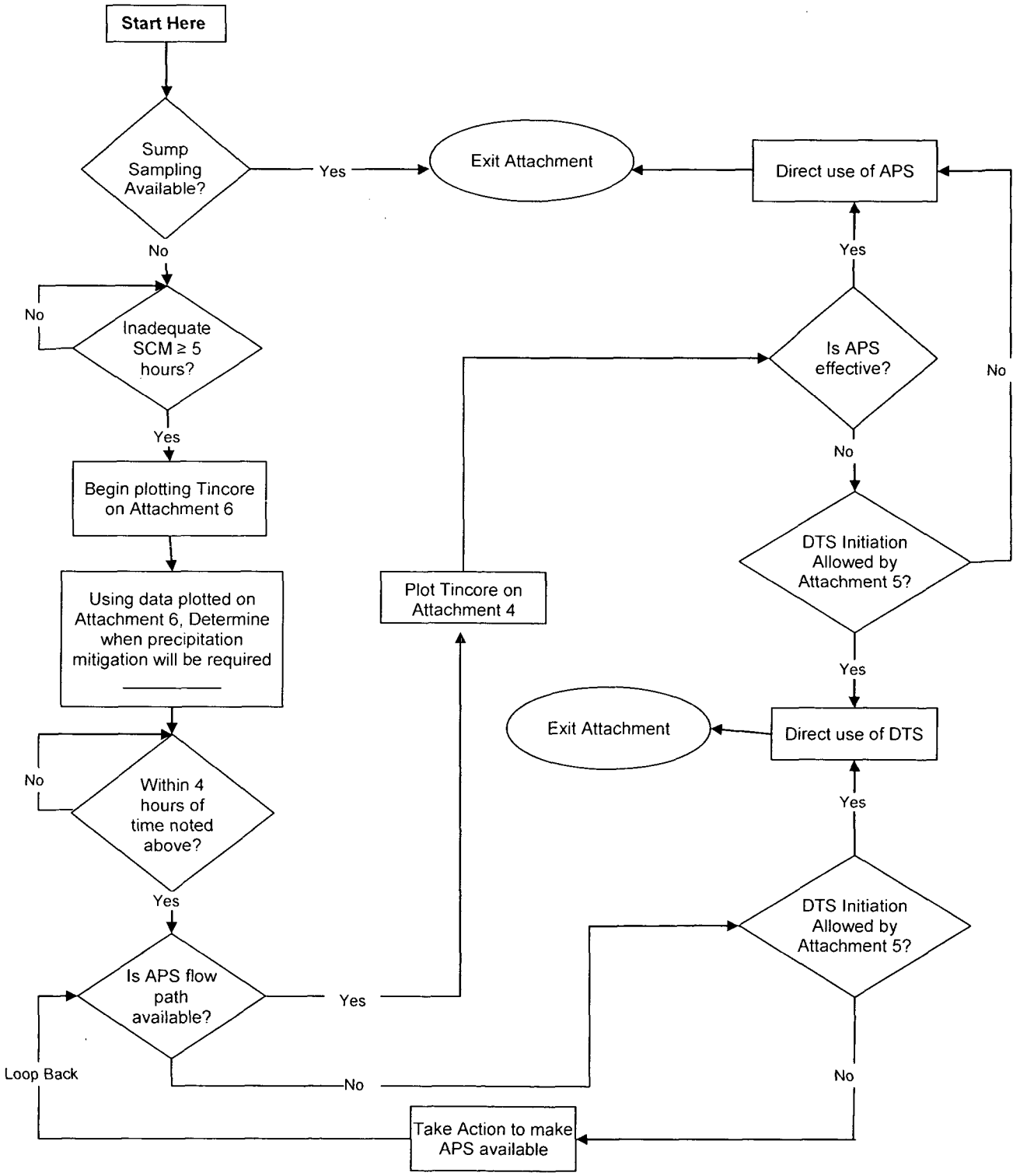
CALCULATION OF EXPECTED RB SUMP CONCENTRATION (CONT'D)



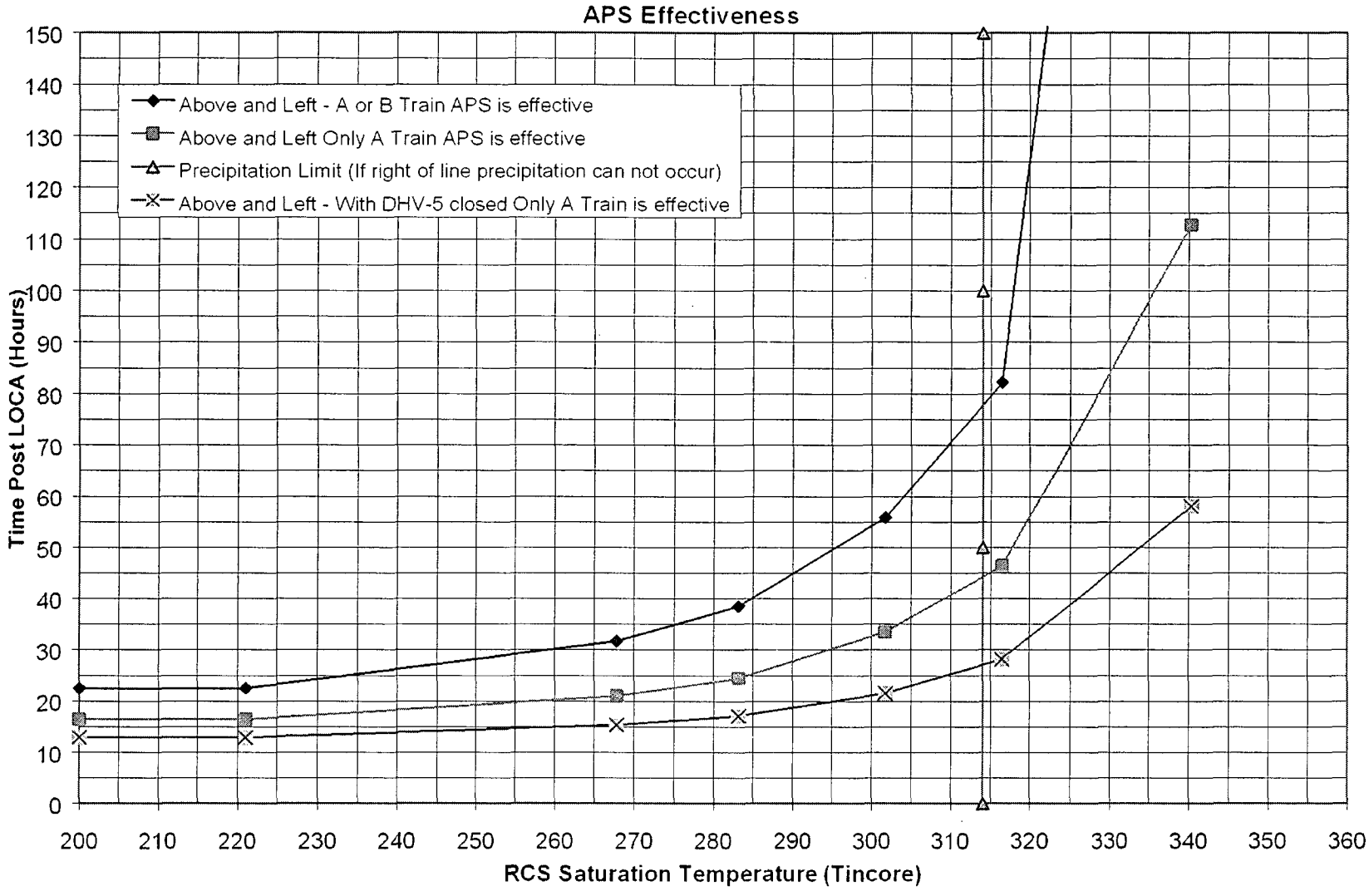
MITIGATION MATRIX WITH RB SUMP SAMPLING



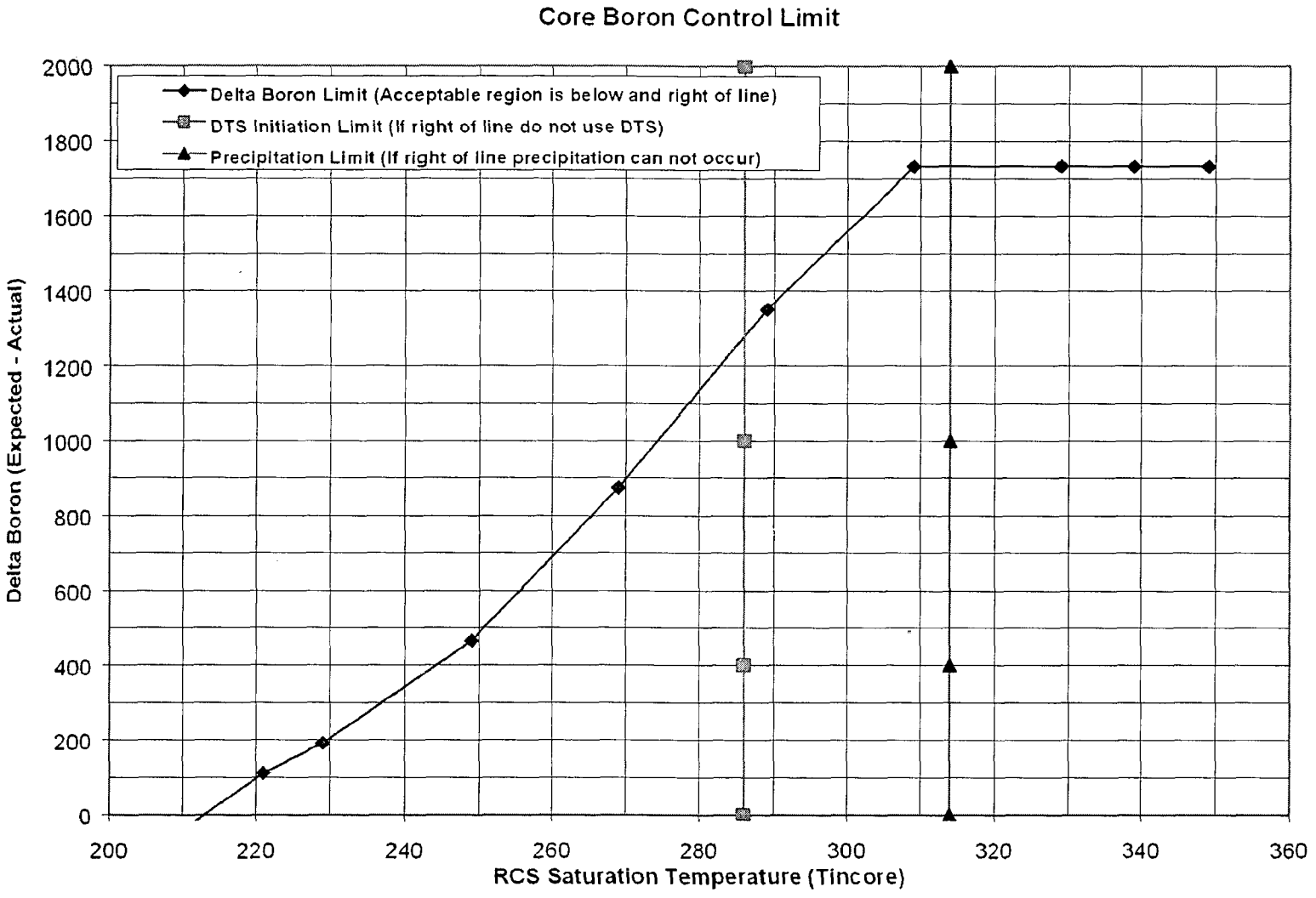
MITIGATION MATRIX WITHOUT RB SUMP SAMPLING



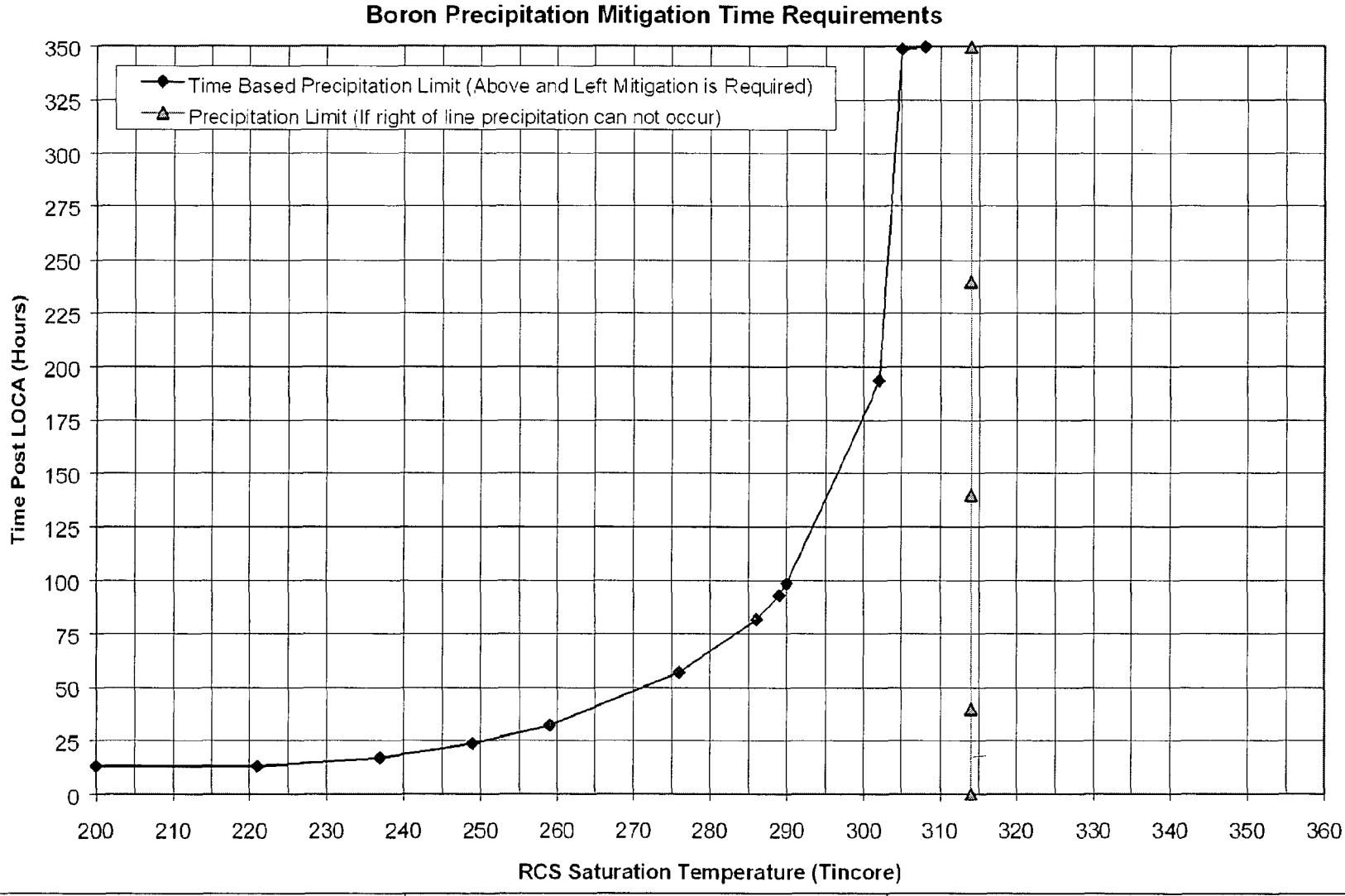
APS EFFECTIVENESS



CORE BORON CONTROL LIMIT



BORON PRECIPITATION MITIGATION TIME REQUIREMENTS



CONTINGENCY ACTIONS FOR ESTABLISHING AUXILIARY PRESSURIZER SPRAY

1.0 PURPOSE

1. The purpose of this attachment is to manually initiate APS. The instructions provide a method for manually opening DHV-91 and establishing temporary power for RCV-53 in the event of a power failure to ES MCC 3AB. The re-powering instructions are set up in two sections, dependent upon the condition and failure mode of ES MCC 3AB. The condition of ES MCC 3AB and the associated area dose rates must be considered before performing these instructions.
2. **Section "A":** Instructions provide temporary power to ES MCC 3AB-5B in the event of loss of power to ES MCC 3AB, however the control circuitry and indication for RCV-53 will still be utilized at ES MCC 3AB-5B.
3. **Section "B":** Instructions provide temporary power and control circuitry for RCV-53, utilizing ES MCC 3B1-8C (Ref. dwg. 206-056). Local control and indication will be at this MCC. ES MCC 3AB is assumed to be inoperable, and no longer intact.

2.0 REFERENCES

2.1 Implementing References

1. MP-405A, Handling, Pulling and Terminations for Safety and Non Safety Related Cables.

2.2 Developmental References

1. Print EC-206-058, One Line - Motor Control Center ES-3AB- AUX. BLDG.- 119'0'
2. Print EC-206-056, One Line - Motor Control Center ES-3B1- AUX. BLDG.-119'0'
3. Print B-208-047 RC-16 Elementary Diagram, RCV-53
4. Print B-208-082 RS-10 Elementary Diagram, Remote Shutdown Panel RCV-53
5. Print 209-047 RC-04 Interconnection Diagram, RCV-53
6. Print 209-101 Sh. 28 Interconnection Diagram, Penetration 308
7. Vendor Drawing Y-90543 Sh. 3, ES MCC 3B1-8C fuses

CONTINGENCY ACTIONS FOR ESTABLISHING AUXILIARY PRESSURIZER SPRAY

3.0 PERSONNEL INDOCTRINATION

3.1 Material Parts List

1. Materials for this procedure are located in EOB-13, located at 145' Aux Bldg. near the RB purge exhaust valve room.

3.2 Limits And Precautions

1. The panel must be de-energized and checked to ensure the absence of any 480 VAC voltage prior to performing work in the panel. Consideration should be given for processing an equipment clearance based on the dose rates and time allowed for this activity.
2. Cables should exit the panel via the bottom.
3. This activity must be fully reviewed with the Radiological Assessment Team in the TSC to determine the best route to take in performing this activity. If dose rates are prohibitive in the areas required by this activity, then this activity should not be performed and other measures should be evaluated by the Accident Assessment Team.

3.3 Prerequisites

1. Personnel assigned shall be knowledgeable, experienced, and qualified to perform the specified tasks as determined by the appropriate supervisor or Maintenance representative in the TSC/OSC ..... ☐
2. Tools and equipment required for this task are pre-staged in the tool box (EOB-13) located at 145' Aux Bldg. near the RB purge exhaust valve room. All cables are pre-lugged and marked for proper installation. Electrical gloves, meter, and safety clothing are obtained from the Electric shop prior to entrance into the Aux Bldg ..... ☐
3. To remove equipment to be worked from service, evaluate the need to obtain an equipment clearance. Due to the plant conditions, which could be present when performing this activity, tags may not be necessary. COORDINATE this activity through the TSC ..... ☐
4. The person in charge of this activity must ensure the following:
   - Work Group has reviewed and understands previous sections of this attachment ..... ☐
   - Initial conditions have been met ..... ☐
   - Safety briefing has been conducted ..... ☐
   - Emergency Coordinator has been notified ..... ☐

Completed by: _____ Date: _____

CONTINGENCY ACTIONS FOR ESTABLISHING AUXILIARY PRESSURIZER SPRAY

3.4 **Responsibilities**

1. The TSC Emergency Repair Team is responsible for ensuring qualified individuals are assigned to perform the temporary power configurations and that proper work practices and boundaries are considered during this evolution, including the use of Concurrent Verification.

4.0 **INSTRUCTIONS**

4.1 **Verify DHV-91 is open:**

1. **IF** DHV-91 cannot be opened from the Main Control Room, **THEN** ESTABLISH a Re-entry Team to manually open DHV-91 "DH TO PZR SPRAY ISO" 119 ft AB penetration area..... N/A ☐ ☐

4.2 **Section "A":**

NOTES:
1. This section of instructions provide temporary power to ES MCC 3AB-5B in the event of loss of power to ES MCC 3AB. However, the control circuitry and indication for RCV-53 will still be utilized at ES MCC 3AB-5B ..... ☐
2. These instructions anticipate that ES MCC 3AB is still intact and the normal breaker cubicle for RCV-53 can be used ..... ☐

1. **IF** required, **THEN** OBTAIN proper clearances from Operations to work in ES MCC 3B1-8C and ES MCC 3AB-5B..... N/A ☐ ☐
2. OBTAIN approximately 100 ft. of 1-3/C-10 cable. This cable is tagged as "power" and is located in the "Section A" materials bag, in EOB-13 located on 145' Aux Bldg. near the RB purge exhaust valve room ..... ☐
3. ROUTE the "power" cable (1-3/C-10) from ES MCC 3B1-8C to ES MCC 3AB-5B..... ☐
4. ENSURE the breaker at 480V ES MCC 3AB-5B is open ..... ☐

CONCURRENT VERIFICATION POINT

5. DETERMINATE the three conductors on the line side of the breaker in ES MCC 3AB-5B **AND** TAPE the bare ends of the conductors **AND** SECURE ..... _____/_____ Initial / CV
6. REMOVE the bottom plate of ES MCC 3AB below breaker 5C, **AND** OPEN the door to breaker 5C to allow the cable to be routed through the bottom of the motor control center ..... ☐

CONTINGENCY ACTIONS FOR ESTABLISHING AUXILIARY PRESSURIZER SPRAY

CONCURRENT VERIFICATION POINT

7. TERMINATE one end of the "power" cable (1-3/C-10) to the line side of breaker located in ES MCC 3AB-5B as follows: L1, L2, L3, left to right respectively ..... _____/_____ Initial / CV

8. ENSURE the breaker located in ES MCC 3B1-8C is open ..... ☐

CONCURRENT VERIFICATION POINT

9. DETERMINATE the three conductors on the load side of the breaker in ES MCC 3B1-8C **AND** TAPE the bare ends of the conductors **AND** SECURE ..... _____/_____ Initial / CV

10. REMOVE the bottom plate of ES MCC 3B1 below breaker 8D, **AND** OPEN the door to breaker 8D to allow the cable to be routed through the bottom of the motor control center ..... ☐

CONCURRENT VERIFICATION POINT

11. TERMINATE the other end of the "power" cable (1-3/C-10) to the load side of the breaker in ES MCC 3B1-8C as follows: L1, L2, L3, left to right respectively ..... _____/_____ Initial / CV

12. **IF** dose rates allow, **THEN** ensure cable is protected where personnel or equipment may need to cross over ..... N/A ☐ ☐

13. INSPECT "power" cable installation **AND** ENSURE ready for energizing ..... ☐

14. OBTAIN permission from Operations to energize the temporary power installation ..... ☐

15. CLOSE the breaker located in ES MCC 3B1-8C ..... ☐

16. VERIFY voltage at the load side of breaker in ES MCC 3B1-8C ..... ☐

17. CLOSE the breaker located in ES MCC 3AB-5B ..... ☐

18. VERIFY voltage at the load side of breaker in ES MCC 3AB-5B ..... ☐

19. NOTIFY the supervisor in charge of this activity that temporary power installation for RCV-53 is ready to test ..... ☐

20. TEST temporary power installation for RCV-53 as described in Section 9.4 ..... ☐

CONTINGENCY ACTIONS FOR ESTABLISHING AUXILIARY PRESSURIZER SPRAY

4.3 **Section "B":**

NOTES:
1. This section of instructions provide temporary power and control circuitry for RCV-53, utilizing ES MCC 3B1-8C (Ref. dwg. 206-056). Local control and indication will be at ES MCC 3B1-8C ☐
2. The normal feed for RCV-53, ES MCC 3AB-5B is assumed to be inoperable, and no longer intact. Remote Shutdown and Control Room indication and control will be removed as a result of this activity ☐

1. COORDINATE with Operations **AND** OBTAIN clearances as required for ES MCC 3B1-8C and ES MCC 3AB-5B (Ref. dwg. 206-056) ☐

CONCURRENT VERIFICATION POINT

2. LOCATE cable RCC281 as indicated on ref. dwg. 209-101 sheet 28, at penetration 308, located outside the RB, in SE quadrant under RB purge exhaust valves **AND** CUT cable RCC281 to allow for butt splicing temporary power to the power cables outside the cable tray ..... _____/_____ Initial / CV

CONCURRENT VERIFICATION POINT

3. DETERMINATE the following conductors (Ref. drawing 209-047 RC-04) at Term Box RC 11, located on the east wall opposite penetration 308:

Circuit	Wire Mark / Color	Term	Performed	Concurrent Verification
RCC283	1/1	TB-A-1		
	11/4	TB-A-5		
	12/2	TB-A-6		
	13/3	TB-A-7		
	14/7	TB-A-8		
	15/9	TB-A-9		
	21/5	TB-A-13		
	33/6	TB-A-14		
	32/8	TB-A-16		
RCC284	17/4	TB-A-10		
	18/3	TB-A-11		
	19/7	TB-A-12		
	34/1	TB-A-15		
RCC312	1/1	TB-A-1		
	5/5	TB-A-3		
	9/3	TB-A-4		
	12/2	TB-A-6		
	21/4	TB-A-13		

CONTINGENCY ACTIONS FOR ESTABLISHING AUXILIARY PRESSURIZER SPRAY

4. OBTAIN materials located in the "Section B" materials bag, in EOB-13, located on the 145' Aux Bldg. near the RB purge exhaust valve room..... ☐

5. ROUTE the "control" cable (1-9/C -14) from Term Box RC 11 and the "power" cable (1-3/C-10) from penetration 308 to ES MCC 3B1..... ☐

6. **IF** time allows, **THEN** ENSURE the cable on the 119' elevation near ES MCC 3B1 is not a tripping hazard. TIE wrap cables as necessary to secure..... N/A ☐ ☐

NOTE: Butt splices are to be made outside the cable tray..... ☐

CONCURRENT VERIFICATION POINT

7. SPLICE the "power" cable (1-3/C-10) to cable RCC281 from penetration 308..... _____/_____
Initial / CV

CONCURRENT VERIFICATION POINT

8. TERMINATE the "control" cable (1-9/C-14) (Ref. dwg. 209-047 RC-04) at Term Box RC 11 as follows:

Wire Color / Mark	Term	Performed	Concurrent Verification
1/1	TB-A-1		
2/5	TB-A-3		
3/9	TB-A-4		
4/11	TB-A-5		
5/13	TB-A-7		
6/14	TB-A-8		

CONCURRENT VERIFICATION POINT

9. TERMINATE the #14 AWG Jumper (Ref. dwg. 209-047 RC-04) at Term Box RC 11 as follows:

From	To	Performed	Concurrent Verification
TB-A-14	TB-A-1		

10. ENSURE the breaker located in ES MCC 3B1-8C is open..... ☐

11. REMOVE the bottom plate of ES MCC 3B1 below breaker 8D, **AND** OPEN the door to breaker 8D to allow the cable to be routed through the bottom of the motor control center..... ☐

CONTINGENCY ACTIONS FOR ESTABLISHING AUXILIARY PRESSURIZER SPRAY

CONCURRENT VERIFICATION POINT

12. TERMINATE "control" cable (1-9/C-14) at ES MCC 3B1-8C as follows:

Wire Color / Mark	Termination	Performed	Concurrent Verification
1/1	8C-1		
2/5	8C-2		
3/9	8C-5		
4/11	8C-8		
5/12	8C-9		
6/14	8C-10		

CONCURRENT VERIFICATION POINT

13. TERMINATE "power" cable (1-3/C-10) at ES MCC 3B1-8C as follows:

Wire Color / Mark	Termination	Performed	Concurrent Verification
1/L1	8C-T1		
1/L2	8C-T2		
1/L3	8C-T3		

14. OBTAIN permission from Operations to energize the temporary power installation ..... ☐

15. CLOSE the breaker located in ES MCC 3B1-8C..... ☐

16. VERIFY voltage at the load side of breaker in ES MCC 3B1-8C..... ☐

17. NOTIFY the supervisor in charge of this activity that temporary power installation for RCV-53 is ready to test ..... ☐

18. TEST the temporary power installation for RCV-53 per Section 9.4 ..... ☐

CONTINGENCY ACTIONS FOR ESTABLISHING AUXILIARY PRESSURIZER SPRAY

4.4 Steps for Checking Proper Motor Rotation for RCV-53

NOTE: Section 9.3 installation instructions remove Remote Shutdown and Control Room indication and control ..... ☐

CAUTION

If the motor leads are reversed, the open limit switch and/or closed torque switch controls will not automatically stop the valve..... ☐

1. **IF** the **amber** light is lit on ES MCC 3B1-8C cubicle door, **THEN** PERFORM the following..... N/A ☐ ☐

   a. While observing the **red** (open) and **green** (close) indicating lights DEPRESS **AND** HOLD the close push button until an indicating light is lit..... ☐

   b. **IF** the **green** light is lit, **THEN** the motor rotation is correct..... N/A ☐ ☐

   c. **IF** the **red** light is lit, **THEN** REVERSE two of the motor leads in the ES MCC 3B1-8C cubicle to correct the rotation..... N/A ☐ ☐

   d. NOTIFY the supervisor that the system is ready for operation..... ☐

CAUTION

If the motor leads are reversed, the open limit switch and/or closed torque switch controls will not automatically stop the valve..... ☐

2. **IF** the **green** light is lit on ES MCC 3B1-8C cubicle door, **THEN** PERFORM the following..... N/A ☐ ☐

   a. DEPRESS **AND** HOLD the open push button for maximum of three (3) seconds and observe indication lights ..... ☐

   b. **IF** the **green** light is lit, **THEN** REVERSE two of the motor leads in the ES MCC 3B1-8C cubicle to correct the rotation ..... N/A ☐ ☐

   c. **IF** the **amber** light is lit, **THEN** the motor rotation is correct..... N/A ☐ ☐

   d. NOTIFY the supervisor that the temporary power for RCV-53 is ready ..... ☐

CONTINGENCY ACTIONS FOR ESTABLISHING AUXILIARY PRESSURIZER SPRAY

CAUTION

If the motor leads are reversed, the open limit switch and/or closed torque switch controls will not automatically stop the valve..... ☐

3. **IF** the **red** light is lit on ES MCC 3B1-8C cubicle door, **THEN** PERFORM the following..... N/A ☐ ☐

   a. DEPRESS **AND** HOLD the close push button for maximum of three (3) seconds and observe indication lights ..... ☐

   b. **IF** the **red** light is lit, **THEN** REVERSE two of the motor leads in the ES MCC 3B1-8C cubicle to correct the rotation..... N/A ☐ ☐

   c. **IF** the **amber** light is lit, **THEN** motor rotation is correct..... N/A ☐ ☐

   d. NOTIFY the supervisor that the temporary power for RCV-53 is ready ..... ☐

Summary of Changes
PRR 321653

NOTES: 1. Writers and Reviewers: Ensure that any changes to this procedure that affect information contained in ERF posters, enclosures, briefing cards, guidelines etc. are made to those items as well.

2. Writers and Reviewers: Changes to certain parts of this procedure may impact other EPIPs. Ensure appropriate PRRs are initiated as needed.

SECTION	CHANGE
Throughout	reformatting IAW PRO-NGGC-0201 and incorporated editorial.
Throughout	Enclosure 1 became Attachment 1 Enclosure 2 became Attachment 2 Enclosure 3 became Attachment 3 Enclosure 4 became Attachment 4 Enclosure 5 became Attachment 5 Enclosure 6 became Attachment 6 Enclosure 7 became Attachment 7
1.0.2	Added new purpose step stating "this procedure is an emergency plan implementing procedure. any revision to this procedure must be carefully considered for emergency plan impact." (PRR 321653)
2.2	Added new implementing reference section
9.1	Changed the title to "Contingency Actions for Establishing Auxiliary Pressurizer Spray"
9.1.1	Changed beginning of step from ____ to "IF auxiliary pressurizer spray will be used and"
Summary of Changes	Added two new notes before Summary of Changes Table (PRR 411913)

#1242

Progress Energy	I Information Use

CRYSTAL RIVER UNIT 3

PLANT OPERATING MANUAL

EM-225C

POST ACCIDENT MONITORING OF REACTOR BUILDING TEMPERATURE

REVISION 6

TABLE OF CONTENTS

1.0 PURPOSE

1. The purpose of this procedure is to provide guidance to the TSC Accident Assessment Team to monitor and take action to ensure Reactor Building (RB) temperatures remain below the qualified threshold limits for environmentally qualified components. If temperatures approach a predetermined limit, then actions will be taken to reduce RB temperatures to acceptable values.
2. This procedure is an emergency plan implementing procedure. Any revisions to this procedure must be carefully considered for emergency plan impact.

2.0 REFERENCES

2.1 Developmental References

1. ITS 3.6.5 Containment Air Temperature
2. Environmental Qualification Plant Profile Document
3. IOC NOE 97-2534, Assessment to support EM-225C for SBLOCA EQ Concerns, dated 12/4/97
4. Calculation M-97-0072, CR-3 Containment Analysis for SBLOCA, Rev. 2
5. PC 97-7607
6. IOC NSM 98-0592, Close out of the DR/JCO related to PC 97-7607 - RB EQ Temperatures from a SBLOCA event, dated 4/2/98
7. Calculation M-97-0132, CR3 Containment Analysis, Rev. 7
8. PC 00-0830, Enclosure 1 curve in EM-225C appears to be incorrect, dated 3/16/00
9. Calculation M-90-0021, Building Spray and Decay Heat NPSH, Rev. 12
10. Calculation E01-0001, Determination of Post Accident Operating Times for EQ Components Subjected To SBLOCA Conditions, Rev. 1, Historical

3.0 DEFINITIONS

None

4.0 RESPONSIBILITIES

The TSC Accident Assessment Team is responsible for monitoring RB temperatures post accident, and to provide recommendations to the Emergency Coordinator to initiate building spray if temperatures reach the limits established in this procedure.

5.0 PREREQUISITES

None

6.0 PRECAUTIONS LIMITATIONS AND NOTES

1. Large break LOCAs and larger small break LOCAs will result in RB Pressures that actuate building spray automatically. Actions to manually start building spray to reduce RB temperatures will not be required in these situations.
2. Prior to starting any ES powered component, adequate load margin must be available if the ES 4160 volt busses are energized from the emergency diesel generators.
3. Prior to starting a building spray pump, building spray flow control valves must be set for 1200 gpm if ECCS suction has been transferred to the RB Sump.
4. If a SGTR is in progress then ensure adequate RB sump level is available prior to transferring or starting a BS pump from the RB Sump. With a SGTR, sufficient RB sump level might not be available due to loss from the SGTR. Reference calculation M-90-0021 for BSP NPSH requirements.

7.0 SPECIAL TOOLS AND EQUIPMENT

None

8.0 ACCEPTANCE CRITERIA

None

9.0 INSTRUCTIONS

1. If at least one building spray pump is running, then exit this procedure. No further action is required.
2. If an RCS leak is occurring in the reactor building, then begin plotting average RB temperature on Enclosure 1, Limiting RB Temperature for at least 1 hour intervals in the beginning of the event. The plotting interval can be changed based on plant conditions.
3. RB Temperature is the average of the following four temperature elements:

TEMPERATURE ELEMENT	CONTROL ROOM RECORDER	RECALL POINT	COMPUTER POINT	RB ELEV.
AH-536-TE	AH-1003-TIR	RECL-77	S358	102
AH-537-TE		RECL-78	S359	125
AH-538-TE		RECL-80	S382	180
AH-539-TE		RECL-81	S383	235
AVERAGE			S837	

4. If average RB Temperature is in the "Acceptable" Region of Enclosure 1, Limiting RB Temperature, and decreasing, then exit this procedure.
5. If at any time average RB temperature reaches "Action Required boundary" region of Enclosure 1, Limiting RB Temperature, then obtain Emergency Coordinator concurrence to start at least one building spray pump.
6. If a building spray pump is required and EC concurrence has been obtained, then perform the following:
   a. Ensure load is available on the ES diesel generators per EOP-13, Rule 5.
   b. Ensure Building Spray flow controls are set at 1500 GPM and "Remote" if pumps are aligned to BWST, or 1200 GPM and "LOCAL" if aligned to the RB Sump.
   c. Notify the control room to start one building spray pump.
7. Continue to monitor RB Temperature.
8. If RB Temperature does not lower to the acceptable region of Enclosure 1, Limiting RB Temperature, then notify control room to start a second building spray pump if available.

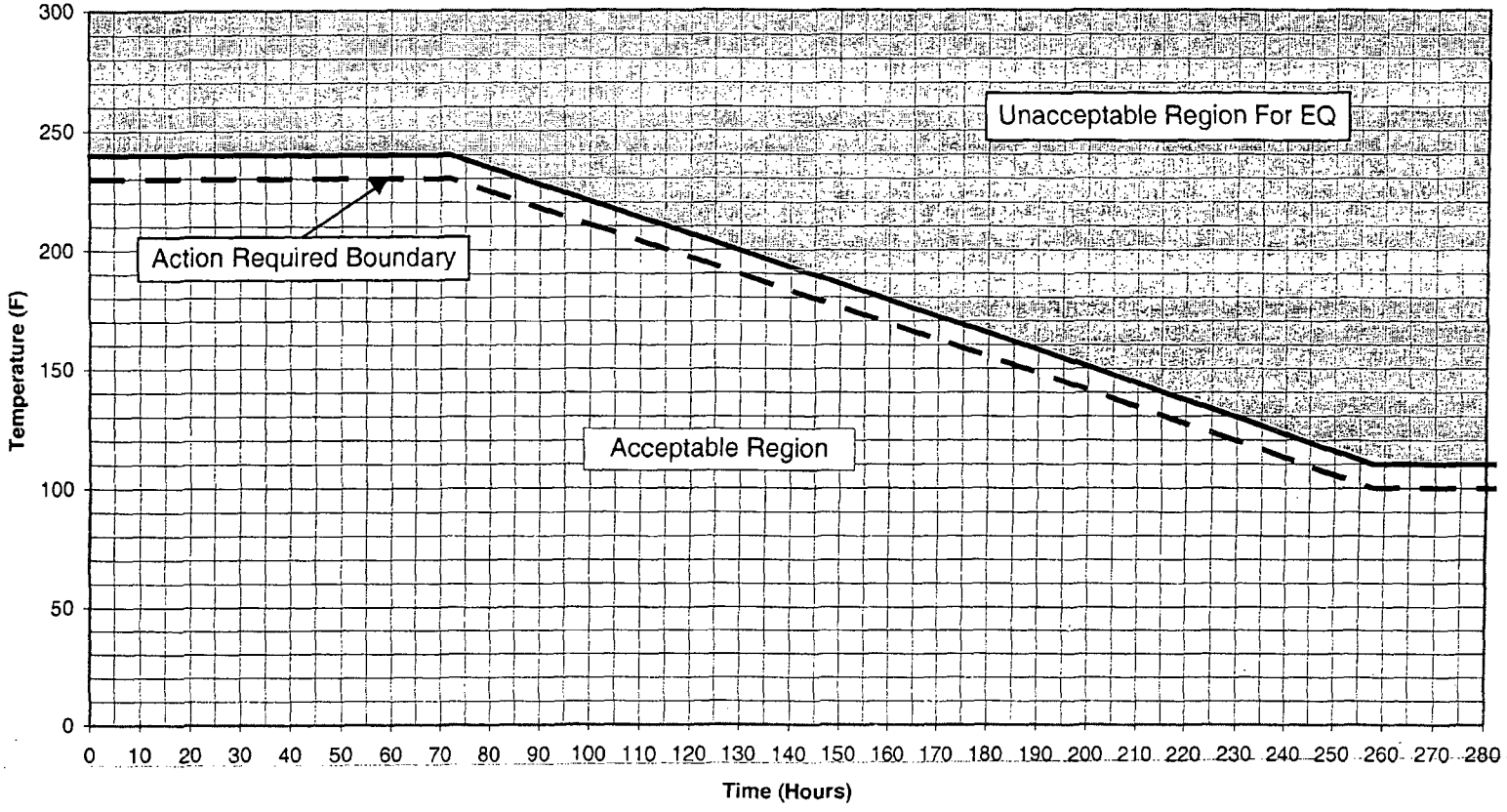
NOTE: If building spray pumps are running, Emergency Operating Procedures provide guidance to secure them. If building spray pumps are secured, begin additional monitoring of RB Temperatures until a continuing decreasing trend is achieved.

9. When building spray pumps are running, then exit this procedure.

10.0 RECORDS

No records generated by this procedure.

LIMITING RB TEMPERATURE



Summary of Changes
PRR 233084

NOTES: 1. Writers and Reviewers: Ensure that any changes to this procedure that affect information contained in ERF posters, enclosures, briefing cards, guidelines etc. are made to those items as well.

2. Writers and Reviewers: Changes to certain parts of this procedure may impact other EPIPs. Ensure appropriate PRRs are initiated as needed.

SECTION	CHANGE
Throughout	reformatting IAW PRO-NGGC-0201
1.0.2	New purpose step stating "this procedure is an emergency plan implementing procedure. any revisions to this procedure must be carefully considered for emergency plan impact." (PRR321654)
2.1.2	Changed from Environmental and Seismic Qualification Program Manual to Environmental Qualification Plant Profile Document (PRR 233084)
2.1.10	Reference has turned to historical. Put the word historical at the end of the reference.
Summary of Changes	Added two new notes infront of summary of changes table (PRR 411914)

#1242

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CRYSTAL RIVER UNIT 3

PLANT OPERATING MANUAL

EM-225D

GUIDANCE FOR OTSG TUBE TO SHELL DELTA T MONITORING AND CONTROL

REVISION 5

TABLE OF CONTENTS

1.0 PURPOSE

1. The purpose of this procedure is to provide guidance to the TSC Accident Assessment Team (AAT) to monitor OTSG conditions that may challenge OTSG tube-to-shell delta T limits, and provide recommendations to the Emergency Coordinator and Control Room on methods to prevent delta T limits from being exceeded.
2. These guidelines are applicable when reliable OTSG Tube to Shell delta T instrumentation is unavailable or Tube to Shell delta T cannot be maintained within Limits.
3. This procedure is an emergency plan implementing procedure. Any revisions to this procedure must be carefully considered for emergency plan impact.

2.0 REFERENCES

2.1 Developmental References

1. Framatome Technology Letter INS-97-4651, dated 11/25/97
2. FTI Document No. 51-1224886-02, OTSG Refill Summary Report
3. Calculation M97-0156, CR-3 EOP Natural Circulation Tube Loads (FTI Document No. 51-1266247-00)
4. Emergency Operating Procedures Technical Bases Document, Volume 1
5. Calculation M01-0001, OTSG Tube-to-Shell Temperature Differential during Idle Loop Cooldown

2.2 Implementing References

1. EOP-13, EOP Rules
2. EOP-14, Emergency Operating Procedure Enclosure
3. OP-407R, Operations Involving MWST Processing via Waste Processing Demineralizer System

3.0 DEFINITIONS

1. **Dry OTSG:** Any OTSG with an indicated level of ≤ 12.5 inches as read on the EFIC low range level instruments.
2. **OTSG integrity:** OTSG integrity exists if the secondary side pressure boundary is intact, allowing an OTSG to pressurize when supplied with feedwater.
3. **OTSG Shell Temperature:** The temperature of the bulk of the metal composing the shell of an OTSG. Shell temperature on a dry OTSG will lower over time as heat is lost to the Reactor Building. The shell is estimated to cool at approximately 3°F/ ½ hour. Enclosure 1, Minimum RCS Temperature Curve provides an estimate of shell temperature versus time.
4. **RCS Tincore:** The temperature indication supplied by the incore thermocouples to SPDS, Tsat monitors and the core exit temperature recorders in the Control Room. Tincore is used to estimate average OTSG tube temperature when at least 1 RCP is running. Tincore can be determined from SPDS, or if SPDS is not available, use average Tincores from the core exit chart recorders on the MCB (RC-171-TR, RC-172-TR).

5. **OTSG Tube Temperature:** The temperature associated with the tubes of an OTSG. Tube temperature can be determined using Tincore when at least 1 RCP is running. If no RCPs are running, tube temperature can only be estimated if natural circulation exists in the OTSG. Natural Circulation will only occur if the dry OTSG is being fed. If natural circulation exists, Thot can be used to approximate tube temperatures.

6. **OTSG Tube to shell delta T:** The difference between OTSG tube temperature and the OTSG shell temperature. If the tubes are hotter than the shell, the tubes are in compression (compressive stress). If the tubes are colder than the shell, the tubes are in tension (tensile stress).

4.0 RESPONSIBILITIES

1. TSC Accident Assessment Team: Responsible for monitoring OTSG conditions that may result in excessive tube to shell delta T, and to recommend actions to the Emergency Coordinator and the Control Room to minimize tube stresses under these conditions.
2. Emergency Coordinator: Responsible for reviewing and approving all recommendations provided by the Accident Assessment Team prior to implementation by the Control Room staff.

5.0 PREREQUISITES

None

6.0 PRECAUTIONS LIMITATIONS AND NOTES

1. Initiating a source of feedwater to an OTSG that does not have integrity must be carefully evaluated and planned to prevent harm to personnel and damage to vital plant equipment.
2. If either ES 4160 volt bus is energized from an emergency diesel generator, then prior to starting any ES powered component ensure adequate load margin is available on the EDG. Refer to EOP-13, Rule 5.
3. Establishing feedwater flow to a faulted OTSG with a feedwater or steam line break in the Reactor Building could dilute sump recirculation fluid if a LOCA was in progress or subsequently occurs.
4. OTSG tube compression limit (tubes hotter than shell) is 60°F.
5. OTSG tube tensile limit (tubes cooler than shell) is 100°F.
6. All actions recommended to the Control Room as a result of this procedure must be pre-approved by the Emergency Coordinator.
7. The operating crew and the TSC staff should monitor for indications of a steam generator tube leak during the RCS cooldown.

7.0 SPECIAL TOOLS AND EQUIPMENT

None

8.0 ACCEPTANCE CRITERIA

None

9.0 INSTRUCTIONS

9.1 General Guidelines

1. Refer to Enclosure 3, Mitigation Strategy Diagram for an overall approach to control OTSG tube to shell delta T.
2. If shell temperatures appear accurate, then monitor shell temperatures using shell thermocouples referenced below. The shell thermocouples may provide useful trend data.

A-OTSG	A-730,731,732,733,734	Average R-771
B-OTSG	A-735,736,737,738,739	Average R-772

3. If any OTSG shell temperature computer points appear inaccurate then average the remaining accurate computer points for the effective OTSG to determine average temperature.
4. If shell thermocouples are accurate, then cooldown rate should be adjusted as necessary to control tube to shell delta T within above limits (Ref 6.0.4 and 6.0.5)
5. If integrity is restored to a dry OTSG, then establish feedwater to the dry OTSG using EOP-14, Enclosure 3, Dry OTSG Recovery.
6. If a SBLOCA or RCS leak is in progress concurrent with a dry OTSG and OTSG shell temperature instruments are not available, then HPI flow may result in RCS cooldown limits being in excess of 3°F/ ½ hour on a dry OTSG. Minimize OTSG cooling on the intact OTSG and attempt to maintain RCS temperature above the minimum RCS temperature curve in Enclosure 1, Minimum RCS Temperature Curve if forced flow exists. The minimum RCS temperature curve was generated assuming forced flow exists.
7. Prior to recommending feeding a faulted OTSG, determine if additional steaming could result in personnel safety hazard or plant equipment damage.
8. If a feedwater or steam line failure has occurred in the Reactor Building, then ensure that Emergency RB Cooling is in service prior to initiating flow to a faulted OTSG. Monitor RB temperature and pressure during feeding.
9. If a LOCA is in progress, and a feedwater or steam line failure has occurred in the Reactor Building, then do not feed the faulted OTSG. Feeding the OTSG will result in dilution of the RB Sump recirculation fluid.
10. If a feedwater or steam line failure has occurred in the Reactor Building, and a LOCA is not in progress, then the RB sump pumps must remain in service to pump condensation from the Reactor Building sump. This may require bypassing ES and reopening WDV-3 and WDV-4. Begin processing water from the Miscellaneous Waste Storage Tank per OP-407R, Operations Involving MWST Processing via Waste Processing Demineralizer System, as soon as possible. Processing rates are 30 to 40 gpm.
11. Minimize subcooling margin based on Tincore to minimize tube pressure stresses.
12. Any source of feedwater flow to a dry OTSG must be established to the upper (EFW) nozzles to minimize tube stresses.

9.2 Guidelines For A Dry OTSG With Forced Flow

1. Plot RCS temperature (Tincores) versus time on Enclosure 1, Minimum RCS Temperature Curve to estimate tube to shell differential temperature. Tincores provide reliable indication of tube temperatures when RCPs are running. Use SPDS to determine incore temperature and Time=0 is based on when the OTSG boiled dry.
2. If SPDS is not available, then use average Tincores from the core exit chart recorders on the MCB to determine RCS temperature (RC-171-TR, RC-172-TR) for plotting RCS temperature versus time on Figure 1.
3. When at least one RCP is running and OTSG shell temperature instruments are not available for the dry OTSG, tube to shell delta T can be maintained within limits by cooling down the RCS at approximately 3°F/ ½ hour using the good OTSG. This cooldown rate is the estimated cooldown rate of the OTSG shell and will minimize differential thermal expansion between the tubes and shell.
4. If OTSG shell instrumentation is not available and the 3°F/ ½ hour rate is not achieved or is exceeded, then the cooldown for the following ½ hour must be adjusted accordingly (i.e., increase or decrease cooldown to achieve a 6°F temperature change over the total hour period).
5. Maintain Tincore above the "Min RCS Temp" curve shown in Enclosure 1, Minimum RCS Temperature Curve to prevent challenging the tensile limit of the tubes.
6. If RCS temperature approaches the "Min RCS Temp" limit, then stop or minimize the cooldown. This minimum temperature limit is only applicable when any RCP is operating.

9.3 Guidelines for a Dry OTSG with Natural Circulation

1. With no RCPs running, natural circulation will not exist in the loop with a dry OTSG. Since the reactor coolant in the affected OTSG tubes is stagnant, cooling the RCS at 3°F/ ½ hour will not be an effective means to minimize tube to shell delta T on the affected loop.
2. With no RCPs running, a dry OTSG may exceed tube to shell compressive limits if feeding does not occur within approximately 5 hours.
3. If forced flow is restored, then cooldown the RCS within ITS limits (see cooldown tables in EOPS) using the good OTSG to equalize RCS temperature (Tincore) with the estimated shell temperature from Enclosure 1, Minimum RCS Temperature Curve. Forced flow will provide a means to monitor and cooldown the idle OTSG. RCP restart guidance is included in EOP-14, Enclosure 16, RCP Recovery. Continue the RCS cooldown at a rate of approximately 3°F/ ½ hour unless instrumentation is available to monitor actual tube to shell temperature within limits and use the forced flow guidance in Section 9.2.
4. If an RCP cannot be started, then determine if the hot leg on the dry OTSG is saturated or subcooled by requesting a reading of the T_{sat} monitor in the Control Room when the loop is selected for "T_{hot}" or by use of the steam tables.

5. If the dry OTSG hot leg is subcooled, and the steaming path is acceptable, then perform the following:
   - Establish EFW or AFW flow to the affected OTSG at ≤ 200gpm in 1 line to initiate natural circulation through the idle loop.
   - Control flow to both the intact and faulted OTSG to prevent exceeding ITS cooldown rates.
   - Attempt to equalize Thot with the estimated shell temperature of Enclosure 1 to limit the compressive tube to shell delta temperature.
   - Terminate flow to affected OTSG if steaming the faulted OTSG is causing a hazard to personnel or vital plant equipment.
   - If OTSG integrity is restored, then feed the dry OTSG per EOP-14, Enclosure 3 Dry OTSG Recovery.
   - Cooldown the RCS at approximately 3°F/ ½ hour to attempt to track the shell cooldown rate. The "Min RCS Temp" curve is not applicable with no RCP in operation.
   - When DH is established, then ensure high point vents are closed.
6. If the dry OTSG hot leg is saturated, and the steaming path is acceptable, then perform the following:
   a. Estimate OTSG tube temperature on the faulted OTSG using Tsat of the primary side, based on RCS P_{sat}.
   b. Stop the cooldown.
   c. Ensure RB cooling is in service prior to opening high point vent valves. Opening the high point vents may result in Reactor Building Pressure reaching the ES actuation setpoint (4 psig nominal) and raise Reactor Building temperature.
   d. Anticipate inventory makeup to the RCS and open the high point vent valves to reduce or eliminate the void.
   e. Establish EFW or AFW flow to the affected OTSG at a rate of ≤ 200 gpm in 1 line for 1 minute.
   f. If OTSG integrity is restored, then feed the dry OTSG per EOP-14, Enclosure 3, Dry OTSG Recovery.
   g. If natural circulation cannot be induced and the faulted OTSG cannot repressurize, then do not reinitiate EFW unless the hot leg becomes subcooled due to natural circulation or by performance of Step 9.3.7.
   h. If the hot leg does become subcooled, then follow the guidance in Step 9.3.5.
   i. Cooldown the RCS at approximately 3°F/ ½ hour to attempt to track the shell cooldown rate. The "Min RCS Temp" curve is not applicable with no RCP in operation.

7. If the dry OTSG hot leg remains saturated after feeding for 1 minute, or a safe steaming path is not available, then perform the following:
   - Consider opening the high point vent valves on the idle hot leg to limit the tube temperature if not already being performed.
     - Flow through the high point vent will allow cooler RCS to refill the hot leg and lower compressive tube stresses.
     - Opening the high point vent may result in Reactor Building Pressure reaching the ES actuation setpoint (4 psig nominal) and raise Reactor Building temperature.
     - Opening the high point vent may require HPI flow to prevent loss of subcooling margin based on Tincores.
     - RB cooling should be in service prior to opening high point vent valves.
     - If the hot leg becomes subcooled as a result of opening the high point vents, then close the high point vents and feed the Dry OTSG per Step 9.3.5.
   - If feeding the OTSG is not possible, then cycle the high point vents as required to continue a cooldown of the idle hot leg.
   - Cooldown the RCS at approximately 3°F/ ½ hour to attempt to track the shell cooldown rate. The "Min RCS Temp" curve is not applicable with no RCP in operation.

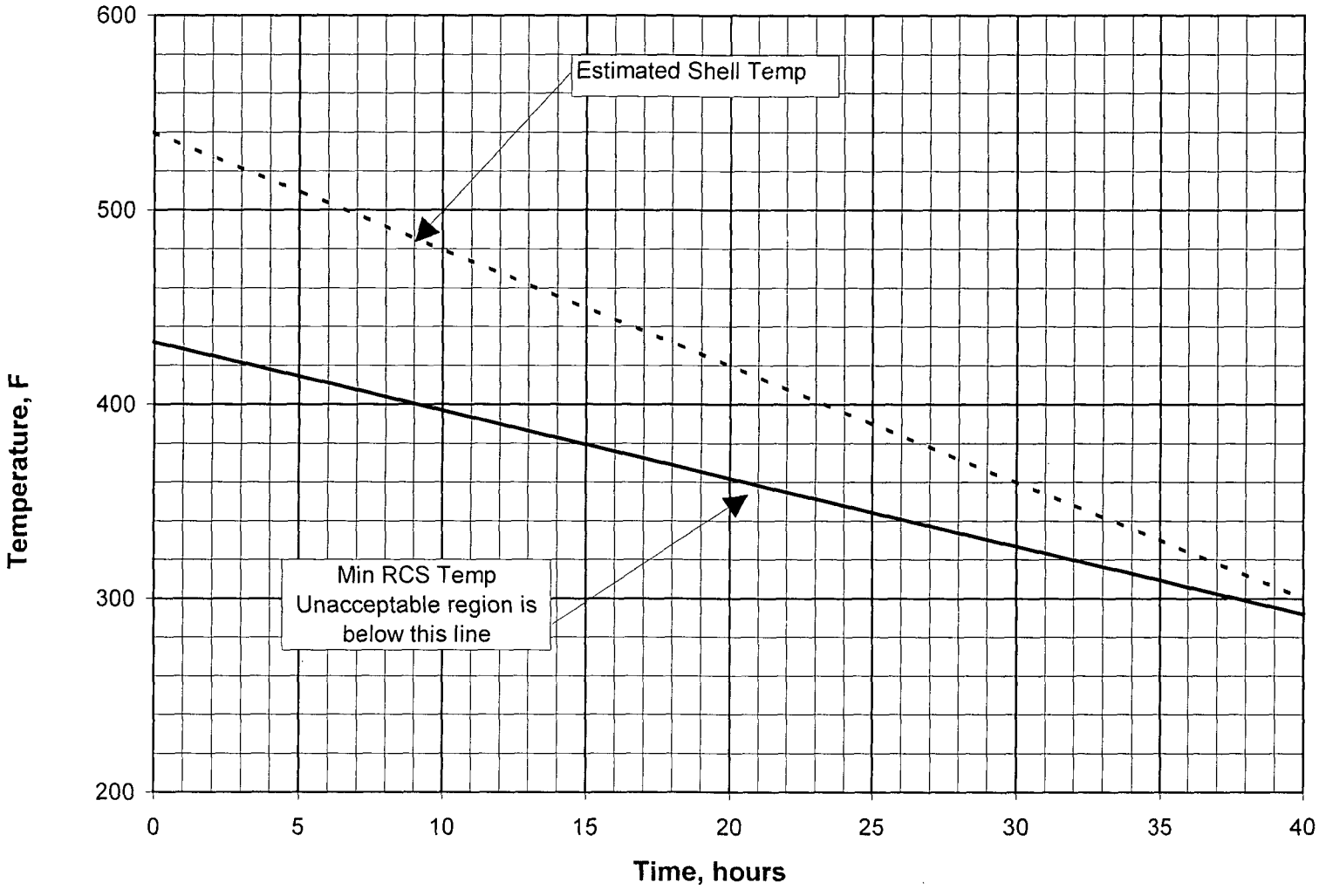
9.4 Guidelines For A Non-Dry OTSG To Maintain OTSG Tubes Within The Allowable Stress Limit

1. If either OTSG is not steaming, and ≥ 1 RCP running, and OTSG shell temperature instruments are not available for OTSG not Steaming, then ensure RCS is within allowable cooldown limits specified Enclosure 2, Maximum Allowable RCS Cooldown for Forced Flow with an Idle OTSG.
2. For all other conditions then ensure RCS is within required cooldown limits (see cooldown tables in EOPS).

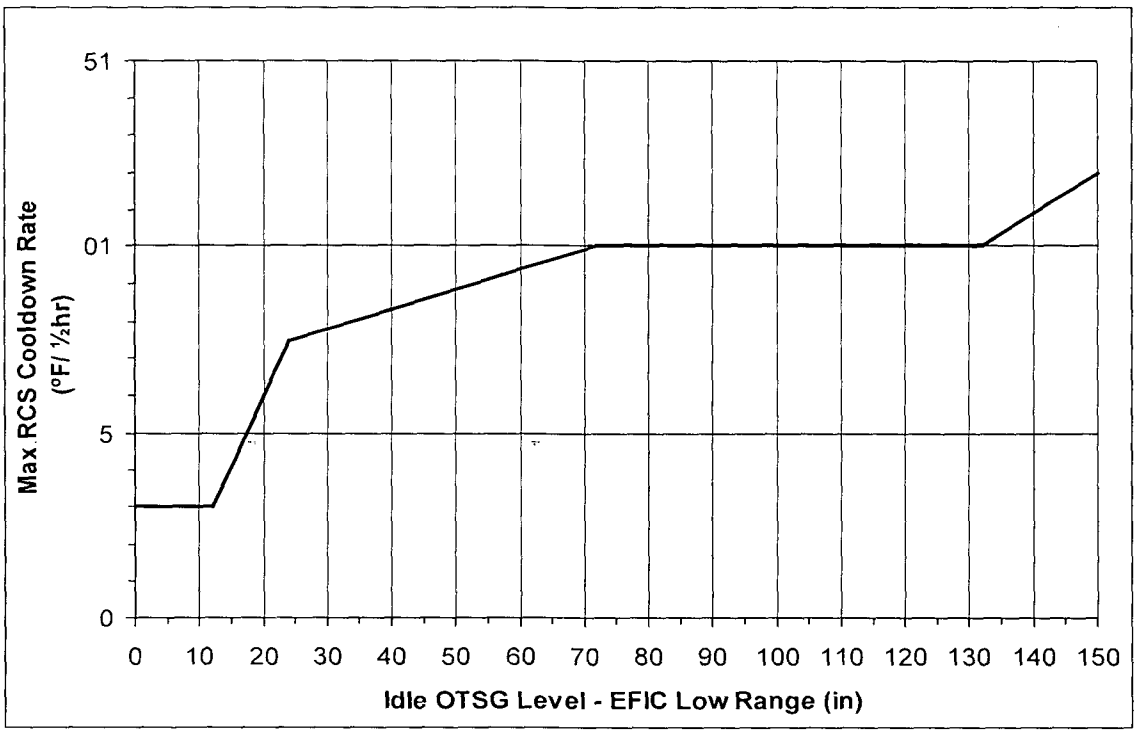
10.0 RECORDS

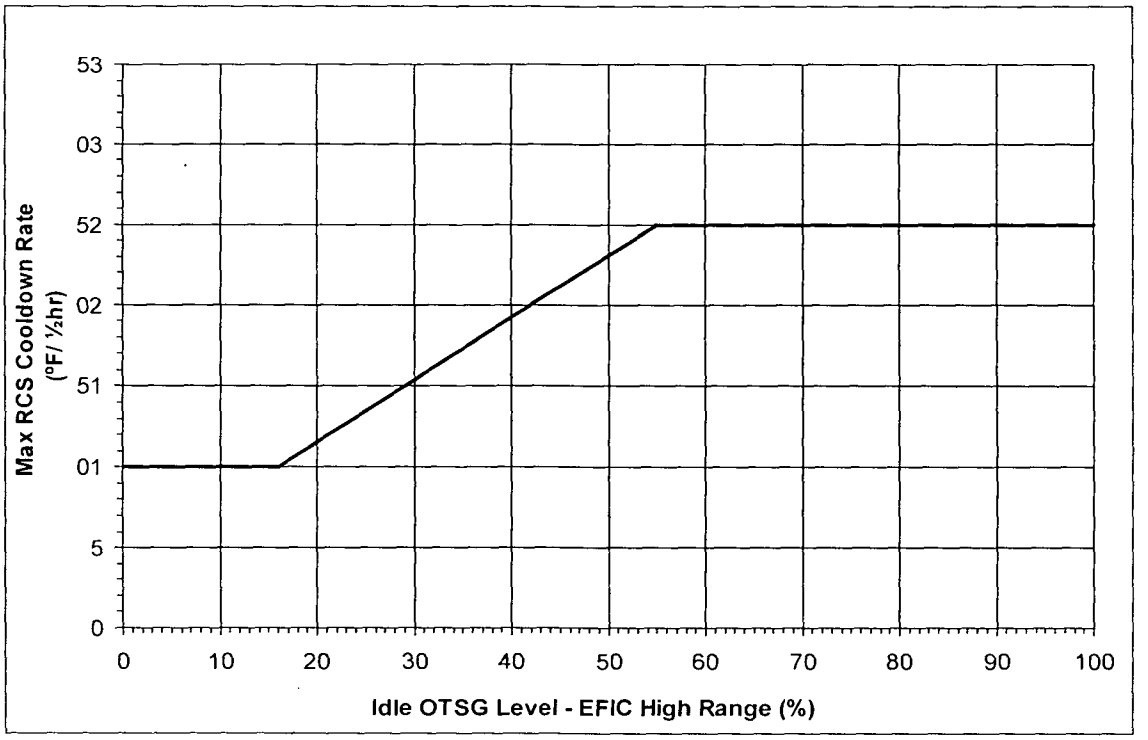
None

MINIMUM RCS TEMPERATURE CURVE



MAXIMUM ALLOWABLE RCS COOLDOWN FOR FORCED FLOW WITH AN IDLE OTSG





MITIGATION STRATEGY DIAGRAM

ENTRY CONDITIONS
- OTSG Tube to Shell ΔT Instrumentation unavailable
- Tube to Shall ΔT cannot be maintained within limits

OSTG/RCS CONDITION
(Ref. Section 9.2)
All the following condition exist:
- Either OTSG dry (<12.5") **AND NOT** steaming
- ≥ RCP operating
- OTSG shell temperature instruments NOT available.

STRATEGY
The dry OTSG prevents heat transfer from the RCS to the dry OTSG shell. Therefore, the RCS must be cooled down along with the estimated dry OTSG shell cooldown from ambient heat loss. This strategy keeps the OTSG shell and RCS tubes within the required tube to shell ΔT limit.

REQUIRED ACTIONS
- Maintain a 3°F/½ hr RCS cooldown
- Maintain Tincore above the Min RCS Temp Curve (Enclosure 1)

OSTG/RCS CONDITION
(Ref. Section 9.3)
All the following conditions exist:
- Either OTSG dry (< 12.5") **AND NOT** steaming
- No RCPs operating

STRATEGY
The dry OTSG prevent heat transfer from the RCS to the dry OTSG shell. Also the RCS fluid in the dry OTSG is idle (no natural circulation flow existing) preventing the RCS in dry OTSG loop from cooling down (CD) along with the remaining RCS. The overall strategy requires promoting some circulation in the idle RCS loop which will mix the RCS. Maintaining the RCS CD rate on the dry OTSG consistent the estimated dry OTSG shell CD keeps the OTSG shell and RCS tubes within the required ΔT limit. The available options are based on whether the dry OTSG hot leg is saturated or subcooled and if a steaming path

REQUIRED ACTIONS
Dry OTSG hot leg subcooled AND steam path is acceptable
- Establish EFW/AFW ≤ 200 gpm in 1 line.
- Equalize Thot with estimated shell temp of Figure 1
- Cooldown RCS at ≈ 3°F/½ hr
- Terminate steaming if hazard

Dry OTSG hot leg saturated AND steam path is acceptable
- Open high point vent on idle OTSG
- Establish EFW/AFW ≤200 gpm in 1 line for 1 min
- IF hot leg becomes subcooled, THEN go to guidance above
- If hot leg remains saturated, then go to guidance below.

Dry OTSG hot leg remains saturated OR steam path is NOT acceptable
- Cycle high point vent on idle OTSG
- If hot leg becomes subcooled AND safe steaming path is available, then go to subcooled guidance above

OTSG/RCS CONDITION
(Ref. Section 9.4)
All the following condition exist:
- Both OTSG NOT dry (≥12.5")
- RCP operating OR NOT operating

STRATEGY
Heat transfer capability from the RCS to the OTSG shell is a function of OTSG level. Enclosure 2 defines the allowable RCS cooldown rate based on OTSG level to maintain the OTSG shell and RCS tubes at a constant tube to shell ΔT limit.

REQUIRED ACTIONS
Either OTSG NOT steaming and ≥ 1 RCP operating AND OTSG shell temperature instruments NOT available
- Ensure RCS is within allowable cooldown limit specified in Enclosure 2

All other Conditions
- Ensure RCS is within required cooldown limits specified in EOPs.

SUMMARY OF CHANGES
PRR 231009

NOTES: 1. Writers and Reviewers: Ensure that any changes to this procedure that affect information contained in ERF posters, enclosures, briefing cards, guidelines etc. are made to those items as well.

2. Writers and Reviewers: Changes to certain parts of this procedure may impact other EPIPs. Ensure appropriate PRRs are initiated as needed.

SECTION	CHANGE
Throughout	reformatting IAW PRO-NGGC-0201
Throughout	Figure 1 became Enclosure 1 Figure 2 became Enclosure 2 Figure 3 became Enclosure 3
1.0.3	Added new purpose step stating "this procedure is an emergency plan implementing procedure. any revisions to this procedure must be carefully considered for emergency plan impact." (PRR 321655)
2.2	New implementing references section
9.1.3	Added new step stating "If any OTSG shell temperature computer points appear inaccurate then average the remaining accurate computer points for the effective OTSG to determine average temperature." (PRR 231009)
Summary of Changes	Added two new steps before summary of changes table (PRR 411915)

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Progress Energy	I Information Use

CRYSTAL RIVER UNIT 3

PLANT OPERATING MANUAL

EM-225E

GUIDELINES FOR LONG TERM COOLING

REVISION 11

TABLE OF CONTENTS

1.0 PURPOSE

1. The purpose of this procedure is to provide guidance to the TSC Accident Assessment Team for maintaining long term core cooling post LOCA.
2. This procedure is an emergency plan implementing procedure. Any revisions to this procedure must be carefully considered for emergency plan impact.

2.0 REFERENCES

2.1 Developmental References

1. Babcock and Wilcox Topical Report BAW-10103A, Rev. 3, ECCS Analysis of B&W's 177-FA Lowered-Loop NSS
2. Calculation M90-0021, Building Spray and Decay Heat Pump NPSH a/r
3. Calculation I97-0008, LPI Crossover Flow Loop Accuracy Calculation
4. Calculation I91-0001, DH (LPI) Flow Indication and Control Loop Error Calculation
5. Calculation M98-0003, TSC Guidance For LPI Cross-Connect (Framatome Technologies Document 51-5001075-01)
6. Framatome Technologies Document 74-1152414, Emergency Operating Procedures Technical Bases Document
7. Calculation I90-0021, Decay Heat Removal Heat Exchanger Outlet Temperature Loop Accuracy Calculation
8. Calculation I88-0011, Containment Sump and Building Flood Level Indication
9. Calculation I91-0012, BWST Level Accuracy
10. Calculation M94-0053, Allowable MUT-1 Indicated Overpressure vs. Indicated Level
11. Calculation M95-0005, Minimum BWST Level to Prevent Vortexing during Drawdown
12. MAR 90-06-10-02, Reactor Building Instrument and Valve Relocation
13. Calculation M90-0023, Reactor Building Flooding
14. Calculation F98-0015, Minimum HPI flow for CR-3 at 72 hours post-LOCA
15. EEM98-001, MU/HPI Pump Qualification
16. Calculation I89-0036, Make-up/HPI Flow Loop Accuracy (High Range)
17. Calculation I89-0037, Make-up/HPI Flow Loop Accuracy (Low Range)
18. EEI98-001, HPI Total Flow Uncertainty
19. BAW-2374, Rev.1, Risk-Informed Assessment of Once-Through Steam Generator Tube Thermal Loads due to Breaks in Reactor Coolant System Upper Hot Leg Large-Bore Piping.
20. Generic Letter 2004-02, Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors
21. EC 58982, Reactor Building Sump Strainer Modification
22. EC59476, RB Sump Level Instrumentation Modifications
23. EC 55315, Alternate AC Diesel Generator
24. EC 68809, Evaluation of RB Sump Backwashing Methods

2.2 **Implementing References**

1. EOP-13, EOP Rules
2. EOP-14, Emergency Operating Procedure Enclosure
3. OP-403B, Chemical Addition- Boric Acid System
4. OP-404, Decay Heat Removal System
5. OP-406, Spent Fuel Cooling System

3.0 **DEFINITIONS**

1. **Duration of Long Term Core Cooling:** The time period between the Onset of Long Term Core Cooling, and the End of ECCS Cooling.
2. **ECCS Suction Transfer:** This necessary operator action involves manual alignments to allow the active ECCS, and Reactor Building Spray components to take suction from the Reactor Building sump.
3. **Emergency Core Cooling Systems (ECCS):** Active components (i.e., High Pressure Injection, Low Pressure Injection, associated flow paths), combined with the passive systems (i.e., Core Flood Tanks (CFT) and the Borated Water Storage Tank), required to be operable to ensure the initial condition assumptions of the accident analysis are met.
4. **End of ECCS Cooling:** The time after a LOCA, when the core has been removed from the Reactor Vessel or other permanent means of core cooling has been established.
5. **Long Term Cooling Modes:** There are three methods that may be available for long term core cooling. The three methods in their order of preference are:
   - Both LPI trains operating and providing flow through their respective injection lines.
   - One LPI train operating and providing flow through its respective injection line, and providing a suction source for the associated HPI pump.
   - One LPI train operating and providing flow through both LPI injection paths through the discharge cross-tie line.
6. **Onset of Long Term Core Cooling:** The time after a LOCA, when operator action is required to ensure the ECCS systems are properly aligned, and the minimum performance requirements are met.

4.0 **RESPONSIBILITIES**

1. The TSC Accident Assessment Team is responsible for the following:
   - Monitoring ECCS system performance and providing recommendations to the EC regarding changes in the established flow paths.
   - Provide input to recovery plans for failed equipment, placing emphasis on the need for at least two ECCS injection paths before, during, and after required maintenance activities.
   - Assess plant conditions and equipment availability to determine the safest and most effective method to achieve LPI injection through both injection paths.

5.0 PREREQUSITIES

None

6.0 PRECAUTIONS, LIMITATIONS, AND NOTES

1. To ensure adequate NPSH is maintained, total actual decay heat pump flow from RB sump must be maintained ≤ 2992 gpm. This is derived from the following:
   - LPI flow control set at 2000 gpm (2312 gpm including instrument uncertainties)
   - 580 gpm HPI flow (derived from hydraulic analysis)
   - 100 gpm LPI pump recirculation
2. Total HPI flow must be limited 72 hours post accident to ensure long term mission time requirements are met (reference section 9.2.3).
3. Any changes to the flow limits associated with Enclosure 4, A LPI Train Crosstie through Enclosure 10, Emergency LPI Crosstie and Piggyback Operations, must consider the following:
   - LPI pump NPSH
   - Instrumentation uncertainty
   - Required LPI flow
   - Required HPI flow
   - HPI pump mission time limitations
4. Do not perform LPI crosstie during boron precipitation mitigation activities.
5. Due to MOV considerations, limit bumps (motor starts) of the HPI valves to 5 consecutive times.
   - If more than 5 consecutive bumps are required, 1 bump may be performed every 7 minutes.
   - After a cooling period of 1.5 hours, 5 consecutive bumps may again be performed.
6. If piggyback operations are in progress, do not perform LPI crosstie until one of the following is met:
   - DHHE outlet temperature ≤ 130°F and > 32 hours since shutdown.
   - DHHE outlet temperature > 130°F to ≤ 175°F and > 81 hours since shutdown.
7. If the affected ES 4160V Bus is being powered by a diesel, then ensure adequate Diesel load margin is available per EOP-13, Rule 5, "Diesel Load Control" prior to starting equipment.
8. For work located in the Radiation Control Area, due consideration must be given to the ALARA program. This will likely result in special precautions and preparations.
9. If indicated RB water level exceeds 7.0 feet (RB elevation of 102ft), instrumentation may be lost (instrument uncertainty not included).
10. The HPI pump mission time study has qualified the pumps for a two month period. This analyzed mission time, relative to previous operational time, should be considered during decisions related to alignment changes.

7.0 SPECIAL TOOLS AND EQUIPMENT

None

8.0 ACCEPTANCE CRITERIA

None

9.0 INSTRUCTIONS

9.1 Emergency LPI Crosstie And Piggyback Operations

1. If HPI piggyback operations are required, and multiple failures result in the inability to align the ECCS systems for piggyback operation, then obtain EC concurrence and perform Enclosure 10, Emergency LPI Crosstie and Piggyback Operations.
2. If only HPI pumps are taking suction from the BWST, then level can be lowered to 2.5 feet (actual) or 3.5 feet (indicated).

9.2 Long Term Cooling Requirements

NOTE:	Refilling the BWST will provide additional ECCS inventory for RCS injection in the unlikely event that severe RB Sump strainer blockage occurs.

1. As soon as possible after ECCS suction transfer is complete, perform the following:
   - Notify the OSC to begin refilling the BWST from the spent fuel pools by performing Enclosure 11, BWST Refill from SF Pool, of this procedure.
   - Notify OSC to commence Boric Acid production per OP-403B, Section 4.2
   - Start trending RB Sump Strainer blockage using RECL 79. An increasing trend could be indication of RB sump strainer blockage. Trend parameters could also be influenced by changes in sump water temperature, LPI flows and RB pressure.
   - Notify Control Room to adjust DHP-1A/1B low amp alarm to identify pump fluctuations (Ref OP-404 for guidance).
2. The most desired long term cooling mode of operation is to supply LPI injection through both injection lines. Review plant conditions for the safest method for achieving this alignment

NOTES:

1. HPI can be terminated if LPI flow is > 1400 gpm in both LPI lines.
2. The flow rates listed below will prevent HPI pump from exceeding maximum allowable flow and ensure continued core cooling for duration of mission.
3. Loss of adequate SCM during establishment of the flow rates below is acceptable.
4. The flow limits supersede the EOP requirement for full HPI after 64 hours.
5. The lower flow limits ensure adequate core cooling beyond 64 hours when flow is not being supplied to the Rx through both LPI injection lines. This parameter is not relevant when RB sump blockage exists.
6. Other configurations (recirc, seal injection, normal makeup) must be individually evaluated.
7. Limiting the maximum allowable HPI flow at ≥ 64 hrs ensures the vendor requirement is not exceeded at 72 hrs.

3. When ≥ 64 hours have elapsed, then provide direction to the Control Room to maintain HPI flow within the following limits (balanced between available digital low range indicators):

	≥ 64 hours without Adequate SCM	**≥ 64 hours with Adequate SCM**
1 HPI pump	> 440 gpm < 500 gpm	< 500 gpm
2 HPI pumps (4 indicators)	> 440 gpm < 760 gpm	< 760 gpm
2 HPI pumps (3 indicators)	> 440 gpm < 560 gpm	< 560 gpm

4. After EOP-8A has been completed, request Control Room trending of the operating components by performance of:
   - Enclosure 1, ECCS Flow Log, every 24 hours
   - Enclosure 2, Long Term Cooling Equipment Log, every 12 hours

9.3 RB Water Level Control

1. Monitor and maintain the RB water level in the appropriate level limits. Consult with engineering personnel for the minimum and maximum levels for current plant conditions. (Reference Section 6.9, Calculation M90-0023 and Calculation M90-0021)
2. If RB water level is lowering, perform walk downs of accessible areas to determine leakage location. If the AB is not accessible, the Control Room radiation monitoring reading may be helpful in determination.

NOTE:	Analysis indicates that a large break LOCA may result in steam generator tube failure due to stresses induced by tube to shell differential temperatures.

3. If RB water level is lowering and no AB leakage exists consider the following:
   - Inadvertent pumping, i.e., RB sump pumps, RCDT pumps
   - Leaking ECCS flow path isolation valves, i.e., DHP recirc to BWST, DHP recirc to SF pools, HPI pump recirc to MUT, RB spray recirc to BWST, etc.
   - Possible SGTR
4. If the leaking component is found, review available equipment to determine possible Long Term Core Cooling alignments to allow faulted equipment isolation.
5. If RB water level loss has occurred consult with engineering personnel to ensure remaining ECCS water inventories (RB sump and BWST) are sufficient to support Long Term Core Cooling.
6. If ECCS water supplies are insufficient to support Long Term Core Cooling then, make preparations to initiate BWST makeup from an available source.
   - Spent Fuel Pool (refer to OP-406)
   - DW/boric acid addition (refer to OP-403B)
7. Reduction in RB sump boron concentration may be indicative of the need to perform boron precipitation mitigation.
8. Rising RB water level and lowering boron concentration may be indicative of unborated water leaking to containment. The following are possible sources of unborated water:
   - SW system
   - CI system
   - DW system
   - FW systems (AFW, EFW, MFW)
   - DC system via DHHEs
9. RB sump boron concentration must be maintained to ensure the Rx remains shutdown. If unborated water is leaking into the RB, attempt isolation efforts.

10. If RB sump water must be drained/pumped to prevent exceeding RB flood plane, then the storage location must be evaluated to prevent excessive dose rates and releases.

9.4 **Long Term Core Cooling Mode Alignment Changes**

1. The most desired long term cooling mode of operation is to supply LPI injection through both injection lines.
2. Enclosure 3, Operator Enclosure Functional Goals, describes the "Functional Goals" of the alternate cooling modes established by Enclosure 4, A LPI Train Crosstie, through Enclosure 10, Emergency LPI Crosstie and Piggyback Operations, of this procedure.
3. If power failures exist, then using OP-700 series procedures to ensure required equipment is energized.
4. During transitions to LPI crosstie mode of operation, the Control Room will ask for TSC assistance for HPI termination. Ensure all the following exist prior to allowing HPI pump shutdown:
   - Stable LPI crosstie flow within the limits of the applicable enclosure.
   - Tincore is **NOT** rising.
   - RCS pressure is **NOT** rising.
5. If the above conditions are not observed, direct the Control Room to re-establish HPI injection flow by performing the following:
   a. Throttle the injection valves until total injection flow is > minimum pump flow.
   b. Close the recirc valves.
   c. Establish maximum allowable injection flow.
6. During LPI crosstie operations, if stable LPI flow within the limits of the applicable enclosure cannot be maintained, provide direction to the Control Room to establish HPI piggyback.
   - If Enclosure 8, Establishing A Train Piggyback or Enclosure 9, Establishing B Train Piggyback are used to establish piggyback, the status statement will not be met. The two status statements regarding LPI system alignment are intended for normal transitions with adequate core cooling.
   - Provided the associated LPI train indicated flow is ≤ 2100 gpm, adequate NPSH margin exists for HPI pump operation.
7. If RB water level losses threaten the ability to maintain Long Term Core Cooling, then, consider establishing core cooling using normal decay heat removal.

9.5 Maintenance during Long Term Cooling

1. Prior to performing maintenance activities, any necessary temporary shielding must be installed, and the associated piping flushed.
2. Storage location for draining and flushing operations must be evaluated to prevent excessive dose rates and releases.
3. A possible flushing activity may be to drain or pump water from the BWST or SF pools to a suitable storage location.

9.6 Contingency Actions for RB Sump Strainer Blockage [NOCS 100408, 100483, 100504]

CAUTIONS

1. Contingency actions contained in EOP-14, Enclosure 19 mitigate symptoms of RB sump strainer blockage by significantly reducing ECCS flow through the sump strainer. As long as ECCS pumps are aligned to the RB sump, the potential for further blockage exists.
2. Actions specified in this section are outside the CR3 design basis and must be performed in accordance with 10 CFR 50.54 sections X and Y.

1. If notified by the control room that indications of RB sump strainer blockage have occurred, then perform the following:
   - Notify EC that sump blockage has occurred.
   - Notify the OSC to expedite BWST refill operations (Enclosure 11, BWST Refill from SF Pool, and Enclosure 12, SF Pool Refill).
   - Ensure Boric Acid production is in progress per OP-403B.

NOTE:
1. RCITS reactor vessel level instrumentation indicates the water level from the top of the reactor vessel head to the bottom of the hot leg. A hot leg or cold leg LOCA in the nozzle belt region may result in no indicated reactor vessel level even with full ECCS flow rate.
2. ECCS flow may impact RCITS reactor vessel level indication.

2. [AAT] Closely monitor RCS / ECCS conditions:
   - RB Sump level indication
   - RB Sump strainer ΔP (Ref RECL 79)
   - ECCS pump flow rates for symptoms of cavitation/ vortexing
   - RCS incore temperature trends
   - RCS subcooling margin
   - RCITS reactor vessel level indication
   - RB pressure / temperature
   - RB radiation levels / Iodine activity

3. If RB spray is in operation (per EOP-14, Enclosure 19), then consult with engineering personnel and dose assessment to determine if alternate shutdown criteria can be established.

   - Consider actual plant radiation levels.
   - Consider RB atmospheric I^{131} trend (if available).
   - Consider status of ECCS systems and Incore thermocouple trends. If ECCS systems are functioning normally and Incore trends indicate adequate core cooling the potential for a delayed release is low.
   - Consider the projected offsite thyroid dose from airborne RB releases. If the dose projection exceeds 5 REM thyroid, RB spray should be maintained, if possible, to reduce RB Iodine concentrations (the 5 REM limit should preserve DBA assumptions for both dose and CR Habitability calculations.
   - If containment temperature / pressure are elevated consider using two RB cooling units (in ES mode) in lieu of RB spray.

NOTE:	LPI instrument uncertainty becomes significant at LPI flows < 800 gpm

4. If indications of sump blocking exist, and LPI has been throttled using EOP-14, Enclosure 19, then provide direction to the Control Room to further reduce ECCS injection flow per the following guidance:

   - Throttle ECCS flow as required to achieve a stable operating point.
   - If both LPI trains are in operation, and LPI flow is < 800 gpm, and HPI is available for piggy back mode, then establish HPI piggy back mode per Enclosure 8, Establishing A Train Piggyback or Enclosure 9, Establishing B Train Piggyback and stopping one train of LPI.
   - If only one train of ECCS is in operation, and HPI is operating in piggy back mode, then direct the control room to fully open all available HPI valves and close the associated LPI throttle valve (DHV-110/111).
   - Closely monitor ECCS pump parameters, Incore temperatures, and RB Sump strainer ΔP.

CAUTIONS

1. If ECCS suction must be realigned to the BWST, ECCS flow rates significantly greater than two times W_{VAP} are undesirable since they will accelerate BWST depletion.
2. Because break location is unknown ECCS flow must be injected through at least 2 nozzles.
3. 200 gpm minimum HPI flow allows MUP recirculation valves to remain closed.

5. If previous actions for RB sump blockage are not effective, and HPI is operating in piggyback mode with the associated LPI throttle valve closed (DHV-110/111) and all available HPI valves cannot be maintained fully open, then provide direction to the Control Room to reestablish ECCS injection flow from the BWST per the following guidance:

   - Ensure BWST level sufficient to support HPI pump operation (>3.5 ft).
   - Align one HPI pump to BWST per Enclosure 14, HPI from BWST during RB Sump Strainer Blockage.
   - Maintain ECCS total flow rate two times W_{VAP} (Enclosure 13, Minimum ECCS Flows Required to Remove DH) or 200 gpm (Whichever is greater).
   - Direct the Control Room to divide ECCS flow evenly between all available HPI nozzles.
   - Closely monitor ECCS pump parameters and Incore temperatures
   - When HPI flow from BWST has been established, then calculate time to BWST depletion based on initial BWST level and HPI flow rate.

   [Depletion Time (min) = ((Initial BWST level (ft) – 3.5 ft) x 9400 gal/ft) / HPI flow rate]

   - Notify control room of minimum allowable BWST level to support HPI pump operation at current flow rate 2.5 feet (actual) or 3.5 feet (indicated).
   - Reg. Guide 1.97 instrumentation may be submerged by the additional inventory, and may subsequently fail. Consult with engineering personnel to predict potential instrument failures and identify any available alternate instrumentation.
   - Additional borated water inventory may adversely affect RB sump water chemistry. Consult with chemistry and engineering personnel to develop a plan for maintaining RB water chemistry within expected post accident range.

CAUTION

The LPI pumps shall **NOT** be running when backwashing the RB sump strainer. This will reduce the effectiveness of cleaning the RB sump strainer and possibly affect the operation of the LPI pump.

6. If ECCS injection flow has been reestablished from the BWST, or as directed by the TSC based on equipment failures, then provide direction to the Control Room to backwash the RB Sump strainer using one of the methods defined below:

   a. Backwashing using gravity flow from the BWST to the RB sump.

      - The water force from gravity draining the BWST through the RB sump strainer can remove debris on the strainer. The effectiveness will be based on the BWST level and RB pressure. This method is more effective for conditions where a high BWST level is available (> 10 ft) and a low RB pressure exist (<10 psig). Flow path for this method is through DHV-34/35 and DHV-42/43. DHV-34/35 stroke time is approximately 10 sec. With the maximum estimated flow (high BWST level/low RB pressure), the BWST level could drop approximately ½ ft.
      - Advantages:
        - Can be used if DH dropline is **NOT** available.
      - Disadvantages:
        - Depletes available BWST inventory
        - Requires both ES electrical trains energized.
      - Limitation:
        - RB pressure is < 10 psig
        - Do **NOT** operate HPI pump from the train that is being used to gravity drain to the RB sump.
        - BWST level > 7 ft
      - Procedural Guidance:
        - Perform Enclosure 15, RB Sump Backwashing using BWST, in this procedure.

Step 9.6.6 (Cont'd)

b. Backwashing using gravity flow from the RCS to the RB sump using the DH drop line.

- The water force from gravity draining the RCS through the RB sump strainer can remove debris on the strainer. The effectiveness will be based on the height of the RCS water level. This method is more effective for hot leg breaks where level exists in the hot legs, but the height of the drop line alone can remove some debris. The flow path for this method is from the DH dropline (DHV-3, DHV-4 DHV-41) through DHV-39/DHV-40 and DHV-42/43. DHV-42/43 will be pre-throttled to limit the flow. DHV-39/40 stroke time is approximately 90 sec.
- Advantages:
  - Does **NOT** reduce the amount of BWST inventory that is available to supply water to the RCS.
  - No additional water inventory added to RB that could result in exceeding initial RB flood elevation.
- Disadvantages:
  - Not as effective if break location is below drop line connection to RCS (elevation 126'-6").
- Limitation:
  - Both ES electrical trains energized.
- Procedural Guidance:
  - Perform Enclosure 16, RB Sump Backwashing using DH Drop Line, in this procedure.

Step 9.6.6 (Cont'd)

c. Backwashing using gravity flow from the Spent Fuel Pool.

- The water force from gravity draining from the Spent Fuel Pool through the RB sump strainer can remove debris on the strainer. This method is a more effective than gravity draining the BWST and possibly the DH dropline because of the elevation of the Spent Fuel Pool. The flow path for this method is from the SF Pool through SFV-89, DHV-39/40 and DHV-42/43. DHV-39/40 stroke time is approximately 90 sec. With the maximum estimated flow (high SF pool level/low RB pressure), the SF Pool level could drop approximately 1 ft.
- Advantages:
  - Separate source of water
  - **NOT** directly tied to the RCS or operating ECCS pumps
- Disadvantages:
  - Requires valve manipulation in the Aux building that could involve high radiation dose rates.
- Limitation:
  - Radiation dose due to valve manipulation in Aux Building
  - SFP level > 156' 0"
  - SF system in normal alignment
  - BWST fill **NOT** in progress from SFP
- Procedural Guidance
  - Perform Enclosure 17, RB Sump Backwashing using Gravity Flow from Spent Fuel Pool, in this procedure.

Step 9.6.6 (Cont'd)

d. Backwashing using the Spent Fuel Pumps flow.

- The spent fuel pump can be used remove debris on the RB sump strainer. This method is a more effective than gravity draining for high RB pressure conditions which could limit backwash flow. The flow path for this method is from the SF pool through the SF pump and discharging through SFV-85, DHV-39/40 and DHV-42/43. DHV-39/40 stroke time is approximately 90 sec. The maximum estimated spent fuel pump flow (high SF pool level/low RB pressure) is approximately 750 gpm.
- Advantages:
  - Separate source of water
  - Better flow control with SF pumps
  - **NOT** directly tied to the RCS or operating ECCS pumps
- Disadvantages:
  - Requires valve manipulation in the Aux building that could involve high radiation dose rates.
- Limitation:
  - Radiation dose due to valve manipulation in Aux Building
  - SFP level > 156' 6"
  - SF system in normal alignment
  - BWST fill **NOT** in progress from SFP
- Procedural Guidance:
  - Perform Enclosure 18, RB Sump Backwashing using Spent Fuel Pump, in this procedure in this procedure.

7. If RB sump strainer has been backwashed, then provide direction to the Control Room to reestablish RB sump flow after cleaning RB sump strainer.

- If the RB sump becomes blocked due to RB debris and RB sump strainer has been cleaned, then re-establishing RB sump flow rates should be limited to a flow rate that is as low as possible to prevent re-blocking the RB sump. Start a LPI pump from the RB sump and slowly increase flow to approximately 600 gpm while maintaining flow from the BWST using HPI pumps. If indication of RB sump blockage does not exist, then the following additional options are available:
- Refer to Enclosure 19, Re-Establish LPI Flow from the RB Sump, in this procedure for guidance on reestablishing flow after cleaning:

a. Transfer to piggyback and maintain all LPI flow through the HPI pumps (close DHV-110/111). Ensure flow is maintained through all available HPI injection nozzles.

- Advantages-Maintaining a piggyback configuration ensures flow is maintained to the RCS with better instrument uncertainty.
- Disadvantages-Piggyback configuration could impact both LPI and HPI pumps if RB sump blockage re-occurs.

b. Start second LPI pump from the RB sump and increase flow to approximately 600 gpm. Monitor for indication of RB sump strainer blockage. If strainer blockage does not exist stop HPI pump from BWST. Adjust LPI flow as required based on decay heat levels and instrument uncertainty.

- Advantages-
  - Ensures adequate flow to the RCS by maintaining two independent flow paths.
  - Eliminates the likelihood of the HPI pump being affected by RB sump blockage.
- Disadvantages-Higher flow rate through the RB sump strainer can increase the likelihood of RB sump blockage.

c. Stop HPI pumps and maintain single LPI Pump operating.

- Advantages-Lower flow rates through RB sump strainer reduce the likelihood of RB sump blockage.
- Disadvantages-Single flow path that could be influenced by core flood line break on the operating LPI pump.

Subsection 9.6, Contingency Actions for RB Sump Strainer Blockage [NOCS 100408, 100483, 100504] (Cont'd)

8. If RB sump blockage has occurred, then develop alternate sources of RCS injection for situations where the existing backwash methods are not effective. (Refer to the CR3 Severe Accident Guideline)

   - Consider aligning 1 HPI pump to MUT. Maintain MUT level by feeding from RCBTs and BASTs.
   - Consult with engineering personnel to determine minimum acceptable HPI flow rate. Maintain injection flow rate ≥ W_{VAP} (Enclosure 13, Minimum ECCS Flows Required to Remove DH).
   - If CFTs were isolated before being fully depleted, consider reopening CF isolation valves.
   - Consult with engineering personnel to determine if plant conditions will support a transition to DHR.

9.7 **Long Term Cooling Termination**

1. When the end of ECCS cooling occurs, then exit this procedure.

10.0 **RECORDS**

The enclosures of this procedure are quality records.

ECCS FLOW LOG

Time (1)	HPI flow (2, 3)	A LPI flow (2)	B LPI flow (2)	LPI Crosstie flow (2)

Note (1) – Suggested minimum time interval is 24 hours.
(2) – If an increasing trend is noted without a corresponding decrease in RCS pressure or increase in valve position, notify the TSC.
(3) – HPI flows must be maintained within the limits of Section 9.2

LONG TERM COOLING EQUIPMENT LOG

DHP-1A Computer Points (1)									
R250									
X318									
X319									
X320									

DHP-1B Computer Points (1)									
R251									
X321									
X322									
X323									

MUP-1A Computer Points (1)									
X324									
X326									
X325									
X070									
X366									
T217									
S292									
S294									

MUP-1B Computer Points (1)									
X327									
X329									
X328									
X071									
X367									
T253									
S311									
S295									

MUP-1C Computer Points (1)									
X330									
X332									
X331									
X072									
A298									
T236									
T216									
S296									

Note (1) – These instruments are NOT safety related or EQ qualified. However, this data may be useful for trending equipment condition.

LONG TERM COOLING EQUIPMENT LOG

BSP-1A Computer Points (1)									
X313									
X312									
X314									

BSP-1B Computer Points (1)									
X316									
X315									
X317									

Note (1) – These instruments are NOT safety related or EQ qualified. However, this data may be useful for trending equipment condition.

OPERATOR ENCLOSURE FUNCTIONAL GOALS

Enclosure	Functional Goal
4	To provide LPI flow through both injection lines using DHP-1A. This alignment allows maintenance on the following equipment: • All HPI pumps • DHP-1B, provided the recirculation fluid downstream of DHV-111 does NOT result in excessive dose rates. The only alignment that should be performed from this alignment is starting the opposite LPI train.
5	To provide LPI flow through both injection lines using DHP-1B. This alignment allows maintenance on the following equipment: • All HPI pumps • DHP-1A, provided the recirculation fluid downstream of DHV-110 does NOT result in excessive dose rates. The only alignment that should be performed from this alignment is starting the opposite LPI train.
6	To provide LPI flow through A Train LPI using DHP-1A. Provided DHP-1B is operating, this alignment allows maintenance activities on all HPI pumps.
7	To provide LPI flow through B Train LPI using DHP-1B. Provided DHP-1A is operating, this alignment allows maintenance activities on all HPI pumps.
8	To provide HPI injection using the A Train ES selected HPI pump. This alignment allows maintenance on the following equipment: • Secured HPI pumps • DHP-1B
9	To provide HPI injection using the B Train ES selected HPI pump. This alignment allows maintenance on the following equipment: • Secured HPI pumps • DHP-1A
10	To provide emergency alignments should Piggyback alignments fail.

A LPI TRAIN CROSSTIE

ACTIONS DETAILS

STATUS

- ECCS suction transfer has been completed.
- DHP-1A is operating.
- A Train ES selected MUP is operating in piggyback.
- BSP-1B is shutdown.
- LPI crosstie NOT in progress.
- DHHE outlet TEMP is ≤ 130°F AND > 32 hours have elapsed since Rx shutdown.

  OR

- DHHE outlet TEMP is > 130°F to ≤ 175°F AND > 81 hours have elapsed since Rx shutdown.

NOTE

Tincore should be closely monitored while changing ECCS alignments.

4.1 ___ Ensure B ES selected MUP is stopped.

___ MUP-1B
___ MUP-1C

4.2 ___ IF both LPI pumps are running,
THEN stop DHP-1B.

A LPI TRAIN CROSSTIE

ACTIONS	DETAILS
4.3 ___ Isolate B LPI Train.	• Ensure the following valves closed: ___ DHV-35 ___ DHV-40 ___ DHV-43 ___ DHV-211 ___ DHV-12 • ___ Select BSV-4 to "MAN" and closed. • ___ Select DHV-111 to "MAN" and closed.
4.4 ___ Adjust DHV-110 setpoint to 1600 gpm.	

A LPI TRAIN CROSSTIE

ACTIONS	DETAILS

NOTE

During crosstie DHV-111 must remain in manual.

4.5 ___ Establish LPI crosstie.

1 ___ Ensure DHV-6 is open.

2 Open LPI crosstie valves:

___ DHV-8

___ DHV-7

3 ___ Throttle DHV-111 to achieve LPI crosstie flow of 900 (800 to 1000) gpm on DH-38-FI1

4 ___ Adjust DHV-110 setpoint to obtain A Train LPI flow of 2000 (1900 to 2100) gpm on DH-1-FI1

4.6 ___ IF HPI flow is > 300 gpm, THEN throttle HPI flow to 300 (200 to 400) gpm.

4.7 ___ Increase LPI flow

1 ___ Throttle DHV-111 to achieve LPI crosstie flow of 900 (800 to 1000) gpm on DH-38-FI1

2 ___ Adjust DHV-110 setpoint to obtain A Train LPI flow of 2100 (2000 to 2200) gpm on DH-1-FI1

A LPI TRAIN CROSSTIE

ACTIONS	DETAILS
4.8 ___ Stop HPI flow.	1 Open all HPI recirc to sump valves: ___ MUV-543 ___ MUV-544 ___ MUV-545 ___ MUV-546 2 Close all HPI valves: ___ MUV-23 ___ MUV-24 ___ MUV-25 ___ MUV-26
4.9 ___ Monitor Tincore to ensure RCS TEMP is NOT rising.	• ___ Contact TSC if RCS TEMP rises.
4.10 ___ WHEN the TSC directs termination of the MUP, THEN stop the operating MUP.	1 Stop the A ES selected MUP: ___ MUP-1A ___ MUP-1B 2 ___ Close DHV-11

A LPI TRAIN CROSSTIE

ACTIONS	DETAILS

NOTE

During crosstie DHV-111 must remain in manual.

4.11 ___ Increase LPI flow.

1 ___ Throttle DHV-111 to obtain LPI crosstie flow of 1250 (1150 to 1350) gpm on DH-38-FI1

2 ___ Adjust DHV-110 setpoint to achieve A Train LPI flow 2600 (2500 to 2700) gpm on DH-1-FI1

4.12 ___ Close all HPI recirc to sump valves.

___ MUV-543
___ MUV-544
___ MUV-545
___ MUV-546

B LPI TRAIN CROSSTIE

ACTIONS DETAILS

STATUS

- ECCS suction transfer has been completed.
- DHP-1B is operating.
- B Train ES selected MUP is operating in piggyback.
- BSP-1A is shutdown.
- LPI crosstie NOT in progress.
- DHHE outlet TEMP is ≤ 130°F AND > 32 hours have elapsed since Rx shutdown.

  OR

- DHHE outlet TEMP is > 130°F to ≤ 175°F AND > 81 hours have elapsed since Rx shutdown.

NOTE

Tincore should be closely monitored while changing ECCS alignments.

5.1 ___ Ensure A ES selected HPI pump is stopped.

___ MUP-1A
___ MUP-1B

B LPI TRAIN CROSSTIE

ACTIONS	DETAILS
5.2 ___ IF both LPI pumps are running, THEN stop DHP-1A	
5.3 ___ Isolate A LPI Train.	• Ensure the following are closed: ___ DHV-34 ___ DHV-39 ___ DHV-42 ___ DHV-210 ___ DHV-11 • ___ Select BSV-3 to "MAN" and closed. • ___ Select DHV-110 to "MAN" and closed.
5.4 ___ Adjust DHV-111 setpoint to 1600 gpm.	

B LPI TRAIN CROSSTIE

ACTIONS	DETAILS

NOTE

During crosstie DHV-110 must remain in manual.

5.5 ___ Establish LPI crosstie.

1 ___ Ensure DHV-5 is open.

2 Open LPI crosstie valves:

___ DHV-8

___ DHV-7

3 ___ Throttle DHV-110 to achieve LPI crosstie flow of 900 (800 to 1000) gpm on DH-38-FI1

4 ___ Adjust DHV-111 setpoint to achieve B Train LPI flow of 2000 (1900 to 2100) gpm on DH-1-FI2

5.6 ___ IF HPI flow is > 300 gpm, THEN throttle HPI flow to 300 (200 to 400) gpm.

5.7 ___ Increase LPI flow

1 ___ Throttle DHV-110 to achieve LPI crosstie flow of 900 (800 to 1000) gpm on DH-38-FI1

2 ___ Adjust DHV-111 setpoint to obtain B Train LPI flow of 2100 (2000 to 2200) gpm on DH-1-FI2

B LPI TRAIN CROSSTIE

ACTIONS	DETAILS
5.8 ___ Stop HPI flow.	1 Open all HPI recirc to sump valves: ___ MUV-543 ___ MUV-544 ___ MUV-545 ___ MUV-546 2 Close all HPI valves: ___ MUV-23 ___ MUV-24 ___ MUV-25 ___ MUV-26
5.9 ___ Monitor Tincore to ensure RCS TEMP is NOT rising.	• ___ Contact TSC if RCS TEMP rises.
5.10 ___ WHEN the TSC directs termination of the MUP, THEN stop the operating MUP.	1 Stop the B ES selected MUP: ___ MUP-1B ___ MUP-1C 2 ___ Close DHV-12

B LPI TRAIN CROSSTIE

ACTIONS	DETAILS

NOTE

During crosstie DHV-110 must remain in manual.

5.11 ___ Increase LPI flow.

1 ___ Throttle DHV-110 to achieve LPI crosstie flow of 1250 (1150 to 1350) gpm on DH-38-FI1

2 ___ Adjust DHV-111 setpoint to achieve B Train LPI flow of 2600 (2500 to 2700) gpm on DH-1-FI2

5.12 ___ Close all HPI recirc to sump valves.

___ MUV-543
___ MUV-544
___ MUV-545
___ MUV-546

STARTING A TRAIN LPI PUMP

ACTIONS | DETAILS

STATUS

- ECCS suction transfer has been completed.
- DHP-1B is operating.
- B Train ES selected MUP is operating in piggyback.

  OR
- LPI crosstie in progress.

NOTE

Tincore should be closely monitored while changing ECCS alignments.

6.1 ___ Ensure proper alignment for the A Train LPI system.

1 Ensure the following valves are closed:

___ DHV-34

___ DHV-39

___ DHV-11

2 ___ IF LPI crosstie is NOT in progress, THEN close DHV-110

3 ___ Ensure DHV-42 is open.

4 ___ Ensure DHV-5 is open.

STARTING A TRAIN LPI PUMP

ACTIONS	DETAILS
6.2 ___ Start A Train LPI. [Rule 5, Diesel Load Control]	1 Ensure required cooling pumps are operating: ___ DCP-1A ___ RWP-3A 2 ___ Start DHP-1A 3 ___ Ensure DHV-210 is open.
6.3 ___ IF LPI crosstie operations are in progress, THEN stop crosstie flow.	• Close LPI crosstie valves: ___ DHV-8 ___ DHV-7
6.4 ___ Ensure LPI flow is properly controlled.	• Ensure LPI control valves are in "AUTO" and set for 2000 gpm: ___ DHV-110 ___ DHV-111

STARTING A TRAIN LPI PUMP

ACTIONS	DETAILS
6.5 ___ WHEN all the following exist: ___ A Train LPI flow > 1400 gpm ___ B Train LPI flow > 1400 gpm THEN stop HPI.	1 Stop B ES selected MUP: ___ MUP-1B ___ MUP-1C 2 ___ Close DHV-12

STARTING B TRAIN LPI PUMP

ACTIONS DETAILS

STATUS

- ECCS suction transfer has been completed.
- DHP-1A is operating.
- A Train ES selected MUP is operating in piggyback.

  OR
- LPI crosstie in progress.

NOTE

Tincore should be closely monitored while changing ECCS alignments.

7.1 ___ Ensure proper alignment for the B Train LPI system.

1 Ensure the following valves are closed:

___ DHV-35

___ DHV-40

___ DHV-12

2 ___ IF LPI crosstie is NOT in progress, THEN close DHV-111

3 ___ Ensure DHV-43 is open.

4 ___ Ensure DHV-6 is open.

STARTING B TRAIN LPI PUMP

ACTIONS	DETAILS
7.2 ___ Start B Train LPI. [Rule 5, Diesel Load Control]	1 Ensure required cooling pumps are operating: ___ DCP-1B ___ RWP-3B 2 ___ Start DHP-1B 3 ___ Ensure DHV-211 is open.
7.3 ___ IF LPI crosstie operations are in progress, THEN stop crosstie flow.	• Close LPI crosstie valves: ___ DHV-8 ___ DHV-7
7.4 ___ Ensure LPI flow is properly controlled.	• Ensure LPI control valves in "AUTO" and set for 2000 gpm: ___ DHV-110 ___ DHV-111

STARTING B TRAIN LPI PUMP

ACTIONS	DETAILS
7.5 ___ WHEN all the following exist: ___ A Train LPI flow > 1400 gpm ___ B Train LPI flow > 1400 gpm THEN stop HPI.	1 Stop A ES selected MUP: ___ MUP-1A ___ MUP-1B 2 ___ Close DHV-11

ESTABLISHING A TRAIN PIGGYBACK

ACTIONS DETAILS

STATUS

- ECCS suction transfer has been completed.
- Both LPI trains are operating and providing flow.
- LPI crosstie NOT in progress.

NOTE

Tincore should be closely monitored while changing ECCS alignments.

8.1 ___ Ensure proper HPI alignment.

1 MUP recirc to MUT valves closed:

___ MUV-53

___ MUV-257

2 HPI recirc to sump valves closed:

___ MUV-543

___ MUV-544

___ MUV-545

___ MUV-546

3 HPI valves are open or throttled as directed by the TSC:

___ MUV-23

___ MUV-24

___ MUV-25

___ MUV-26

ESTABLISHING A TRAIN PIGGYBACK

	ACTIONS	DETAILS
8.2	___ Align DHP-1A discharge to MUP suction.	• ___ Open DHV-11
8.3	___ Ensure DHP-1A flow is within limits.	• ___ Ensure DHV-110 in "AUTO" and set for 2000 gpm.
8.4	___ Start A Train HPI. [Rule 5, Diesel Load Control]	• Start the A ES selected MUP and required cooling pumps: ___ MUP-1A ___ MUP-1B
8.5	___ Stop B Train ECCS pumps.	1 Ensure the B ES selected MUP stopped: ___ MUP-1B ___ MUP-1C 2 ___ Ensure DHP-1B is stopped. 3 ___ Close DHV-12 4 ___ Close DHV-6

ESTABLISHING A TRAIN PIGGYBACK

ACTIONS	DETAILS
8.6 ___ IF ≥ 64 hrs post accident, THEN ensure HPI flow is within limits (use digital low range).	• ___ IF adequate SCM does NOT exist, THEN throttle HPI flow to 470 gpm (440 to 500 gpm). • ___ IF adequate SCM exists, THEN throttle HPI flow to < 500 gpm.
8.7 ___ IF < 64 hrs post accident, THEN ensure HPI flow is within limits (use digital low range).	• ___ IF adequate SCM does NOT exist, THEN establish full HPI. • ___ IF adequate SCM exists, THEN throttle HPI to maintain minimum adequate SCM.

ESTABLISHING B TRAIN PIGGYBACK

ACTIONS | DETAILS

STATUS

- ECCS suction transfer has been completed.
- Both LPI trains are operating and providing flow.
- LPI crosstie NOT in progress.

NOTE

Tincore should be closely monitored while changing ECCS alignments.

9.1 ___ Ensure proper HPI alignment.

1 MUP recirc to MUT valves closed:

___ MUV-53

___ MUV-257

2 HPI recirc to sump valves closed:

___ MUV-543

___ MUV-544

___ MUV-545

___ MUV-546

3 HPI valves are open or throttled as directed by the TSC:

___ MUV-23

___ MUV-24

___ MUV-25

___ MUV-26

ESTABLISHING B TRAIN PIGGYBACK

	ACTIONS	DETAILS
9.2	___ Align DHP-1B discharge to MUP suction.	• ___ Open DHV-12
9.3	___ Ensure DHP-1B flow is within limits.	• ___ Ensure DHV-111 in "AUTO" and set for 2000 gpm.
9.4	___ Start B Train HPI. [Rule 5, Diesel Load Control]	• Start the B ES selected MUP and required cooling pumps: ___ MUP-1B ___ MUP-1C
9.5	___ Stop A Train ECCS pumps.	1 Ensure the A ES selected MUP is stopped: ___ MUP-1A ___ MUP-1B 2 ___ Ensure DHP-1A is stopped. 3 ___ Close DHV-11 4 ___ Close DHV-5

ESTABLISHING B TRAIN PIGGYBACK

ACTIONS	DETAILS
9.6 ___ IF ≥ 64 hrs post accident, THEN ensure HPI flow is within limits (use digital low range).	• ___ IF adequate SCM does NOT exist, THEN throttle HPI flow to 470 gpm (440 to 500 gpm). • ___ IF adequate SCM exists, THEN throttle HPI flow to < 500 gpm.
9.7 ___ IF < 64 hrs post accident, THEN ensure HPI flow is within limits (use digital low range).	• ___ IF adequate SCM does NOT exist, THEN establish full HPI. • ___ IF adequate SCM exists, THEN throttle HPI to maintain minimum adequate SCM.

EMERGENCY LPI CROSSTIE AND PIGGYBACK OPERATIONS

ACTIONS	DETAILS

STATUS

- At least 1 LPI pump is operating.
- Multiple failures have resulted in the inability to establish Piggyback.

10.1 ___ IF all the following exist:

___ LPI flow exists

___ Only 1 LPI train is operating

THEN crosstie LPI trains.

1 Ensure DHP isolation valve on idle train is closed:

___ DHV-210 (A Train)

___ DHV-211 (B Train)

2 Ensure LPI block valve on idle train is open:

____ DHV-5 (A Train)

____DHV-6 (B Train)

3 Ensure LPI control valve on idle train is closed:

____DHV-110 (A Train)

____DHV-111 (B Train)

4 Open LPI crosstie valves:

___DHV-8

___DHV-7

5 Establish the following flows using DHV-110 and DHV-111:

___LPI crosstie flow
1250 (1150 to 1350) gpm
on DH-38-FI1

___ Operating LPI train flow
2600 (2500 to 2700) gpm

EMERGENCY LPI CROSSTIE AND PIGGYBACK OPERATIONS

ACTIONS	DETAILS
10.2 ___ IF RCS PRESS prevents LPI flow, THEN establish alternate piggyback alignment.	• Open the necessary valves: ___ DHV-11 ___ DHV-12 ___ MUV-62 ___ MUV-69

BWST REFILL FROM SF POOL

ACTIONS DETAILS

STATUS

BWST refill from SF Pool desired.

11.1 ___ Establish SF cooling with SFP-1A and SFHE-1A per OP-406.

[Rule 5, Diesel Load Control]

11.2 ___ Verify SF pool boron concentration ≥ 2270 ppm.

BWST REFILL FROM SF POOL

ACTIONS	DETAILS
11.3 ___ Align SFP-1B for BWST refill.	1 ___ Ensure SFP-1B stopped 2 Ensure the following valves are closed: ___ SFV-12 "SFP COMMON SUCTION ISOLATION" ___ SFV-34 "SFP-1A/1B DISCHARGE CROSSTIE" ___ SFV-35 "SFP-1A/1B DISCHARGE CONTROL TO FUEL TRANSFER CANAL" ___ SFV-43 "SFHE-1A/1B TO SFFL-1A/1B ISOLATION" ___ SFV-50 "SFHE OUTLET CROSSTIE" ___ SFV-87 "DHP TO SFFL-1A/1B ISOLATION" ___ SFV-89 "SPENT FUEL HEADER TO DHP SUCTION ISOLATION" 3 Ensure the following valves are open: ___ SFV-7 "SFP-1A/1B SUCTION CROSSTIE" ___ SFV-11 "SFP-1B SUCTION ISOLATION" ___ SFV-46 "SFHE-1A/1B TO BWST ISOLATION" ___ SFV-37 "SFHE-1B INLET ISOLATION" ___ SFV-49 "SFHE-1B OUTLET ISOLATION"

BWST REFILL FROM SF POOL

ACTIONS	DETAILS
NOTE **If SFV-28 has been previously positioned per Detail 6 of this Enclosure, Detail 4 may be omitted.**	
11.4 ___ Start BWST refill. [Rule 5, Diesel Load Control]	1 ___ Record SF Pool initial level SF Pool Level: _____ 2 ___ Record BWST initial level BWST Level: _____ 3 ___ Ensure SFV-46 open 4 ___ Throttle SFV-28 "SFP-1B DISCHARGE ISOLATION" 3 turns open 5 ___ Start SFP-1B 6 ___ Throttle SFV-28 as required, to maintain SFP-1B differential pressure between 45 and 50 psig. (SF-4-PI2 minus SF-16-PI2) [NOCS 040415]

BWST REFILL FROM SF POOL

ACTIONS	DETAILS

NOTE

Stopping BWST refill at 156' (-2.5') keeps SF Pool level indication on scale while accomplishing the necessary actions. Zero on SF-1-LI or SF-1-LI2 is equivalent to 158' 6" elevation.

11.5 ___ WHEN SF Pool level 156', THEN Stop BWST refill.

1 ___ Stop SFP-1B

2 ___ Close SFV-46

3 ___ Record SF Pool final level

SF Pool Level: _____

4 ___ Record BWST final level

BWST Level: _____

11.6 ___ Restore SF Pool level.

- **PERFORM** Enclosure 12, SF Pool Refill, in this procedure.

11.7 ___ WHEN SF Pool level restored per Enclosure 12, AND additional BWST inventory required, THEN **GO TO** step 11.4 in this enclosure.

11.8 ___ **EXIT** this enclosure.

SF POOL REFILL

ACTIONS	DETAILS

STATUS

Spent Fuel Pool level restoration desired

12.1 ___ Determine total SF pool volume addition required to restore level to 159 feet.

- Perform the following calculations:

  $L^{final} - L^{initial} = L\Delta$

  L^{final} = final SF pool level = 159 (feet)
  $L^{initial}$ = initial SF pool level _____ (feet)

  (LΔ) (11100 gal. per foot) =_____(gal.)

  Total Volume Addition = _____(gal.)

12.2 ___ Restore SF Pool level to 159 feet per OP-406.

- **PERFORM** OP-406, Section 4.7, Filling Spent Fuel Pools (Alternate Method).

NOTE

To expedite BWST refill consider using reduced SF pool recirculation times and preliminary sample results for boron concentration verification.

12.3 ___ WHEN SF Pool level restored to 159 feet, THEN verify SF pool boron concentration ≥ 2270 ppm.

SF POOL REFILL

ACTIONS	DETAILS

NOTE

OP-403B requires 10.25 hour SF pool recirculation time prior to obtaining final SF boron concentration. To expedite BWST refill consider using the results of the preliminary (1 hour) sample.

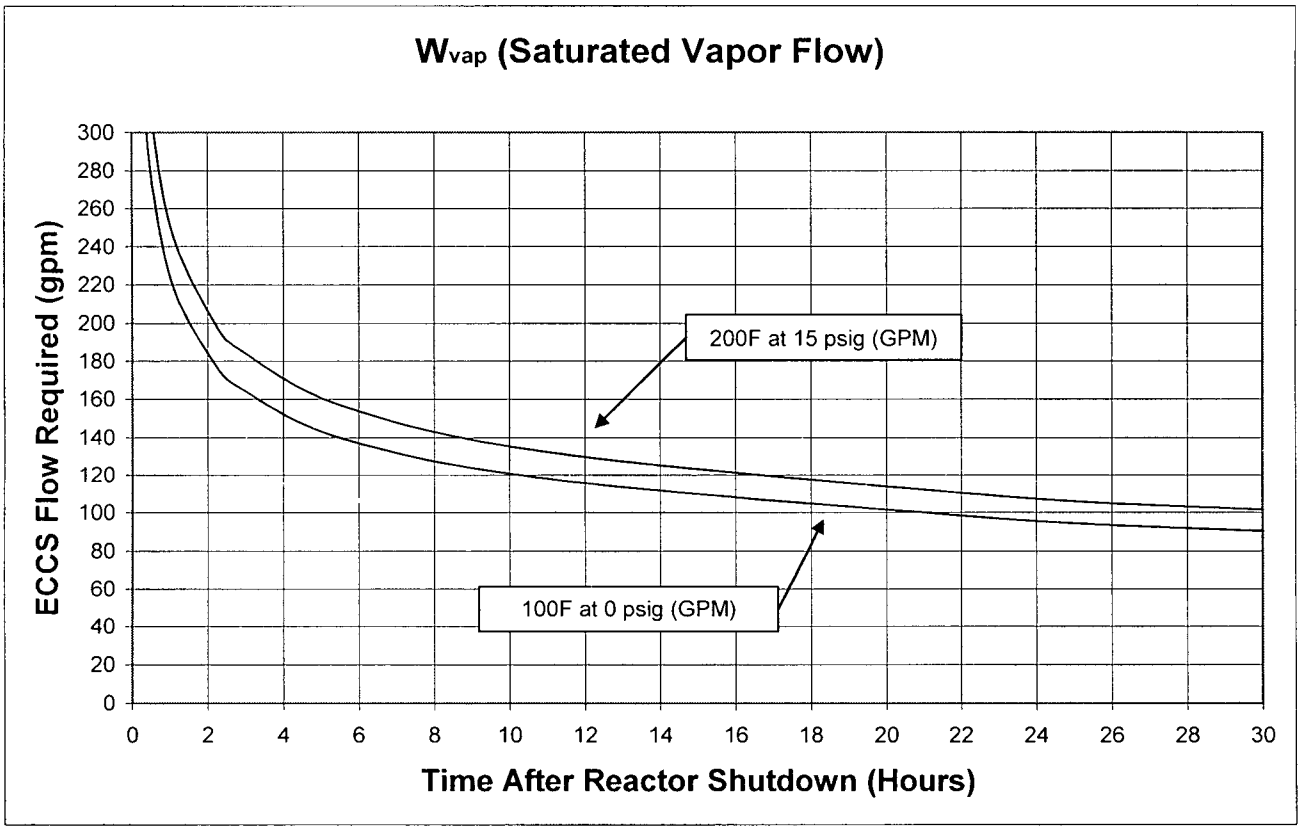
12.4 ___ IF SF Pool boron concentration < 2270 ppm, THEN increase SF pool boron per OP-403B.

- **PERFORM** OP-403B, Boric Acid Addition to the SF Pools.

12.5 ___ WHEN SF Pool boron concentration verified ≥ 2270 ppm, THEN **EXIT** this enclosure.

MINIMUM ECCS FLOWS REQUIRED TO REMOVE DH

W_{vap} (Saturated Vapor Flow) is the flow rate of water (@ 100 °F with 0 psig Reactor Building pressure; **OR** @ 200 °F with 15 psig Reactor Building pressure) that, when injected into the reactor vessel, will remove all the decay heat and exit as a saturated vapor. ECCS flow rates < W_{vap} may NOT keep up with vessel boil off rate and will potentially result in core damage.



NOTES:

1. ECCS flow rates are **NOT** adjusted for HPI instrument uncertainty.
2. Flow Rates > two times Wvap bound HPI instrument uncertainty.
3. Compare redundant HPI flow indications. If significant deviations exist consider using lowest indicated flow.

HPI FROM BWST DURING RB SUMP STRAINER BLOCKAGE

ACTIONS | DETAILS

STATUS

- HPI pump in piggy back operation.
- ECCS suction path to RB sump unavailable or challenged due to RB sump strainer blockage.
- ECCS (HPI) injection from BWST required to support RB sump strainer cleaning.
- TSC has verified BWST level sufficient to support HPI at reduced flow rate.

14.1 ___ Align desired MUP suction to BWST.

- Open BWST to MUP suction:

A Train	B Train
___ MUV-73	___ MUV-58

- Close LPI discharge to MUP suction:

A Train	B Train
___ DHV-11	___ DHV-12

14.2 ___ Adjust HPI flow rate per TSC guidance.

- Split flow between all available HPI nozzles.
- Do NOT reduce HPI flow < 200 gpm.

HPI FROM BWST DURING RB SUMP STRAINER BLOCKAGE

ACTIONS | DETAILS

CAUTION

BWST level must be maintained ≥ 3.5 ft while injecting from BWST.

14.3 ___ IF at any time, BWST level is ≤ 4.5 ft, THEN contact TSC.

14.4 ___ IF at any time, MUP cavitation or vortexing exists, THEN immediately shutdown MUP and notify TSC.

14.5 ___ Exit this enclosure when notified by the TSC.

RB SUMP BACKWASHING USING BWST

ACTIONS	DETAILS

STATUS

RB Sump Backwashing required using BWST.

15.1 ___ Ensure the appropriate system conditions exist to backwash the RB Sump using the BWST.

- ___ Ensure MUP suction has been transferred to the BWST per Enclosure 14
- ___ BWST level is > 7 ft.
- ___ Ensure MUP suction is NOT aligned to the train being used for backwash.
- Ensure both DHPs are stopped:

  ___ DHP-1A

  ___ DHP-1B

- Ensure both BSPs are stopped:

  ___ BSP-1A

  ___ BSP-1B

RB SUMP BACKWASHING USING BWST

ACTIONS	DETAILS
15.2 ___ IF backwashing is through DHV-42 (A Train), THEN align the system for backwashing through DHV-42	1 Ensure the following valves are closed: ___ DHV-210 ___ DHV-91 ___ DHV-39 ___ DHV-34 2 ___ Select BSV-3 to "MAN" closed. 3 ___ Ensure DHV-42 is open.

15.3 ___ IF backwashing is through DHV-43 (B Train), THEN align the system for backwashing through DHV-43	1 Ensure the following valves are closed: ___ DHV-211 ___ DHV-40 ___ DHV-35 2 ___ Select BSV-4 to "MAN" closed. 3 ___ Ensure DHV-43 is open.

RB SUMP BACKWASHING USING BWST

ACTIONS | DETAILS

CAUTION

- **BWST level must be maintained ≥ 3.5 ft during HPI injection from BWST.**
- **BWST outlet valve (DHV-34 or DHV-35) must be cycled quickly to preserve BWST level for MUP suction.**

15.4 ___ Cycle the BWST outlet valve on the line being backwashed.

- ___ IF backwashing is through DHV-42, THEN cycle DHV-34 open and closed.
- ___ IF backwashing is through DHV-43, THEN cycle DHV-35 open and closed.

RB SUMP BACKWASHING USING BWST

ACTIONS | DETAILS

NOTE

Waiting 30 minutes allows the RB sump debris to settle.

15.5 ___ WHEN 30 minutes has elapsed from the time backwashing was performed, OR as directed by the TSC, THEN restore LPI cooling and BS.

- ___ Perform Enclosure 19 in this procedure.

15.6 ___ Exit this enclosure when notified by the TSC.

RB SUMP BACKWASHING USING DH DROP LINE

ACTIONS | DETAILS

STATUS

RB Sump Backwashing required using DH drop line.

16.1 ___ Ensure the appropriate system conditions exist to backwash the RB Sump using the DH Drop line.

- ___ Ensure MUP suction has been transferred to the BWST per Enclosure 14
- Ensure both DHPs are stopped:

  ___ DHP-1A

  ___ DHP-1B
- Ensure both BSPs are stopped:

  ___ BSP-1A

  ___ BSP-1B
- ___ Average Tincore < 286°F by <u>any</u> of the following:

  ___ SPDS

  ___ Tincore recorders

RB SUMP BACKWASHING USING DH DROP LINE

ACTIONS	DETAILS
16.2 ___ IF backwashing is through DHV-43 (B Train), THEN **GO TO** Step 16.10 in this procedure.	

16.3 ___ Align the system for backwashing through DHV-42 (A Train).	1 Open DC knife switches for A Train pumps on A ES 4160V BUS: ___ Bkr 3A8 "BSP-1A BUILDING SPRAY PUMP A" ___ Bkr 3A4 "DHP-1A DECAY HEAT PUMP A" 2 ___ Select BSV-3 to "MAN" and closed. 3 ___ WHEN DC knife switches are open, THEN ensure the following valves are closed: ___ DHV-34 ___ DHV-42 ___ DHV-210 ___ DHV-8 ___ DHV-5 ___ DHV-11

RB SUMP BACKWASHING USING DH DROP LINE

ACTIONS	DETAILS

NOTE

Insulated 5/16" nut driver is available in EOB-3 and EOB-11 to open sliding links.

16.4 ___ Defeat DHV-42 seal-in circuits.

- Open the following sliding links for DHV-42 seal-in circuits (inside MCB behind ES A panel bottom section):

  ___ TB16-8 (open seal-in)

  ___ TB16-6 (close seal-in)

RB SUMP BACKWASHING USING DH DROP LINE

ACTIONS	DETAILS
16.5 ___ WHEN DHV-42 seal-in circuits are defeated, THEN establish drop line flow to RB sump.	1 ___ Open DHV-4 2 ___ Open DHV-41 3 ___ Select DHV-42 to "OPEN" position for 10 seconds and release. 4 ___ WHEN at least 2 min have elapsed, THEN verify DHV-42 red open light is not lit. 5 ___ IF DHV-42 red open light is lit, THEN notify TSC for further guidance. 6 ___ Open DHV-3 7 ___ Cycle DHV-39 open and closed. 8 ___ Close DHV-3 9 ___ Close DHV-4 10 ___ Close DHV-41

RB SUMP BACKWASHING USING DH DROP LINE

ACTIONS	DETAILS
16.6 ___ Enable DHV-42 seal-in circuits.	• Close the following sliding links for DHV-42 seal-in circuits (inside MCB behind ES A panel bottom section): ___ TB16-8 (open seal-in) ___ TB16-6 (close seal-in)
16.7 ___ WHEN DHV-42 seal-in circuit is enabled THEN open DHV-42	
16.8 ___ Close the DC knife switches for A Train pumps on A ES 4160V BUS.	• ___ Bkr 3A8 "BSP-1A BUILDING SPRAY PUMP A" • ___ Bkr 3A4 "DHP-1A DECAY HEAT PUMP A"
16.9___ **GO TO** Step 16.16	

RB SUMP BACKWASHING USING DH DROP LINE

ACTIONS | DETAILS

STATUS

RB Sump Backwashing using B Train Equipment.

16.10 ___ Align the system for backwashing through DHV-43

1 Open DC knife switches for B Train pumps on B ES 4160V BUS:

___ Bkr 3B7 "BSP-1B BUILDING SPRAY PUMP B"

___ Bkr 3B11 "DHP-1B DECAY HEAT PUMP B"

2 ___ Select BSV-4 to "MAN" and closed.

3 ___ WHEN DC knife switches are open, THEN ensure the following valves are closed:

___ DHV-35

___ DHV-43

___ DHV-211

___ DHV-7

___ DHV-6

___ DHV-12

RB SUMP BACKWASHING USING DH DROP LINE

ACTIONS	DETAILS

NOTE

Insulated 5/16" nut driver is available in EOB-3 and EOB-11 to open sliding links.

16.11 ___ Defeat DHV-43 seal-in circuits.

- Open the following sliding links for DHV-43 seal-in circuits (inside MCB behind ES B panel bottom section):

  ___ TB6-18 (open seal-in)

  ___ TB6-16 (close seal-in)

RB SUMP BACKWASHING USING DH DROP LINE

ACTIONS	DETAILS
16.12___ WHEN DHV-43 seal-in circuits are defeated, THEN establish drop line flow to RB sump.	1 ___ Open DHV-4 2 ___ Open DHV-41 3 ___ Select DHV-43 to "OPEN" position for 10 seconds and release. 4 ___ WHEN at least 2 min have elapsed, THEN verify DHV-43 red open light is not lit. 5 ___ IF DHV-43 red open light is lit, THEN notify TSC for further guidance. 6 ___ Open DHV-3 7 ___ Cycle DHV-40 open and closed. 8 ___ Close DHV-3 9 ___ Close DHV-4 10___ Close DHV-41

RB SUMP BACKWASHING USING DH DROP LINE

ACTIONS	DETAILS
16.13 ___ Enable DHV-43 seal-in circuits.	• Close the following sliding links for DHV-43 seal-in circuits (inside MCB behind ES B panel bottom section): ___ TB6-18 (open seal-in) ___ TB6-16 (close seal-in)
16.14 ___ WHEN DHV-43 seal-in circuit is enabled, THEN open DHV-43	
16.15 ___ Close the DC knife switches for B Train pumps on B ES 4160V BUS.	• ___ Bkr 3B7 "BSP-1B BUILDING SPRAY PUMP B" ___ Bkr 3B11 "DHP-1B DECAY HEAT PUMP B"

RB SUMP BACKWASHING USING DH DROP LINE

ACTIONS | DETAILS

NOTE

Waiting 30 minutes allows the RB sump debris to settle.

16.16___ WHEN 30 minutes has elapsed from the time backwashing was performed, OR as directed by the TSC, THEN restore LPI cooling and BS.

- ___ Perform Enclosure 19 in this procedure.

16.17___ Exit this enclosure when notified by the TSC.

RB SUMP BACKWASHING USING GRAVITY FLOW FROM SPENT FUEL POOL

ACTIONS DETAILS

STATUS

RB Sump Backwashing required using gravity flow from the spent fuel pool.

NOTE

Establishing SF Pool level >156' 0" (-2.5') keeps SF Pool level indication on scale while accomplishing the necessary actions. Zero on SF-1-LI1 or SF-1-LI2 is equivalent to 158' 6" elevation.

17.1 ___ Ensure the appropriate system conditions exist to backwash the RB Sump using Spent Fuel Pool.

- ___ Ensure MUP suction has been transferred to the BWST per Enclosure 14
- Ensure both DHPs are stopped:

  ___ DHP-1A

  ___ DHP-1B
- Ensure both SFPs are stopped:

  ___ SFP-1A

  ___ SFP-1B
- Ensure both BSPs are stopped:

  ___ BSP-1A

  ___ BSP-1B
- ___ Ensure Spent Fuel Pool level > 156' 0" (-2.5' on SF-1-LI1 or SF-1-LI2).
- ___ Notify TSC to trend SFP temperature.

RB SUMP BACKWASHING USING GRAVITY FLOW FROM SF POOL

ACTIONS	DETAILS

NOTE

- **Operating SFVs requires coordination with the OSC for AB entry.**
- **AB entry should be made via Hot Machine Shop (119').**
- **Flow to RB sump will terminate when SFP level goes below the SF Pump suction line at 154' 6" elevation.**

17.2 ___ IF backwashing is through DHV-42 (A Train), THEN establish RB sump backwash through DHV-42

1 Ensure the following valves are closed:

___ DHV-210

___ DHV-39

2 ___ Open SFV-89 (119 ft AB Spent Fuel Pump Room in overhead by mezzanine)

3 ___ Ensure DHV-42 is open.

4 ___ Cycle DHV-39 open and closed.

5 ___ Re-cycle DHV-39 open and close at the discretion of the TSC based on available SF Pool level.

6 ___ Close SFV-89

7 ___ **GO TO** Step 17.4

RB SUMP BACKWASHING USING GRAVITY FLOW FROM SF POOL

ACTIONS	DETAILS
17.3 ___ IF backwashing is through DHV-43 (B Train), THEN establish RB sump backwash through DHV-43	1 Ensure the following valves are closed: ___ DHV-211 ___ DHV-40 2 ___ Open SFV-89 (119 ft AB Spent Fuel Pump Room in overhead by mezzanine). 3 ___ Ensure DHV-43 is open. 4 ___ Cycle DHV-40 open and closed. 5 ___ Re-cycle DHV-40 open and close at the discretion of the TSC based on available SF Pool level. 6 ___ Close SFV-89

NOTE

Waiting 30 minutes allows the RB sump debris to settle.

17.4 ___ WHEN 30 minutes has elapsed from the time backwashing was performed, OR as directed by the TSC, THEN restore LPI back in service.	• ___ Perform Enclosure 19 in this procedure.

RB SUMP BACKWASHING USING GRAVITY FLOW FROM SF POOL

ACTIONS	DETAILS
17.5 ___ IF backwashing using SF pool gravity flow is no longer necessary, THEN restore SFP cooling as directed per the TSC.	• ___ Ensure Spent Fuel Pool cooling and level are restored per OP-406, Spent Fuel Pool Cooling System.

17.6 ___ Exit this enclosure when notified by the TSC.

RB SUMP BACKWASHING USING SPENT FUEL PUMP

ACTIONS | DETAILS

STATUS

RB Sump Backwashing required using spent fuel pumps.

NOTE

Establishing SF Pool level >156' 6" (-2.5') keeps SF Pool level indication on scale while accomplishing the necessary actions. Zero on SF-1-LI or SF-1-LI2 is equivalent to 158' 6"

18.1 ___ Ensure the appropriate system conditions exist to backwash the RB Sump using Spent Fuel pumps.

- ___ Ensure MUP suction has been transferred to the BWST per Enclosure 14
- Ensure both DHPs are stopped:

  ___ DHP-1A

  ___ DHP-1B
- Ensure both BSPs are stopped:

  ___ BSP-1A

  ___ BSP-1B
- ___ Ensure SFP level > 156' 6" (-2' on SF-1-LI1 or SF-1-LI2).
- ___ Ensure Spent Fuel Pool cooling is aligned per OP-406, Spent Fuel Pool Cooling System.
- ___ Notify TSC to trend SFP temperature.

RB SUMP BACKWASHING USING SPENT FUEL PUMP

ACTIONS	DETAILS

NOTE

Operating SFVs requires coordination with the OSC for AB entry.

18.2 ___ Establish required SF system alignment.

1 Ensure SFPs are NOT running:

___ SFP-1A

___ SFP-1B

2 Ensure the following DH valves are closed:

___ DHV-40

___ DHV-39

3 Ensure the following SF valves are closed (valves located in AB):

___ SFV-55

___ SFV-43

___ SFV-1

___ SFV-4

___ SFV-89

4 Ensure the following SF valves are open (valves located in AB):

___ SFV-53

___ SFV-54

___ SFV-85

RB SUMP BACKWASHING USING SPENT FUEL PUMP

ACTIONS	DETAILS

CAUTION

Damage to SFP may occur if SF Pool level is < 155' 6" (-3' on SF-1-LI1 or SF-1-LI2).

18.3 ___ IF backwashing is through DHV-42 (A Train), THEN establish RB sump backwash through DHV-42

1 ___ Ensure DHV-210 is closed.

2 ___ Ensure DHV-42 is open.

3 ___ Open DHV-39

4 ___ Start the designated SFP.

[Rule 5, Diesel Load Control]

5 ___ WHEN approximately 60 seconds has elapsed from the start of the SFP, THEN stop the SFP.

6 ___ Close DHV-39

7 ___ **GO TO** Step 18.5

RB SUMP BACKWASHING USING SPENT FUEL PUMP

ACTIONS	DETAILS
18.4 ___ IF backwashing is through DHV-43 (B Train), THEN establish RB sump backwash through DHV-43	1 ___ Ensure DHV-211 is closed. 2 ___ Ensure DHV-43 is open. 3 ___ Open DHV-40 4 ___ Start the designated SFP [Rule 5, Diesel Load Control] 5 ___ WHEN approximately 60 seconds has elapsed from the start of the SFP, THEN stop the SFP. 6 ___ Close DHV-40

NOTE

Waiting 30 minutes allows the RB sump debris to settle.

18.5 ___ WHEN 30 minutes has elapsed from the time backwashing was performed, OR as directed by the TSC, THEN restore LPI cooling and BS.	• ___ Perform Enclosure 19 in this procedure.

RB SUMP BACKWASHING USING SPENT FUEL PUMP

ACTIONS	DETAILS
18.6 ___ If backwashing using the SF Pump is no longer necessary, THEN restore SFP cooling as directed per the TSC.	• ___ Ensure Spent Fuel Pool cooling and level are restored per OP-406, Spent Fuel Pool Cooling System.

18.7 ___ Exit this enclosure when notified by the TSC.

RE-ESTABLISH LPI FLOW FROM THE RB SUMP

ACTIONS DETAILS

STATUS

- RB Sump has been backwashed
- Both DHPs NOT running
- Both BSPs NOT running

NOTE

It is preferable to start the LPI pump on the train of the operating MUP.

19.1 ___ IF DHP-1B will be started,
THEN **GO TO** Step 19.9

RE-ESTABLISH LPI FLOW FROM THE RB SUMP

ACTIONS	DETAILS
19.2 ___ Align DHP-1A to re-establish flow from the RB sump.	1 Ensure the following valves are closed: ___ DHV-3 ___ DHV-4 ___ DHV-41 ___ DHV-39 ___ DHV-34 ___ DHV-11 2 Ensure the following valves are open: ___ DHV-42 ___ DHV-5 ___ DHV-210 3 ___ Ensure DHV-110 is selected to "MAN" and closed.

19.3 ___ Start DHP-1A and required cooling water pumps.

[Rule 5, Diesel Load Control]

___ DCP-1A
___ RWP-3A
___ DHP-1A

RE-ESTABLISH LPI FLOW FROM THE RB SUMP

ACTIONS	DETAILS

CAUTION

Maintain a minimum HPI flow > 200 gpm.

19.4 ___ IF A ES selected MUP is running,
THEN establish piggyback operation.

1 ___ Open DHV-11

2 ___ IF at any time, indications of RB Sump blockage exist while increasing HPI flow,
THEN reduce flow until conditions do NOT exist and contact TSC.

3 Increase HPI flow at 100 gpm increments, waiting 2 minutes between increments until all HPI valves are open:

___ MUV-23

___ MUV-24

___ MUV-25

___ MUV-26

4 ___ Close MUV-73

RE-ESTABLISH LPI FLOW FROM THE RB SUMP

ACTIONS	DETAILS
19.5 ___ IF A ES selected MUP is NOT running, THEN establish LPI flow.	1 ___ IF at any time, indications of RB Sump blockage exist while increasing LPI flow, THEN reduce flow until conditions do NOT exist and contact TSC. 2 ___ Manually throttle DHV-110 to establish 600 gpm (500 to 600 gpm) at 100 gpm increments every 2 minutes. 3 ___ Ensure DHV-110 setpoint is adjusted to 600 gpm and select to "AUTO".
19.6 ___ IF piggyback operation is NOT established, AND stopping HPI flow from the BWST is desired, THEN stop the HPI flow from the BWST.	1 Stop any running HPI pump: ___ MUP-1A ___ MUP-1B ___ MUP-1C 2 Ensure all HPI valves are fully closed: ___ MUV-23 ___ MUV-24 ___ MUV-25 ___ MUV-26 3 Ensure MUP BWST suction valves are closed: ___ MUV-58 ___ MUV-73

RE-ESTABLISH LPI FLOW FROM THE RB SUMP

ACTIONS	DETAILS
19.7 ___ Contact TSC for guidance to restore BS.	

19.8 ___ Exit this enclosure when notified by the TSC.	

RE-ESTABLISH LPI FLOW FROM THE RB SUMP

ACTIONS	DETAILS

STATUS

DHP-1B will be started.

19.9___ Align DHP-1B to re-establish flow from the RB sump.

1 Ensure the following valves are closed:

___ DHV-3

___ DHV-4

___ DHV-41

___ DHV-40

___ DHV-35

___ DHV-12

2 Ensure the following valves are open:

___ DHV-43

___ DHV-6

___ DHV-211

3 ___ Ensure DHV-111 is selected to "MAN" and closed.

RE-ESTABLISH LPI FLOW FROM THE RB SUMP

ACTIONS	DETAILS
19.10 ___ Start DHP-1B and required cooling water pumps. [Rule 5, Diesel Load Control]	___ DCP-1B ___ RWP-3B ___ DHP-1B

CAUTION

Maintain a minimum HPI flow > 200 gpm.

19.11 ___ IF B ES selected MUP is running,
THEN establish piggyback operation.

1 ___ Open DHV-12

2 ___ IF at any time, indications of RB Sump blockage exist while increasing HPI flow,
THEN reduce flow until conditions do NOT exist and contact TSC.

3 Increase HPI flow at 100 gpm increments, waiting 2 minutes between increments until all HPI valves are open:

___ MUV-23

___ MUV-24

___ MUV-25

___ MUV-26

4 ___ Close MUV-58

RE-ESTABLISH LPI FLOW FROM THE RB SUMP

ACTIONS	DETAILS
19.12 ___ IF B ES selected MUP is NOT running, THEN establish LPI flow.	1 ___ IF at any time, indications of RB Sump blockage exist while increasing LPI flow, THEN reduce flow until conditions do NOT exist and contact TSC. 2 ___ Manually throttle DHV-111 to establish 600 gpm (500 to 600 gpm) at 100 gpm flow increments every 2 minutes. 3 ___ Ensure DHV-111 setpoint is adjusted to 600 gpm and select to "AUTO".
19.13 ___ IF piggyback operation is NOT established, AND stopping HPI flow from the BWST is desired, THEN stop HPI flow from the BWST.	1 Stop any running HPI pumps: ___ MUP-1A ___ MUP-1B ___ MUP-1C 2 Ensure all HPI valves are fully closed: ___ MUV-23 ___ MUV-24 ___ MUV-25 ___ MUV-26 3 Ensure MUP BWST suction valves are closed: ___ MUV-58 ___ MUV-73

RE-ESTABLISH LPI FLOW FROM THE RB SUMP

ACTIONS	DETAILS
19.14___ Contact TSC for guidance to restore BS.	

19.15___ Exit this enclosure when notified by the TSC.

SUMMARY OF CHANGES
PRR 332831

NOTES: 1. Writers and Reviewers: Ensure that any changes to this procedure that affect information contained in ERF posters, enclosures, briefing cards, guidelines etc. are made to those items as well.

2. Writers and Reviewers: Changes to certain parts of this procedure may impact other EPIPs. Ensure appropriate PRRs are initiated as needed.

SECTION	CHANGE
Throughout	Reformatting IAW PRO-NGGC-0201.
1.0.2	Added new purpose step stating "this procedure is an emergency plan implementing procedure. any revisions to this procedure must be carefully considered for emergency plan impact." (PRR321656)
2.2	Added new implementing references section
6.0.2	added "(reference section 9.2.3)"
9.2.1 bullet 3	Changed from "Recall Point" to "RECL"
9.2.1 bullet 4	Deleted reference to OP-404 section. Removing the section number prevent inconsistency for future reformatting of OP-404 which affects the section numbers. (PRR 332831)
9.2.4	Added EOP-8A for clarification
9.3	Added reference to Section 6.9, calculation M90-0023 and Calculation M90-0021 for information on RB water level requirements.
9.6	Added reference to NOCS 100504 and deleted reference to NOCS 100484
9.6.2 bullet 2	Changed from "Recall Point" to "RECL"
Enclosure 11 step 11.1	Deleted reference to OP-406 section. Removing the section number prevent inconsistency for future reformatting of OP-406 which affects the section numbers.
Enclosure 12 step 12.4	Deleted reference to OP-403B section. Removing the section number prevent inconsistency for future reformatting of OP-403B which affects the section numbers.

SECTION	CHANGE
Enclosure 11 Note prior to step 11.5 Enclosure 17 Note prior to step 17.1 Enclosure 18 Note prior to step 18.1	Added a note prior to step 11.4 and revised note prior to step 17.1 and 18.1 to define the bases for the 156' and 156' 6" elevation for stopping BWST fill or back washing the RB sump. (Ref PRR 461294)
Summary of Changes	Added two new steps before summary of changes table (PRR 411916)

#1242

Progress Ene	I Information Use

CRYSTAL RIVER UNIT 3

PLANT OPERATING MANUAL

EMERGENCY PLAN IMPLEMENTING PROCEDURE

EM-225F

LONG TERM EMERGENCY FEEDWATER MANAGEMENT

REVISION 7

TABLE OF CONTENTS

1.0 PURPOSE

1. The purpose of this procedure is to provide guidance to the TSC Accident Assessment Team (AAT) to ensure Emergency Feedwater (EFW) or Auxiliary Feedwater (AFW) remains available when OTSG heat transfer is required to remove core decay heat.
2. These guidelines are applicable if EFW or AFW is operating for extended periods of time and normal surveillance testing is not in progress.
3. This procedure is an emergency plan implementing procedure. Any revisions to this procedure must be carefully considered for emergency plan impact.

2.0 REFERENCES

2.1 Developmental References

1. PC 99-1710
2. M 99-0027 Rev. 8, CR-3 Emergency Feedwater System Hydraulic Design Verification Analysis
3. NRC Letter to FPC, 3N0899-05, dated 8/11/99, NRC Safety Evaluation Related to Amendment 182
4. Engineering Calculation E 91-0026 Revision 5, EGDG-1A Scenario Based Loading, Voltage Dip, Frequency Dips and Transient Motor Starting Analysis
5. PC 99-3329
6. FPC Letter to NRC, 3F1198-01, dated 11/24/98
7. EC 55315, Alternate AC Diesel Generator
8. Engineering Calculation E91-0027, Revision 5, EGDG-1B Scenario Based Loading, Voltage Dip, Frequency Dips and Transient Motor Starting Analysis

3.0 DEFINITIONS

None

4.0 RESPONSIBILITIES

1. TSC Accident Assessment Team (AAT)
   - Monitor EFT-2 temperature and provide recommendations to resolve high temperatures if approached.
   - Provide recommendations for alternate feedwater sources and feedwater flow paths during long term EFW or AFW operation.
   - Ensure EFW or AFW is maintained until OTSG heat transfer is no longer required.
2. Emergency Coordinator (EC)
   - Review and approve all recommendations provided by the Accident Assessment Team prior to implementation by the Control Room staff.
3. Emergency Repair Team (ERT)
   - Install support equipment for transferring the contents of EFT-2 to either FST-1A or CDT-1 due to elevated temperatures in EFT-2.
4. Operations (OPS)
   - Coordinate with the Control Room and provide alternate alignments for EFW or AFW systems and support systems.

5.0 PREREQUISTIES

None

6.0 PRECAUTIONS LIMITATIONS AND NOTES

1. If the affected ES 4160V Bus is being powered by a diesel, then ensure adequate Diesel load margin is available per EOP-13, Rule 5, "Diesel Load Control" prior to starting equipment.
2. EFT-2 tank temperature is only available on a local gauge (EF-28-TI) inside the tank building. Hazardous conditions may exist due to nitrogen gas leakage. If a loss of off-site power has occurred, ventilation and lighting will not be available in the enclosure.
3. EFT-2 temperature increases faster as level decreases.
4. EFW or AFW pump discharge TEMP of > 150°F can challenge NPSH limits, equipment qualifications, and RB penetration stresses. EFT-2 TEMP is limited to < 139°F to prevent exceeding these limits.
5. All actions recommended to the Control Room as a result of this procedure must be pre-approved by the Emergency Coordinator.
6. Inadequate NPSH could occur if EFP-3 is placed in STOP and allowed to run at reduced speed if EFT-2 is isolated. Stop EFP-3 by placing control switch in Pull To Lock.
7. FW-336-TI (95 IB on the RB wall across from EFP-2) can be used to monitor EFW discharge temperature only if flow to the OTSGs exists.
8. Use hand-held contact thermometers to monitor temperatures locally at EFW/AFW pumps if other instrumentation is not available and pump discharge temps are desired.
9. Following a steam generator overfill event ensure the main steam lines and the EFP-2 steam supply header are properly drained prior to starting EFP-2.
10. When operating EFP-1 or EFP-2 with the pump suction aligned solely to CDT-1 or FST-1A/1B maintain EFV-142 in the full open position to ensure adequate NPSH to the EFPs.
11. The maximum flow for FWP-7 is 600 gpm (runout flow limit). This takes into consideration the maximum possible recirculation flow rate back to CDT-1 and the possible instrument uncertainty that could be associated with the instrumentation.
12. Starting FWP-7 when Alternate AC Diesel is aligned to an ES Bus has not been analyzed. (Ref E91-0026 and E91-0027)

7.0 SPECIAL TOOLS AND EQUIPMENT

None

8.0 ACCEPTANCE CRITERIA

None

9.0 INSTRUCTIONS

9.1 General Guidelines

NOTES: 1. Closing NGV-243 early will ensure EFT-2 and CDT-1/FST-1A levels will draw down together.

2. EFT-2 Building may be locked requiring use of a master key (P Key) to obtain access.

1. If EFW is operating, then notify the TSC Repair Coordinator that an available operator and re-entry team are needed to isolate the nitrogen supply to EFT-2 by closing NGV-243 "N2 TO EFT-2" (119 ft TB by FWHE-2B).

NOTE: EFT-2 temperature is only available on a local gauge (EF-28-TI) inside the tank building.

2. If EFW or AFW is operating, then start plotting EFT-2 level, CDT-1 level and EFT-2 temperatures on Enclosure 1, EFT-2/CDT-1 Trends in this procedure.

3. Review EFW Management Plan, Enclosure 2, EFW Management Plan in this procedure, and perform appropriate actions if required.

NOTE: EFT-2 temperature limit of 139°F can be challenged within 8 hours under extreme conditions.

4. If at any time, any EFW pump is running and EFT-2 level is < 20 ft, then refer to Enclosure 3, EFT-2/CDT-1 Inventory Control in this procedure for guidance.

5. If at any time, FWP-7 is running and CDT-1 level is < 20 ft, then refer to Enclosure 3, EFT-2/CDT-1 Inventory Control in this procedure for guidance.

6. If at any time, EFT-2 TEMP is ≥ 110°F, then notify the TSC Repair Coordinator to install EFT-2 temporary transfer hose per Enclosure 4, Installation of EFT-2 Temporary Transfer Line in this procedure.

7. If at any time, EFT-2 TEMP reaches 130°F, then refer to Enclosure 5, EFT-2 Transfer to Alternate Tanks for Cooling in this procedure for guidance.

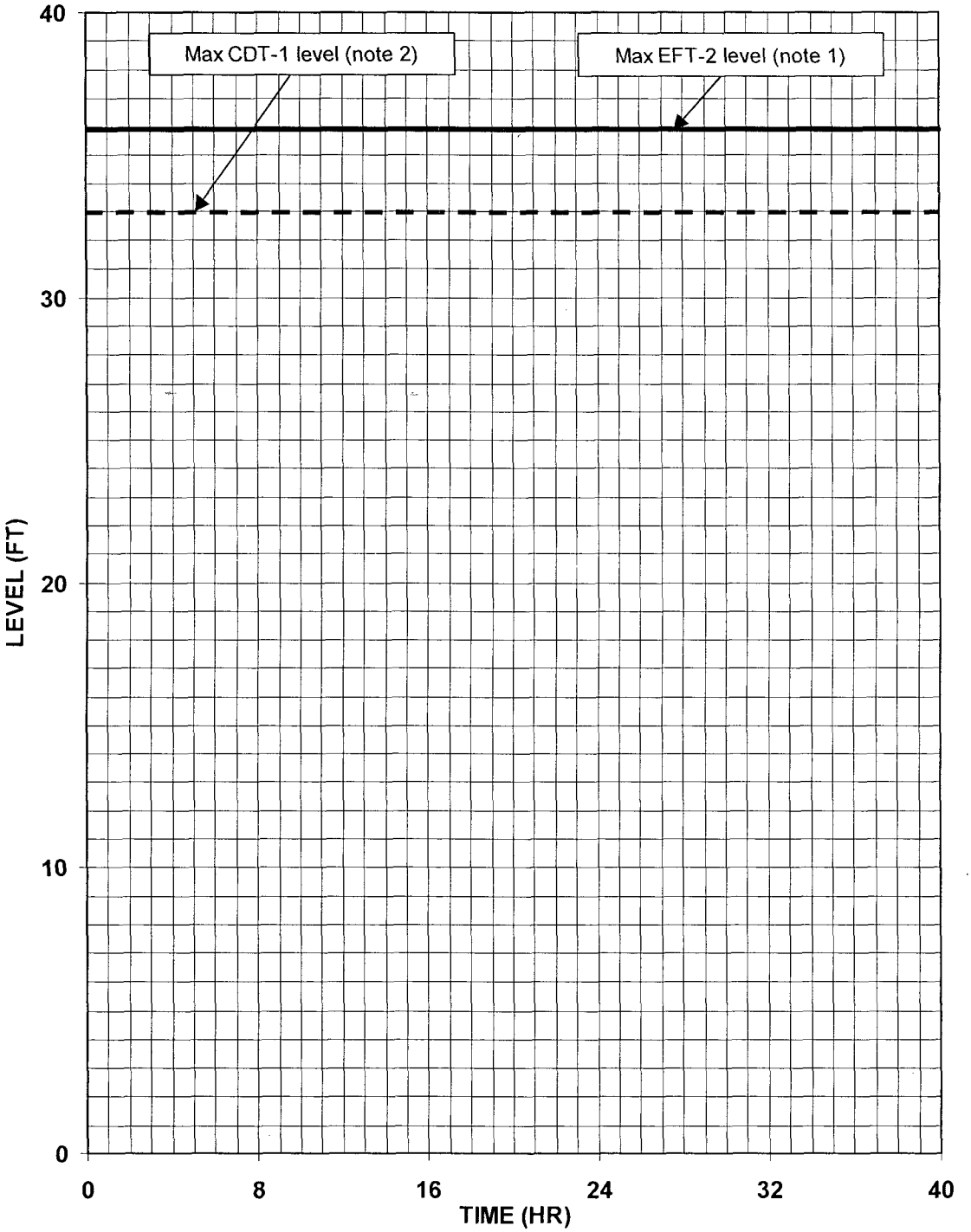
8. If at any time, EFT-2 will be cross-tied to CDT-1, then notify Chemistry to consider Amerzine addition to CDT-1.

9. When performance of EM-225F is not required, then ensure EFT-2 building penetrations and EF/CD system configuration is restored.

10.0 RECORDS

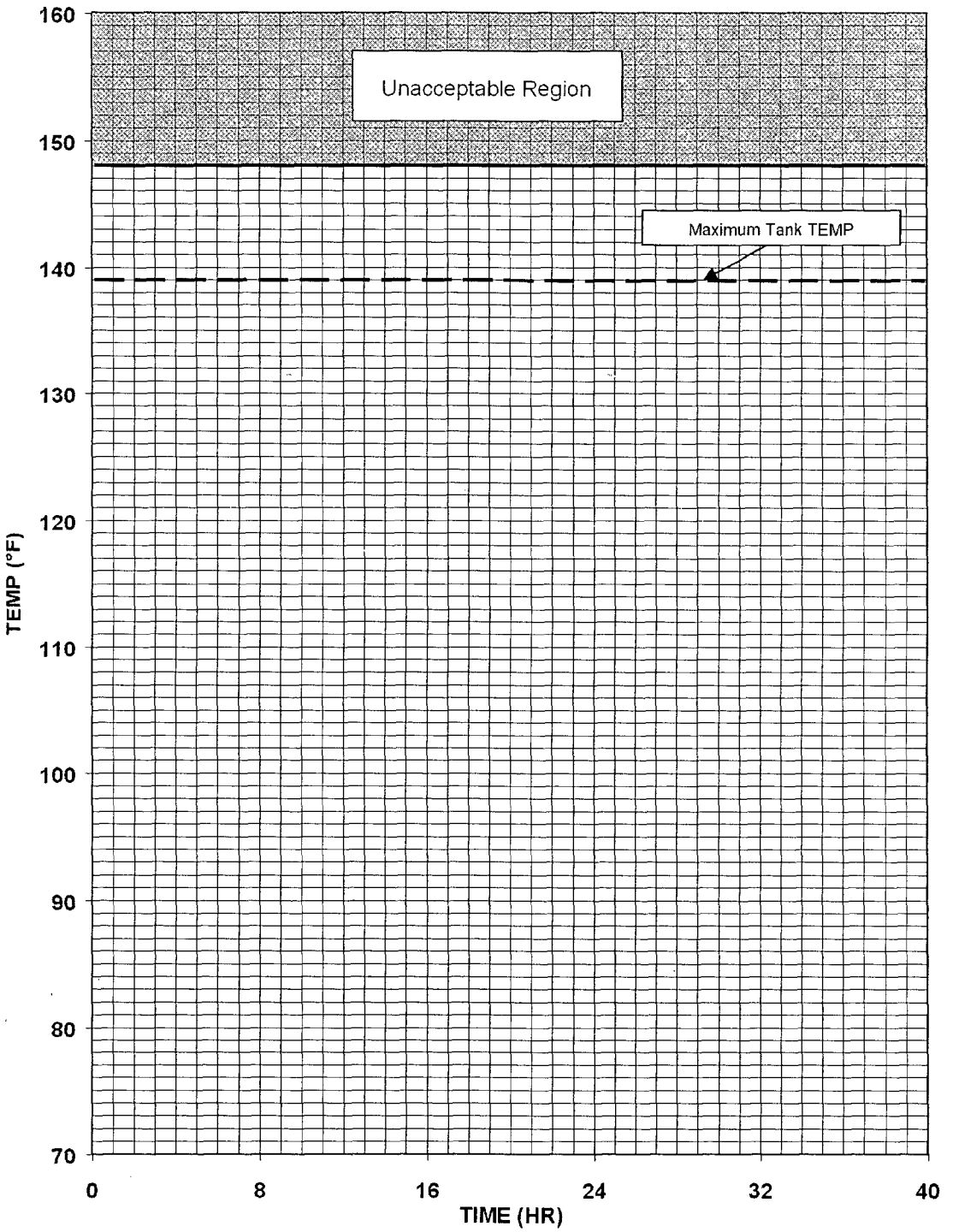
All enclosures are quality records.

EFT-2/CDT-1 TRENDS
LEVEL TRENDS



Note 1: EFT-2 level instrumentation reference leg will flood if level is > 36 ft.
Note 2: CDT-1 will overflow to TB if level is > 33 ft.

EFT-2/CDT-1 TRENDS
TEMP TRENDS



Note 1: EFT-2 TEMP can be obtained from EF-28-TI (119 ft EFT-2 Building).

EFW MANAGEMENT PLAN

STATUS: EFP-3 IS RUNNING		
PROBLEM	**SOLUTION**	**REFER TO**
Any of the following are failed: • A ES 4160V bus • A Train battery chargers • A Train battery failure	• START EFP-2 • **IF** Alternate AC Diesel is **NOT** aligned to a ES 4160V Bus **AND** FWP-7 is available, **THEN** START FWP-7 • STOP EFP-3 before A Train battery fails. ----------OR---------- • **IF** EFP-2 or FWP-7 **NOT** available, **THEN** CROSS-TIE EFP-3 to B Train EFW.	Enclosure 9 ----------OR---------- Enclosure 16
Water sources on berm are depleted **AND** all the following are **NOT** available: • EFP-1 • FWP-7	• START EFP-2 aligned to hotwell. • ALIGN Units 1 or 2 Aux steam to EFP-2 before OTSG PRESS < 200 psig. ----------OR---------- • **IF** EFP-2 is **NOT** available, **THEN** FILL FST-1A/B using Units 1/2 fire service.	Enclosure 12 Enclosure 6 ----------OR---------- Enclosure 13
Water sources on berm are depleted **AND** all the following are **NOT** available: • FWP-7 • EFP-2	• **IF** EFP-1 is available **AND** only A ES 4160V BUS energized, **THEN** START EFP-1 **AND** ALIGN to the hotwell. ----------OR---------- • **IF** EFP-1 is available **AND** Both ES 4160V Buses are energized by EDGs, **THEN** START EFP-1 and align to the hotwell.	Enclosure 10 then Enclosure 12 ----------OR---------- Enclosure 11 then Enclosure 12
EFT-2 TEMP is ≥ 130°F	• ALIGN EFP-3 to CDT-1 **AND** ISOLATE EFT-2 ----------OR---------- • **IF** Alternate AC Diesel is **NOT** powering an ES 4160V Bus, **THEN** START FWP-7 aligned to CDT-1 • STOP EFP-3 ----------OR---------- • START EFP-2 aligned to the hotwell. • ALIGN Units 1 or 2 Aux steam to EFP-2 before OTSG PRESS < 200 psig. • STOP EFP-3	Enclosure 5 ----------OR---------- Enclosure 9 ----------OR---------- Enclosure 12 Enclosure 6 Enclosure 9
Water sources on berm are depleted **AND** all the following are **NOT** available: • FWP-7 • B-Battery	• START EFP-1 on A ES 4160V BUS • ALIGN EFP-1 to hotwell. ----------OR---------- • CROSS-TIE EFP-2 to A Train EFW. ----------OR---------- • REFILL EFT-2 using EFP-2	Enclosure 10 then Enclosure 12 ----------OR---------- Enclosure 7 ----------OR---------- Enclosure 8

EFW MANAGEMENT PLAN

STATUS: EFP-2 IS RUNNING		
PROBLEM	**SOLUTION**	**REFER TO**
EFT-2 TEMP is ≥ 130°F	• **IF** Alternate AC Diesel is **NOT** powering an ES 4160V Bus, **THEN** START FWP-7 aligned to CDT-1 • START FWP-7 aligned to CDT-1 • STOP EFP-2 ----------OR---------- • ALIGN EFP-2 to hotwell. • ALIGN Units 1 or 2 Aux steam to EFP-2 before OTSG PRESS < 200 psig. ----------OR---------- • ALIGN EFP-2 to CDT-1 **AND** ISOLATE EFT-2	Enclosure 9 ----------OR---------- Enclosure 12 Enclosure 6 ----------OR---------- Enclosure 5
All the following exist: • Water sources on berm are depleted • Hotwell is not available	• FILL Fire Storage Tanks using Units 1/2 Fire Service.	Enclosure 13
All the following exist: • EFP-2 suction is aligned to hotwell • Hotwell level is approaching 24 in	• **IF** adequate level exists in EFT-2, **AND** EFT-2 temperature is < 139°F, **THEN** ALIGN EFP-2 suction to EFT-2 ----------OR---------- • Gravity drain water from CDT-1 and FST-1A/B to hotwell using CDV-88	Enclosure 14 ---------- N/A
All the following are **NOT** available: • EFP-3 • FWP-7	• **IF** EFP-1 is **NOT** available, **THEN** ALIGN Unit 1 or 2 steam to EFP-2 ---------- OR---------- • **IF** EFP-1 is available **AND** only A ES 4160V BUS energized, **THEN** START EFP-1 • STOP EFP-2 ----------OR---------- • **IF** EFP-1 is available **AND** Both ES 4160V Buses are energized by Diesel, **THEN** START EFP-1 • STOP EFP-2	Enclosure 6 ----------OR---------- Enclosure 10 Enclosure 9 ----------OR---------- Enclosure 11 Enclosure 9

EFW MANAGEMENT PLAN

STATUS: EFP-1 IS RUNNING		
PROBLEM	**SOLUTION**	**REFER TO**
EFT-2 TEMP is ≥ 130°F	• **IF** Alternate AC Diesel is **NOT** powering an ES 4160V Bus, **THEN** START FWP-7 aligned to CDT-1 • STOP EFP-1 ----------OR---------- • ALIGN suction of EFP-1 to hotwell. ----------OR---------- • ALIGN EFP-1 to CDT-1 **AND** ISOLATE EFT-2	Enclosure 9 ----------OR---------- Enclosure 12 ----------OR---------- Enclosure 5
All the following exist: • Water sources on berm are depleted • Hotwell is **NOT** available	• FILL Fire Storage Tanks using Units 1/2 Fire Service.	Enclosure 13
All the following exist: • EFP-1 suction is aligned to hotwell • Hotwell level is approaching 24 in	• **IF** adequate level exists in EFT-2, **AND** EFT-2 temperature is < 139°F, **THEN** ALIGN EFP-1 suction to EFT-2 ----------OR---------- • **IF** adequate level exists in EFT-2, **AND** EFT-2 temperature is < 139°F, **THEN** START EFP-3 aligned to EFT-2 ----------OR---------- • Gravity drain water from CDT-1 and FST-1A/B to hotwell using CDV-88	Enclosure 14 ----------OR---------- Enclosure 9 ---------- N/A
Any of the following are failed: • A Train battery chargers • A Train battery failure	• START EFP-2 • **IF** Alternate AC Diesel is **NOT** aligned to a ES 4160V Bus **AND** FWP-7 is available, **THEN** start FWP-7 • STOP EFP-1 before A Train battery fails. ----------OR---------- **IF** EFP-2 or FWP-7 **NOT** available, **THEN** CROSS-TIE EFP-1 to B Train EFW	Enclosure 9 ----------OR---------- Enclosure 16

EFW MANAGEMENT PLAN

STATUS: FWP-7 IS RUNNING		
PROBLEM	**SOLUTION**	**REFER TO**
CDT-1 TEMP is ≥ 130°F	• **IF** adequate level exists in EFT-2, **AND** EFT-2 temperature is < 139°F, **THEN** START EFP-2 aligned to EFT-2 • STOP FWP-7 • ALIGN Unit 1 or 2 steam to EFP-2 ----------OR---------- • ALIGN suction of FWP-7 to hotwell. • Gravity drain CDT-1 to hotwell using CDV-88 ----------OR---------- • **IF** Off-site power is available, **THEN** REFILL CDT-1 with Demin Water.	Enclosure 9 Enclosure 9 Enclosure 6 ----------OR---------- Enclosure 12 ----------OR---------- Enclosure 3
All the following exist: • FWP-7 suction is aligned to hotwell • Hotwell level approaching 24 in	• Gravity drain water from CDT-1 and FST-1A/B to hotwell using CDV-88	N/A
All the following exist: • EFP-1 start up is desired • EDG load management **NOT** possible	• **IF** EFP-1 is available **AND** only A ES 4160V BUS energized, **THEN** START EFP-1 • STOP FWP-7 ----------OR---------- • **IF** EFP-1 is available, **AND** Both ES 4160V Buses are energized by Diesel, **THEN** START EFP-1 • STOP FWP-7	Enclosure 10 Enclosure 9 ----------OR---------- Enclosure 11 Enclosure 9

EFT-2/CDT-1 INVENTORY CONTROL

ACTIONS	DETAILS
3.1 ___ IF at least 1 CDP is running, THEN maintain EFT-2 level.	1 ___ Ensure CD Hdr PRESS is between 90 and 150 psig. 2 Notify SPO to maintain EFT-2 level between 10 and 36 ft (95 ft TB behind Atmospheric Drain Tank): ___ Open CDV-260 "EFT-2 FILL FROM CONDENSATE". ___ Throttle CDV-259 "EFT-2 FILL FROM CONDENSATE" as necessary to maintain EFT-2 level.

EFT-2/CDT-1 INVENTORY CONTROL

ACTIONS	DETAILS
3.2 ___ Maintain CDT-1 level.	• ___ IF at least 1 CDP is running, THEN maintain CDT-1 level between 10 and 31 ft using CD: ___ Ensure CD Hdr PRESS is between 90 and 150 psig. ___ Notify SPO to throttle CDV-88 "CONDENSATE REJECT TO CDT-1" as necessary to maintain CDT-1 level (95 ft TB behind Atmospheric Drain Tank). • ___ IF no CDPs are running, THEN notify SPO to maintain CDT-1 level between 10 and 31 ft using DW: ___ Ensure CDV-88 "CONDENSATE REJECT TO CDT-1" is closed (95 ft TB behind Atmospheric Drain Tank). ___ Throttle CDV-112 "DW MAKEUP TO CDT-1" as necessary to maintain CDT-1 level (95 ft TB by MFWBPs).

INSTALLATION OF EFT-2 TEMPORARY TRANSFER LINE

ACTIONS	DETAILS

CAUTION

Entry into EFT-2 Building may require additional precautions if power is not available to ventilation fan.

NOTE

- **All fittings, hoses, and tools are located in the Fire Pump House.**
- **Five individuals are required to perform this enclosure**

4.1 ___ Notify Control Room that EFT-2 temporary transfer line is being installed.

4.2 ___ IF B 4160V UNIT BUS is energized,
THEN ensure AHF-152 "EFT-2 ENC Vent Fan" runs for > 10 min prior to entry (Entrance to EFT-2).

4.3 ___ Ensure EFV-96 "EFT-2 DRAIN" is closed (Inside EFT-2 Building north wall). (OPS or ERT)

- Refer to Enclosure 17, "EFP-2 TEMPORARY TRANSFER LINE CONFIGURATION," Figures 1 and 2, in this procedure.

4.4 ___ Remove 4 in blank flange from EFV-96 "EFT-2 DRAIN" (Inside EFT-2 Building north wall). (ERT)

- Refer to Enclosure 17, "EFP-2 TEMPORARY TRANSFER LINE CONFIGURATION," Figures 1 and 2, in this procedure.

INSTALLATION OF EFT-2 TEMPORARY TRANSFER LINE

ACTIONS		DETAILS
NOTE Match marks are installed on the flexible spool piece for match-up with EFV-96.		
4.5	___ Install flexible spool piece with gaskets between EFV-96 "EFT-2 DRAIN" and spare penetration (Inside EFT-2 Building north wall). (ERT)	• Refer to Enclosure 17, "EFP-2 TEMPORARY TRANSFER LINE CONFIGURATION," Figures 1 and 2, in this procedure
4.6	___ Ensure flange bolts and hose clamps are tight. (ERT)	• Refer to Enclosure 17, "EFP-2 TEMPORARY TRANSFER LINE CONFIGURATION," Figures 1 and 2, in this procedure
4.7	___ Remove 4 in blank flange on spare penetration (Maintenance Support Building under diamond plate, below stairs south wall). (ERT)	• Refer to Enclosure 17, "EFP-2 TEMPORARY TRANSFER LINE CONFIGURATION," Figures 1 and 2, in this procedure
4.8	___ Install double elbow assembly with gaskets on spare penetration. (ERT)	• Refer to Enclosure 17, "EFP-2 TEMPORARY TRANSFER LINE CONFIGURATION," Figures 1 and 2, in this procedure

INSTALLATION OF EFT-2 TEMPORARY TRANSFER LINE

	ACTIONS	DETAILS
4.9 ___	Install hose adapter with gaskets to double elbow assembly.	• Refer to Enclosure 17, "EFP-2 TEMPORARY TRANSFER LINE CONFIGURATION," Figures 1 and 2, in this procedure
4.10 ___	Ensure flange bolts are tight. (ERT)	• Refer to Enclosure 17, "EFP-2 TEMPORARY TRANSFER LINE CONFIGURATION," Figures 1 and 2, in this procedure
4.11 ___	Ensure adequate temporary support is placed under hose adapter.	
4.12 ___	Connect 6 in hose to hose adapter on double elbow assembly and tighten securely. (ERT)	
4.13 ___	IF EFT-2 connection to FST-1A is desired, THEN **GO TO** Step 4.22 in this enclosure.	

INSTALLATION OF EFT-2 TEMPORARY TRANSFER LINE

ACTIONS DETAILS

STATUS

EFT-2 connection to CDT-1 is desired.

CAUTION

FWP-7 cannot be operated if EFT-2 is connected to CDT-1 unless FWV-265 is closed.

4.14 ___ Install 4x6 in adapter with gaskets on FWV-265 "FWP-7 FW EMERGENCY TRANSFER TO FS OR SD SYSTEM ISO" (119 ft TB near southwest stairway). (ERT)

- Refer to Enclosure 17, "EFP-2 TEMPORARY TRANSFER LINE CONFIGURATION," Figure 3, in this procedure.

4.15 ___ Install hose adapter with gaskets to 4 x 6 in adapter.

- Refer to Enclosure 17, "EFP-2 TEMPORARY TRANSFER LINE CONFIGURATION," Figure 3, in this procedure.

4.16 ___ Ensure adequate temporary support is placed under hose adapter.

INSTALLATION OF EFT-2 TEMPORARY TRANSFER LINE

ACTIONS	DETAILS

NOTE

Route Hose Between Fsts, Down East Side Of Fst-1a And Through Turbine Building Door.

4.17 ___	Connect sections of 6 in hose together and attach to hose adapter on FWV-265 "FWP-7 FW EMERGENCY TRANSFER TO FS OR SD SYSTEM ISO" (119 ft TB near southwest stairway).(ERT)	• Refer to Enclosure 17, "EFP-2 TEMPORARY TRANSFER LINE CONFIGURATION," Figure 3, in this procedure.

INSTALLATION OF EFT-2 TEMPORARY TRANSFER LINE

ACTIONS	DETAILS
4.18 ___ Ensure all couplings and fittings are tight.(ERT)	
4.19 ___ Pressurize transfer hose. (OPS)	1 ___ Slowly open EFV-96 "EFT-2 DRAIN" (Inside EFT-2 Building north wall). 2 ___ Check all hoses and connections for leaks. 3 ___ IF leaks exist, THEN perform the following in order: ___ Close EFV-96 "EFT-2 DRAIN" (Inside EFT-2 Building north wall). ___ Repair leaks.
4.20 ___ Close EFV-96 "EFT-2 DRAIN" (Inside EFT-2 Building north wall).	
4.21 ___ **EXIT** this enclosure.	

INSTALLATION OF EFT-2 TEMPORARY TRANSFER LINE

ACTIONS		DETAILS

STATUS

EFT-2 connection to FST-1A is desired.

4.22 ___	Install 2½ x 4 in adapter and 4 x 6 in adapter with gaskets to FSV-919 "FST-1A DRAIN AND SAMPLE VALVE" (Southeast side of FST-1A).	• Refer to Enclosure 17, "EFP-2 TEMPORARY TRANSFER LINE CONFIGURATION," Figure 4, in this procedure.
4.23 ___	Install hose adapter with gaskets to 4 x 6 in adapter.	• Refer to Enclosure 17, "EFP-2 TEMPORARY TRANSFER LINE CONFIGURATION," Figure 4, in this procedure.
4.24 ___	Ensure adequate temporary support is placed under hose adapter.	
4.25 ___	Connect sections of 6 in hose together and attach to hose adapter on FSV-919 "FST-1A DRAIN AND SAMPLE VALVE" (Southeast side of FST-1A).	• Refer to Enclosure 17, "EFP-2 TEMPORARY TRANSFER LINE CONFIGURATION," Figure 4, in this procedure.
4.26 ___	Ensure all couplings and fittings are tight.	

INSTALLATION OF EFT-2 TEMPORARY TRANSFER LINE

ACTIONS	DETAILS
4.27 ___ Pressurize transfer hose. (OPS)	1 ___ Slowly open EFV-96 "EFT-2 DRAIN" (Inside EFT-2 Building north wall). 2 ___ Check all hoses and connections for leaks. 3 ___ IF leaks exist, THEN perform the following in order: ___ Close EFV-96 "EFT-2 DRAIN" (Inside EFT-2 Building north wall). ___ Repair leaks.
4.28 ___ Close EFV-96 "EFT-2 DRAIN" (Inside EFT-2 Building north wall).	
4.29 ___ **EXIT** this enclosure.	

EFT-2 TRANSFER TO ALTERNATE TANKS FOR COOLING

ACTIONS	DETAILS
5.1 ___ IF EFT-2 transfer to FST-1A is desired, THEN **GO TO** Step 5.12 in this enclosure.	

EFT-2 TRANSFER TO ALTERNATE TANKS FOR COOLING

	ACTIONS	DETAILS
5.2	___ Verify 6 in hose is installed between EFT-2 and FWV-265 "FWP-7 FW EMERGENCY TRANSFER TO FS OR SD SYSTEM ISO" (119 ft TB near southwest stairway).	
	___ IF hose is NOT installed between EFT-2 and FWV-265, THEN **PERFORM** Enclosure 4 in this procedure.	

EFT-2 TRANSFER TO ALTERNATE TANKS FOR COOLING

ACTIONS DETAILS

CAUTION

Entry into EFT-2 Building may require additional precautions if power is not available to ventilation fan.

5.3 ___ IF B 4160V UNIT BUS is energized, THEN ensure AHF-152 "EFT-2 ENC Vent Fan" runs for > 10 min prior to entry (Entrance to EFT-2).

5.4 ___ Open EFV-96 "EFT-2 DRAIN" (Inside EFT-2 Building north wall).

5.5 ___ Ensure transfer hose is not leaking.

NOTE

The next steps may result in a rapid decrease in EFT-2 level.

5.6 ___ Notify Control Room EFT-2 alignment to CDT-1 is in progress.

EFT-2 TRANSFER TO ALTERNATE TANKS FOR COOLING

		ACTIONS	DETAILS
5.7	___	Open FWV-265 "FWP-7 FW EMERGENCY TRANSFER TO FS OR SD SYSTEM ISO" (119 ft TB near south west stairway).	
5.8	___	Ensure CDV-103 "CDT-1 TO EFP SUCTION" is open (119 ft Berm by CDT-1).	
5.9	___	Unlock and close EFV-111 "EFT-2 TO EFP SUCTION ISOLATION " (Inside EFT-2 Building northwest corner).	
5.10	___	Unlock and close EFV-109 "EFT-2 TO EFP SUCTION ISOLATION" (Inside EFT-2 Building north wall).	
5.11	___	**EXIT** this enclosure.	

EFT-2 TRANSFER TO ALTERNATE TANKS FOR COOLING

ACTIONS DETAILS

STATUS

EFT-2 transfer to FST-1A is desired.

5.12 ___ Verify 6 in hose is installed between EFT-2 and FSV-919 "FST-1A DRAIN AND SAMPLE VALVE" (Southeast side of FST-1A).

___ IF hose is NOT installed between EFT-2 and FSV-919, THEN **PERFORM** Enclosure 4 in this procedure.

CAUTION

Entry into EFT-2 Building may require additional precautions if power is not available to ventilation fan.

5.13 ___ IF B 4160V UNIT BUS is energized, THEN ensure AHF-152 "EFT-2 ENC Vent Fan" runs for > 10 min prior to entry (Entrance to EFT-2).

EFT-2 TRANSFER TO ALTERNATE TANKS FOR COOLING

ACTIONS	DETAILS

5.14 ___ Open EFV-96
"EFT-2 DRAIN"
(Inside EFT-2 Building
north wall).

5.15 ___ Ensure transfer hose is not
leaking.

NOTE

The next step may result in a rapid decrease in EFT-2 level.

5.16 ___ Notify Control Room EFT-2
alignment to FST-1A
is in progress.

5.17 ___ Open FSV-919
"FST-1A DRAIN AND
SAMPLE VALVE"
(Southeast side of FST-1A).

5.18 ___ Close CDV-288
"FST TO CDT-1
CROSS-TIE DRAIN"
(119 ft Berm by FST-1A).

EFT-2 TRANSFER TO ALTERNATE TANKS FOR COOLING

ACTIONS	DETAILS
5.19 ___ Open CDV-289 "FST TO CDT-1 CROSS-TIE ISO" (119 ft Berm by FST-1A).	
5.20 ___ Open FSV-918 "FST TO CDT-1 CROSS-TIE ISO" (119 ft Berm by FST-1A).	
5.21 ___ Unlock and close EFV-111 "TO EFW PUMP SUCTION" (Inside EFT-2 Building northwest corner).	
5.22 ___ Unlock and close EFV-109 "TO EFW PUMP SUCTION" (Inside EFT-2 Building north wall).	
5.23 ___ **EXIT** this enclosure.	

ALIGNING UNIT 1 OR 2 STEAM TO EFP-2

ACTIONS	DETAILS

NOTE

If EFP-2 is the only available FW source, then not aligning Unit 1 or 2 steam may require EFP-2 to be cycled on and off based on available steam pressure.

6.1 ___ IF Unit 1 or 2 steam is available,
AND 95 ft IB is accessible,
THEN notify SPO to perform warmup and pressurization of AS line to EFP-2

1 ___ Throttle ASV-15
"AS ISO TO EFP-2"
1 turn open
(119 ft TB NW stairs).

2 ___ WHEN steam PRESS is equalized around ASV-15,
THEN open ASV-15

3 ___ Blowdown condensate from ASDT-2 by cycling ASV-110
"ASDT-2 BLOWDOWN"
(95 ft TB behind Atmospheric Drain Tank).

4 ___ WHEN AS lines are warmed and free of condensate,
THEN notify Control Room.

6.2 ___ WHEN AS lines are warmed and pressurized,
THEN notify PPO to blowdown MSDT-21

- Blowdown condensate from MSDT-21 by throttling open MSV-290
"MSDT-21 BLOWDOWN"
(95 ft IB by EFP-2).

ALIGNING UNIT 1 OR 2 STEAM TO EFP-2

ACTIONS	DETAILS
6.3 ___ WHEN AS is ready to be aligned to EFP-2, THEN notify PPO to align Unit 1 or 2 steam to EFP-2	1 ___ Ensure MSDT-21 is free of condensate and close MSV-290 "MSDT-21 BLOWDOWN" (95 ft IB by EFP-2). 2 ___ Open ASV-23 "UNITS 1 OR 2 STEAM TO EFP-2" (95 ft IB by EFP-2).

6.4 ___ **EXIT** this enclosure.

EFP-2 CROSS-TIE TO A TRAIN EFW

ACTIONS	DETAILS

STATUS

- **A ES 4160V BUS is energized by the A ES Diesel or Alternate AC Diesel.**
- **B ES 4160V BUS is de-energized.**
- **EFP-2 cross-tie to A Train EFW is desired.**

7.1 ___ Verify ASV-50 "EFP-2 TRIP & THROTTLE VALVE" is not tripped.

- "EF PUMP 2 TRIP" annunicator alarm (H-07-04) not lit.

___ IF ASV-50 is tripped, THEN notify SPO to perform Enclosure 15, "EFP-2 TRIP RECOVERY" in this procedure.

EFP-2 CROSS-TIE TO A TRAIN EFW

ACTIONS	DETAILS
7.2 ___ Ensure EFP-2 normal discharge path is isolated.	1 ___ Depress "MANUAL PERMISSIVE" push buttons on EFIC channels A and B. 2 Close EFP-2 discharge block valves: ___ EFV-11 ___ EFV-32 3 Notify PPO to open EFP-2 discharge block valve switches (A ES 480V SWGR Room): ___ DPDP 8C-1 "EFV-11 MOTOR POWER" ___ DPDP 8C-3 "EFV-32 MOTOR POWER"
7.3 ___ Start EFP-2	• Open ASV-204

EFP-2 CROSS-TIE TO A TRAIN EFW

ACTIONS	DETAILS
7.4 ___ Notify PPO to cross connect EFW trains.	1 Unlock and close EFV-12 switches (A ES 480V SWGR Room): ___ DPDP 8C-5 "EFV-12 MOTOR POWER" ___ DPDP 8C-6 "EFV-12 CONTROL POWER" 2 ___ Depress the open push button on EFV-12-MST (A ES 480V SWGR Room). 3 ___ WHEN EFV-12 is open, THEN open and lock EFV-12 switches (A ES 480V SWGR Room): ___ DPDP 8C-5 "EFV-12 MOTOR POWER" ___ DPDP 8C-6 "EFV-12 CONTROL POWER" 4 ___ Notify Control Room that EFV-12 is open.

7.5 ___ WHEN EFP-2 is aligned to supply EFW to OTSGs, THEN stop EFP-3

EFP-2 CROSS-TIE TO A TRAIN EFW

ACTIONS		DETAILS
7.6	___ Depress both "EFW INITIATE" push buttons on EFIC channels A and B.	
7.7	___ Ensure EFW flow is controlled. [Rule 3, EFW/AFW Control]	
7.8	___ **EXIT** this enclosure.	

TRANSFERRING HOTWELL TO EFT-2 USING EFP-2

ACTIONS DETAILS

STATUS

All the following exist:

- **B-Battery failed**
- **Water sources on berm depleted**
- **Hotwell transfer to EFT-2 using EFP-2 is desired**

8.1 ___ IF hotwell is NOT at atmospheric PRESS, THEN break condenser vacuum.

1 Close all MSIVs:

___ MSV-412

___ MSV-413

___ MSV-414

___ MSV-411

2 ___ Control OTSG PRESS using ADVs.

3 Select condenser ARPs to "PULL TO LOCK":

___ ARP-1A

___ ARP-1B

4 Open condenser vacuum Bkrs:

___ ARV-48

___ ARV-49

TRANSFERRING HOTWELL TO EFT-2 USING EFP-2

	ACTIONS	DETAILS
8.2 ___	Ensure EFP-2 EFW block valves are closed.	• ___ EFV-11 • ___ EFV-32
8.3 ___	WHEN condenser is at atmospheric PRESS, THEN notify SPO to align EFP-2 to hotwell.	1 ___ Ensure EFV-36 "EFW &AFW SUCTION ISO FROM HOTWELL" is open (95 ft TB between C & D inlet waterboxes). 2 ___ Unlock and open EFV-1 "EFP-2 SUCTION FROM CONDENSER" (95 ft IB by EFP-2). 3 ___ Unlock and close EFV-4 "EFP-2 SUCTION FROM EFT-2" (95 ft IB by EFP-2).
8.4 ___	Start EFP-2	• Open ASV-204

TRANSFERRING HOTWELL TO EFT-2 USING EFP-2

	ACTIONS	DETAILS
8.5	___ WHEN hotwell ≤ 24 in, OR EFT-2 is at desired level, THEN stop EFP-2	• Close ASV-204

8.6 ___ **EXIT** this enclosure.

START UP AND SHUTDOWN OF EFW/AFW PUMPS

ACTIONS DETAILS

CAUTION

Ensure adequate diesel loading margin is available before starting EFP-1

9.1 ___ IF EFP-1 start is desired from hotwell, THEN ensure flow path is properly aligned and start EFP-1

1 ___ Ensure condenser is at atmospheric PRESS.

2 ___ Ensure EFV-36 "EFW & AFW SUCTION ISO FROM HOTWELL" is open (95 ft TB between C & D inlet waterboxes).

3 ___ Unlock and open EFV-2 "EFP-1 SUCTION FROM CONDENSER" (95 ft IB by EFP-1).

4 ___ Unlock and close EFV-3 "EFP-1 SUCTION FROM EFT-2" (95 ft IB by EFP-1).

5 ___ Ensure EFP-1 EFIC control valves are closed.

6 ___ Ensure EFP-3 is in "PULL TO LOCK".

7 ___ Start EFP-1 and ensure EFW flow is controlled.

[Rule 5, Diesel Load Control]

8 ___ Ensure EFW flow is maintained < limit of EOP-14, Emergency Operating Procedures Enclosures, Figure 3

START UP AND SHUTDOWN OF EFW/AFW PUMPS

ACTIONS DETAILS

CAUTION

Ensure adequate diesel loading margin is available before starting EFP-1

9.2 ___ IF EFP-1 start is desired from EFT-2, THEN ensure flow path is properly aligned and start EFP-1

1 ___ OPEN EFV-109 "EFT-2 TO EFW PUMP SUCTION" (119 ft berm inside EFT-2 Building).

2 ___ Open EFV-111 "EFT-2 TO EFW PUMP SUCTION" (119 ft Berm inside EFT-2 Building).

3 ___ Unlock and open EFV-3 "EFP-1 SUCTION FROM EFT-2" (95 ft IB by EFP-1).

4 ___ Unlock and close EFV-2 "EFP-1 SUCTION FROM CONDENSER" (95 ft IB by EFP-1).

5 ___ Ensure EFP-1 EFIC control valves are closed.

6 ___ Ensure EFP-3 is in "PULL TO LOCK".

7 ___ Start EFP-1 and ensure EFW flow is controlled.

[Rule 5, Diesel Load Control]

8 ___ Ensure EFW flow is controlled.

[Rule 3, EFW/AFW Control]

START UP AND SHUTDOWN OF EFW/AFW PUMPS

ACTIONS	DETAILS
9.3 ___ IF EFP-2 start is desired from hotwell, THEN ensure flow path is properly aligned and start EFP-2	1 ___ Ensure condenser is at atmospheric PRESS. 2 ___ Ensure EFV-36 "EFW & AFW SUCTION ISO FROM HOTWELL" is open (95 ft TB between C & D inlet waterboxes). 3 ___ Unlock and open EFV-1 "EFP-2 SUCTION FROM CONDENSER" (95 ft IB by EFP-2). 4 ___ Unlock and close EFV-4 "EFP-2 SUCTION FROM EFT-2" (95 ft IB by EFP-2). 5 ___ Ensure EFP-2 EFIC control valves are closed. 6 Start EFP-2 by opening 1 of the following: ___ ASV-5 ___ ASV-204 7 ___ Ensure EFW flow is controlled. [Rule 3, EFW/AFW Control]

START UP AND SHUTDOWN OF EFW/AFW PUMPS

ACTIONS	DETAILS
9.4 ___ IF EFP-2 start is desired from EFT-2, THEN ensure flow path is properly aligned and start EFP-2	1 ___ OPEN EFV-109 "EFT-2 TO EFW PUMP SUCTION" (119 ft berm inside EFT-2 Building). 2 ___ Open EFV-111 "EFT-2 TO EFW PUMP SUCTION" (119 ft Berm inside EFT-2 Building). 3 ___ Unlock and open EFV-4 "EFP-2 SUCTION FROM EFT-2" (95 ft IB by EFP-2). 4 ___ Unlock and close EFV-1 "EFP-2 SUCTION FROM CONDENSER" (95 ft IB by EFP-2). 5 ___ Ensure EFP-2 EFIC control valves are closed. 6 Start EFP-2 by opening 1 of the following: ___ ASV-5 ___ ASV-204 7 ___ Ensure EFW flow is controlled. [Rule 3, EFW/AFW Control]

START UP AND SHUTDOWN OF EFW/AFW PUMPS

ACTIONS	DETAILS
9.5 ___ IF EFP-3 start is desired, THEN ensure flow path is properly aligned and start EFP-3	1 ___ IF starting EFP-3 from EFT-2, THEN ensure the following valves are open: ___ EFV-109 "EFT-2 TO EFW PUMP SUCTION" (119 ft berm inside EFT-2 Building) ___ EFV-111 "EFT-2 TO EFW PUMP SUCTION" (119 ft Berm inside EFT-2 Building) 2 ___ IF EFP-3 will NOT be aligned to EFT-2, THEN ensure proper suction flow path exists. 3 ___ Ensure EFP-3 EFIC control valves are closed. 4 ___ Ensure EFP-1 is in "PULL TO LOCK". 5 ___ Depress "MANUAL PERMISSIVE" push button on EFIC channel A. 6 ___ Select EFP-3 to "NORMAL AFTER STOP". 7 ___ Reset the fuel rack on EFP-3 diesel (119 ft Berm inside EFP-3 Building). 8 ___ Start EFP-3 9 ___ Ensure EFW flow is controlled. [Rule 3, EFW/AFW Control]

START UP AND SHUTDOWN OF EFW/AFW PUMPS

ACTIONS DETAILS

NOTE

AP-770, Emergency Diesel Actuation will energize 4160V REACTOR AUX BUS 3 using the Alternate AC Diesel.

9.6 ___ IF FWP-7 start is desired from CDT-1, THEN ensure flow path is properly aligned and start FWP-7

1 ___ Ensure CDT-1 level ≥ 5 ft.

2 ___ Ensure CDV-102 "CDT-1 LOWER ISO" is open (119 ft Berm by CDT-1).

3 ___ OPEN FWV-214 "FWP-7 SUCTION FROM CDT-1" (95 ft TB by FWP-7).

4 ___ Close FWV-213 "FWP-7 SUCTION FROM HOTWELL" (95 ft TB by FWP-7).

5 ___ Ensure all AFW control valves are closed.

6 ___ Start FWP-7

[Rule 5, Diesel Load Control]

START UP AND SHUTDOWN OF EFW/AFW PUMPS

ACTIONS	DETAILS
9.7 ___ IF FWP-7 start is desired from hotwell, THEN ensure flow path is properly aligned and start FWP-7	1 ___ Ensure condenser is at atmospheric PRESS. 2 ___ Ensure hotwell level ≥ 48 in. 3 ___ Ensure EFV-36 "EFW & AFW SUCTION ISO FROM HOTWELL" is open (95 ft TB between C & D inlet waterboxes). 4 ___ Open FWV-213 "FWP-7 SUCTION FROM HOTWELL" (95 ft TB by FWP-7). 5 ___ Close FWV-214 "FWP-7 SUCTION FROM CDT-1" (95 ft TB by FWP-7). 6 ___ Ensure all AFW control valves are closed. 7 ___ Start FWP-7 [Rule 5, Diesel Load Control]

START UP AND SHUTDOWN OF EFW/AFW PUMPS

ACTIONS	DETAILS
9.8 ___ IF FWP-7 start is desired from EFT-2, THEN ensure flow path is properly aligned and start FWP-7	1 ___ Ensure EFT-2 level ≥ 9 ft. 2 ___ Ensure EFP-1 and EFP-2 are not running. 3 ___ OPEN EFV-109 "EFT-2 TO EFW PUMP SUCTION" (119 ft berm inside EFT-2 Building). 4 ___ Ensure EFV-3 is open "EFP-1 SUCTION FROM EFT-2" (95 ft IB by EFP-1). 5 ___ Unlock and open EFV-2 "EFP-1 SUCTION FROM CONDENSER" (95 ft IB by EFP-1). 6. ___ Open FWV-213 "FWP-7 SUCTION FROM HOTWELL" (95 ft TB by FWP-7). 7 ___ Close FWV-214 "FWP-7 SUCTION FROM CDT-1" (95 ft TB by FWP-7). 8 ___ Close EFV-36 "EFW & AFW SUCTION ISO FROM HOTWELL" (95 ft TB between C & D inlet waterboxes). 9 ___ Ensure all AFW control valves are closed. 10 ___ Start FWP-7 [Rule 5, Diesel Load Control]

START UP AND SHUTDOWN OF EFW/AFW PUMPS

ACTIONS	DETAILS
9.9 ___ IF stopping any EFW OR AFW pump is desired, THEN stop affected pump.	1 ___ IF EFP-1 shutdown is desired, THEN select EFP-1 to "PULL TO LOCK". 2 ___ IF EFP-2 shutdown is desired, THEN perform the following in order: ___ Depress "MANUAL PERMISSIVE" push button on EFIC channel B. ___ Close ASV-204 ___ Close ASV-5 3 ___ IF EFP-3 shutdown is desired, AND EFP-3 is aligned to EFT-2, THEN perform the following in order: ___ Depress "MANUAL PERMISSIVE" push button on EFIC channel A. ___ Stop EFP-3 4 ___ IF EFP-3 shutdown is desired, AND EFT-2 is isolated, THEN select EFP-3 to "PULL TO LOCK". 5 ___ IF FWP-7 shutdown is desired, THEN stop FWP-7

9.10 ___ **EXIT** this enclosure.

EFP-1 TO DHR TRANSITION

ACTIONS | DETAILS

STATUS

All the following exist:

- **EFP-1 starting desired**
- **B ES 4160V BUS not energized**
- **A ES Diesel or Alternate AC Diesel supplying power to A ES 4160V BUS**
- **DHR not in service**
- **LPI not required**

10.1 ___ Ensure available load margin on running diesel.

- Ensure all the following are not running:

  ___ DHP-1A

  ___ RWP-3A

  ___ DCP-1A

  ___ BSP-1A

  ___ AHF-15A

- ___ Ensure BAST OFF/REMOTE switch for CAT-5A Heater CAHE-3A is selected to "OFF"
- ___ Ensure BWST Htr control switch selected to "LOCAL"

EFP-1 TO DHR TRANSITION

ACTIONS	DETAILS
10.2 ___ Start EFP-1	1 ___ Ensure proper suction flow path exists. 2 ___ IF EFP-3 is running, THEN stop select EFP-3 to "PULL TO LOCK". 3 Ensure EFP-1 EFIC control valves are closed: ___ EFV-58 ___ EFV-57 4 ___ Start EFP-1 [Rule 5, Diesel Load Control] 5 ___ Ensure EFW flow is controlled. [Rule 3, EFW/AFW Control]

EFP-1 TO DHR TRANSITION

ACTIONS	DETAILS
10.3 ___ WHEN transition to DHR is required, THEN stop EFP-1	1 ___ Raise level in available OTSGs to > 90%. 2 Close EFP-1 EFIC control valves ___ EFV-58 ___ EFV-57 3 ___ Select EFP-1 to "PULL TO LOCK".

10.4 ___ Transition to DHR using applicable EOP or AP.

10.5 ___ **EXIT** this enclosure.

EFP-1 ALIGNMENT TO A EDG WITHOUT LOAD MANAGEMENT

ACTIONS	DETAILS

STATUS

All the following exist:

- **EFP-1 starting desired**
- **BOTH ES 4160V Buses energized by diesels**
- **Stopping SWP-1A or RWP-2A not desired**
- **DHR not in service**
- **LPI not required**

11.1 ___ Ensure CC ventilation and CC chiller is aligned to B ES 4160V BUS.

- Refer to EOP-14, Enclosure 17, Control Complex Emergency Ventilation and Cooling, for guidance.

11.2 ___ Ensure available diesel load margin for starting EFP-1

- Ensure all the following are not running:

  ___ DHP-1A

  ___ RWP-3A

  ___ DCP-1A

  ___ BSP-1A

  ___ AHF-15A

EFP-1 ALIGNMENT TO A EDG WITHOUT LOAD MANAGEMENT

ACTIONS	DETAILS
11.3 ___ Start EFP-1	1 ___ Ensure a proper suction flow path exists. 2 ___ IF EFP-3 is running, THEN select EFP-3 to "PULL TO LOCK". 3 Ensure EFP-1 EFIC control valves are closed: ___ EFV-58 ___ EFV-57 4 ___ Start EFP-1 [Rule 5, Diesel Load Control] 5 ___ Ensure EFW flow is controlled. [Rule 3, EFW/AFW Control]
11.4 ___ WHEN transition to DHR is required, THEN ensure DHR is aligned to the B ES 4160V BUS.	• Transition to DHR using applicable EOP or AP.
11.5 ___ **EXIT** this enclosure.	

ALIGNING EFW/AFW PUMPS TO HOTWELL

ACTIONS	DETAILS
12.1 ___ Ensure hotwell is at atmospheric PRESS.	1 Close all MSIVs: ___ MSV-412 ___ MSV-413 ___ MSV-414 ___ MSV-411 2 ___ Control OTSG PRESS using ADVs. 3 Select condenser ARPs to "PULL TO LOCK": ___ ARP-1A ___ ARP-1B 4 Open condenser vacuum Bkrs: ___ ARV-48 ___ ARV-49
12.3 ___ WHEN hotwell is at atmospheric PRESS, THEN notify SPO to determine hotwell TEMP.	• Record hotwell TEMP: CD-53-TI "CDHE-4A SOUTHSIDE TEMPERATURE": _____ °F (95 ft TB south of A hotwell) CD-55-TI "CDHE-4B SOUTHSIDE TEMPERATURE": _____ °F (95 ft TB south of B hotwell)

ALIGNING EFW/AFW PUMPS TO HOTWELL

ACTIONS	DETAILS
12.4 ___ Verify hotwell is available.	• Verify all the following exist: ___ Hotwell level > 48 in ___ Hotwell TEMP < 139°F
___ IF hotwell is NOT available, THEN **EXIT** this enclosure.	
12.5 ___ IF EFP-1 alignment to the hotwell is desired, THEN align EFP-1 to hotwell.	1 ___ Ensure EFV-36 "EFW & AFW SUCTION ISO FROM HOTWELL" is open (95 ft TB between C & D inlet waterboxes). 2 ___ Unlock and open EFV-2 "EFP-1 SUCTION FROM CONDENSER" (95 ft IB by EFP-1). 3 ___ Unlock and close EFV-3 "EFP-1 SUCTION FROM EFT-2" (95 ft IB by EFP-1). 4 ___ IF EFP-1 start up is desired, THEN **CONCURRENTLY PERFORM** Enclosure 9 in this procedure. 5 ___ Maintain total EFW flow ≤ limits of EOP-14, Emergency Operating Procedures Enclosures, Figure 3

ALIGNING EFW/AFW PUMPS TO HOTWELL

ACTIONS	DETAILS
12.6 ___ IF EFP-2 alignment to the hotwell is desired, THEN align EFP-2 to hotwell.	1 ___ Ensure EFV-36 "EFW & AFW SUCTION ISO FROM HOTWELL" is open (95 ft TB between C & D inlet waterboxes). 2 ___ Unlock and open EFV-1 "EFP-2 SUCTION FROM CONDENSER" (95 ft IB by EFP-2). 3 ___ Unlock and close EFV-4 "EFP-2 SUCTION FROM EFT-2" (95 ft IB by EFP-2). 4 ___ IF EFP-2 start up is desired, THEN **CONCURRENTLY PERFORM** Enclosure 9 in this procedure. 5 ___ Maintain total EFW flow ≤ limits of EOP-14, Emergency Operating Procedures Enclosures, Figure 3

ALIGNING EFW/AFW PUMPS TO HOTWELL

ACTIONS	DETAILS
12.7 ___ IF FWP-7 alignment to the hotwell is desired, THEN align FWP-7 suction from hotwell.	1 ___ Ensure EFV-36 "EFW & AFW SUCTION ISO FROM HOTWELL" is open (95 ft TB between C & D inlet waterboxes). 2 ___ Open FWV-213 "FWP-7 SUCTION FROM HOTWELL" (95 ft TB by FWP-7). 3 ___ Close FWV-214 "FWP-7 SUCTION FROM CDT-1" (95 ft TB by FWP-7). 4 ___ IF FWP-7 start up is desired, THEN **CONCURRENTLY PERFORM** Enclosure 9 in this procedure.
12.8 ___ IF at any time hotwell level is ≤ 24 in, THEN ensure adequate suction source exists.	• Perform 1 of the following: ___ Transfer pump suction to alternate supply. ___ Refill hotwell. ___ Stop any running EFW or AFW pump aligned to the hotwell.
12.9 ___ WHEN no running EFW OR AFW pump is aligned to the hotwell, THEN **EXIT** this enclosure.	

REFILLING FST-1A/1B FROM UNIT 1 OR 2 FIRE SYSTEM

ACTIONS	DETAILS

13.1 ___ Notify CR-1/2 Control Room that FST filling evolution will be performed.

NOTE

FST-1A or 1B is full when level is 36 ft (Approximately 9,860 gal = 1 ft.)

13.2 ___ Start FST-1A fill.

1 ___ Ensure FSV-27 "FST-1A INLET ISO" is open (119 ft Berm between FSTs).

2 ___ IF FST-1A and FST-1B are NOT cross-tied, THEN ensure FSV-28 "FST-1B INLET ISO" is closed (119 ft Berm between FSTs).

3 Open 1 of the following valves:

___ FSV-25 "UNIT 1 & 2 FILL ISOLATION TO UNIT 3 FIRE SERVICE" (95 ft West of Berm outside protected area)

___ FSV-285 "FSV-25 BYPASS" (95 ft West of Berm outside protected area)

REFILLING FST-1A/1B FROM UNIT 1 OR 2 FIRE SYSTEM

ACTIONS	DETAILS
13.3 ___ WHEN FSTs are at desired level, THEN stop FST fill.	1 ___ Close FSV-25 "UNIT 1 & 2 FILL ISOLATION TO UNIT 3 FIRE SERVICE" (95 ft West of Berm outside protected area). 2 ___ Close FSV-285 "FSV-25 BYPASS" (95 ft West of Berm outside protected area). 3 ___ IF FST-1A and FST-1B are NOT cross-tied, THEN perform the following: ___ Open FSV-28 "FST-1B INLET ISO (119 ft Berm between FSTs). ___ Close FSV-27 "FST-1A INLET ISO" (119 ft Berm between FSTs).

13.4 ___ **EXIT** this enclosure.

ALIGNING EFW PUMPS TO EFT-2

ACTIONS	DETAILS

14.1 ___ Ensure EFT-2 level is ≥ 9 ft.

14.2 ___ Verify CDT-1 level is ≥ 5 ft.

___ IF CDT-1 level is < 5 ft,
THEN ensure CDV-103
"CDT-1 TO EFP SUCTION"
is closed
(119 ft Berm by CDT-1).

14.3 ___ IF EFP-1 alignment to EFT-2 is desired,
THEN align EFP-1 to EFT-2

1 ___ Ensure EFV-109
"EFT-2 TO EFW PUMP SUCTION"
is open
(119 ft berm inside EFT-2 Building).

2 ___ Ensure EFV-111
"EFT-2 TO EFW PUMP SUCTION"
is open
(119 ft Berm inside EFT-2 Building).

3 ___ Unlock and open EFV-3
"EFP-1 SUCTION FROM EFT-2"
(95 ft IB by EFP-1).

4 ___ Unlock and close EFV-2
"EFP-1 SUCTION FROM
CONDENSER"
(95 ft IB by EFP-1).

ALIGNING EFW PUMPS TO EFT-2

ACTIONS	DETAILS
14.4 ___ IF EFP-2 alignment to EFT-2 is desired, THEN align EFP-2 to EFT-2	1 ___ Ensure EFV-109 "EFT-2 TO EFW PUMP SUCTION" is open (119 ft berm inside EFT-2 Building). 2 ___ EFV-111 "EFT-2 TO EFW PUMP SUCTION" is open (119 ft Berm inside EFT-2 Building). 3 ___ Unlock and open EFV-4 "EFP-2 SUCTION FROM EFT-2" (95 ft IB by EFP-2). 4 ___ Unlock and close EFV-1 "EFP-2 SUCTION FROM CONDENSER" (95 ft IB by EFP-2).

14.5 ___ **EXIT** this enclosure.

EFP-2 TRIP RECOVERY

ACTIONS	DETAILS

CAUTION

If EFP-2 trip recovery follows an OTSG overfill event ensure MS lines and EFP-2 steam supply header are drained prior to performing EFP-2 trip recovery.

15.1 ___ Ensure cause of the EFP-2 trip has been identified and corrected.

15.2 ___ Ensure EFP-2 steam supply isolation valves are closed.

- ___ ASV-5
- ___ ASV-204

15.3 ___ Ensure EFP-2 normal discharge path is isolated.

1 ___ Depress "MANUAL PERMISSIVE" push buttons on EFIC channels A and B.

2 Close EFP-2 EFIC control valves:

___ EFV-55

___ EFV-56

EFP-2 TRIP RECOVERY

ACTIONS	DETAILS
15.4 ___ Notify SPO to reset ASV-50 (95 ft IB by EFP-2).	1 ___ Turn handwheel clockwise to raise latch collar. 2 ___ Ensure tappet and tappet nut are fully depressed. 3 ___ Engage latch lever. 4 ___ Slowly open ASV-50 by turning handwheel counterclockwise until full open. 5 ___ Notify Control Room to verify Annunciator alarm "EF PUMP 2 TRIP" (H-07-04) clears.

15.5 ___ Notify Control Room EFP-2 is reset.

15.6 ___ **EXIT** this enclosure.

EFP-1/EFP-3 CROSS-TIE TO B TRAIN EFW

ACTIONS | DETAILS

STATUS

- **EFP-1/EFP-3 cross-tie to B Train EFW is desired.**

16.1___ Ensure EFP-1 / EFP-3 normal discharge path is isolated.

1 ___ Depress "MANUAL PERMISSIVE" push buttons on EFIC channels A and B.

2 Close EFP-1/ EFP-3 discharge block valves:

___ EFV-14

___ EFV-33

3 Notify PPO to open EFP-1 / EFP-3 discharge block valve switches (B ES 480V SWGR Room):

___ DPDP 8D-1 "EFV-14 MOTOR POWER"

___ DPDP 8D-3 "EFV-33 MOTOR POWER"

EFP-1/EFP-3 CROSS-TIE TO B TRAIN EFW

ACTIONS	DETAILS
16.2 ___ IF EFV-12 power available, THEN notify PPO to open EFV-12 electrically.	1 Unlock and close EFV-12 switches (A ES 480V SWGR Room): ___ DPDP 8C-5 "EFV-12 MOTOR POWER" ___ DPDP 8C-6 "EFV-12 CONTROL POWER" 2 ___ Depress the open push button on EFV-12-MST (A ES 480V SWGR Room). 3 ___ WHEN EFV-12 is open, THEN open and lock EFV-12 switches (A ES 480V SWGR Room): ___ DPDP 8C-5 "EFV-12 MOTOR POWER" ___ DPDP 8C-6 "EFV-12 CONTROL POWER"
___ IF EFV-12 power is NOT available, THEN notify PPO to open EFV-12 manually. (95 ft IB by EFP-1)	

16.3 ___ IF EFP-2 is NOT running, THEN close EFP-2 EFIC control valves.	• Close EFP-2 EFIC control valves: ___ EFV-55 ___ EFV-56

EFP-1/EFP-3 CROSS-TIE TO B TRAIN EFW

ACTIONS	DETAILS

16.4 ___ Start one of the following:

___ EFP-1

[Rule 5, Diesel Load Control]

___ EFP-3

16.5 ___ Depress both "EFW INITIATE" push buttons on EFIC channels A and B.

16.6 ___ IF EFP-2 is running, THEN stop EFP-2

16.7 ___ Ensure EFW flow is controlled.

[Rule 3, EFW/AFW Control]

16.8 ___ **EXIT** this enclosure.

EFP-2 TEMPORARY TRANSFER LINE CONFIGURATION

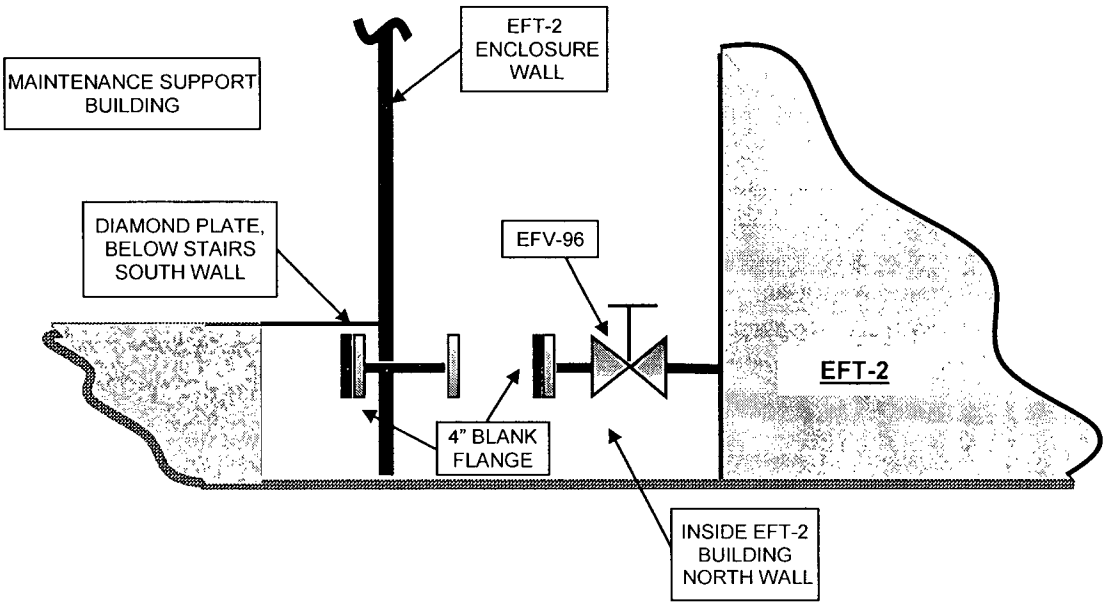


FIGURE 1 - CONFIGURATION OF EFT-2 PIPING
AT BEGINING ENCLOSURE 4.0

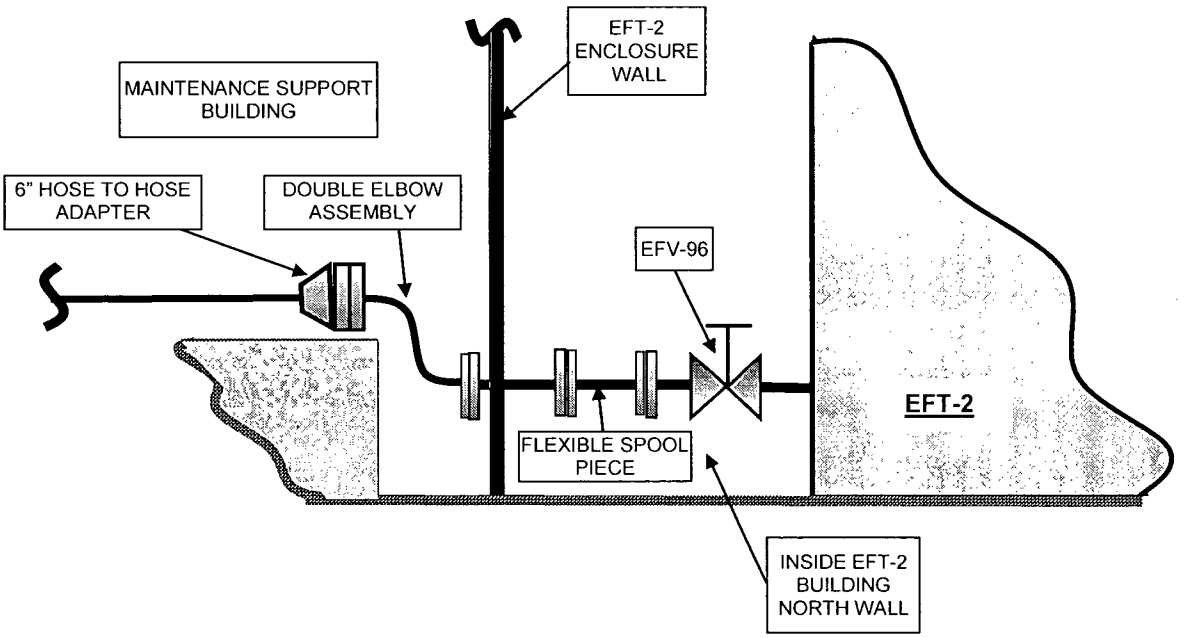


FIGURE 2 - CONFIGURATION OF EFT-2 TRANSFER LINE
CONNECTION AT THE END OF ENCLOSURE 4, STEP 4.11

EFP-2 TEMPORARY TRANSFER LINE CONFIGURATION

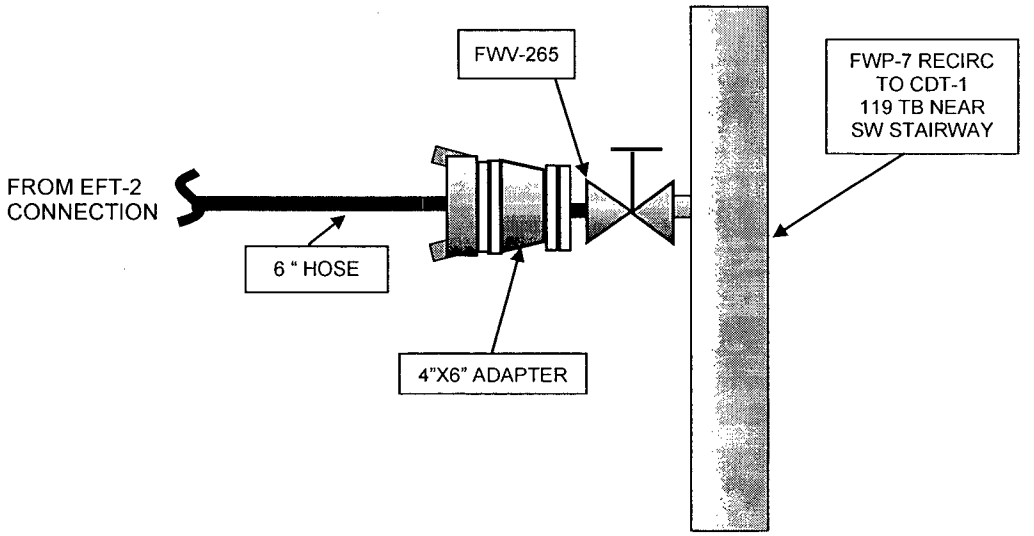


FIGURE 3 - CONFIGURATION OF EFT-2 CONNECTIONS TO
CDT-1 AT THE END OF ENCLOSURE 4, STEP 4.16

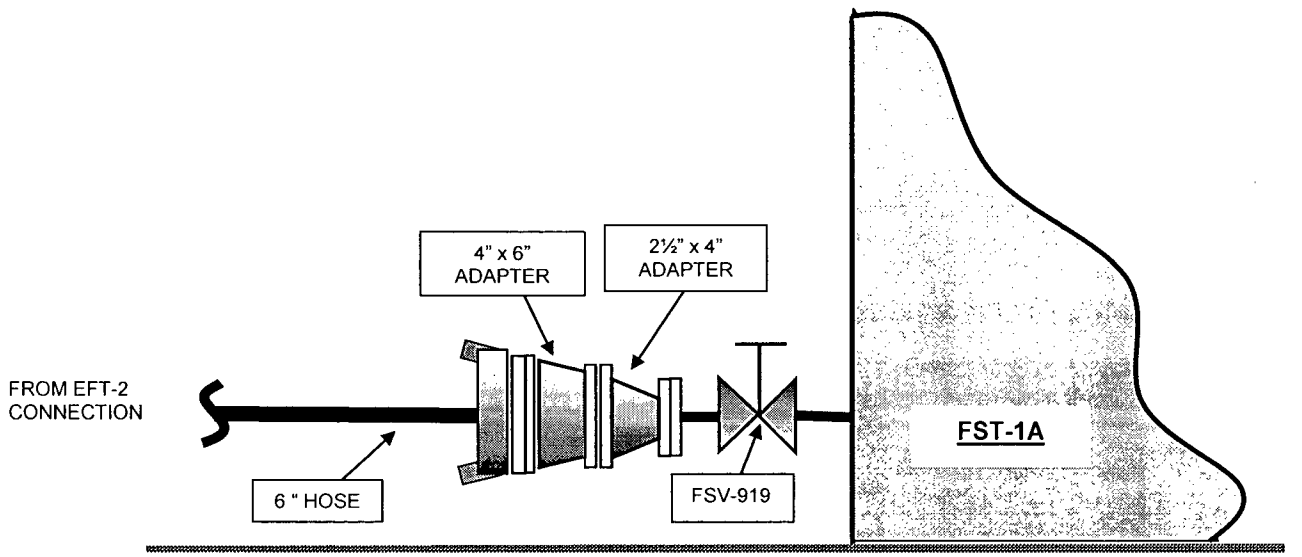


FIGURE 4 - CONFIGURATION OF FST-1A SOUTHEAST SIDE
AT THE END OF ENCLOSURE 4, STEP 4.25

SUMMARY OF CHANGES
PRR 437102

NOTE:
1. Writers and Reviewers: Ensure that any changes to this procedure that affect information contained in ERF posters, Enclosures, briefing cards, guidelines, etc. are made to those items as well.
2. Writers and Reviewers: Changes to certain parts of this procedure may impact guidance in EM-225 Enclosure 11.

SECTION	CHANGE
Throughout	Reformatting IAW PRO-NGGC-0201
4.0.3	Deleted duplicate TSC Accident Assessment Team responsibilities (PRR 437102)
Enclosure 15 Page 1 of 2 Step 15.1	Added the word ensure to include an action verb.
Enclosure 15 Page 2 of 2	Replaced "EFT-2 Trip" Recovery with "EFP-2 Trip Recovery" (PRR 475803)