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NO ACKNOWLEDGEMENT REQUIRED

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A045

FLORIDA POWER
CRYSTAL RIVER UNIT 3
PLANT OPERATING MANUAL

EMERGENCY PLAN IMPLEMENTING PROCEDURE

EM-225A

POST ACCIDENT RB HYDROGEN CONTROL

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1.0 PURPOSE

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 Generating Complex personnel during an emergency at CR-3.

2.0 REFERENCES

2.1 Developmental References

2.1.1 FSAR Chapter 14 Appendix B

2.1.2 MAR 91-05-03-01, "Hydrogen Purge Redundancy Restoration"

2.1.3 MAR 93-05-03-02, "Hydrogen Purge Redundancy Restoration, Elect. & I&C"

2.1.4 CALC M-99-0051, "Mission Dose Assessment"

2.1.5 CALC I-90-0013, "Post Accident Reactor Building Hydrogen Purge Flow Accuracy"

2.1.6 CALC M-90-0056, "Hydrogen Mini Purge Pressure Loss"

2.1.7 CALC M-99-0052, "Zone Environmental Radiation Dose for LOCA"

2.1.8 CALC N-00-0002, "Public And Control Room Dose From A LOCA Using The Alternative Source Term"

2.1.9 CALC M-85-1004, "H2 Generation Rate"

2.1.10 CALC I-90-0023, "RB Hydrogen Concentration Loop Accuracy"

3.0 PERSONNEL INDOCTRINATION

3.1 Definitions

3.1.1 Off-shore winds - winds originating from NNE to SE sectors (011.2° to 146.3°). The most common time for this to occur is midnight.

3.2 Responsibilities

3.2.1 Emergency Coordinator (EC) or designee

- Approves RB purge prior to initiation (Enclosure 6).
- Ensures coordination with off-site agencies prior to initiation of RB purges.

3.2.2 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).

3.2.3 Dose Assessment Team

- Monitors meteorological conditions and predicts when off-shore winds should exist.
- Projects off-site doses for proposed RB purges.

3.2.4 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.

3.2.5 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.

3.2.6 Radiation Monitoring Team

- Evaluates actual plant radiological conditions and determine routes to be used (see Enclosure 9).

3.2.7 Operations

- Performs RB purge per Enclosure 7.

3.3 Limits and Precautions

- 3.3.1 All hydrogen concentration values referenced in this procedure are presented in % by volume as indicated on the hydrogen analyzers.
- 3.3.2 Maintain RB hydrogen concentration < 3.6% to provide adequate margin below the lower flammability limit of 4.1% for hydrogen in air.
- 3.3.3 Travel through radiation areas should be as shown in Enclosure 9 unless otherwise directed by the emergency RWP.
- 3.3.4 Purging should be performed under favorable meteorological conditions (off-shore winds) whenever possible.
- 3.3.5 RB pressure must be carefully controlled during purge evolutions to prevent ES actuations from high RB pressure.
- 3.3.6 The purging criteria established by this procedure is not valid during Severe Accidents.
- 3.3.7 Mission dose calculations credit 10 days of radioactive decay when determining the dose received for performance of local actions. Taking local actions prior to this time may result in excessive radiation exposure.
- 3.3.8 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.
- 3.3.9 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.

NOTE

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

- 4.1 IF RCS LOCA conditions exist,
THEN monitor RB hydrogen concentration in accordance with Enclosure 1, Hydrogen Monitoring, of this procedure.
- 4.2 IF at any time RB hydrogen concentration $\geq 1\%$,
THEN perform the following:
- Perform Enclosure 2, Initial Preparations For Purging, in this procedure.
 - Notify Procurement Representative to contact Hydrogen Recombiner vendor to coordinate preliminary transportation plan and schedule for delivery of recombinder. Refer to EM-104.
 - DAT/AAT evaluate plant conditions and equipment availability to determine if a Hydrogen Recombiner will be required. Notify Procurement Representative if recombinder is required.
- 4.3 WHEN at any time RB purge compressors arrive on site,
AND radiological conditions permit,
THEN perform Enclosure 3, Portable Compressor Installation, of this procedure.
- 4.4 WHEN RB hydrogen concentration $\geq 3.3\%$,
AND radiological conditions permit,
THEN perform Enclosure 4, Prerequisite Field Actions, of this procedure.
- 4.5 WHEN RB hydrogen concentration $\geq 3.4\%$,
THEN perform Enclosure 5, RB Pressurization For Hydrogen Purge, of this procedure.
- 4.6 WHEN RB hydrogen concentration $\geq 3.5\%$,
THEN begin Enclosure 6, Purge Release Authorization Form, of this procedure.
- 4.7 WHEN any of the following conditions exist:
____ RB H₂ concentration $\geq 3.5\%$ for ≥ 24 hours
____ RB H₂ concentration $\geq 3.5\%$ and off shore winds exist
____ RB H₂ concentration $\geq 3.6\%$,
THEN perform Enclosure 7, Purging RB, of this procedure.
- 4.8 WHEN RB purge is stopped,
THEN GO TO Step 4.6 or this procedure.

HYDROGEN MONITORING

STATUS

- LOCA Conditions Exist

ACTIONS

DETAILS

- 1.1 ☐ Ensure one H₂ analyzer is aligned and placed in service (Ops).

- ☐ Ensure applicable steps of EOP-14, Enclosure 2, PPO Post Event Actions, have been completed for H₂ analyzers.

- 1.2 ☐ Plot RB H₂ concentration on Enclosure 8 of this procedure (AAT).

- Obtain H₂ concentrations from either of the following:

☐ EOP-14, Enclosure 21, RB Hydrogen Monitor Log.

☐ RECALL

- 1.3 ☐ Project when RB H₂ concentration will exceed action levels of this procedure (AAT).

- ☐ Use H₂ concentration plotted on Enclosure 8 of this procedure.
- ☐ Extrapolate to estimate time when H₂ concentration will reach procedure action levels.

| <u>Action Level</u> | <u>Date</u> | <u>Time</u> |
|-----------------------|----------------------|----------------------|
| H ₂ ≥ 1% | <input type="text"/> | <input type="text"/> |
| H ₂ ≥ 3.3% | <input type="text"/> | <input type="text"/> |
| H ₂ ≥ 3.4% | <input type="text"/> | <input type="text"/> |
| H ₂ ≥ 3.5% | <input type="text"/> | <input type="text"/> |
| H ₂ ≥ 3.6% | <input type="text"/> | <input type="text"/> |

HYDROGEN MONITORING (Cont'd)

| <u>ACTIONS</u> | <u>DETAILS</u> | | | | | | | | | | |
|---|--|---------------------|------------------------|---------------------|--------------|-----------------------|--------------|-----------------------|--------------|-----------------------|--------------|
| <p>1.4 <u>IF</u> at anytime H₂ concentration is ≥ an action level of this procedure, <u>THEN</u> immediately notify the Accident Assessment Team Coordinator (AAT).</p> | <ul style="list-style-type: none"> Action levels based on RB H₂ concentrations. <table> <tr> <th><u>Action Level</u></th><th><u>Required Action</u></th></tr> <tr> <td>H₂ ≥ 1%</td><td>See step 4.2</td></tr> <tr> <td>H₂ ≥ 3.3%</td><td>See step 4.4</td></tr> <tr> <td>H₂ ≥ 3.4%</td><td>See step 4.5</td></tr> <tr> <td>H₂ ≥ 3.5%</td><td>See step 4.6</td></tr> </table> | <u>Action Level</u> | <u>Required Action</u> | H ₂ ≥ 1% | See step 4.2 | H ₂ ≥ 3.3% | See step 4.4 | H ₂ ≥ 3.4% | See step 4.5 | H ₂ ≥ 3.5% | See step 4.6 |
| <u>Action Level</u> | <u>Required Action</u> | | | | | | | | | | |
| H ₂ ≥ 1% | See step 4.2 | | | | | | | | | | |
| H ₂ ≥ 3.3% | See step 4.4 | | | | | | | | | | |
| H ₂ ≥ 3.4% | See step 4.5 | | | | | | | | | | |
| H ₂ ≥ 3.5% | See step 4.6 | | | | | | | | | | |
| <p>1.5 Continue monitoring RB H₂ concentration (AAT).</p> | <ul style="list-style-type: none"> Plot RB H₂ concentration on Enclosure 8 of this procedure every 8 hours. Perform Step 1.3 of this Enclosure every 8 hours. | | | | | | | | | | |

INITIAL PREPARATIONS FOR PURGING

| STATUS | |
|---|--|
| <ul style="list-style-type: none"> • RB H₂ Concentration \geq 1% | |

| <u>ACTIONS</u> | | <u>DETAILS</u> |
|----------------|--|---|
| 1.1 | <p>___ Notify the Procurement Representative, Radiation Controls Coordinator, Repairs Coordinator and Control Room to begin preparations for RB purge.</p> | <ul style="list-style-type: none"> • Review this procedure for: <ul style="list-style-type: none"> ___ 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 | <p>___ Evaluate plant radiological conditions and determine routes to be used to perform Enclosures 2, 3, 4, 5, and 7 (RMT).</p> | <ul style="list-style-type: none"> • Refer to Enclosure 9 for locations of required actions/components and suggested routes. |
| 1.3 | <p>___ Notify off-site sources to obtain portable air compressors (Procurement Representative).</p> | <ul style="list-style-type: none"> • Obtain 3 or more air compressors from one of the following off-site sources: <ul style="list-style-type: none"> ___ Compressed Air Systems, Telephone (800) 626-8177 <u>OR</u> (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 | <p>___ Ensure all CCHE habitability breaches are sealed (ERT).</p> | |

PREPARATIONS FOR RB HYDROGEN PURGE (Cont'd)ACTIONSDETAILS

-
- | | |
|---|--|
| 1.5 <input type="checkbox"/> Monitor meteorological conditions to predict off-shore wind cycle (DAT). | <ul style="list-style-type: none">• <input type="checkbox"/> Off-shore winds originate from NNE to SE sectors (011.2° to 146.3°).• <input type="checkbox"/> Most common time for off-shore winds is midnight. |
|---|--|
-
- | | |
|--|---|
| 1.6 <input type="checkbox"/> Ensure the purge flow instrumentation cart is properly staged and equipped (ERT). | <ul style="list-style-type: none">• <input type="checkbox"/> Refer to MP-815 for location of equipment.• <input type="checkbox"/> DO NOT install purge instruments until Enclosure 4 is performed. |
|--|---|
-
- | | |
|---|---|
| 1.7 <input type="checkbox"/> Ensure power is available to LR-82-FI and LR-83-FI receptacle (OPS). | <ul style="list-style-type: none">• <input type="checkbox"/> RX MCC 3B2 is energized.• <input type="checkbox"/> RX MCC 3B2, BKR 8AR closed.• <input type="checkbox"/> ACDP-20, BKR 12 closed. (143 ft AB near elevator) |
|---|---|
-
- | | |
|--|--|
| 1.8 <input type="checkbox"/> Notify the Accident Assessment Team Coordinator that Enclosure 2 is complete (AAT). | |
|--|--|
-

PORTABLE COMPRESSOR INSTALLATION

STATUS

- Purge Compressors Are On Site
- Hydrogen Concentration $\geq 1\%$

ACTIONSDETAILS

- 1.1 ☐ Consult Radiation Monitoring Team to determine routes and precautions to be used during compressor installation (ERT).

- Refer to Enclosure 9 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):

| | |
|---------------------------------|---------------------------------|
| <input type="checkbox"/> LRV-11 | <input type="checkbox"/> LRV-16 |
| <input type="checkbox"/> LRV-12 | <input type="checkbox"/> LRV-17 |
| <input type="checkbox"/> LRV-13 | <input type="checkbox"/> LRV-18 |
| <input type="checkbox"/> LRV-14 | <input type="checkbox"/> LRV-19 |
| <input type="checkbox"/> LRV-15 | <input type="checkbox"/> LRV-20 |

- ☐ Alternate - H₂ recombiner connections (119 ft IB outside west wall):
(adapters in stores – FIMIS #01260356)

| |
|---|
| <input type="checkbox"/> LRV-92 (Pen 125) |
| <input type="checkbox"/> LRV-90 (Pen 121) |
| <input type="checkbox"/> LRV-94 (Pen 125) |
| <input type="checkbox"/> LRV-88 (Pen 122) |

PORTABLE COMPRESSOR INSTALLATION (Cont'd)

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 is complete (OPS/ERT).

PREREQUISITE FIELD ACTIONS

| STATUS | |
|---|--|
| <ul style="list-style-type: none"> • RB H₂ Concentration ≥ 3.3% | |

| <u>ACTIONS</u> | <u>DETAILS</u> |
|--|--|
| 1.1 <input type="checkbox"/> Consult Radiation Monitoring Team to determine routes and precautions to be used while performing RB Purge Field Actions (ERT). | <ul style="list-style-type: none"> • Refer to Enclosure 9 for locations of required actions/components and suggested routes. |
| 1.2 <input type="checkbox"/> Defeat all starting interlocks on AHF-7A and 7B (OPS). | <ol style="list-style-type: none"> 1. <input type="checkbox"/> Obtain key 92 from the Control Room. 2. Select RB exhaust fan permissive bypass switches to the "Emergency" position . (119 ft IB East Door) <ul style="list-style-type: none"> • <input type="checkbox"/> AHF-7A, Ventilation MCC 3A-10C • <input type="checkbox"/> AHF-7B, Ventilation MCC 3B-9C |
| 1.3 <input type="checkbox"/> Open RB exhaust dampers for emergency operation (OPS). | <ul style="list-style-type: none"> • Align 3 way valves on door of air handling panel 13 to point to the right (143 ft AB Ventilation Equipment Area): <ul style="list-style-type: none"> <input type="checkbox"/> Emergency operation of AHD-95, AHD-96, and AHD-94 <input type="checkbox"/> Emergency operation of AHD-97, AHD-98, and AHD-94 |

PREREQUISITE FIELD ACTIONS (Cont'd)

| <u>ACTIONS</u> | <u>DETAILS</u> |
|---|---|
| 1.4 <input type="checkbox"/> Ensure RM-A1 is in service (OPS/DAT). | <ul style="list-style-type: none">• <input type="checkbox"/> Ensure RM-A1 pump is running with path to and from pump (143 ft AB).• <input type="checkbox"/> Ensure RM-A1 monitors have power aligned.• <input type="checkbox"/> Ensure the following MCB annunciator links are closed:<ul style="list-style-type: none"><input type="checkbox"/> 1712<input type="checkbox"/> 1713<input type="checkbox"/> 1714• <input type="checkbox"/> Adjust RM-A1 gas channel "HIGH" alarm setting potentiometer to maximum (clockwise).• <input type="checkbox"/> Ensure LMH controller associated with RM-A1 is in "AUTO". |
| 1.5 <input type="checkbox"/> Notify Repairs Coordinator to obtain and install flow instrumentation (ERT). | <ul style="list-style-type: none">• <input type="checkbox"/> CONCURRENTLY PERFORM MP-815, Installation of Post Accident H₂ Purge Flow Instruments. |
| 1.6 <input type="checkbox"/> <u>WHEN</u> H ₂ Purge Flow Instruments are installed <u>THEN</u> notify the Accident Assessment Team Coordinator that Enclosure 4 is complete (OPS/ERT). | |

RB PRESSURIZATION FOR HYDROGEN PURGE

STATUS

- RB H₂ Concentration \geq 3.4%
- Portage Air Compressors are installed.

ACTIONSDETAILS

- 1.1 Consult Radiation Monitoring Team to determine routes and precautions to be used while performing RB Pressurization (ERT).

- Refer to Enclosure 9 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):

| | |
|----------------------|----------------------|
| <u> </u> LRV-11 | <u> </u> LRV-16 |
| <u> </u> LRV-12 | <u> </u> LRV-17 |
| <u> </u> LRV-13 | <u> </u> LRV-18 |
| <u> </u> LRV-14 | <u> </u> LRV-19 |
| <u> </u> LRV-15 | <u> </u> LRV-20 |

- 3 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 (Cont'd)ACTIONS

- 1.3 IF portable air compressors were connected to H₂ recombiner connections, THEN start air supply to RB and establish and maintain RB PRESS at \approx 2 psig (ERT/Ops).

DETAILS

- 1 Start portable air compressors.
- 2 Open H₂ recombiner connection isolations for operating air compressors (119 ft IB):

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

- 3 Adjust the compressor output to establish and maintain RB PRESS at \approx 2 psig.

-
- 1.4 WHEN RB PRESS is being maintained at \approx 2 psig, THEN notify the Accident Assessment Team Coordinator that Enclosure 5 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 ($\mu\text{Ci/cc}$)

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 prior to initiating purge.

EMERGENCY COORDINATOR APPROVAL _____

/ _____
Sign/Date

PURGING RB

| STATUS | |
|--------|----------------------|
| • | RB Purge Is Required |

| <u>ACTIONS</u> | <u>DETAILS</u> |
|---|---|
| 1.1 <u> </u> Ensure Enclosure 2, 3, 4, and 5 of this procedure have been completed (AAT). | <ul style="list-style-type: none"> • <u> </u> Enclosure 2 complete • <u> </u> Enclosure 3 complete • <u> </u> Enclosure 4 complete • <u> </u> Enclosure 5 complete |
| 1.2 <u> </u> Determine required purge flow rate (AAT/DAT). | <ul style="list-style-type: none"> • <u> </u> IF H₂ purge has been previously performed, <u>THEN</u> use flows from previous purge. • <u> </u> IF H₂ purge has <u>NOT</u> been previously performed, <u>THEN</u> refer to Enclosure 10 to determine flows: <div style="margin-left: 40px;"> <u> </u> Required Purge Flow <u> </u> scfm <u> </u> Error Corrected Flow <u> </u> scfm </div> • <u> </u> Record Error Corrected Flow on Enclosure 6. |
| 1.3 <u> </u> Consult Radiation Monitoring Team to determine routes and precautions to be used while performing RB Pressurization (ERT). | <ul style="list-style-type: none"> • Refer to Enclosure 9 for locations of required actions/components and suggested routes. |
| 1.4 <u> </u> <u>WHEN</u> Enclosure 6, Purge Release Authorization Form is complete and approved by the EC, <u>THEN</u> continue with this enclosure. | |

PURGING RB (Cont'd)

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

DETAILS

- _____ Record reading from LR-83-FI
_____ scfm

PURGING RB (Cont'd)

ACTIONS

- 1.9 _____ Maintain RB PRESS constant at
 ≈ 2 psig (OPS).

DETAILS

- _____ 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 H₂ recombiner connections,
 THEN adjust the compressor output to
 maintain RB PRESS at ≈ 2 psig.

PURGING RB (Cont'd)

ACTIONS

DETAILS

1.10 WHEN all of the following exist:

- RB H₂ Concentration is
≤ 3.5%
- EC approves termination

THEN stop RB purge (OPS/ERT).

1 Ensure the following valves are closed:

| A Train | B Train |
|---------------|---------------|
| <u>LRV-70</u> | <u>LRV-72</u> |
| <u>LRV-71</u> | <u>LRV-73</u> |

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 H₂ recombiner connections, THEN close the following valves:

| | |
|---------------|---------------|
| <u>LRV-87</u> | <u>LRV-88</u> |
| <u>LRV-89</u> | <u>LRV-90</u> |
| <u>LRV-91</u> | <u>LRV-92</u> |
| <u>LRV-93</u> | <u>LRV-94</u> |

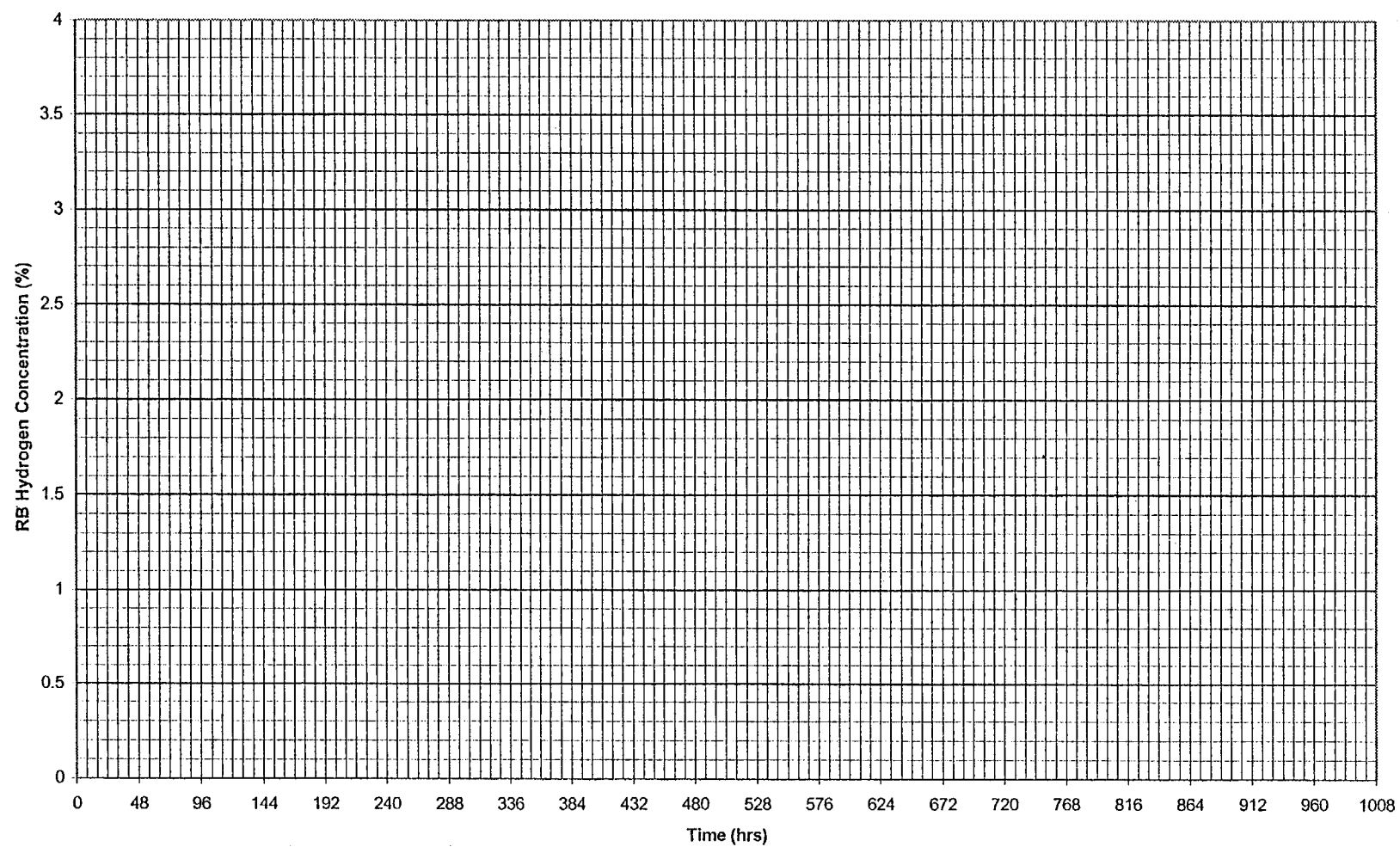
5 Stop portable air compressors.

PURGING RB (Cont'd)

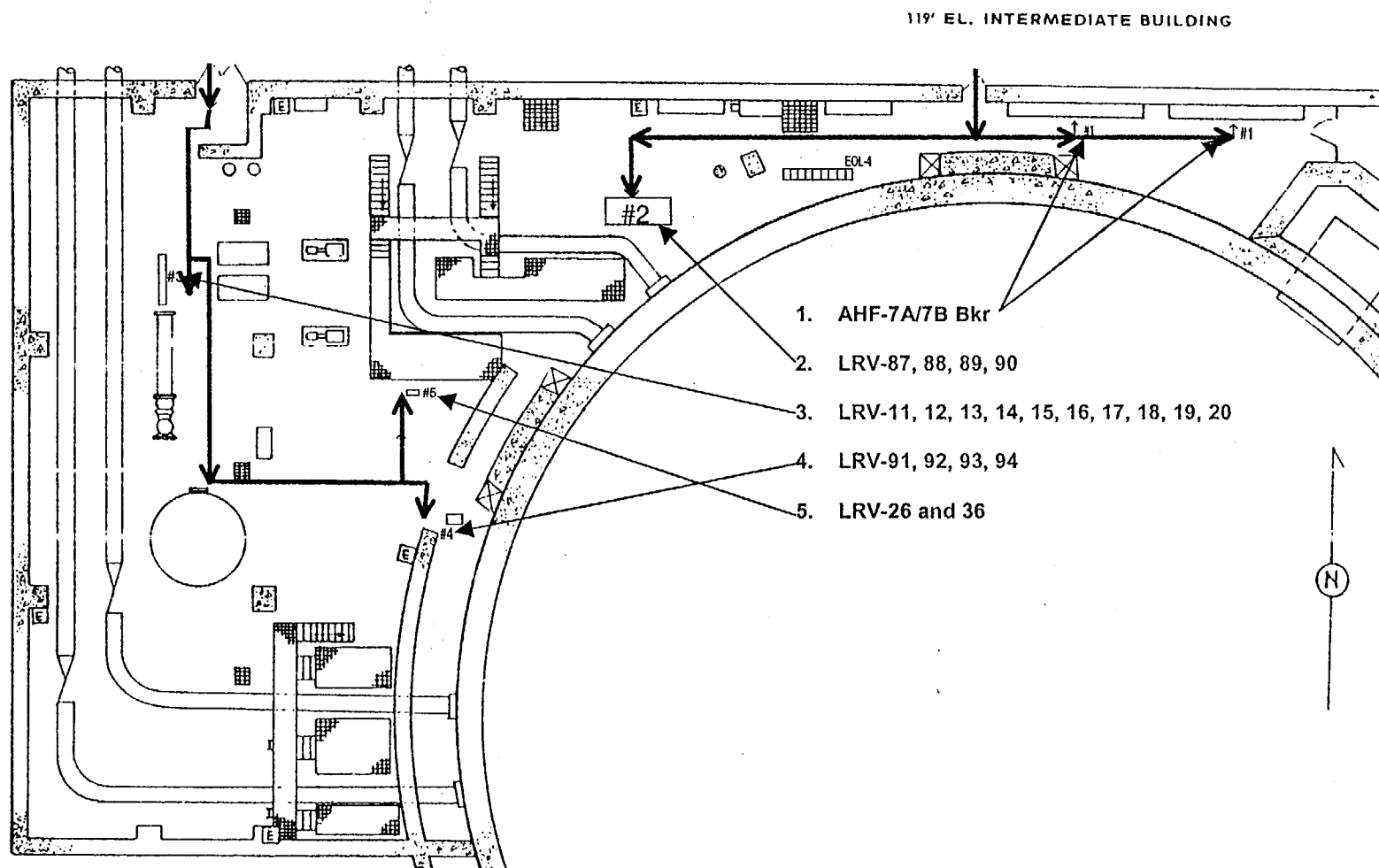
ACTIONS

DETAILS

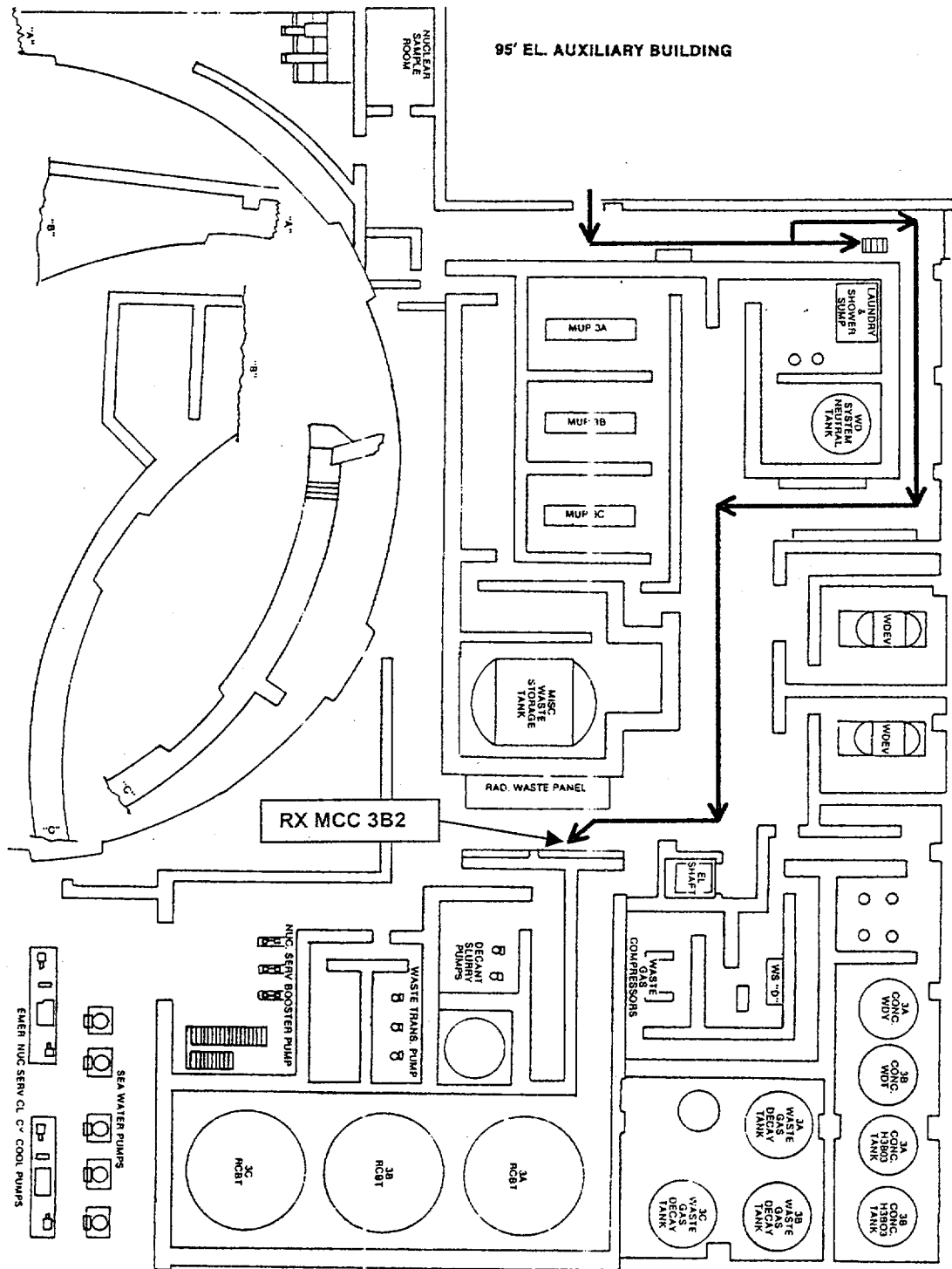
- 1.11 — Notify the Accident Assessment
Team Coordinator that RB purge is
secured.

RB HYDROGEN CONCENTRATION TREND

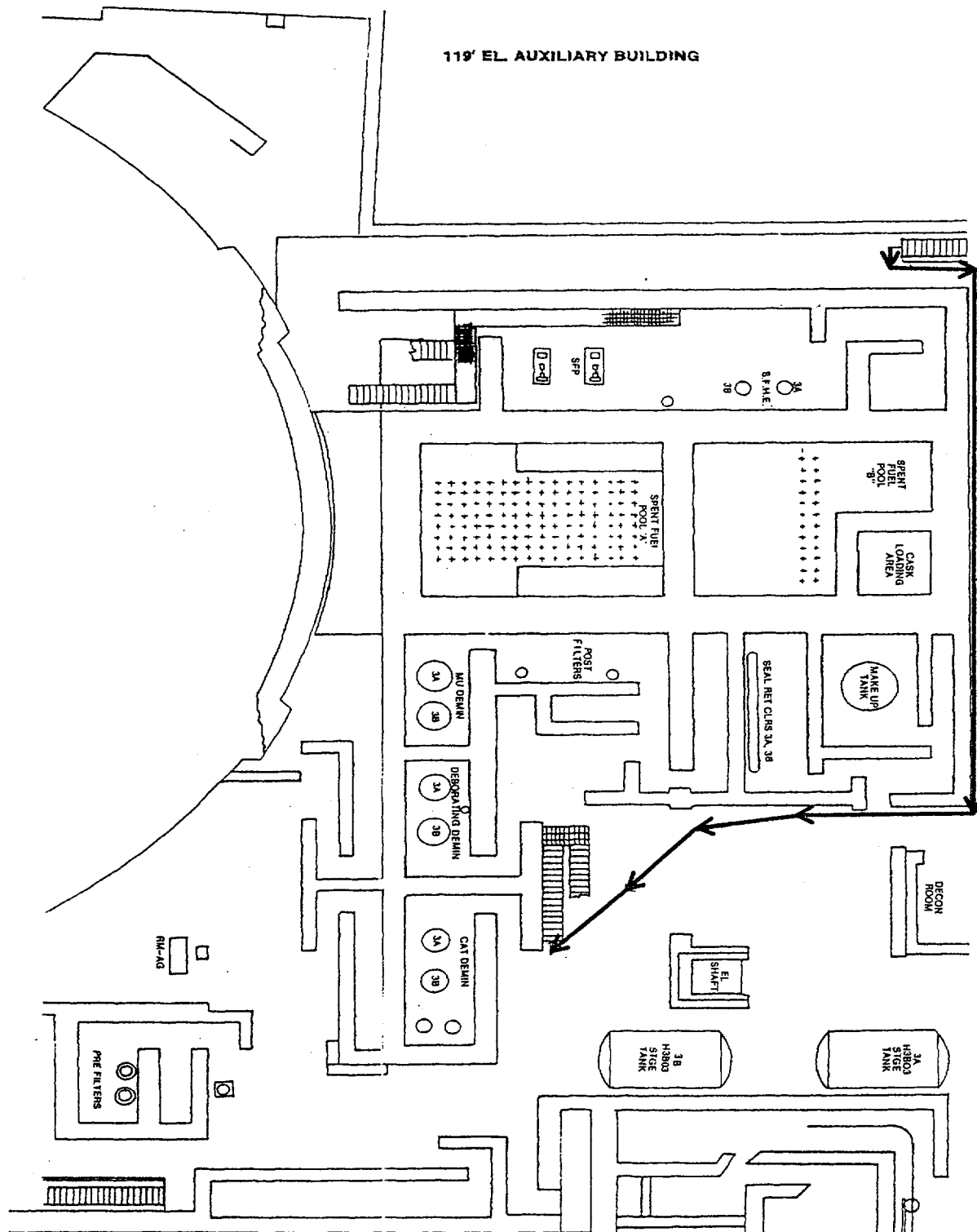
ACCESS ROUTES



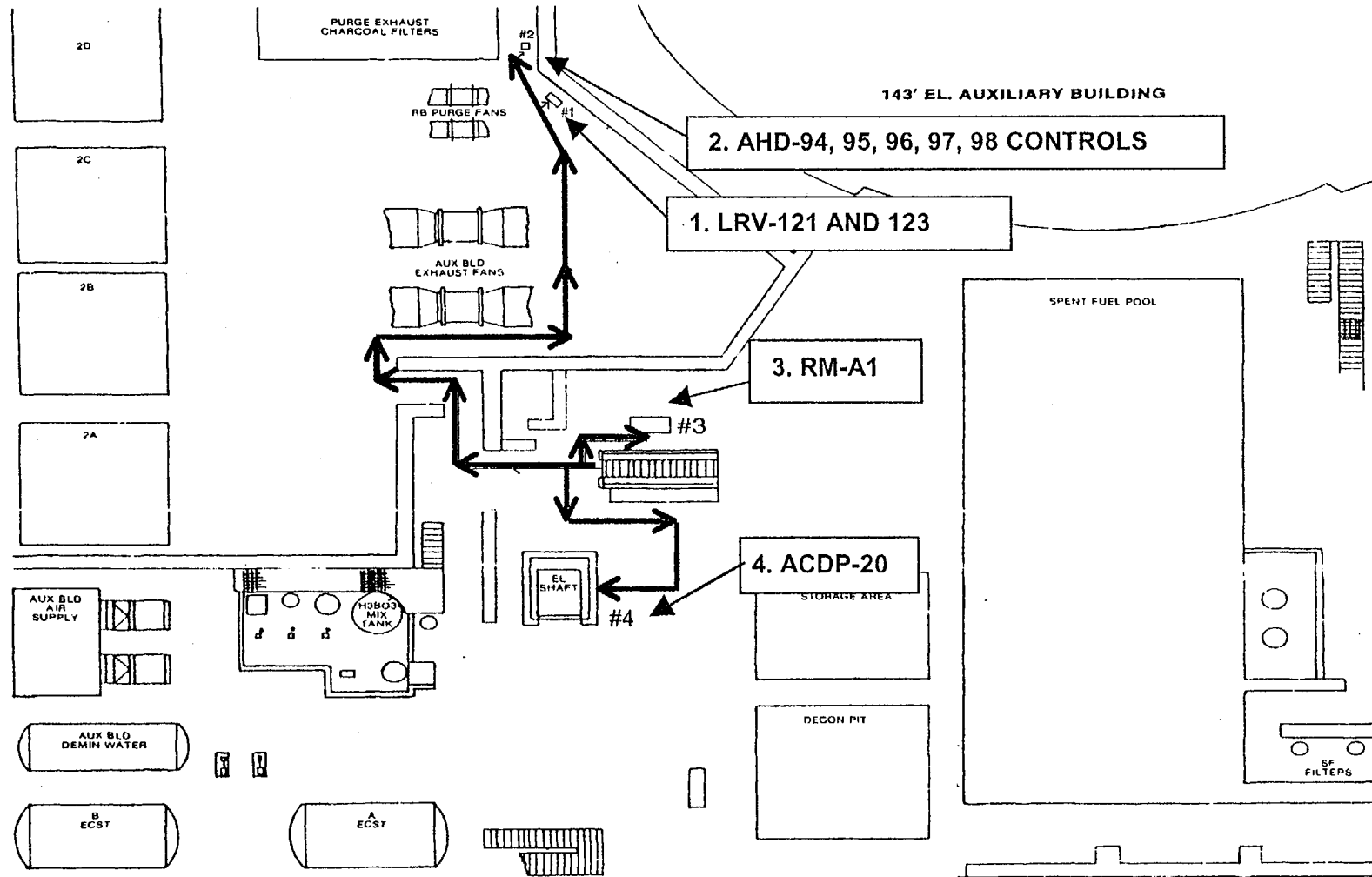
ACCESS ROUTES (Cont'd)

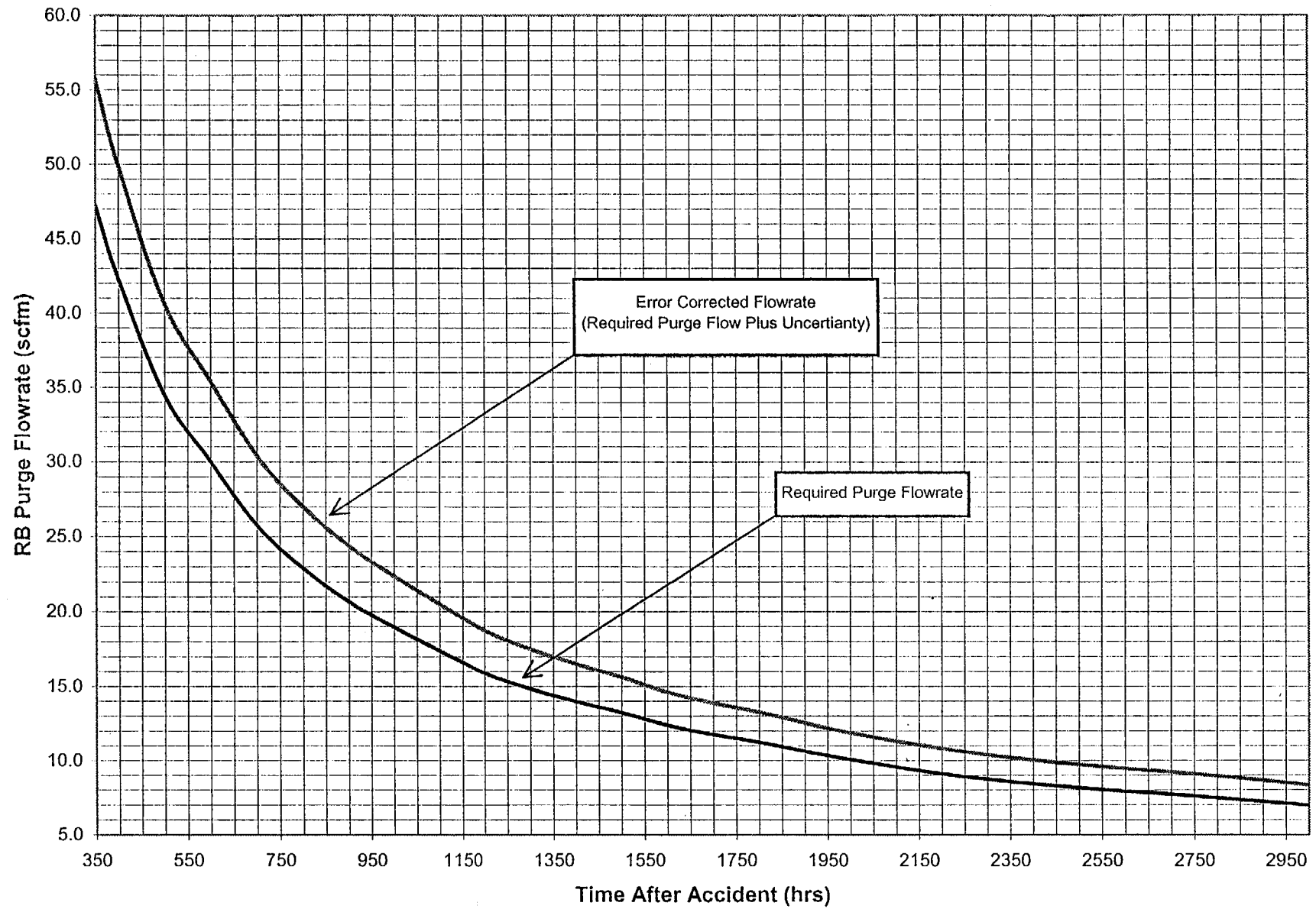


ACCESS ROUTES (Cont'd)



ACCESS ROUTES (Cont'd)



CONTINUOUS PURGE FLOW RATES AFTER A LOCA

FLORIDA POWER CORPORATION

CRYSTAL RIVER UNIT 3

PLANT OPERATING MANUAL

EMERGENCY PLAN IMPLEMENTING PROCEDURE

EM-225B

POST-ACCIDENT BORON CONCENTRATION MANAGEMENT

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1.0 PURPOSE

The purpose of this procedure is to provide methodology for determining when post LOCA boron precipitation mitigation is required.

2.0 REFERENCES

2.1 Developmental References

FPC Calculation M97-0120 – Sump Suction Valve Open Area

FPC Calculation M97-0122 – DH Dropline Backflow for Boron Dilution

FPC Calculation M97-0097 – Auxiliary Pressurizer Spray Flow Rate

FTI Letter IRS-97-4045 dated 10/10/97 Subject: Required APS Flow

FTI Letter IRS-97-4220 dated 10/29/97 Subject: DH Drop Line Backflow RELAP Sensitivity Evaluation

NOE 97-1628, Instrument Uncertainty Analysis for Boronometer (CA-56-CI)

NOE 97-2696, Engineering Evaluation: Incore Temperature Uncertainty

FPC Calculation M97-0138, "Temperature/Time Response for the Auxiliary Spray Line During Boron Precipitation Mitigation"

FPC Calculation M97-0139, "Temperature/Time Response for the DH Dropline with Gravity Flow Initiated for Born Precipitation"

FPC Calculation M97-0098, Boron Dilution by Hot-Leg Injection

FPC Calculation M97-0119, Post-LOCA Boron Concentration Management

FPC Calculation S96-0134, Fluid Velocity Analysis for RB Sump Screens

FPC Calculation M97-0146, Post-LOCA Boron Concentration Management for CR-3

3.0 PERSONNEL INDOCTRINATION

3.1 Definitions

- **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.
- **Delta Boron** - The difference between Expected RB Sump Concentration and actual measured RB sump boron concentration (boronometer, grab sample) after ECCS suction transfer.
- **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 through 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.
- **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.

3.2 Responsibilities

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

3.3

Limits And Precautions

- 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.
- If required for A Train APS effectiveness DHV-5 may be closed provided HPI has been established.
- Grab samples should be taken from the recirculating fluid to assure correct boronometer performance, if dose limitations allow.
- Sump sampling should continue to be used after initiation of an active method to assure the boron concentration control mechanism is working effectively.
- 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 a chesel recorder (If all inputs are operable the average point may be used).
- The "Delta Boron Limit" as shown on Enclosure 5, 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.
- Boron precipitation can not occur if adequate SCM exists.

4.0 INSTRUCTIONS

4.1 Emergency Repair Team Maintenance

- 4.1.1 IF ES MCC 3AB can NOT be energized,
THEN coordinate performance of Enclosure 7 in this procedure.

4.2 Boron Precipitation Mitigation Determination

- 4.2.1 IF adequate SCM exists,
THEN Exit this procedure.
- 4.2.2 WHEN ECCS suction transfer has been completed,
THEN calculate Expected RB Sump Concentration (Sump_{EXP}) using Enclosure 1 in this procedure.
- 4.2.3 Request the OSC Chemistry Coordinator to have RB sump boron concentration determined on a 2 hour interval.
- 4.2.4 IF at any time RB sump sample results are received,
THEN calculate Delta Boron (Sump_{EXP} - Measured Sump Boron Concentration).
- 4.2.5 IF the RB sump can be sampled,
THEN perform Enclosure 2 of this procedure.
- 4.2.6 IF RB sump can NOT be sampled,
THEN perform Enclosure 3 of this procedure.

4.3 Boron Precipitation Mitigation Prerequisites

- 4.3.1 IF LPI crosstie is in progress,
THEN prior to directing performance of EOP-14, Enclosure 20, establish HPI piggyback using EM-225E, Guidelines for Long Term Cooling.
- 4.3.2 IF an HPI pump will be started using EOP-14, Enclosure 20,
THEN ensure HPI flow is controlled within the limits of EM-225E.

4.4 Boron Precipitation Mitigation Initiation

4.4.1 IF APS will be directed,
THEN consider the following regarding use and effectiveness:

- 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 \approx DHHE outlet temperature in ≤ 1 minute.
 - Continued RB sump sampling, in the longer term, will provide positive verification of successful mitigation.

4.4.2 IF DTS will be directed,
THEN consider the following regarding use and effectiveness:

- 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 $\leq 40^{\circ}$ F,
THEN Tincore should be 90% of average RB temperature within 13 minutes.
 - IF the difference between initial Tincore and average RB temperature is $> 40^{\circ}$ F,
THEN Tincore should be 90% of average RB temperature within 26 minutes.

4.4.3 WHEN boron precipitation mitigation is required,
THEN direct the Control Room to perform the appropriate alignment
using EOP-14, Enclosure 20

4.4.4 IF all the following exist:

___ 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

___ Tincore plots on Enclosure 4 indicate DHV-5 must be closed for APS
effectiveness

THEN direct the Control Room to close DHV-5

5.0 FOLLOW-UP ACTIONS

- Continue RB sump monitoring and plotting of Delta Boron.

CALCULATION OF EXPECTED RB SUMP CONCENTRATION

1. Obtain the following data:

Pre-LOCA BWST Boron Concentration _____ ppmb
(C_{BWST})

Pre-LOCA RCS Boron Concentration (C_{RCS}) _____ ppmb

2. Determine ΔM_{BWST} using Page 2 of this Enclosure _____

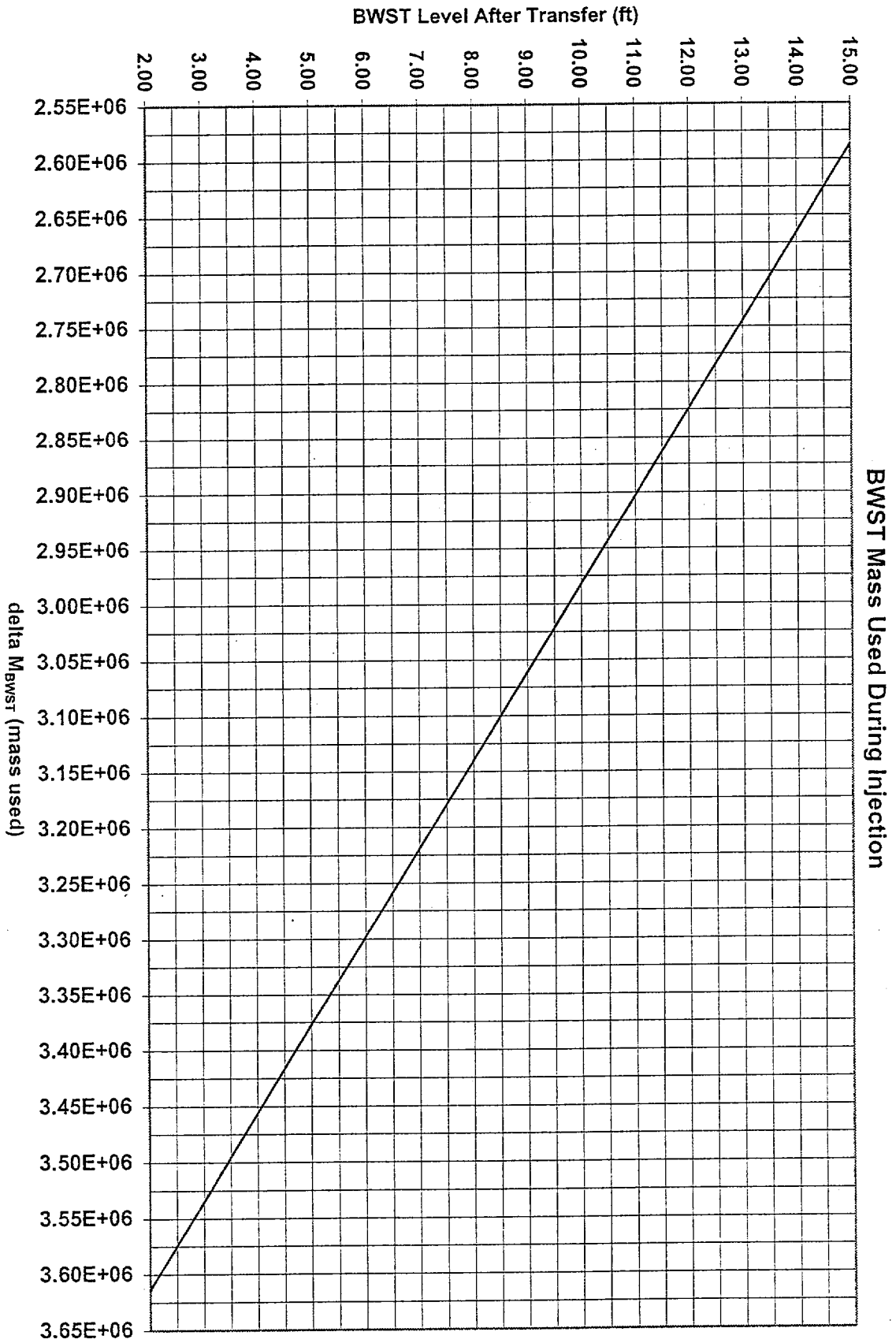
3. Calculate Expected RB Sump Concentration (Sump_{EXP}):

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

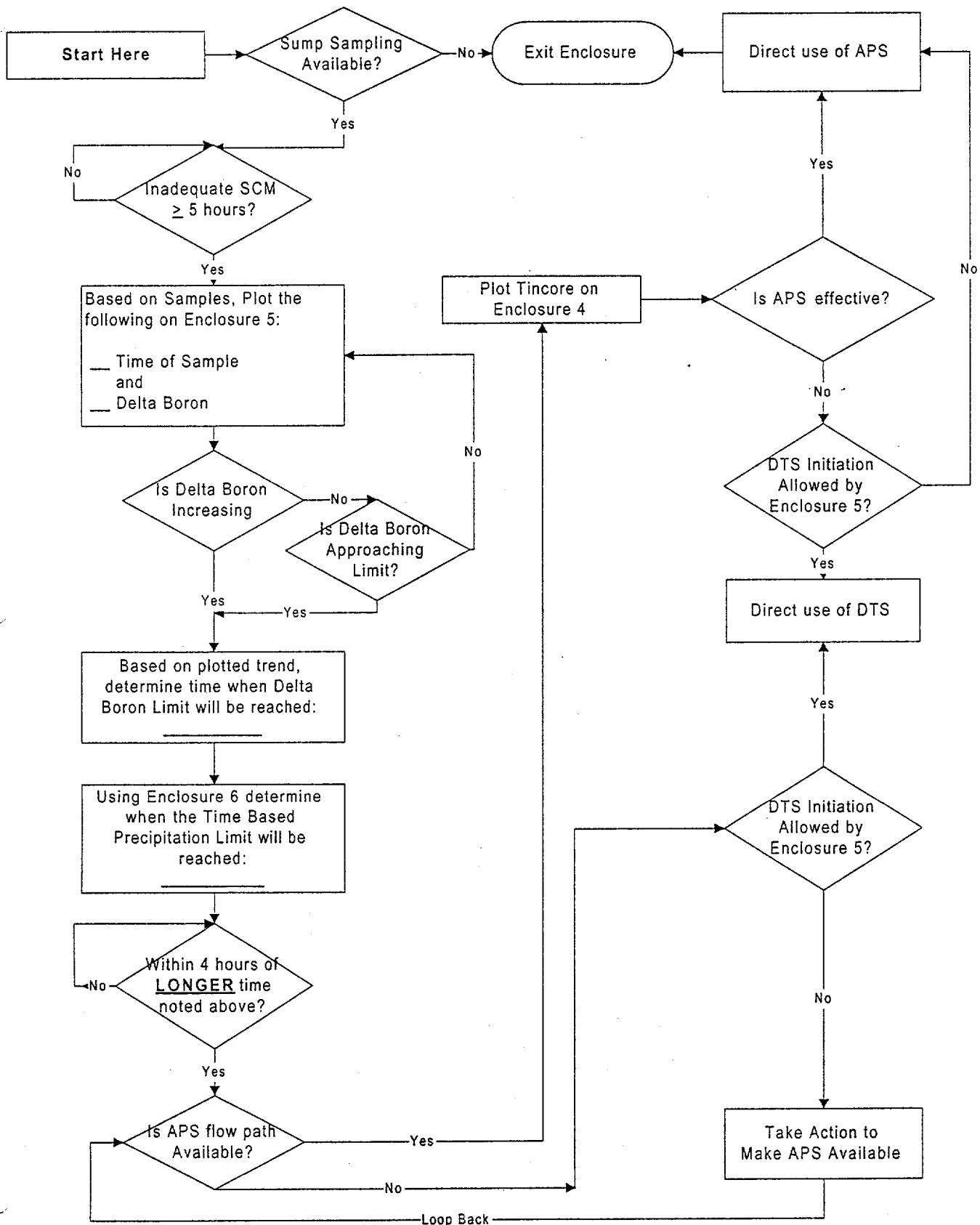
| | | |
|---|---|---|
| <div style="border-bottom: 1px solid black; margin-bottom: 5px;"></div> | = | $\frac{(\quad * \quad) + (4.7 \text{ E}^8) + (5.1 \text{ E}^5 * \quad)}{(\quad) + (1.3 \text{ E}^5) + (5.1 \text{ E}^5)}$ |
|---|---|---|

CALCULATION OF EXPECTED RB SUMP CONCENTRATION (Cont'd)

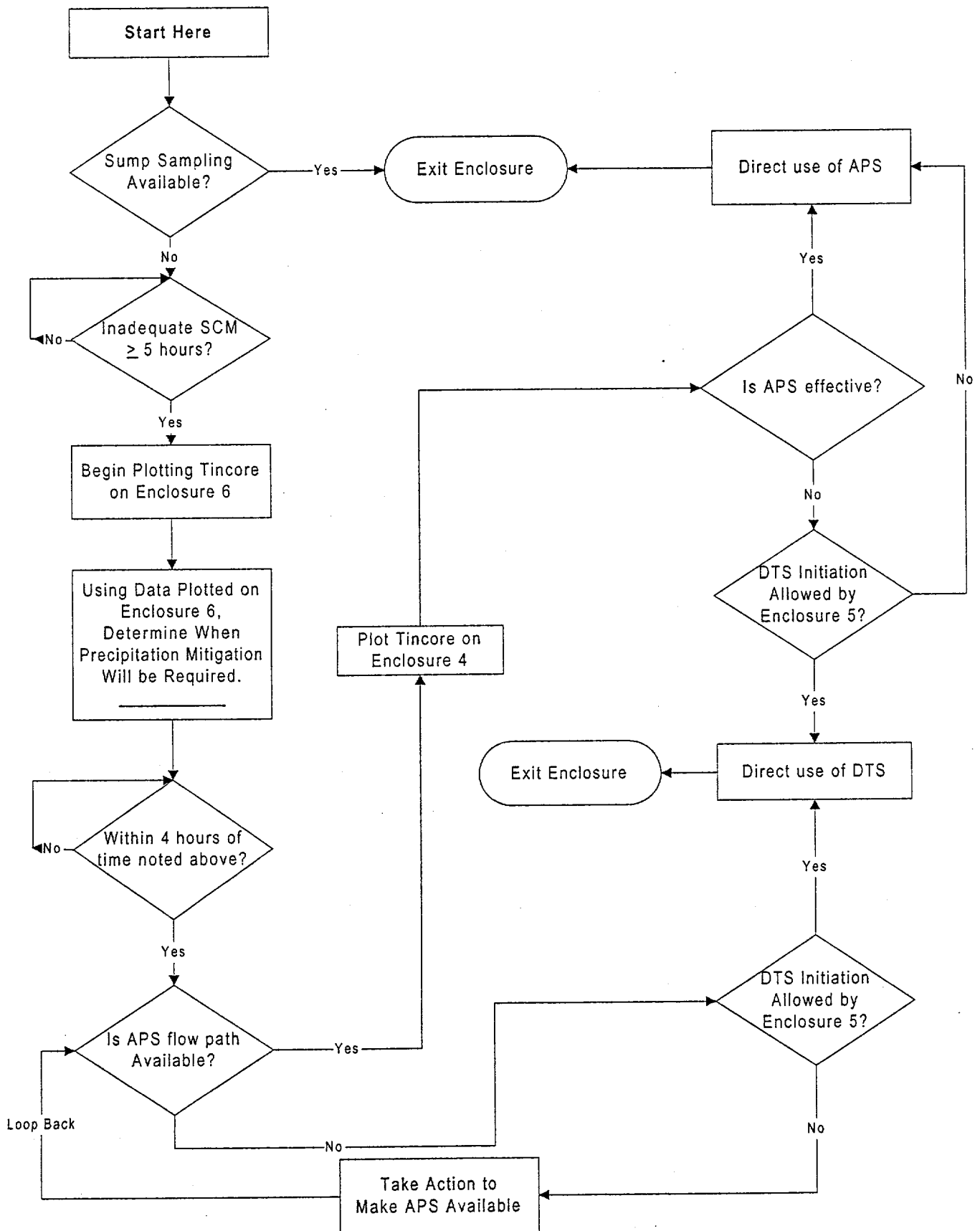
ENCLOSURE 1
(Page 2 of 2)

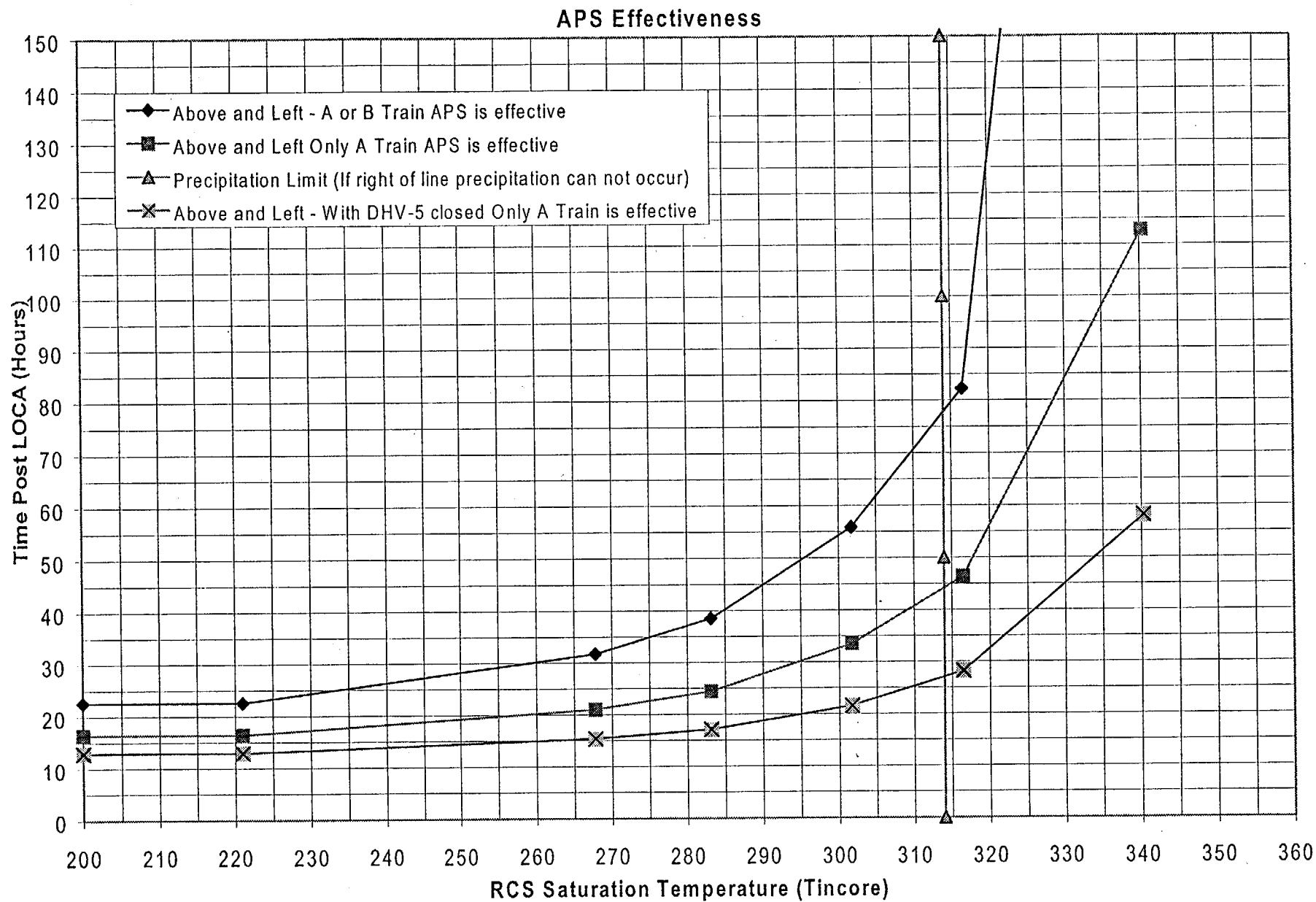


MITIGATION MATRIX WITH RB SUMP SAMPLING

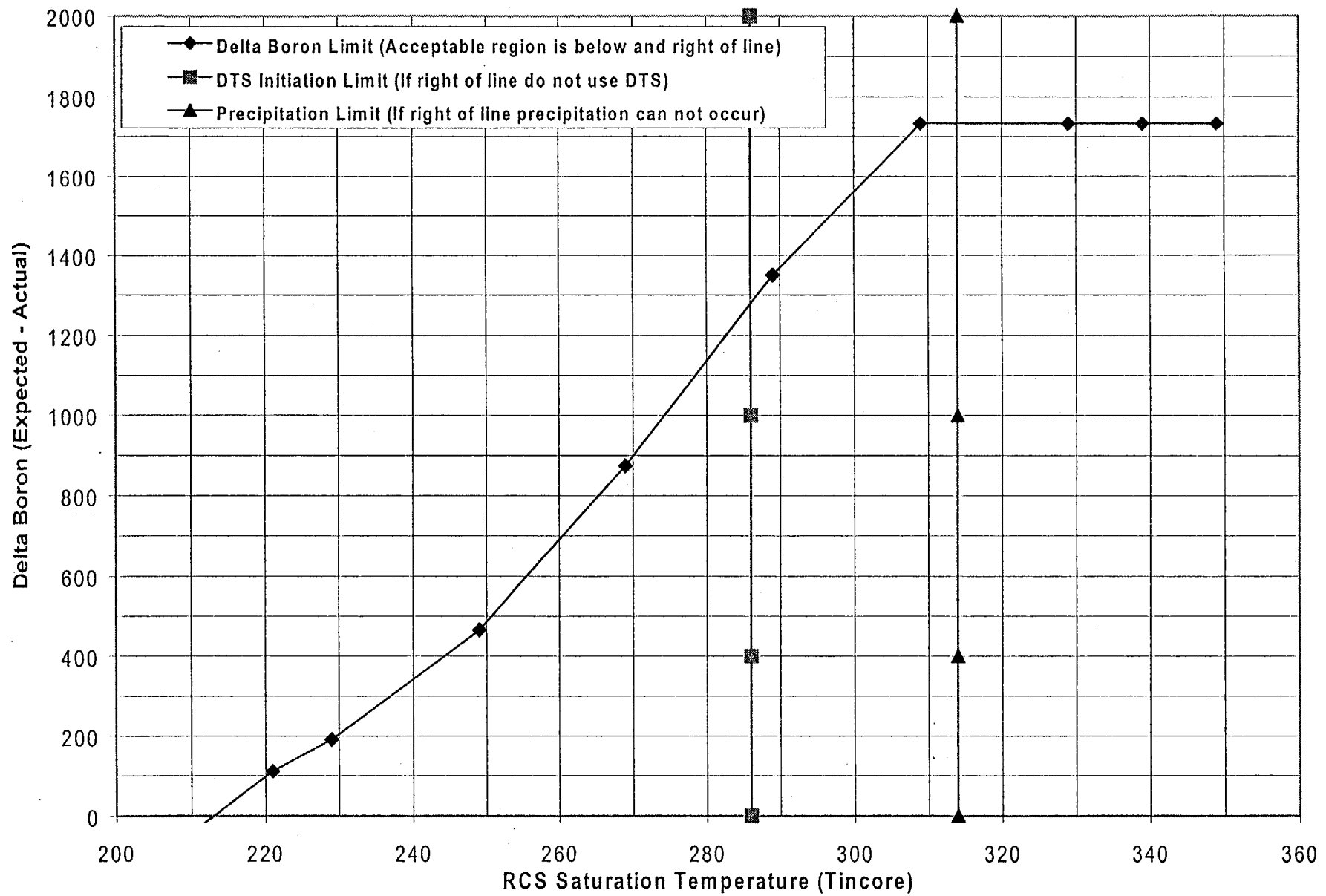


MITIGATION MATRIX WITHOUT RB SUMP SAMPLING

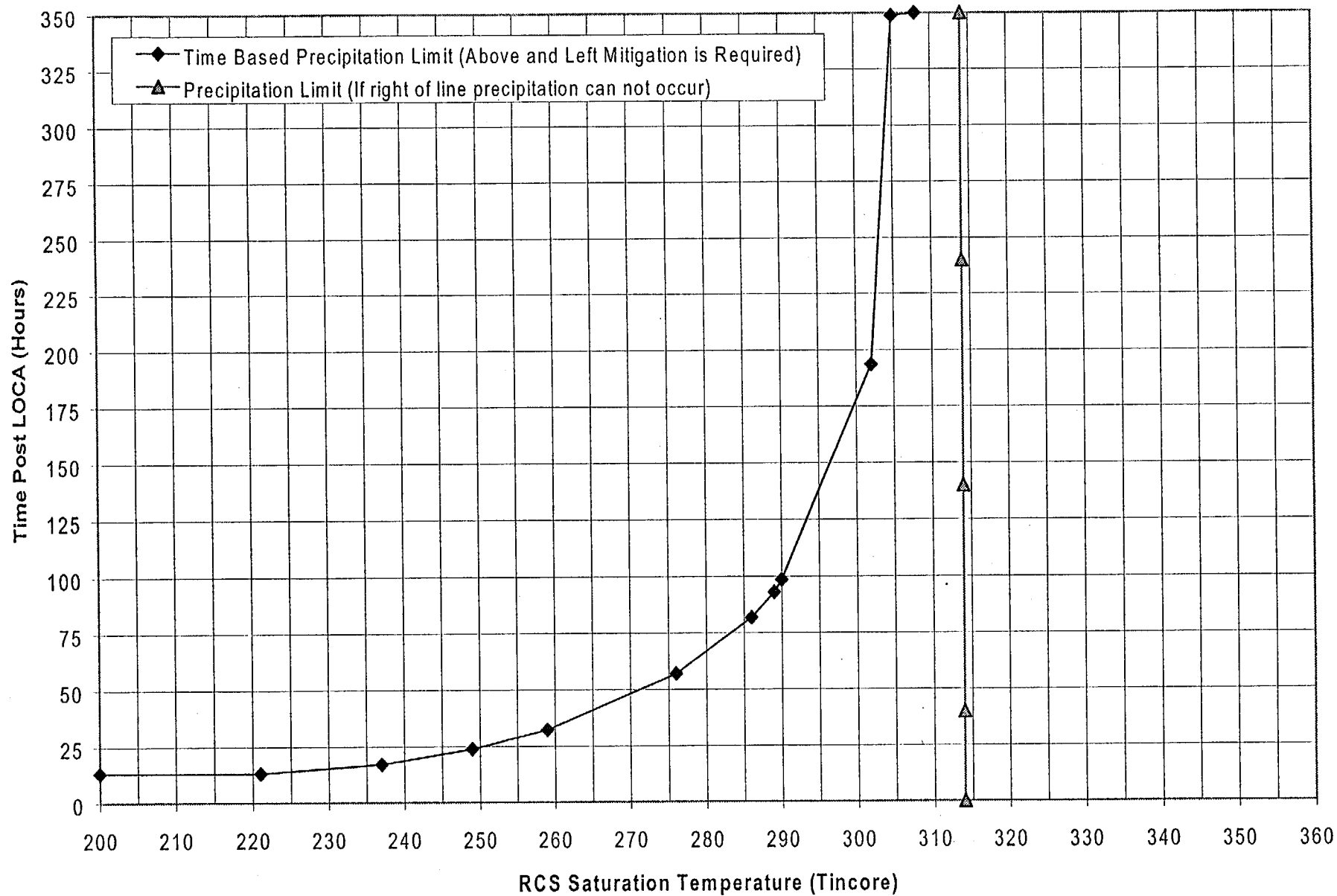




Core Boron Control Limit



Boron Precipitation Mitigation Time Requirements



CONTINGENCY ACTIONS FOR ESTABLISHING
AUXILIARY PRESSURIZER SPRAY

1.0 PURPOSE

The purpose of this enclosure 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.

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.

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

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

2.2 Developmental References

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

3.0 PERSONNEL INDOCTRINATION

3.1 Material Parts List

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

- 3.2.1 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.
- 3.2.2 Cables should exit the panel via the bottom.
- 3.2.3 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

- 3.3.1 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.
- 3.3.2 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.
- 3.3.3 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.
- 3.3.4 The person in charge of this activity must ensure the following:
- Work Group has reviewed and understands previous sections of this enclosure.
 - Initial conditions have been met.
 - Safety briefing has been conducted.
 - Emergency Coordinator has been notified.

Completed by: _____ Date: _____

3.4 Responsibilities

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.

4.1.1 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.

4.2 **Section "A"**: 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. These instructions anticipate that ES MCC 3AB is still intact and the normal breaker cubicle for RCV-53 can be used.

4.2.1 If required, obtain proper clearances from Operations to work in ES MCC 3B1-8C and ES MCC 3AB-5B.

4.2.2 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.

4.2.3 Route the "power" cable (1-3/C-10) from ES MCC 3B1-8C to ES MCC 3AB-5B.

4.2.4 Ensure the breaker at 480V ES MCC 3AB-5B is open.

4.2.5 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.

Performed

Concurrent Verification

4.2.6 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.

4.2.7 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.

Performed

Concurrent Verification

- 4.2.8 Ensure the breaker located in ES MCC 3B1-8C is open.
- 4.2.9 Determine 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.
- | Performed | Concurrent Verification |
|-----------|-------------------------|
| _____ | _____ |
- 4.2.10 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.
- 4.2.11 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.
- | Performed | Concurrent Verification |
|-----------|-------------------------|
| _____ | _____ |
- 4.2.12 If dose rates allow, then ensure cable is protected where personnel or equipment may need to cross over.
- 4.2.13 Inspect "power" cable installation and ensure ready for energizing.
- 4.2.14 Obtain permission from Operations to energize the temporary power installation.
- 4.2.15 Close the breaker located in ES MCC 3B1-8C.
- 4.2.16 Verify voltage at the load side of breaker in ES MCC 3B1-8C.
- 4.2.17 Close the breaker located in ES MCC 3AB-5B.
- 4.2.18 Verify voltage at the load side of breaker in ES MCC 3AB-5B.
- 4.2.19 Notify the supervisor in charge of this activity that temporary power installation for RCV-53 is ready to test.
- 4.2.20 Test temporary power installation for RCV-53 as described in Section 4.4

4.3 **Section "B":** 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. 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.

4.3.1 Coordinate with Operations and obtain clearances as required for ES MCC 3B1-8C and ES MCC 3AB-5B (Ref. dwg. 206-056).

4.3.2 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.

Performed

Concurrent Verification

4.3.3 Determine 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 | _____ | _____ |

- 4.3.4 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.
- 4.3.5 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.
- 4.3.6 If time allows ensure the cable on the 119' elevation near ES MCC 3B1 is not a tripping hazard. Tie wrap cables as necessary to secure.

NOTE

Butt splices are to be made outside the cable tray.

- 4.3.7 Splice the "power" cable (1-3/C-10) to cable RCC281 from penetration 308.

Performed _____

Concurrent Verification _____

- 4.3.8 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 | _____ | _____ |

- 4.3.9 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 | _____ | _____ |

- 4.3.10 Ensure the breaker located in ES MCC 3B1-8C is open.

- 4.3.11 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.

4.3.12 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 | _____ | _____ |

4.3.13 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 | _____ | _____ |

4.3.14 Obtain permission from Operations to energize the temporary power installation.

4.3.15 Close the breaker located in ES MCC 3B1-8C.

4.3.16 Verify voltage at the load side of breaker in ES MCC 3B1-8C.

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

4.3.18 Test the temporary power installation for RCV-53 per Section 4.4

4.4 STEPS FOR CHECKING PROPER MOTOR ROTATION FOR RCV-53

NOTE

Section 4.3 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.

4.4.1 IF the **amber** light is lit on ES MCC 3B1-8C cubicle door,
THEN perform the following:

- 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.
- 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.
- 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.

4.4.2

IF the **green** light is lit on ES MCC 3B1-8C cubicle door,
THEN perform the following:

- 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.
- C. IF the amber light is lit,
THEN the motor rotation is correct.
- D. Notify the supervisor that the temporary power for RCV-53 is ready.

CAUTION

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

4.4.3

IF the **red** light is lit on ES MCC 3B1-8C cubicle door,
THEN perform the following:

- 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.
- C. IF the amber light is lit,
THEN motor rotation is correct.
- D. Notify the supervisor that the temporary power for RCV-53 is ready.