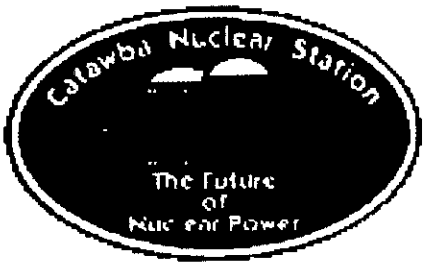
Duke Power SM

A Duke Energy Company



2001 NRC EXAM
SRO ADMIN JPM SET

2001 NRC EXAM SRO ADMIN JPM SET	
JPM #	Title
S-1/ADMIN	Perform Autolog Entry
S-2/ADMIN	Perform a Manual Shutdown Margin Calculation for NCS Cooldown to 140° F.
S-3/ADMIN	Complete Technical Specification Evaluation and TSAIL Entry
S-4/ADMIN	Review and Authorize a Gaseous Waste Release Document
S-5/ADMIN	Classify an Event and Complete the Emergency Notification Form

CATAWBA
INITIAL LICENSE EXAMINATION
JOB PERFORMANCE MEASURE

JPM 1S/ADMIN

Perform Autolog Entry

CANDIDATE _____

EXAMINER _____

CATAWBA
INITIAL LICENSE EXAMINATION
JOB PERFORMANCE MEASURE

Task:

Perform an Autolog Entry for PT/1/A/4200/005A (Safety Injection Pump 1A Performance Test)

Alternate Path:

N/A

Facility JPM #:

NEW

K/A Rating(s):

GA2.1.18 (2.9/3.0)

Task Standard:

Candidate performs an Autolog Entry to perform PT/1/A/4200/005A (Safety Injection Pump 1A Performance Test).

Preferred Evaluation Location:

Simulator ____ In-Plant _X___

Preferred Evaluation Method:

Perform __X__ Simulate _____

References:

OMP 2-17 (Unit Unified Logbook Maintenance) Rev. 31

Validation Time: 8 min **Time Critical:** No

==========

Candidate: _____ Time Start : _____
NAME Time Finish: _____

Performance Rating: SAT _____ UNSAT _____ Performance Time _____

Examiner: _____ _____/_____
NAME SIGNATURE DATE

==========

COMMENTS

_____

_____

_____

Tools/Equipment/Procedures Needed:

Computer with Autolog Capability

READ TO OPERATOR

DIRECTION TO TRAINEE:

I will explain the initial conditions, and state the task to be performed. All steps shall be performed for this JPM. I will provide initiating cues and reports on other actions when directed by you. Ensure you indicate to me when you understand your assigned task. To indicate that you have completed your assigned task return the handout sheet I provided you.

INITIAL CONDITIONS:

You are the Unit 1 Balance of Plant Operator

PT/1/A/4200/005A (Safety Injection Pump 1A Performance Test) is to be performed by a current, on duty shift NLO.

INITIATING CUE:

The CRSRO instructs you to make applicable Autolog entry for performance of PT/1/A/4200/005A (Safety Injection Pump 1A Performance Test) to begin at the current date and time.

JPM OVERALL STANDARD:

Candidate correctly completes Autolog entry for PT/1/A/4200/005A (Safety Injection Pump 1A Performance Test) to begin at the current date and time.

STEP 1: Candidate initializes Autolog program for Unit 1 from the DAE Screen. STANDARD: Candidate clicks on "Autolog – CNS" on DAE Screen COMMENTS:	**CRITICAL STEP** ___SAT ___UNSAT
STEP 2: Candidate enters proper LAN ID and Autolog Password STANDARD: Information correctly entered. COMMENTS:	**CRITICAL STEP** ___SAT ___UNSAT
STEP 3: Candidate clicks "New Entry" button to bring up "Log Entry" menu STANDARD: "New Entry" button is clicked and "Log Entry" menu appears COMMENTS:	**CRITICAL STEP** ___SAT ___UNSAT
STEP 4: Candidate selects "Open/Performed" option located beside "Periodic Tests" STANDARD: "Open/Performed" is selected and list of procedure numbers and titles appears COMMENTS:	**CRITICAL STEP** ___SAT ___UNSAT

STEP 5: Operator highlights PT/1/A/4200/005A TANDARD: PT/1/A/4200/005A highlighted COMMENTS:	**CRITICAL STEP** ___SAT ___UNSAT
STEP 6: Operator selects "START" button and "Log Entry" Screen appears STANDARD: "START" selected and "Log Entry" Screen appears COMMENTS:	**CRITICAL STEP** ___SAT ___UNSAT
STEP 7: Candidate enters following data: Date and Time: Current date and time Train: A Test Group: Operations Test Coordinator: Title of any on duty SRO STANDARD: Date and Time: Current date and time Train: A Test Group: Operations Test Coordinator: Any on duty SRO, (OSM, CRSRO, Unit SRO, WCC SRO COMMENTS:	**CRITICAL STEP** ___SAT ___UNSAT
STEP 8: Candidate selects "PT Logs – PT Logs" From the pulldown menu of the sublog and selects "OK" STANDARD: "PT Logs – PT Logs"highlighted COMMENTS:	___SAT ___UNSAT

NOTE: Candidate may deselect Spell Check or run Spell Check. Either is acceptable STEP 9: Candidate selects "OK" to complete entry STANDARD: Candidate selects "OK" to complete entry ***CUE: "OK" has been selected.*** COMMENTS:	**CRITICAL STEP** ___SAT ___UNSAT
This JPM is complete.	

TIME STOP: _____

CANDIDATE CUE SHEET
(TO BE RETURNED TO EXAMINER UPON COMPLETION OF TASK)

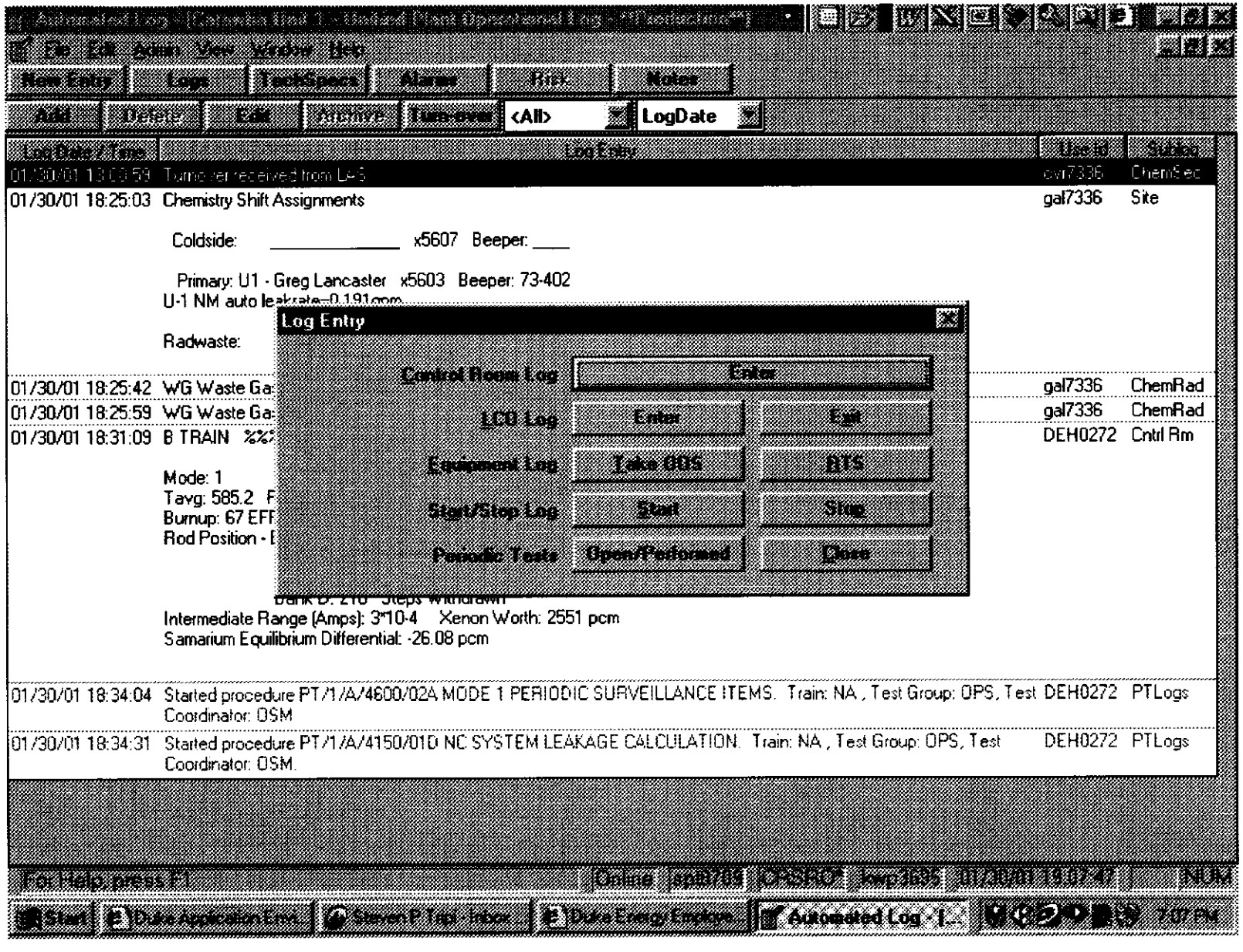
INITIAL CONDITIONS:

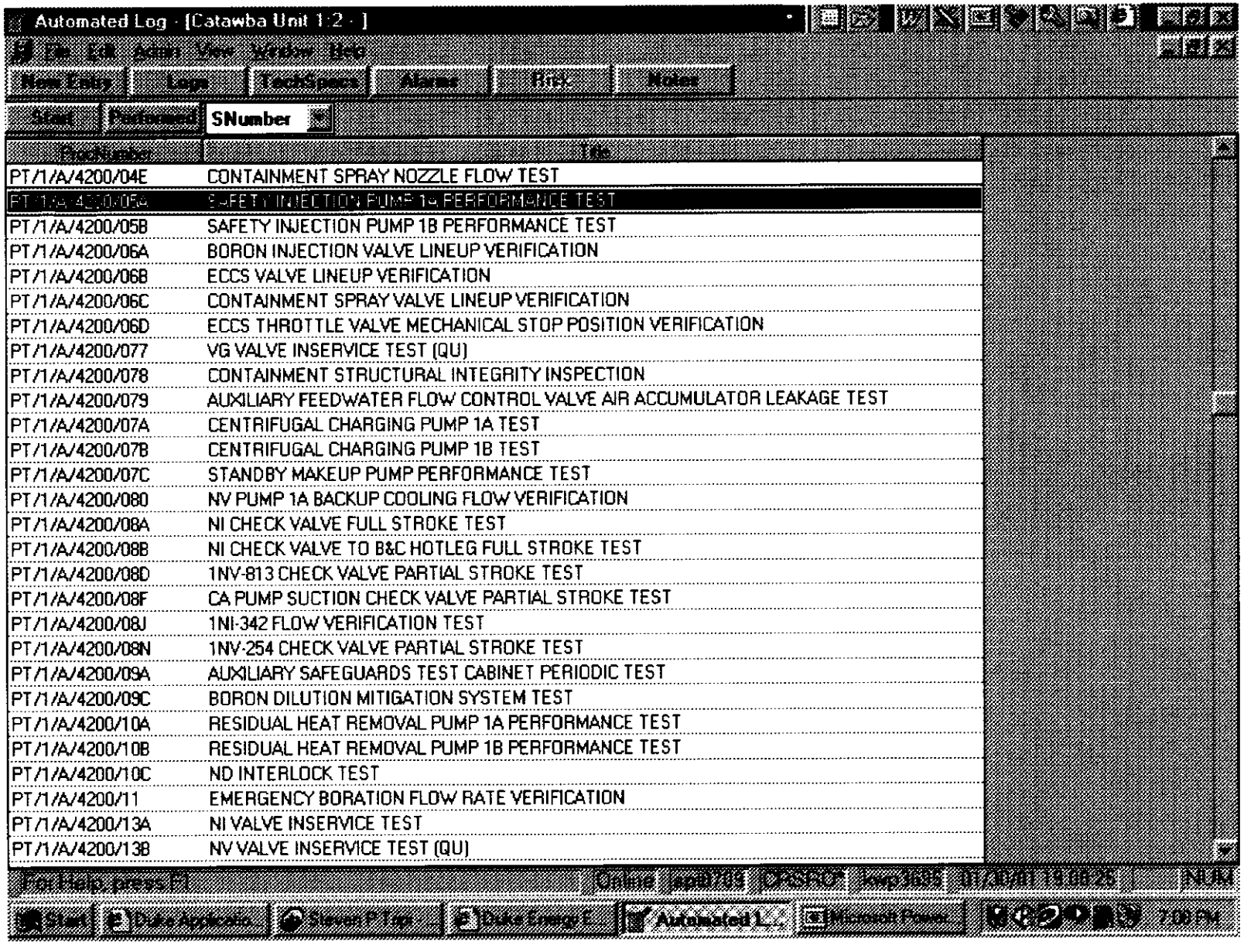
You are the Unit 1 Balance of Plant Operator

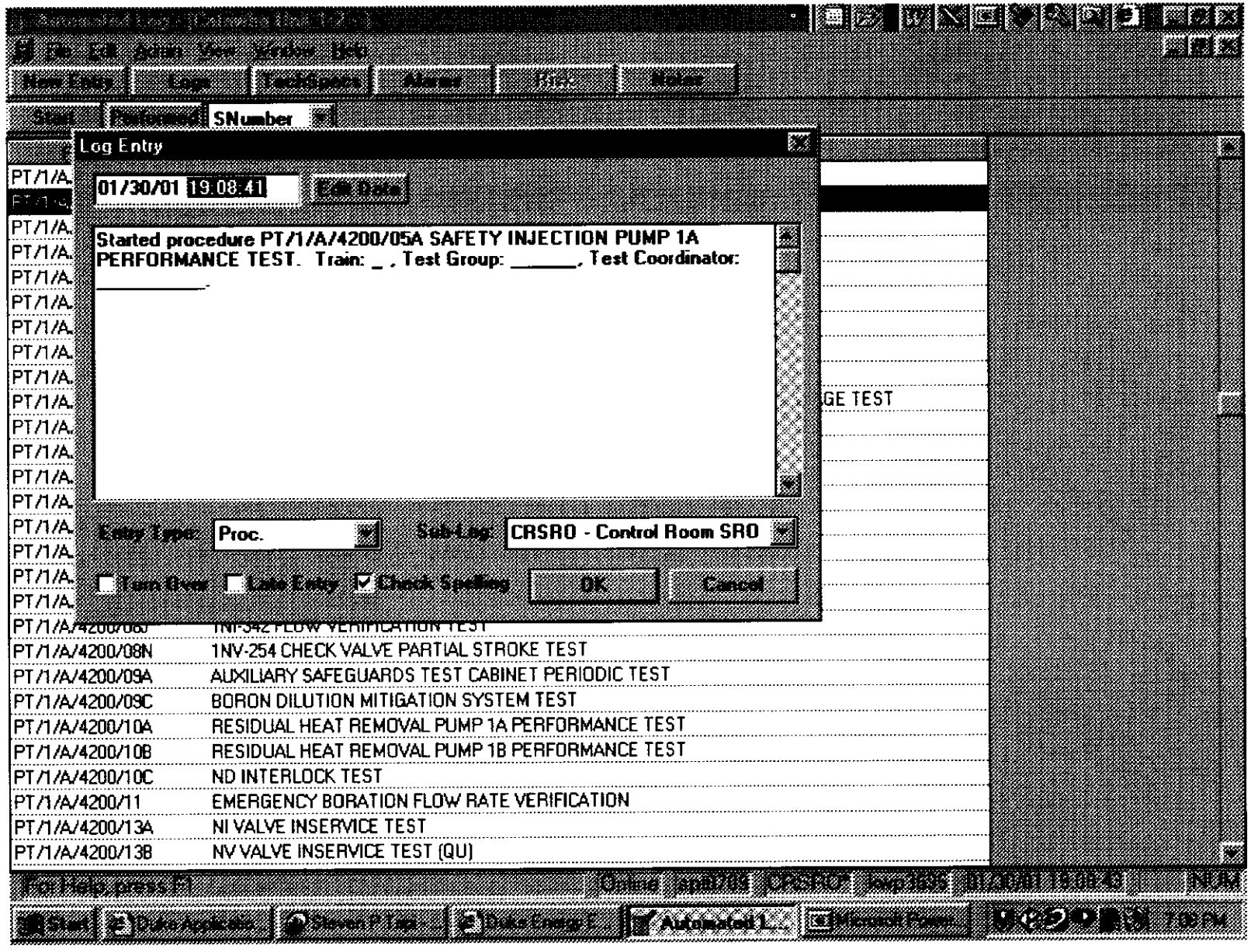
PT/1/A/4200/005A (Safety Injection Pump 1A Performance Test) is to be performed by a current, on duty shift NLO.

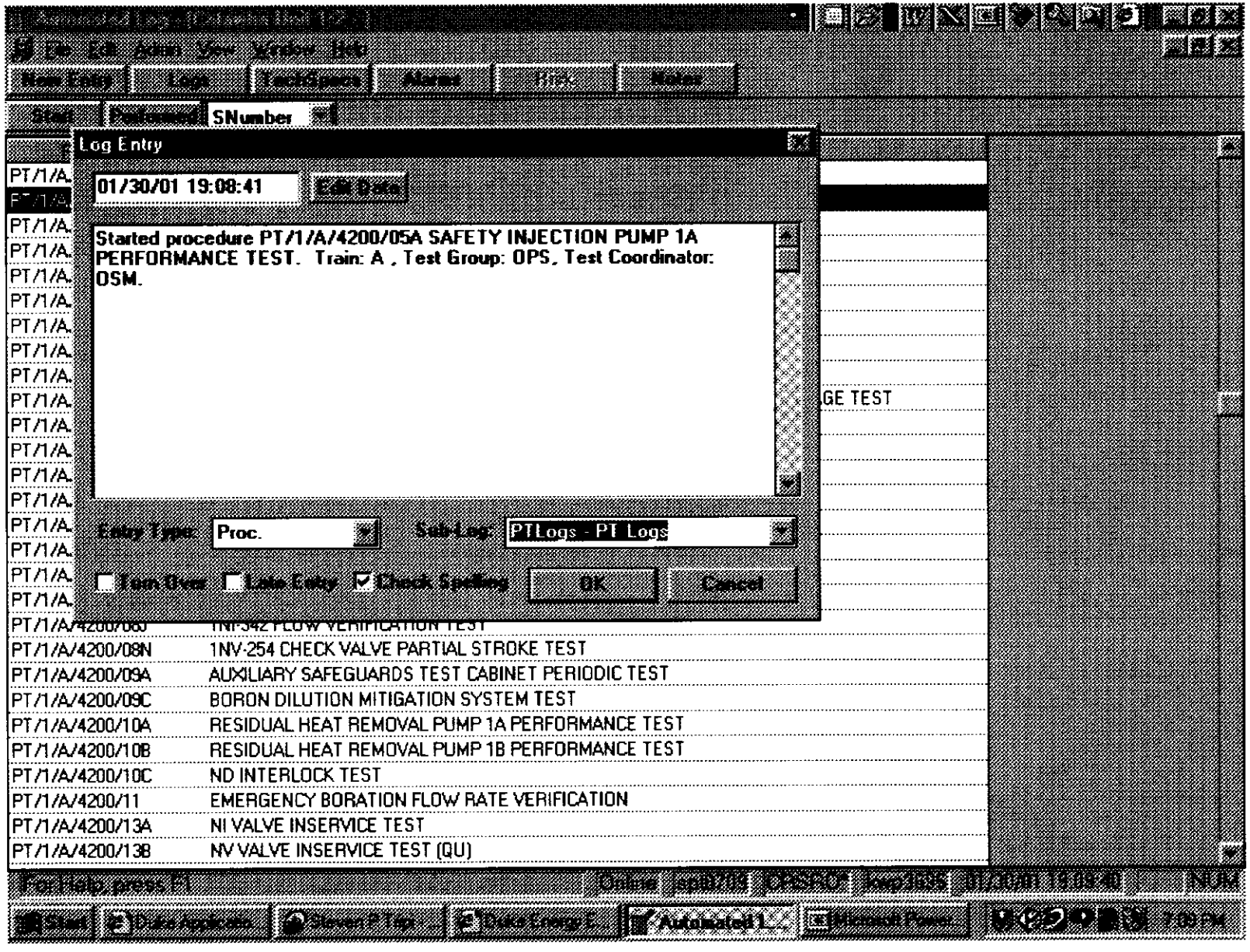
INITIATING CUE:

The CRSRO instructs you to make applicable Autolog entry for performance of PT/1/A/4200/005A (Safety Injection Pump 1A Performance Test) to begin at the current date and time.


File Edit Admin View Window Help
New Entry
Logs
TechSpecs
Alarms
RIA
Notes
Add
Delete
Edit
Activate
Turn-over
<All>
LogDate
Log Date / Time
Log Entry
User Id
Subloc
01/30/01 18:25:03 Chemistry Shift Assignments gal7336 Site
Coldside: _____ x5607 Beeper: ____
Primary: U1 - Greg Lancaster x5603 Beeper: 73-402
Radwaste:
Log Entry
Control Room Log
Enter
LCO Log
Enter
Exit
Equipment Log
Take OOS
RTS
Start/Stop Log
Start
Stop
Periodic Tests
Open/Performed
Close
01/30/01 18:25:42 WG Waste Ga gal7336 ChemRad
01/30/01 18:25:59 WG Waste Ga gal7336 ChemRad
01/30/01 18:31:09 B TRAIN DEH0272 Cntrl Rm
Mode: 1
Tavg: 585.2
Burnup: 67 EFF
Rod Position -
Intermediate Range (Amps): 3*10-4 Xenon Worth: 2551 pcm
Samarium Equilibrium Differential: -26.08 pcm
01/30/01 18:34:04 Started procedure PT/1/A/4600/02A MODE 1 PERIODIC SURVEILLANCE ITEMS. Train: NA , Test Group: OPS, Test Coordinator: OSM DEH0272 PTLogs
01/30/01 18:34:31 Started procedure PT/1/A/4150/01D NC SYSTEM LEAKAGE CALCULATION. Train: NA , Test Group: OPS, Test Coordinator: OSM. DEH0272 PTLogs
For Help, press F1
Start
7:07 PM


Automated Log - [Catawba Unit 1:2 -]
File Edit Admin View Window Help
New Entry
Logs
TechSpecs
Alarms
RCE
Notes
Start
Performed
SNumber
ProcNumber
Title
PT/1/A/4200/04E CONTAINMENT SPRAY NOZZLE FLOW TEST
PT/1/A/4200/05A SAFETY INJECTION PUMP 1A PERFORMANCE TEST
PT/1/A/4200/05B SAFETY INJECTION PUMP 1B PERFORMANCE TEST
PT/1/A/4200/06A BORON INJECTION VALVE LINEUP VERIFICATION
PT/1/A/4200/06B ECCS VALVE LINEUP VERIFICATION
PT/1/A/4200/06C CONTAINMENT SPRAY VALVE LINEUP VERIFICATION
PT/1/A/4200/06D ECCS THROTTLE VALVE MECHANICAL STOP POSITION VERIFICATION
PT/1/A/4200/077 VG VALVE INSERVICE TEST (QU)
PT/1/A/4200/078 CONTAINMENT STRUCTURAL INTEGRITY INSPECTION
PT/1/A/4200/079 AUXILIARY FEEDWATER FLOW CONTROL VALVE AIR ACCUMULATOR LEAKAGE TEST
PT/1/A/4200/07A CENTRIFUGAL CHARGING PUMP 1A TEST
PT/1/A/4200/07B CENTRIFUGAL CHARGING PUMP 1B TEST
PT/1/A/4200/07C STANDBY MAKEUP PUMP PERFORMANCE TEST
PT/1/A/4200/08D NV PUMP 1A BACKUP COOLING FLOW VERIFICATION
PT/1/A/4200/08A NI CHECK VALVE FULL STROKE TEST
PT/1/A/4200/08B NI CHECK VALVE TO B&C HOTLEG FULL STROKE TEST
PT/1/A/4200/08D 1NV-813 CHECK VALVE PARTIAL STROKE TEST
PT/1/A/4200/08F CA PUMP SUCTION CHECK VALVE PARTIAL STROKE TEST
PT/1/A/4200/08J 1NI-342 FLOW VERIFICATION TEST
PT/1/A/4200/08N 1NV-254 CHECK VALVE PARTIAL STROKE TEST
PT/1/A/4200/09A AUXILIARY SAFEGUARDS TEST CABINET PERIODIC TEST
PT/1/A/4200/09C BORON DILUTION MITIGATION SYSTEM TEST
PT/1/A/4200/10A RESIDUAL HEAT REMOVAL PUMP 1A PERFORMANCE TEST
PT/1/A/4200/10B RESIDUAL HEAT REMOVAL PUMP 1B PERFORMANCE TEST
PT/1/A/4200/10C ND INTERLOCK TEST
PT/1/A/4200/11 EMERGENCY BORATION FLOW RATE VERIFICATION
PT/1/A/4200/13A NI VALVE INSERVICE TEST
PT/1/A/4200/13B NV VALVE INSERVICE TEST (QU)
For Help, press F1
Online
NUM
Start
Duke Applicatio...
Steven P Tap...
Duke Energy E...
Automated L...
Microsoft Power...
7:00 PM


Log Entry
01/30/01 19:08:41
Edit Date
Started procedure PT/1/A/4200/05A SAFETY INJECTION PUMP 1A PERFORMANCE TEST. Train: _ . Test Group: _____. Test Coordinator: _____.
Entry Type: Proc.
Sub-Log: CRSRO - Control Room SRO
Turn Over
Late Entry
Check Spelling
OK
Cancel
PT/1/A/4200/08N 1NV-254 CHECK VALVE PARTIAL STROKE TEST
PT/1/A/4200/09A AUXILIARY SAFEGUARDS TEST CABINET PERIODIC TEST
PT/1/A/4200/09C BORON DILUTION MITIGATION SYSTEM TEST
PT/1/A/4200/10A RESIDUAL HEAT REMOVAL PUMP 1A PERFORMANCE TEST
PT/1/A/4200/10B RESIDUAL HEAT REMOVAL PUMP 1B PERFORMANCE TEST
PT/1/A/4200/10C ND INTERLOCK TEST
PT/1/A/4200/11 EMERGENCY BORATION FLOW RATE VERIFICATION
PT/1/A/4200/13A NI VALVE INSERVICE TEST
PT/1/A/4200/13B NV VALVE INSERVICE TEST (QU)


Log Entry
01/30/01 19:08:41
Edit Date
Started procedure PT/1/A/4200/05A SAFETY INJECTION PUMP 1A PERFORMANCE TEST. Train: A , Test Group: OPS, Test Coordinator: OSM.
Entry Type: Proc.
Sub-Log: PTLogs - PT Logs
Turn Over
Late Entry
Check Spelling
OK
Cancel
PT/1/A/4200/08N 1NV-254 CHECK VALVE PARTIAL STROKE TEST
PT/1/A/4200/09A AUXILIARY SAFEGUARDS TEST CABINET PERIODIC TEST
PT/1/A/4200/09C BORON DILUTION MITIGATION SYSTEM TEST
PT/1/A/4200/10A RESIDUAL HEAT REMOVAL PUMP 1A PERFORMANCE TEST
PT/1/A/4200/10B RESIDUAL HEAT REMOVAL PUMP 1B PERFORMANCE TEST
PT/1/A/4200/10C ND INTERLOCK TEST
PT/1/A/4200/11 EMERGENCY BORATION FLOW RATE VERIFICATION
PT/1/A/4200/13A NI VALVE INSERVICE TEST
PT/1/A/4200/13B NV VALVE INSERVICE TEST (QU)

CATAWBA
INITIAL LICENSE EXAMINATION
JOB PERFORMANCE MEASURE

JPM 2S/ADMIN

Perform a Manual Shutdown Margin Calculation
For NCS Cooldown to 140° F.

CANDIDATE _____

EXAMINER _____

CATAWBA
INITIAL LICENSE EXAMINATION
JOB PERFORMANCE MEASURE

Task:

Perform a manual shutdown margin calculation for NCS Cooldown to 140° F.

Alternate Path:

N/A

Facility JPM #:

OP-CN-RT-RB-108 (Modified)

K/A Rating(s):

GKA 2.1.25 (2.8/3.1)

Task Standard:

Determine if adequate shutdown margin exists per Technical Specifications for a cooldown of the NC System to 140° F.

Preferred Evaluation Location:

Simulator __X__ In-Plant _____

Preferred Evaluation Method:

Perform __X__ Simulate _____

References:

OP/0/A/6100/006 (Reactivity Balance Calculation)
Unit One Reactor Operating Data Book.
EP/1/A/5000/ES-0.2 (Natural Circulation Cooldown) Rev. 15

Validation Time: 15 min. **Time Critical:** No

==========

Candidate: _____ Time Start : _____
NAME Time Finish: _____

Performance Rating: SAT _____ UNSAT _____ Performance Time _____

Examiner: _____ _____/_____
NAME SIGNATURE DATE

==========

COMMENTS

_____

_____

_____

Simulator Setup
N/A.

Too easy. Add I stuck rod and Δ initial T_{Ave} to 495°F.

READ TO OPERATOR

DIRECTION TO TRAINEE:

I will explain the initial conditions, and state the task to be performed. All control room steps shall be performed for this JPM, including any required communications. I will provide initiating cues and reports on other actions when directed by you. Ensure you indicate to me when you understand your assigned task. To indicate that you have completed your assigned task return the handout sheet I provided you.

INITIAL CONDITIONS:

Unit One has experienced a loss of offsite power.
ES-0.2 (Natural Circulation Cooldown) is in progress with step 3 having already been completed.
The Reactivity Computer (REACT) is out-of-service
Current boron concentration is 1360 ppm.
Core Life is 10 EFPD
Current T-Ave is 557° F.
Current NC Pressure is 2235 psig
All control rods fully inserted

? Not Encl. 4.4

INITIATING CUE:

You are instructed to determine the required Cold Shutdown Boron Concentration for a cooldown to 140° F per step 4 of ES-0.2 (Natural Circulation Cooldown) for Xenon free conditions. to meet

Why minimum required SDM limits.

Verification of calculations is waived.

JPM OVERALL STANDARD:

Candidate determines required Boron concentration for NCS cooldown to 140° F.

STEP 1 The Candidate determines OP/0/A/6100/006 is the appropriate procedure for calculation STANDARD: The Candidate obtains a current copy of OP/0/A/6100/006 COMMENTS: What about proc. verification?	___SAT ___UNSAT
STEP 2: Review Purpose and Limits and Precautions and determines that Enclosure 4.4 is required to be performed for this calculation. (Steps 1 & 2). Make another step STANDARD: ~~None Required~~ Identify that SDM must be ≥ 1300 pcm per step 2.4 until in Mode 5 (then must be ≥ 1000 pcm) **EXAMINERS CUE: ~~Limits and Precautions have been reviewed~~ COMMENTS: Step 3: Reviews Procedure (step 3) to determine which enclosure to perform. Standard: Determines Enclosure 4.4 is required to be performed based on initial conditions	___SAT ___UNSAT
STEP ~~2.5~~ If performing a manual calculation, N/A Section 2.2. STANDARD: Step 2.2 marked N/A. COMMENTS:	___SAT ___UNSAT

Step 4: Implements Encl. 4.4 and goes to step 1.1
Standard: Indicates that P&L have been reviewed.
Goes to step 2.1

STEP 4: Record data required in step 2.3. STANDARD: Operator determines the following using the initial conditions. Unit: 1 Date/Time: Current Date/Time Present NC System Boron Concentration: 1360 ppm Present NC System T-AVG: 557° F Desired NC System T-AVG: 140° F Present Cycle Burnup: 10 EFPD Present Difference from Equilibrium Samarium Worth: -0 pcm Date and time of last valid Iodine and Xenon Concentrations: N/A (since calculation is for Xenon free condition) Iodine Concentration: 0 atm/cc (since calculation is for Xenon free condition) Xenon Concentration: 0 atm/cc (since calculation is for Xenon free condition) COMMENTS:	___SAT ___UNSAT
STEP 5: Select the HIGHEST boron concentration for the T-AVG's between the range of present and desired T-AVG's at current cycle burnup per Section 5.11 of the R.O.D. Manual (Step 2.4) STANDARD: Determine the HIGHEST boron concentration for the T-AVG's to be 1348 ppm per section 5.11 of the R.O.D. Manual. COMMENTS:	**CRITICAL STEP** ___SAT ___UNSAT
STEP 6: Determine there are no untrippable RCCA's per the initial conditions.(Step 2.5.1) STANDARD: Determines the untrippable rod penalty to be 0 pcm. COMMENTS:	**CRITICAL STEP** ___SAT ___UNSAT

STEP 7: Enter 0 ppm for Zero power physics testing penalty in step 2.5.2. STANDARD: Enter 0 ppm for Zero power physics testing penalty in step 2.5.2. ***CUE**: Zero Power Physics Testing has been completed*** COMMENTS:	**CRITICAL STEP** ___SAT ___UNSAT
STEP 8: Calculate the total additional boron concentration penalty (Step 2.5.3). STANDARD: Determines penalty to be 0 ppm since there are no inoperable rods and ZPPT is complete. COMMENTS:	**CRITICAL STEP** ___SAT ___UNSAT
STEP 9: Calculate total required boron concentration for SDM.(Step 2.6). STANDARD: Calculates a required boron concentration of 1348 pcm. COMMENTS:	**CRITICAL STEP** ___SAT ___UNSAT
STEP 10: Determine the Boron Difference between Required Boron Concentration from SDM and current NC Boron Concentration (Step 2.7). STANDARD: Calculates a Boron difference of -12 ppm. COMMENTS:	**CRITICAL STEP** ___SAT ___UNSAT

STEP 11 Determine the Xenon Credit as follows (Step 2.8). STANDARD: Determines from Step 2.7 that SDM is maintained for Xenon Free conditions and N/A's step 2.8. COMMENTS:	___SAT ___UNSAT
STEP 12: Sign the appropriate space. STANDARD: Signs "Performed By" with today's date and time COMMENTS:	___SAT ___UNSAT
STEP 13: Calculate required Boron Concentration for adequate SDM at 140° F per Step 4 of ES-0.2. STANDARD: Determines required boron concentration to be 1348 ppm from step 2.7 of the SDM calculation plus an additional 150 ppm required in step 4 of ES-0.2 for a total required boron concentration of 1498 ppm. COMMENTS:	**CRITICAL STEP** ___SAT ___UNSAT
This JPM is complete	

TIME STOP: _____

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

C. Operator Actions

__ 1. **Monitor Enclosure 1 (Foldout Page).**

NOTE Preference should be given to running NC Pump 1B and then NC Pump 1A to provide Pzr spray capability.

2. **Attempt to start one NC pump as follows:**

a. Verify NC pump seal cooling has been maintained from one of the following:

__ • Seal injection flow

OR

__ • KC flow to thermal barrier.

a. Perform the following:

__ 1) Notify station management to perform a status evaluation prior to starting an NC pump.

__ 2) **GO TO** Step 3.

__ b. Establish conditions for starting an NC pump. **REFER TO** OP/1/A/6150/002A (Reactor Coolant Pump Operation).

__ b. **GO TO** Step 3.

c. **WHEN** conditions for starting an NC pump have been established, **THEN**:

__ 1) Start one NC pump.

__ 2) **GO TO** OP/1/A/6100/002 (Controlling Procedure For Unit Shutdown).

__ 1) **RETURN TO** step in effect.

__ 3. **Verify all CRD vent fans - ON.**

__ **Start all available CRD vent fans.**

4. **Borate NC System to Cold Shutdown boron concentration as follows:**

__ a. Perform shutdown margin calculation. **REFER TO** OP/0/A/6100/006 (Reactivity Balance Calculations).

__ b. Borate NC System to required value plus an additional 150 PPM.

PROCEDURE PROCESS RECORD

Revision No. 62

PREPARATION

(2) Station CATAWBA NUCLEAR STATION

(3) Procedure Title **Reactivity Balance Calculation**

(4) Prepared By D P Anderson Date 11/14/00

Additional Changes Included. ☒ Yes ☐ No Update Audit Review Date ☐ Yes ☒ No

(5) Requires 10CFR50.59 evaluation?
- ☐ Yes (New procedure or revision with major changes)
- ☒ No (Revision with minor changes)
- ☐ No (To incorporate previously approved changes)

(6) Reviewed By _____ (QR) Date 11/14/00

Cross-Disciplinary Review By MT Lee (QR) NA ____ Date 11/16/00

Reactivity Mgmt. Review By MT Lee (QR) NA ____ Date 11/16/00

(7) Additional Reviews

Reviewed By _____ Date _____

Reviewed By _____ Date _____

(8) Temporary Approval *(if necessary)*

By _____ (SRO/QR) Date _____

By _____ (QR) Date _____

(9) APPROVED BY _____ Date 11/16/00

PERFORMANCE (Compare with control copy at least once every 14 calendar days while work is being performed)

(10) Compared with Control Copy _____ Date _____

Compared with Control Copy _____ Date _____

Compared with Control Copy _____ Date _____

(11) Dates(s) Performed _____

Work Order Number (W/O #) _____

COMPLETION

(12) Procedure Completion Verification

- ☐ Yes ☐ N/A Check lists and/or blanks properly initialed, signed, dated, or filled in NA, as appropriate?
- ☐ Yes ☐ N/A Listed enclosures attached?
- ☐ Yes ☐ N/A Data sheets attached, completed, dated and signed?
- ☐ Yes ☐ N/A Charts, graphs, etc. attached and properly dated, identified and marked?
- ☐ Yes ☐ N/A Procedure requirements met?

Verified By _____ Date _____

(13) Procedure Completion Approved _____ Date _____

(14) Remarks *(attach additional pages, if necessary)*

INFORMATION ONLY

Removed option to use REACT to calculate modes 1 and 2 shutdown margin. The manual option is unchanged and will be used when performing Enclosure 4.3.

Duke Power Company
Catawba Nuclear Station

Reactivity Balance Calculation

Procedure No.
OP/0/A/6100/006

Revision No.
062

Electronic Reference No.
CN0092MR

Continuous Use

PERFORMANCE

PDF Format

Compare with Control Copy every 14 calendar days while work is being performed.

Compared with Control Copy _____ Date _____

Compared with Control Copy _____ Date _____

Compared with Control Copy _____ Date _____

COMPLETION

Yes	NA	
☐	☐	Checklists and/or blanks properly initialed, signed, dated, or filled in NA, as appropriate?
☐	☐	Listed enclosures attached?
☐	☐	Data sheets attached, completed, dated, and signed?
☐	☐	Charts, graphs, etc. attached and properly dated, identified, and marked?
☐	☐	Procedure requirements met?

Verified By _____ Date _____

Procedure Completion Approved _____ Date _____

Remarks (*attach additional pages, if necessary*)

Reactivity Balance Calculation

1. Purpose

1.1 To estimate critical NC System boron concentration before criticality based on other assumed core reactivity conditions.

1.2 To estimate critical control bank position before criticality based on other assumed core reactivity conditions.

1.3 To calculate shutdown margin in Modes 1 and 2 with UNTRIPPABLE RCCA's. (ITS 3.1.4)

1.4 To calculate the NC System boron concentration at which shutdown margin will NOT be met in Modes 2 (with K-eff < 1.0), 3, 4, and 5. (ITS 3.1.1)

1.5 To verify K-eff < 0.99 with shutdown banks withdrawn.

1.6 To calculate the NC System boron concentration at which refueling boron concentration will NOT be met in Mode 6. (ITS 3.9.1)

2. Limits and Precautions

NOTE: All curves/tables used in this procedure are found in Unit One (Two) Reactor Operating Data (R.O.D.) manual.

2.1 Ensure all data used by this procedure are for the correct unit.

2.2 NC System T-AVG should be maintained within ±1 °F of T-REF in Modes 1 and 2 to reduce uncertainties in calculations.

2.3 Shutdown margin (SDM) shall be ≥1000 pcm in Mode 5. (Tech Spec 3.1.1 and Enclosure 4.4)

2.4 SDM shall be ≥1300 pcm in Modes 1, 2, 3, and 4. (Tech Spec 3.1.1 and Enclosure 4.3, or 4.4)

2.5 Required refueling boron concentration is obtained from Tech Spec 3.9.1 and Enclosure 4.6.

2.6 IF T-AVG is <500 °F, credit for only 50% of xenon worth can be taken for verifying SDM.

2.7 NC System boron concentration shall be ≥ required boron concentration for SDM at a new NC System T-AVG before beginning NC System T-AVG changes in Modes 3, 4, and 5.

2.8 Criticality shall NOT be obtained outside the maximum window (±750 pcm) of estimated critical control bank position.

2.9 Desired critical control bank position shall NOT be below the control bank insertion limits OR above any temporary control bank withdrawal limits.

2.10 Verification of K-eff < 0.99 with shutdown banks withdrawn shall only be performed above 200 °F.

3. Procedure

3.1 For estimated critical NC System boron concentration (ECB), refer to Enclosure 4.1.

3.2 For estimated critical control bank position (ECP) refer to Enclosure 4.2.

3.3 For SDM calculation with untrippable RCCA's, refer to Enclosure 4.3.

3.4 For SDM verification in Modes 5, 4, 3, or 2 (with K-eff < 1.0), (with or without xenon credit), refer to Enclosure 4.4.

3.5 For Verification of K-eff < 0.99 with shutdown banks withdrawn, refer to Enclosure 4.5.

3.6 For refueling boron concentration verification in Mode 6, refer to Enclosure 4.6.

3.7 For instructions on running REACT computer program, refer to Enclosure 4.7.

3.8 For Shutdown Fission Product Correction Factor, refer to Enclosure 4.8.

4. Enclosures

4.1 Estimated Critical Boron Concentration (ECB).

4.2 Estimated Critical Control Bank Position (ECP).

4.3 Shutdown Margin - Modes 1 and 2 - Untrippable RCCA(s).

4.4 Shutdown Margin - (With or Without Xenon Credit).

4.5 Verification of K-eff < 0.99 with Shutdown Banks Withdrawn

4.6 Shutdown Boron Concentration - Mode 6.

4.7 REACT Computer Program Directions.

4.8 Shutdown Fission Product Correction Factor

1. Initial Conditions

1.1 Limits and Precautions have been reviewed.

2. Procedure

NOTE:
1. Assume all values are positive unless otherwise indicated by parentheses. **IF** parentheses precede the value [i.e.( )_____pcm], enter the sign provided with data. The calculations account for these sign conventions.
2. All ECB calculations must be performed independently by a Qualified Reactor Engineer and a Licensed Operator.

2.1 **IF** cycle burnup is > 12 EFPD, perform Enclosure 4.8 to determine Shutdown Fission Product Correction Factor.
Shutdown Fission Product Correction Factor _____ppm

2.2 Access Reactivity Balance Program per Enclosure 4.7.

2.3 Select "View" then "Reactivity Balance Calculations" on toolbar.

2.4 Select ECB (Estimated Critical Boron Concentration) tab in Reactivity Balance Calcu[redacted]

NOTE:
1. Sign must be provided with Difference from Equilibrium Samarium [i.e., ( ) _____ pcm].
2. **IF** cycle burnup is < 12 EFPD, 0 pcm should be used for Difference from Equilibrium Samarium.

2.5 Enter appropriate values as prompted.

2.6 Enter a desired critical rod position at least 1000 pcm above HZP Rod Insertion Limit (Section 2.2 of ROD Manual).

2.7 Click Calculate, print program results, label appropriately, and attach to this enclosure.

2.8 Ensure that separate, independent calculation has been performed per steps 2.1 through 2.7.

2.9 Verify that both attachments to this enclosure yield the same result.

Licensed Operator: _____ Date/Time: _____/_____

Reactor Engineer: _____ Date/Time: _____/_____

1. Initial Conditions

1.1 Limits and Precautions have been reviewed.

2. Procedure

NOTE:
1. Assume all values are positive unless otherwise indicated by parentheses. **IF** parentheses precede the value [i.e.( )_____pcm], enter the sign provided with data. The calculations account for these sign conventions.
2. All ECP calculations must be performed independently by a Qualified Reactor Engineer and a Licensed Operator.

2.1 **IF** cycle burnup is > 12 EFPD, perform Enclosure 4.8 to determine Shutdown Fission Product Correction Factor.
Shutdown Fission Product Correction Factor _____ppm

2.2 Access Reactivity Balance Program per Enclosure 4.7.

2.3 Select "View" then "Reactivity Balance Calculations" on toolbar.

2.4 Select ECP (Estimated Critical Control Bank Position) tab in Reactivity Balance Calculations window.

NOTE:
1. Sign must be provided with Difference from Equilibrium Samarium [i.e., ( ) _____ pcm].
2. **IF** cycle burnup is < 12 EFPD, 0 pcm should be used for Difference from Equilibrium Samarium.

2.5 Enter appropriate values as prompted.

2.6 Click Calculate and verify that Rod Insertion Limits and (if applicable) Rod Withdrawal Limits will **NOT** be violated based on ECP results.

2.7 Print program results, label appropriately, and attach to this enclosure.

2.8 Ensure that separate, independent calculation has been performed per steps 2.1 through 2.7.

2.9 Verify that both attachments to this enclosure yield the same results.

Licensed Operator:_____ Date/Time: _____/_____

Reactor Engineer: _____ Date/Time: _____/_____

Shutdown Margin - Untrippable RCCA(S) - Modes 1 & 2

1. Initial Conditions

1.1 Limits and Precautions have been reviewed.

2. Procedure

NOTE: 1. In Modes 1 or 2 with all RCCA's trippable, shutdown margin is satisfied provided control banks are positioned above the Control Rod Insertion limits in Section 2.2 of the R.O.D. manual (and if Unit shutdown occurs, T-COLD remains above the Allowable Moderator Temperature limit of Section 2.6 of the R.O.D. manual.)

2. Assume all values are positive unless otherwise indicated by parentheses. **IF** parentheses precede the value [i.e. ( )_____ pcm], record the sign provided with data. The calculations account for these sign conventions.

2.1 Determine the following information:

Step	Description	Reference	Value
2.1.1	Unit	N/A	
2.1.2	Date/Time	N/A	
2.1.3	Present Thermal Power, Best Estimate	P1385	%
2.1.4	Present cycle burnup	P1457 or Reactor Group Duty Engineer	EFPD
2.1.5	Present control bank position	N/A	_____ SWD on Control Bank_____
2.1.6	Number of untrippable RCCA(s)	N/A	
2.1.7	Untrippable RCCA(s) core locations(s).	N/A	

2.2 Determine available reactivity worth of trippable RCCA's for present conditions:

2.2.1 Determine Total Available Rod Worth (Section 5.7 of R.O.D. manual) _____ pcm

2.2.2 **IF** there are multiple untrippable RCCA's, N/A steps 2.2.3 and 2.2.4

2.2.3 Determine reactivity worth penalty for untrippable RCCA core location of Step 2.1.7 (Section 5.8 of R.O.D. manual). _____ pcm

2.2.4 N/A steps 2.2.5 through 2.2.8.

2.2.5 Determine untrippable RCCA of Step 2.1.7 with the highest reactivity worth penalty(Section 5.8 of ROD Manual). Core Location _____

2.2.6 Record reactivity worth of the untrippable RCCA of Step 2.2.5 (Section 5.8 of ROD Manual). _____ pcm

2.2.7 Determine maximum stuck rod worth during cycle (Section 5.7 of the R.O.D. manual). _____ pcm

2.2.8 Calculate total untrippable RCCA reactivity worth penalty for multiple untrippable RCCA's per the table below.

Description	Reference	Value
A.Number of Untrippable RCCA's	Step 2.1.6	
B.Additional Penalty (Max Stuck Rod)	Step 2.2.7	pcm
C. Highest Penalty	Step 2.2.6	pcm
Total untrippable RCCA Worth Penalty for Multiple RCCA's	**{ [(A) - 1] X (B) } + (C)**	**pcm**

2.2.9 Record Total Untrippable RCCA Penalty from Step 2.2.3 or Step 2.2.8, whichever is applicable. _____ pcm

NOTE: Interpolation is not required in step 2.2.10. Reactivity worth may be determined by choosing the highest reactivity worth from Section 5.6 of the R.O.D Manual associated with rod positions that bound the present rod position.

2.2.10 Use present control bank position of Step 2.1.5 to look up specified data from Section 5.6 of ROD Manual and calculate inserted reactivity worth as follows:

(_____ pcm + _____ pcm) x 0.5 =_____ pcm
(HZP, No Xenon) (HZP, Peak Xenon)

2.2.11 Calculate available reactivity worth of trippable RCCA's:

Description	Reference	Value
A. Total Available Rod Worth	Step 2.2.1	pcm
B. Untrippable RCCA's Penalty	Step 2.2.9	pcm
C. Inserted Worth of Present Position	Step 2.2.10	pcm
Available Worth of Trippable RCCA's	(A) - (B) - (C)	pcm

NOTE: Interpolation of Power Defect is not required for step 2.3. Bounding burnups and power levels may be used to select the highest Power Defect from section 5.9 of the R.O.D. manual.

2.3 Determine worst case power defect for present conditions:

Description	Reference	Value
A. Total Power Defect at present thermal power (Step 2.1.3) and cycle burnup (Step 2.1.4)	Section 5.9 of R.O.D. manual	Pcm
B. Transient Flux Redistribution Allowance	Section 5.7 of R.O.D. manual	Pcm
Worst case power defect for present conditions:	**(A) + (B)**	**Pcm**

CAUTION: SDM shall be within the limits specified by the COLR per Tech Spec 3.1.1.

2.4 Calculate SDM for present conditions:

Description	Reference	Value
A. Available worth of Trippable RCCA's	Step 2.2.11	pcm
B. Worst Case Power Defect	Step 2.3	pcm
Present SDM	**(A) - (B)**	**( ) pcm**

NOTE: Separate, independent calculation must be performed by the verifier.

2.5 Sign the appropriate space below. N/A the unsigned space.

Performed By: _____ Date/Time: _____/_____

Verified By: _____ Date/Time: _____/_____

1. Initial Conditions

✓ 1.1 Limits and Precautions have been reviewed.

2. Procedure

2.1 IF performing a MANUAL calculation, N/A Step 2.2 (including all substeps).

N/A 2.2 Perform the following steps if using the REACT program to complete the calculation:

2.2.1 Access Reactivity Balance Program per Enclosure 4.7.

2.2.2 Select "View" then "Reactivity Balance Calculations" on toolbar.

NOTE: "SDM – Mode 5, 4, or 3" option also applies to Mode 2 with K-eff < 1.0.

2.2.3 Select "SDM – Mode 5, 4, or 3" tab in Reactivity Balance Calculations window.

NOTE:
1. Sign must be provided with Difference from Equilibrium Samarium [i.e., ( ) ___ pcm].
2. IF cycle burnup is < 12 EFPD, 0 pcm should be used for Difference from Equilibrium Samarium.
3. In REACT, "Inoperable RCCAs" refers to untrippable RCCAs.
4. Rod locations are put in REACT in a text only format (e.g. B12 or B-12). REACT uses the maximum stuck rod worth for all known untrippable control rods.

2.2.4 Enter appropriate values as prompted.

2.2.5 Click Calculate, print program results, label appropriately, and attach to this enclosure.

2.2.6 Compare required boron concentration to present boron concentration.

2.2.7 **IF** Xenon Credit was selected **AND** a potential boron deficit is indicated in the calculation results, complete the following steps:

A. Record "Adjusted SDM Deficit" from Reacivity Balance Calculation output:

_____pcm

B. Select "View" then "Xenon/Samarium Calculations" on toolbar.

N/A

C. Select "Xenon" for Isotope and "Transient Prediction" for Calculation Type.

D. Enter initial concentrations. These can be obtained from the OAC or Reactor Engineering. The OAC point id's for these concentrations are C1(2)P0125 and C1(2)P0124.

E. Enter appropriate power history.

F. Print program results, label appropriately, and attach to this enclosure.

NOTE: Adequate SDM exists when Xenon worth from Xenon predict calculation equals or exceeds adjusted SDM deficit recorded in step 2.2.7.A.

2.2.8 Ensure that a separate, independent calculation has been performed per steps 2.2.1 through 2.2.7.

2.2.9 Verify that both attachments to this enclosure yield the same results.

2.2.10 N/A the rest of this enclosure (steps 2.3 through 2.9).

Performed By: _____ Date/Time: _____/_____

Verified By: _____ Date/Time: _____/_____

NOTE: Assume all values are positive unless otherwise indicated by parentheses. **IF** parentheses precede the value [i.e. ( )_____ pcm], record the sign provided with data. The calculations account for these sign conventions.

2.3 Determine the following information:

Step	Description	Reference	Value	
2.3.1	Unit	N/A	1	1
2.3.2	Date/Time	N/A		PRESENT
2.3.3	Present NC System Boron Conc	N/A	1360 ppm	1360
2.3.4	Present NC System T-AVG	N/A	557 °F	557
2.3.5	Desired NC System T-AVG	N/A	140 °F	140
2.3.6	Present cycle burnup	P1457 or Reactor Group Duty Engineer	10 EFPD	10
2.3.7	Present Difference from Equilibrium Samarium Worth (use 0 pcm if burnup is ≤ 12 EFPD)	P1475 or Reactor Group Duty Engineer	( ) 0 pcm	0
2.3.8	Date and time of latest valid Iodine and Xenon concentrations. N/A if xenon free.	Reactor Group Duty Engineer or current time if using OAC	N/A	N/A
2.3.9	Iodine concentration at time listed in step 2.3.8; 0 if xenon free.	P0124 or Reactor Group Duty Engineer	0 atm/cc	0
2.3.10	Xenon concentration at time listed in step 2.3.8; 0 if xenon free.	P0125 or Reactor Group Duty Engineer	0 atm/cc	0

NOTE: Interpolation is not required for step 2.4. Bounding temperatures and burnups may be used to select the highest boron concentration in Section 5.11 of R.O.D manual.

2.4 Select the highest boron concentration for the T-AVG's between the range of Step 2.3.4 and Step 2.3.5 at current cycle burnup (Step 2.3.6) in Section 5.11 of the R.O.D. manual. {PIP 0-C99-0318} 1348 ppm

2.5 Calculate additional boron concentration penalties:

2.5.1 Calculate untrippable RCCA penalty:

Description	Reference	Value
A. Number of Untrippable RCCA(s) not fully inserted	N/A	0
B. Boron Penalty per Untrippable rod	N/A	160 ppm
Untrippable RCCA Penalty	(A) X (B)	0 ppm

2.5.2 Enter Zero Power Physics Testing penalty; 100 ppm if physics testing is not complete, otherwise, enter 0 ppm. 0 ppm

2.5.3 Calculate total additional boron concentration penalty:

Description	Reference	Value
A. Untrippable RCCA Penalty	Step 2.5.1	0 ppm
B. Additional Boron Conc Penalty for ZPPT	Step 2.5.2	0 ppm
Total Boron Penalty	**(A) + (B)**	0 ppm

2.6 Calculate total required boron concentration for SDM:

Description	Reference	Value
A. Required SDM Boron	Step 2.4	1348 ppm
B. Total Boron Penalty	Step 2.5.3	0 ppm
Total Required Boron Concentration for SDM (Xenon Free)	**(A) + (B)**	1348 ppm

2.7 Determine the Boron Difference between Required Boron Concentration for SDM and current NC System boron concentration.

Description	Reference	Value
A. Total Required Boron Concentration for SDM	Step 2.6	1348 ppm
B. Present NC System Boron Concentration	Step 2.3.3	1360 ppm
Boron Difference	**(A) - (B)**	-12 ppm

NOTE: A negative boron difference in Step 2.7 implies that SDM is maintained for Xenon free conditions. A positive boron difference means that SDM is maintained using a Xenon credit and/or boration. {0-C99-0318}

2.7.1 **IF** Boron Difference (Step 2.7) is negative, N/A Step 2.8.

2.8 Determine the Xenon Credit as follows:

> **NOTE:** Interpolation is not required for step 2.8.1. Bounding NC System T-AVG and cycle burnup may be used to select the highest Differential Boron Worth from Section 5.3 of R.O.D manual.

2.8.1 Determine the ARI, Differential Boron Worth at lower T-AVG of Step 2.3.4 or 2.3.5 **AND** cycle burnup of step 2.3.6 from Section 5.3 of the R.O.D. manual. _____ pcm/ppm

2.8.2 Calculate the reactivity worth of the boron difference:

Description	Reference	Value
A. Boron Difference	Step 2.7	ppm
B. ARI Differential Boron Worth	Step 2.8.1	pcm/ppm
Reactivity Worth of Boron Difference	**(A) X (B)**	**pcm**

2.8.3 Calculate the xenon worth that is required to ensure SDM at the present NC System boron.

A. **IF** T-AVG is $\geq$ 500 ° F, calculate the Xenon Worth as follows:

Description	Reference	Value
A. Reactivity Worth	Step 2.8.2	pcm
B. Difference from Eq Sm Worth	Step 2.3.7	( ) pcm
Xenon Worth	**{(A) - (B)} / 0.85**	**pcm**

B. **IF** T-AVG is < 500 ° F, calculate the Xenon Worth as follows:

Description	Reference	Value
A. Reactivity Worth	Step 2.8.2	pcm
B. Difference from Eq Sm Worth	Step 2.3.7	( ) pcm
Xenon Worth	**{(A) - (B)} X 2**	**pcm**

2.8.4 Predict Xenon for approximately two days into the future using OAC Xenon Predict Program or REACT program (per Enclosure 4.7) and data from 2.3.1 through 2.3.10.

NOTE: SDM is ensured between the Dates/Times of step 2.8.5 at the present NC System boron or higher. After the Date/Time of xenon decay of step 2.8.5, NC System boration will be required to maintain SDM.

N/A 2.8.5 Interpolate the Dates/Times from the xenon predict of step 2.8.4 that equal the xenon worth of step 2.8.3.

xenon build-in _____/_____

xenon decay _____/_____

NOTE: Separate, independent calculation must be performed by the verifier.

2.9 Sign the appropriate space below. N/A the unsigned space.

Performed By: _____ Date/Time: _____/_____

Verified By: _____ Date/Time: _____/_____

Verification of K-eff < 0.99 With Shutdown Banks Withdrawn

1. Initial Conditions

1.1 Limits and Precautions have been reviewed.

2. Procedure

NOTE: Assume all values are positive unless otherwise indicated by parentheses. IF parentheses precede the value [i.e.( )_____pcm], enter the sign provided with data. The calculations account for these sign conventions.

2.1 IF cycle burnup is > 12 EFPD, perform Enclosure 4.8 to determine Shutdown Fission Product Correction Factor.

Shutdown Fission Product Correction Factor _____ppm

2.2 Access Reactivity Balance Program per Enclosure 4.7.

2.3 Select "View" then "Reactivity Balance Calculations" on toolbar.

2.4 Select "Mode 3 Verification" tab in Reactivity Balance Calculations window.

NOTE:
1. Sign must be provided with Difference from Equilibrium Samarium [i.e.( )_____pcm].
2. IF cycle burnup is < 12 EFPD, 0 pcm should be used for Difference from Equilibrium Samarium.

2.5 Enter appropriate values as prompted.

2.6 Click calculate, print program results, label appropriately, and attach to this enclosure.

2.7 Compare current boron concentration to required.

2.8 Ensure that separate, independent calculation has been performed per steps 2.1 through 2.7.

2.9 Verify that attachments to this enclosure yield the same result.

Performed By: _____ Date/Time: _____/_____

Verified By: _____ Date/Time: _____/_____

1. Initial Conditions

1.1 Limits and Precautions have been reviewed.

2. Procedure

2.1 Determine present boron concentration of the operating ND train. _____ ppm

2.2 Record Tech Spec Refueling Boron Concentration from bottom of page of Section 5.11 of the R.O.D. manual. _____ ppm

2.3 Verify present boron concentration of Step 2.1 is greater than refueling boron concentration of Step 2.2.

NOTE: Separate, independent calculation must be performed by the verifier.

2.4 Sign the appropriate space below. N/A the unsigned space.

Performed By: _____ Date/Time: _____/_____

Verified By: _____ Date/Time: _____/_____

1. Initial Conditions

1.1 Limits and Precautions have been reviewed.

2. Procedure

NOTE: The following steps assume the use of the BOP PC located in the control room horseshoe.

2.1 Select (Double-Click) the Reactivity Balance icon on the desktop.

CAUTION: Check all inputs carefully and correct as needed before calculating results. Ensure the correct Unit is specified.

2.2 Select an option as directed by the procedure. Input data appropriately where prompted. Hit the tab key or use left mouse button to move from one item to the next.

2.3 Once the "Calculate" button is left clicked, results will be displayed. The program output can then be printed by clicking on "File" followed by "Print".

2.4 When finished using program, select "File" and "Exit" or left click on x in upper right corner.

1. Initial Conditions

1.1 Limits and Precautions have been reviewed.

2. Procedure

2.1 IF no previous Unit Trip/Shutdown has occurred in the last 3 EFPD, determine the Shutdown Fission Product Correction Factor as follows:

Description	Reference	Value
A. Date/Time of Unit Trip or Shutdown:	Control Room Log Books	_____/_____
B. Date/Time of anticipated Unit Startup:	N/A	_____/_____
C. Duration of Shutdown	(B) - (A)	hours
D. Shutdown Fission Product Correction Factor(using duration from 2.1.C)	**ROD Manual (Sec 5.13)**	ppm

2.1.1 N/A Steps 2.2 and 2.3.

2.2 IF previous Unit Trip/Shutdown has occurred in the last 1 EFPD, perform the following:

Description	Reference	Value
A. Date/Time of previous Unit Trip or Shutdown:	Control Room Log Books	_____/_____
B. Date/Time of anticipated Unit Startup:	N/A	_____/_____
C. Duration of Shutdown	(B) - (A)	hours
D. Shutdown Fission Product Correction Factor (using duration from 2.2.C)	**ROD Manual (Sec 5.13)**	ppm

2.2.1 N/A Step 2.3

2.3 IF there has been 1 to 3 EFPD of burnup between present Unit Trip/Shutdown and previous Unit Trip/Shutdown, perform the following:

Description	Reference	Value
A. Date/Time of Unit Trip or Shutdown:	Control Room Log Books	_____/_____
B. Date/Time of anticipated Unit Startup:	N/A	_____/_____
C. Duration of Shutdown	(B) - (A)	hours
D. Shutdown Fission Product Correction Factor - Present Shutdown (using duration from 2.3.C)	**ROD Manual (Sec 5.13)**	**ppm**

2.3.1 IF duration of shutdown from 2.3.C is > 72 hours Shutdown Fission Product Correction Factor is as shown in Step 2.3.D.

A. N/A Step 2.3.2.

2.3.2 IF duration from 2.3.C is < 72 hours perform the following:

Description	Reference	Value
A. Date/Time of previous Unit Trip or Shutdown:	Control Room Log Books	_____/_____
B. Date/Time of previous Unit Startup:	Control Room Log Books	_____/_____
C. Duration of Previous Shutdown	(B) - (A)	hours
D. Shutdown Fission Product Correction Factor - Previous Shutdown (using duration from 2.3.2.C)	ROD Manual (Sec 5.13)	ppm
E. Shutdown Fission Product Correction Factor	**(2.3.2.D) * 0.5 + (2.3.D)**	**ppm**

2.4 Ensure that separate, independent calculation has been performed and yields the same result.

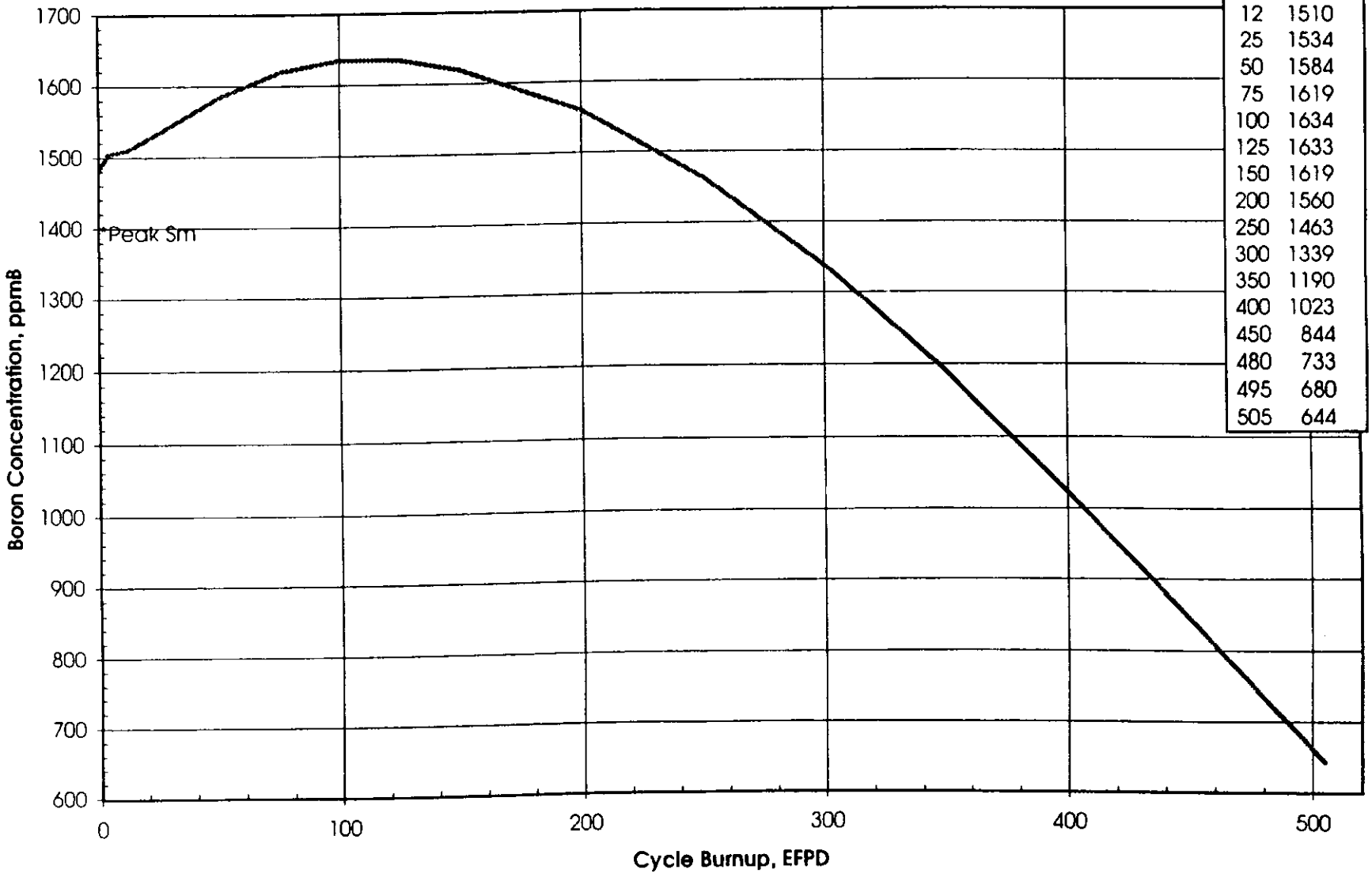
Performed By: _____ Date/Time: _____/_____

Verified By: _____ Date/Time: _____/_____

Source: CNEI-0400-26
Prepared by: M.W. Hawes
Revision Number: 306
Date: 11/16/00

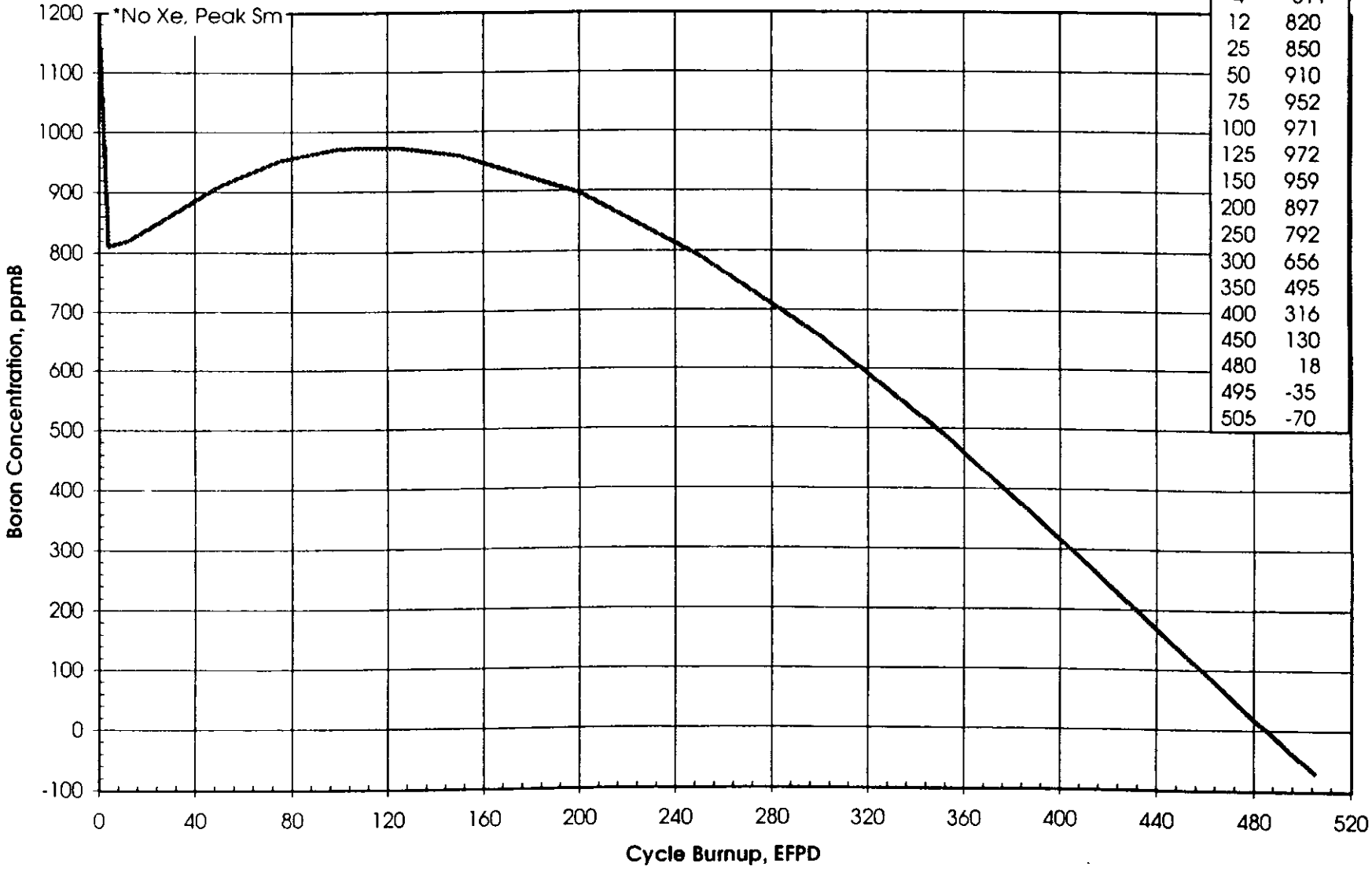
UNIT ONE
REACTOR OPERATING DATA
SECTION 5.1
HZP CRITICAL BORON CONCENTRATION
(ARO, NO XE, EQ SM)

EFPD	PPMB
0*	1481
4	1504
12	1510
25	1534
50	1584
75	1619
100	1634
125	1633
150	1619
200	1560
250	1463
300	1339
350	1190
400	1023
450	844
480	733
495	680
505	644



Source: CNEI-0400-26
Prepared by: MW Hawes
Revision Number: 306
Date: 11/16/00

UNIT ONE
REACTOR OPERATING DATA
SECTION 5.2
HFP CRITICAL BORON CONCENTRATION
(ARO, EQ XE, EQ SM)



EFPD	PPMB
0*	1196
4	811
12	820
25	850
50	910
75	952
100	971
125	972
150	959
200	897
250	792
300	656
350	495
400	316
450	130
480	18
495	-35
505	-70

UNIT ONE
REACTOR OPERATING DATA
SECTION 5.3
ARI DIFFERENTIAL BORON WORTH

Source: CNEI-0400-26
Prepared By: M.W. Hawes
Revision Number: 306
Date: 11/16/00

BURNUP	TEMPERATURE (deg F)															
(EFPD)	68	100	150	200	250	300	350	400	450	500	510	520	530	540	550	557
0	-9.25	-9.20	-9.07	-8.91	-8.67	-8.43	-8.17	-7.91	-7.59	-7.26	-7.18	-7.10	-7.02	-6.94	-6.87	-6.81
20	-9.25	-9.20	-9.07	-8.91	-8.66	-8.41	-8.15	-7.89	-7.57	-7.24	-7.16	-7.08	-7.00	-6.92	-6.84	-6.78
40	-9.25	-9.20	-9.07	-8.91	-8.65	-8.39	-8.13	-7.87	-7.55	-7.22	-7.14	-7.06	-6.98	-6.90	-6.81	-6.76
60	-9.26	-9.21	-9.07	-8.91	-8.64	-8.38	-8.12	-7.86	-7.53	-7.20	-7.12	-7.04	-6.95	-6.87	-6.79	-6.73
80	-9.26	-9.21	-9.07	-8.91	-8.63	-8.36	-8.10	-7.84	-7.51	-7.18	-7.10	-7.01	-6.93	-6.85	-6.76	-6.71
100	-9.26	-9.21	-9.07	-8.91	-8.62	-8.34	-8.08	-7.82	-7.49	-7.16	-7.08	-6.99	-6.91	-6.82	-6.74	-6.68
120	-9.30	-9.25	-9.11	-8.95	-8.66	-8.37	-8.11	-7.85	-7.52	-7.18	-7.10	-7.02	-6.93	-6.85	-6.77	-6.71
140	-9.35	-9.30	-9.16	-8.99	-8.70	-8.40	-8.14	-7.88	-7.55	-7.21	-7.13	-7.04	-6.96	-6.88	-6.79	-6.74
160	-9.40	-9.35	-9.21	-9.04	-8.75	-8.45	-8.19	-7.93	-7.59	-7.25	-7.17	-7.08	-7.00	-6.92	-6.84	-6.78
180	-9.46	-9.41	-9.27	-9.09	-8.81	-8.52	-8.26	-7.99	-7.65	-7.31	-7.23	-7.14	-7.06	-6.98	-6.89	-6.83
200	-9.52	-9.46	-9.32	-9.15	-8.87	-8.59	-8.32	-8.06	-7.71	-7.37	-7.29	-7.20	-7.12	-7.03	-6.95	-6.89
220	-9.58	-9.52	-9.38	-9.21	-8.93	-8.65	-8.38	-8.12	-7.77	-7.43	-7.35	-7.26	-7.18	-7.09	-7.01	-6.95
240	-9.64	-9.58	-9.44	-9.26	-8.99	-8.72	-8.45	-8.18	-7.83	-7.49	-7.40	-7.32	-7.23	-7.15	-7.06	-7.00
260	-9.72	-9.66	-9.52	-9.34	-9.07	-8.80	-8.53	-8.26	-7.91	-7.57	-7.48	-7.39	-7.31	-7.22	-7.13	-7.07
280	-9.84	-9.77	-9.63	-9.45	-9.17	-8.90	-8.63	-8.35	-8.00	-7.65	-7.57	-7.48	-7.40	-7.31	-7.22	-7.16
300	-9.95	-9.88	-9.74	-9.55	-9.28	-9.00	-8.73	-8.45	-8.10	-7.75	-7.66	-7.57	-7.48	-7.40	-7.31	-7.25
320	-10.05	-10.00	-9.85	-9.66	-9.38	-9.10	-8.82	-8.55	-8.19	-7.83	-7.75	-7.66	-7.57	-7.49	-7.40	-7.34
340	-10.16	-10.11	-9.96	-9.77	-9.48	-9.20	-8.92	-8.64	-8.28	-7.92	-7.84	-7.75	-7.66	-7.57	-7.49	-7.43
360	-10.29	-10.23	-10.08	-9.89	-9.60	-9.32	-9.04	-8.75	-8.39	-8.03	-7.94	-7.86	-7.77	-7.68	-7.59	-7.53
380	-10.44	-10.38	-10.23	-10.03	-9.74	-9.45	-9.17	-8.88	-8.52	-8.16	-8.07	-7.98	-7.89	-7.80	-7.71	-7.65
400	-10.59	-10.52	-10.37	-10.18	-9.88	-9.59	-9.30	-9.01	-8.65	-8.28	-8.19	-8.10	-8.01	-7.92	-7.83	-7.76
420	-10.73	-10.67	-10.52	-10.32	-10.02	-9.73	-9.44	-9.15	-8.77	-8.40	-8.31	-8.22	-8.13	-8.04	-7.95	-7.88
440	-10.88	-10.82	-10.66	-10.46	-10.16	-9.86	-9.57	-9.27	-8.90	-8.53	-8.44	-8.34	-8.25	-8.16	-8.07	-8.00
460	-11.04	-10.98	-10.82	-10.61	-10.33	-10.06	-9.74	-9.42	-9.04	-8.67	-8.57	-8.47	-8.37	-8.27	-8.18	-8.11
480	-11.21	-11.15	-10.98	-10.78	-10.54	-10.31	-9.94	-9.57	-9.19	-8.82	-8.71	-8.60	-8.49	-8.39	-8.28	-8.20
495	-11.33	-11.27	-11.11	-10.91	-10.70	-10.49	-10.09	-9.68	-9.31	-8.93	-8.82	-8.70	-8.59	-8.47	-8.35	-8.27
505	-11.42	-11.36	-11.19	-10.99	-10.80	-10.62	-10.19	-9.76	-9.38	-9.01	-8.89	-8.77	-8.65	-8.53	-8.40	-8.32

Note: Calculated at the ARI critical boron concentration for each temperature and burnup.

Source: CNEI-0400-26, C1C13 SOR
Prepared by: MW Hawes
Revision Number: 306
Date: 11/16/00

UNIT ONE
REACTOR OPERATING DATA
SECTION 5.4
HZP DIFFERENTIAL BORON WORTH

Cycle Burnup (EFPD)	Critical Boron Concentration (PPMB)	Differential Boron Worth (PCM/PPMB)
0*	1481	-6.41
4	1504	-6.41
12	1510	-6.40
25	1534	-6.39
50	1584	-6.37
75	1619	-6.38
100	1634	-6.40
125	1633	-6.43
150	1619	-6.47
200	1560	-6.58
250	1463	-6.72
300	1339	-6.88
350	1190	-7.07
400	1023	-7.29
450	844	-7.53
480	733	-7.69
495	680	-7.76
505	644	-7.79

*Peak Samarium

Source: CNEI-0400-26, C1C13 SOR
Prepared By: MW Hawes
Revision Number 306
Date: 11/16/00

UNIT ONE
REACTOR OPERATING DATA
SECTION 5.5
HFP DIFFERENTIAL BORON WORTH

(HFP, ARO, Eq Xe, Eq Sm)

Cycle Burnup (EFPD)	Critical Boron Concentration (PPMB)	Differential Boron Worth (PCM/PPMB)	ITC (PCM/°F)
0*	1196	-6.15	-17.45
4	811	-6.15	-20.40
12	820	-6.15	-20.25
25	850	-6.13	-19.84
50	910	-6.11	-19.20
75	952	-6.12	-18.96
100	971	-6.14	-19.07
125	972	-6.18	-19.44
150	959	-6.23	-19.99
200	897	-6.35	-21.56
250	792	-6.51	-23.71
300	656	-6.67	-26.27
350	495	-6.88	-29.18
400	316	-7.15	-32.37
450	130	-7.45	-35.68
480	18	-7.65	-37.74
495	-35	-7.74	-38.44
505	-70	-7.78	-38.64

* No Xenon, Peak Samarium

Source: CNEI-0400-26
Prepared by: M.W. Hawes
Revision Number: 306
Date: 11/16/00

UNIT ONE
REACTOR OPERATING DATA
SECTION 5.6
INTEGRAL ROD WORTH IN OVERLAP

Integral Rod Worth in Overlap
HZP, No Xenon

Control Bank Position Steps Withdrawn				50 EFPD	150 EFPD	250 EFPD	350 EFPD	450 EFPD
				0 - 100 EFPD	101 - 200 EFPD	201 - 300 EFPD	301 - 400 EFPD	401 - 505 EFPD
Bk A	Bk B	Bk C	Bk D	IRW (PCM)	IRW (PCM)	IRW (PCM)	IRW (PCM)	IRW (PCM)
226	226	226	226	0	0	0	0	0
226	226	226	225	1	1	1	3	4
226	226	226	220	6	6	9	15	24
226	226	226	215	11	10	16	28	44
226	226	226	210	16	15	24	41	64
226	226	226	205	31	30	46	71	101
226	226	226	200	46	45	67	101	139
226	226	226	195	61	59	89	131	177
226	226	226	190	75	74	111	161	214
226	226	226	185	95	94	135	190	245
226	226	226	180	115	114	160	220	276
226	226	226	175	135	134	185	249	307
226	226	226	170	155	154	210	278	338
226	226	226	165	177	175	231	300	359
226	226	226	160	198	195	253	322	379
226	226	226	155	220	216	275	344	400
226	226	226	150	241	236	297	366	420
226	226	226	145	264	256	315	382	435
226	226	226	140	286	276	333	399	450
226	226	226	135	308	296	351	415	465
226	226	226	130	330	316	369	432	480
226	226	226	125	352	335	384	443	489
226	226	226	120	373	353	399	455	498
226	226	226	116	391	368	411	464	505
226	226	226	110	416	390	429	478	515
226	226	221	105	440	411	449	501	546
226	226	216	100	464	432	468	524	576
226	226	211	95	494	461	504	574	643
226	226	206	90	525	490	539	625	709
226	226	201	85	555	519	575	675	776

Source: CNEI-0400-26
Prepared by: M.W. Hawes
Revision Number: 306
Date: 11/16/00

UNIT ONE
REACTOR OPERATING DATA
SECTION 5.6
INTEGRAL ROD WORTH IN OVERLAP

Integral Rod Worth in Overlap
HZP, No Xenon

Control Bank Position Steps Withdrawn				50 EFPD	150 EFPD	250 EFPD	350 EFPD	450 EFPD
				0 - 100 EFPD	101 - 200 EFPD	201 - 300 EFPD	301 - 400 EFPD	401 - 505 EFPD
Bk A	Bk B	Bk C	Bk D	IRW (PCM)	IRW (PCM)	IRW (PCM)	IRW (PCM)	IRW (PCM)
226	226	196	80	586	547	610	726	842
226	226	191	75	622	583	654	783	909
226	226	186	70	658	619	698	841	975
226	226	181	65	694	655	742	899	1041
226	226	176	60	730	691	785	956	1108
226	226	171	55	768	730	828	1004	1156
226	226	166	50	806	769	870	1051	1205
226	226	161	45	844	808	912	1099	1254
226	226	156	40	882	847	954	1146	1302
226	226	151	35	921	886	994	1187	1341
226	226	146	30	959	924	1035	1228	1381
226	226	141	25	998	963	1075	1269	1420
226	226	136	20	1036	1002	1116	1309	1459
226	226	131	15	1077	1043	1154	1345	1490
226	226	126	10	1119	1084	1193	1382	1521
226	226	121	5	1160	1125	1232	1418	1552
226	226	116	0	1201	1166	1270	1454	1583
226	226	110	0	1226	1191	1294	1476	1601
226	221	105	0	1260	1225	1324	1504	1631
226	216	100	0	1294	1258	1354	1532	1661
226	211	95	0	1333	1298	1391	1573	1711
226	206	90	0	1373	1338	1429	1613	1762
226	201	85	0	1412	1378	1467	1653	1812
226	196	80	0	1452	1418	1504	1694	1862
226	191	75	0	1496	1464	1550	1740	1915
226	186	70	0	1540	1510	1597	1787	1968
226	181	65	0	1585	1555	1643	1834	2021
226	176	60	0	1629	1601	1689	1881	2074
226	171	55	0	1674	1649	1738	1928	2117
226	166	50	0	1719	1697	1787	1975	2160

UNIT ONE
REACTOR OPERATING DATA
SECTION 5.6
INTEGRAL ROD WORTH IN OVERLAP

Integral Rod Worth in Overlap
HZP, No Xenon

Control Bank Position Steps Withdrawn				50 EFPD	150 EFPD	250 EFPD	350 EFPD	450 EFPD
				0 - 100 EFPD	101 - 200 EFPD	201 - 300 EFPD	301 - 400 EFPD	401 - 505 EFPD
Bk A	Bk B	Bk C	Bk D	IRW (PCM)	IRW (PCM)	IRW (PCM)	IRW (PCM)	IRW (PCM)
226	161	45	0	1764	1744	1836	2022	2203
226	156	40	0	1810	1792	1885	2069	2246
226	151	35	0	1854	1834	1929	2107	2275
226	146	30	0	1898	1876	1972	2144	2305
226	141	25	0	1943	1919	2016	2182	2334
226	136	20	0	1987	1961	2060	2219	2363
226	131	15	0	2024	1997	2090	2242	2381
226	126	10	0	2061	2032	2121	2266	2399
226	121	5	0	2097	2068	2151	2289	2416
226	116	0	0	2134	2104	2182	2312	2434
226	110	0	0	2156	2125	2200	2326	2445
221	105	0	0	2186	2151	2223	2349	2473
216	100	0	0	2215	2176	2245	2372	2501
211	95	0	0	2250	2208	2276	2411	2550
206	90	0	0	2285	2239	2307	2451	2600
201	85	0	0	2319	2270	2337	2490	2649
196	80	0	0	2354	2301	2368	2529	2698
191	75	0	0	2392	2337	2404	2571	2744
186	70	0	0	2431	2373	2441	2613	2790
181	65	0	0	2469	2409	2477	2655	2835
176	60	0	0	2507	2445	2513	2697	2881
171	55	0	0	2546	2482	2550	2733	2914
166	50	0	0	2584	2518	2588	2770	2947
161	45	0	0	2623	2555	2625	2806	2980
156	40	0	0	2662	2591	2662	2843	3014
151	35	0	0	2697	2624	2694	2871	3035
146	30	0	0	2733	2657	2727	2899	3057
141	25	0	0	2768	2690	2759	2927	3079
136	20	0	0	2803	2723	2791	2955	3101
131	15	0	0	2831	2751	2817	2975	3115

UNIT ONE
REACTOR OPERATING DATA
SECTION 5.6
INTEGRAL ROD WORTH IN OVERLAP

Integral Rod Worth in Overlap
HZP, No Xenon

Control Bank Position Steps Withdrawn				50 EFPD	150 EFPD	250 EFPD	350 EFPD	450 EFPD
				0 - 100 EFPD	101 - 200 EFPD	201 - 300 EFPD	301 - 400 EFPD	401 - 505 EFPD
Bk A	Bk B	Bk C	Bk D	IRW (PCM)	IRW (PCM)	IRW (PCM)	IRW (PCM)	IRW (PCM)
126	10	0	0	2859	2779	2843	2995	3129
121	5	0	0	2887	2808	2868	3015	3143
116	0	0	0	2914	2836	2894	3034	3156
110	0	0	0	2931	2853	2910	3046	3165
105	0	0	0	2950	2872	2926	3057	3171
100	0	0	0	2969	2892	2942	3067	3177
95	0	0	0	2987	2910	2956	3074	3181
90	0	0	0	3005	2929	2970	3082	3186
85	0	0	0	3023	2948	2984	3089	3190
80	0	0	0	3041	2967	2998	3097	3195
75	0	0	0	3056	2982	3009	3101	3196
70	0	0	0	3070	2997	3020	3105	3198
65	0	0	0	3084	3012	3031	3109	3200
60	0	0	0	3099	3027	3042	3114	3202
55	0	0	0	3108	3037	3048	3116	3202
50	0	0	0	3118	3047	3055	3118	3203
45	0	0	0	3127	3058	3062	3120	3203
40	0	0	0	3137	3068	3069	3121	3203
35	0	0	0	3142	3073	3072	3123	3204
30	0	0	0	3147	3078	3076	3125	3205
25	0	0	0	3152	3083	3079	3126	3205
20	0	0	0	3156	3088	3082	3128	3206
15	0	0	0	3158	3090	3083	3128	3206
10	0	0	0	3160	3092	3085	3128	3206
5	0	0	0	3162	3094	3086	3128	3206
0	0	0	0	3164	3096	3087	3128	3206

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Prepared by: M.W. Hawes
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UNIT ONE
REACTOR OPERATING DATA
SECTION 5.6
INTEGRAL ROD WORTH IN OVERLAP

Integral Rod Worth in Overlap
HZP, No Xenon

Control Bank Position	Shutdown Bank Position Steps Withdrawn					50 EFPD 0 - 100 EFPD IRW (PCM)	150 EFPD 101 - 200 EFPD IRW (PCM)	250 EFPD 201 - 300 EFPD IRW (PCM)	350 EFPD 301 - 400 EFPD IRW (PCM)	450 EFPD 401 - 505 EFPD IRW (PCM)
	SD E	SD D	SD C	SD B	SD A					
226	226	226	226	226	226	0	0	0	0	0
0	226	226	226	226	226	3164	3096	3087	3128	3206
0	0	226	226	226	226	3930	3955	3988	4040	4099
0	0	0	226	226	226	4636	4572	4565	4617	4710
0	0	0	0	226	226	5520	5275	5202	5258	5390
0	0	0	0	0	226	6694	6324	6196	6246	6391
0	0	0	0	0	0	6882	6488	6350	6412	6589

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Prepared by: M.W. Hawes
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UNIT ONE
REACTOR OPERATING DATA
SECTION 5.6
INTEGRAL ROD WORTH IN OVERLAP

Integral Rod Worth in Overlap
HZP, Peak Xenon

Control Bank Position Steps Withdrawn				50 EFPD	150 EFPD	250 EFPD	350 EFPD	450 EFPD
				0 - 100 EFPD	101 - 200 EFPD	201 - 300 EFPD	301 - 400 EFPD	401 - 505 EFPD
Bk A	Bk B	Bk C	Bk D	IRW (PCM)	IRW (PCM)	IRW (PCM)	IRW (PCM)	IRW (PCM)
226	226	226	226	0	0	0	0	0
226	226	226	225	2	2	3	4	5
226	226	226	220	12	12	16	22	29
226	226	226	215	23	22	29	40	53
226	226	226	210	33	32	42	58	77
226	226	226	205	61	60	74	94	118
226	226	226	200	88	88	105	131	160
226	226	226	195	116	115	136	167	201
226	226	226	190	144	143	168	204	243
226	226	226	185	173	172	198	236	274
226	226	226	180	203	201	229	267	306
226	226	226	175	232	230	260	299	338
226	226	226	170	262	259	290	331	370
226	226	226	165	287	282	313	353	391
226	226	226	160	311	306	337	375	412
226	226	226	155	336	329	360	397	433
226	226	226	150	361	353	383	419	454
226	226	226	145	381	372	401	436	469
226	226	226	140	402	391	419	453	485
226	226	226	135	423	411	436	470	500
226	226	226	130	443	430	454	486	516
226	226	226	125	461	445	467	497	525
226	226	226	120	478	460	480	508	535
226	226	226	116	491	473	491	516	542
226	226	226	110	512	491	506	529	554
226	226	221	105	535	513	529	556	588
226	226	216	100	558	534	552	583	622
226	226	211	95	596	575	601	643	692
226	226	206	90	635	616	651	704	763
226	226	201	85	674	656	700	764	833

Source: CNEI-0400-26
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UNIT ONE
REACTOR OPERATING DATA
SECTION 5.6
INTEGRAL ROD WORTH IN OVERLAP

Integral Rod Worth in Overlap
HZP, Peak Xenon

Control Bank Position Steps Withdrawn				50 EFPD	150 EFPD	250 EFPD	350 EFPD	450 EFPD
				0 - 100 EFPD	101 - 200 EFPD	201 - 300 EFPD	301 - 400 EFPD	401 - 505 EFPD
Bk A	Bk B	Bk C	Bk D	IRW (PCM)	IRW (PCM)	IRW (PCM)	IRW (PCM)	IRW (PCM)
226	226	196	80	713	697	749	824	904
226	226	191	75	757	744	805	887	970
226	226	186	70	802	792	861	950	1037
226	226	181	65	847	839	917	1013	1103
226	226	176	60	892	887	973	1075	1170
226	226	171	55	934	930	1019	1123	1217
226	226	166	50	976	973	1066	1171	1264
226	226	161	45	1018	1017	1112	1218	1311
226	226	156	40	1061	1060	1159	1266	1358
226	226	151	35	1101	1100	1200	1306	1396
226	226	146	30	1142	1140	1240	1346	1434
226	226	141	25	1182	1180	1281	1387	1473
226	226	136	20	1223	1220	1322	1427	1511
226	226	131	15	1259	1257	1358	1459	1540
226	226	126	10	1296	1294	1393	1492	1568
226	226	121	5	1332	1331	1429	1525	1597
226	226	116	0	1368	1368	1465	1557	1625
226	226	110	0	1390	1390	1486	1577	1642
226	221	105	0	1420	1419	1515	1608	1676
226	216	100	0	1449	1447	1544	1638	1710
226	211	95	0	1486	1485	1586	1689	1773
226	206	90	0	1523	1523	1629	1740	1835
226	201	85	0	1560	1560	1671	1791	1898
226	196	80	0	1597	1598	1713	1842	1960
226	191	75	0	1642	1644	1762	1897	2022
226	186	70	0	1688	1690	1812	1953	2083
226	181	65	0	1733	1736	1861	2008	2145
226	176	60	0	1779	1783	1910	2063	2206
226	171	55	0	1829	1834	1960	2110	2252
226	166	50	0	1880	1885	2009	2158	2298

UNIT ONE
REACTOR OPERATING DATA
SECTION 5.6
INTEGRAL ROD WORTH IN OVERLAP

Integral Rod Worth in Overlap
HZP, Peak Xenon

Control Bank Position Steps Withdrawn				50 EFPD	150 EFPD	250 EFPD	350 EFPD	450 EFPD
				0 - 100 EFPD	101 - 200 EFPD	201 - 300 EFPD	301 - 400 EFPD	401 - 505 EFPD
				IRW	IRW	IRW	IRW	IRW
Bk A	Bk B	Bk C	Bk D	(PCM)	(PCM)	(PCM)	(PCM)	(PCM)
226	161	45	0	1931	1936	2059	2205	2345
226	156	40	0	1981	1987	2108	2252	2391
226	151	35	0	2030	2036	2151	2288	2423
226	146	30	0	2079	2084	2194	2323	2455
226	141	25	0	2127	2132	2237	2359	2487
226	136	20	0	2176	2181	2280	2394	2519
226	131	15	0	2213	2216	2309	2419	2541
226	126	10	0	2250	2250	2338	2443	2562
226	121	5	0	2286	2285	2367	2467	2584
226	116	0	0	2323	2320	2396	2491	2605
226	110	0	0	2346	2341	2414	2506	2618
221	105	0	0	2373	2367	2439	2533	2650
216	100	0	0	2401	2392	2464	2560	2681
211	95	0	0	2435	2426	2502	2605	2732
206	90	0	0	2469	2460	2540	2649	2782
201	85	0	0	2503	2493	2578	2693	2832
196	80	0	0	2537	2527	2616	2738	2883
191	75	0	0	2576	2566	2657	2781	2926
186	70	0	0	2616	2604	2698	2825	2970
181	65	0	0	2655	2643	2739	2868	3014
176	60	0	0	2695	2682	2779	2912	3057
171	55	0	0	2736	2722	2816	2946	3087
166	50	0	0	2777	2761	2853	2979	3116
161	45	0	0	2818	2801	2890	3013	3146
156	40	0	0	2859	2841	2927	3047	3176
151	35	0	0	2894	2874	2955	3069	3194
146	30	0	0	2930	2908	2983	3091	3212
141	25	0	0	2965	2942	3011	3114	3230
136	20	0	0	3000	2975	3039	3136	3248
131	15	0	0	3024	2998	3059	3151	3260

UNIT ONE
REACTOR OPERATING DATA
SECTION 5.6
INTEGRAL ROD WORTH IN OVERLAP

Integral Rod Worth in Overlap
HZP, Peak Xenon

Control Bank Position Steps Withdrawn				50 EFPD	150 EFPD	250 EFPD	350 EFPD	450 EFPD
				0 - 100 EFPD	101 - 200 EFPD	201 - 300 EFPD	301 - 400 EFPD	401 - 505 EFPD
Bk A	Bk B	Bk C	Bk D	IRW (PCM)	IRW (PCM)	IRW (PCM)	IRW (PCM)	IRW (PCM)
126	10	0	0	3047	3021	3078	3166	3273
121	5	0	0	3071	3044	3097	3182	3286
116	0	0	0	3095	3067	3117	3197	3298
110	0	0	0	3109	3080	3128	3206	3306
105	0	0	0	3122	3093	3138	3213	3311
100	0	0	0	3134	3105	3148	3219	3316
95	0	0	0	3145	3116	3155	3224	3319
90	0	0	0	3155	3126	3162	3228	3322
85	0	0	0	3166	3136	3169	3233	3325
80	0	0	0	3177	3146	3176	3237	3328
75	0	0	0	3185	3154	3180	3240	3330
70	0	0	0	3193	3161	3184	3243	3332
65	0	0	0	3201	3169	3188	3246	3334
60	0	0	0	3209	3176	3193	3248	3336
55	0	0	0	3214	3181	3195	3249	3336
50	0	0	0	3219	3185	3197	3250	3336
45	0	0	0	3224	3190	3199	3251	3337
40	0	0	0	3229	3195	3201	3252	3337
35	0	0	0	3232	3197	3203	3253	3337
30	0	0	0	3235	3199	3204	3254	3337
25	0	0	0	3238	3201	3206	3254	3337
20	0	0	0	3240	3204	3208	3255	3337
15	0	0	0	3241	3204	3208	3255	3337
10	0	0	0	3242	3205	3208	3255	3337
5	0	0	0	3243	3206	3208	3255	3337
0	0	0	0	3244	3207	3209	3255	3337

Source: CNEI-0400-26
Prepared by: M.W. Hawes
Revision Number: 306
Date: 11/16/00

UNIT ONE
REACTOR OPERATING DATA
SECTION 5.6
INTEGRAL ROD WORTH IN OVERLAP

Integral Rod Worth in Overlap
HZP, Peak Xenon

Control Bank Position	Shutdown Bank Position Steps Withdrawn					50 EFPD 0 - 100 EFPD IRW (PCM)	150 EFPD 101 - 200 EFPD IRW (PCM)	250 EFPD 201 - 300 EFPD IRW (PCM)	350 EFPD 301 - 400 EFPD IRW (PCM)	450 EFPD 401 - 505 EFPD IRW (PCM)
	SD E	SD D	SD C	SD B	SD A					
226	226	226	226	226	226	0	0	0	0	0
0	226	226	226	226	226	3244	3207	3209	3255	3337
0	0	226	226	226	226	3984	4012	4040	4084	4141
0	0	0	226	226	226	4713	4676	4678	4728	4816
0	0	0	0	226	226	5630	5451	5403	5461	5596
0	0	0	0	0	226	6833	6548	6450	6493	6628
0	0	0	0	0	0	7069	6767	6668	6733	6922

UNIT ONE
REACTOR OPERATING DATA
SECTION 5.6
INTEGRAL ROD WORTH IN OVERLAP

Integral Rod Worth in Overlap
HFP, Equilibrium Xenon

Control Bank Position Steps Withdrawn				50 EFPD	150 EFPD	250 EFPD	350 EFPD	450 EFPD
				0 - 100 EFPD	101 - 200 EFPD	201 - 300 EFPD	301 - 400 EFPD	401 - 505 EFPD
Bk A	Bk B	Bk C	Bk D	IRW (PCM)	IRW (PCM)	IRW (PCM)	IRW (PCM)	IRW (PCM)
226	226	226	226	0	0	0	0	0
226	226	226	225	1	1	1	2	3
226	226	226	220	7	7	9	12	16
226	226	226	215	13	13	16	22	30
226	226	226	210	18	18	23	32	44
226	226	226	205	32	32	39	52	68
226	226	226	200	45	45	55	72	91
226	226	226	195	58	58	70	92	115
226	226	226	190	72	72	86	112	139
226	226	226	185	89	88	104	133	161
226	226	226	180	106	105	123	153	184
226	226	226	175	122	122	141	174	207
226	226	226	170	139	139	160	195	230
226	226	226	165	158	156	178	213	249
226	226	226	160	177	174	196	232	269
226	226	226	155	196	191	215	250	289
226	226	226	150	215	209	233	269	308
226	226	226	145	234	227	251	287	327
226	226	226	140	254	246	269	304	346
226	226	226	135	273	264	286	322	364
226	226	226	130	293	282	304	340	383
226	226	226	125	314	301	321	357	400
226	226	226	120	334	320	338	374	417
226	226	226	116	351	335	352	387	430
226	226	226	110	376	358	373	407	450
226	226	221	105	400	381	396	432	480
226	226	216	100	425	403	418	458	510
226	226	211	95	459	436	453	497	556
226	226	206	90	493	469	488	537	601
226	226	201	85	526	502	522	576	647

Source: CNEI-0400-26
Prepared by: M.W. Hawes
Revision Number: 306
Date: 11/16/00

UNIT ONE
REACTOR OPERATING DATA
SECTION 5.6
INTEGRAL ROD WORTH IN OVERLAP

Integral Rod Worth in Overlap
HFP, Equilibrium Xenon

Control Bank Position Steps Withdrawn				50 EFPD	150 EFPD	250 EFPD	350 EFPD	450 EFPD
				0 - 100 EFPD	101 - 200 EFPD	201 - 300 EFPD	301 - 400 EFPD	401 - 505 EFPD
Bk A	Bk B	Bk C	Bk D	IRW (PCM)	IRW (PCM)	IRW (PCM)	IRW (PCM)	IRW (PCM)
226	226	196	80	560	534	557	615	692
226	226	191	75	601	575	599	661	741
226	226	186	70	642	615	642	706	789
226	226	181	65	683	656	684	751	837
226	226	176	60	724	696	726	797	886
226	226	171	55	768	739	770	842	931
226	226	166	50	813	783	815	887	977
226	226	161	45	857	826	859	932	1022
226	226	156	40	901	870	903	977	1068
226	226	151	35	946	914	948	1023	1114
226	226	146	30	991	959	993	1068	1160
226	226	141	25	1036	1003	1038	1114	1206
226	226	136	20	1081	1048	1083	1159	1251
226	226	131	15	1125	1091	1125	1202	1294
226	226	126	10	1169	1134	1168	1244	1338
226	226	121	5	1213	1177	1210	1287	1381
226	226	116	0	1257	1220	1253	1329	1424
226	226	110	0	1283	1246	1278	1354	1449
226	221	105	0	1319	1281	1312	1388	1485
226	216	100	0	1355	1316	1346	1422	1521
226	211	95	0	1397	1358	1389	1466	1570
226	206	90	0	1438	1400	1432	1510	1619
226	201	85	0	1479	1441	1475	1555	1667
226	196	80	0	1520	1483	1518	1599	1716
226	191	75	0	1569	1532	1567	1650	1769
226	186	70	0	1617	1582	1616	1701	1823
226	181	65	0	1666	1631	1665	1752	1876
226	176	60	0	1714	1680	1714	1803	1929
226	171	55	0	1766	1734	1768	1858	1983
226	166	50	0	1819	1787	1822	1912	2037

Source: CNEI-0400-26
Prepared by: M.W. Hawes
Revision Number: 306
Date: 11/16/00

UNIT ONE
REACTOR OPERATING DATA
SECTION 5.6
INTEGRAL ROD WORTH IN OVERLAP

Integral Rod Worth in Overlap
HFP, Equilibrium Xenon

Control Bank Position Steps Withdrawn				50 EFPD	150 EFPD	250 EFPD	350 EFPD	450 EFPD
				0 - 100 EFPD	101 - 200 EFPD	201 - 300 EFPD	301 - 400 EFPD	401 - 505 EFPD
Bk A	Bk B	Bk C	Bk D	IRW (PCM)	IRW (PCM)	IRW (PCM)	IRW (PCM)	IRW (PCM)
226	161	45	0	1871	1841	1876	1966	2091
226	156	40	0	1923	1894	1930	2020	2145
226	151	35	0	1974	1946	1984	2075	2200
226	146	30	0	2026	1998	2038	2130	2255
226	141	25	0	2077	2050	2092	2185	2310
226	136	20	0	2128	2103	2146	2240	2365
226	131	15	0	2172	2145	2189	2284	2411
226	126	10	0	2216	2188	2231	2327	2457
226	121	5	0	2260	2231	2274	2371	2502
226	116	0	0	2304	2274	2316	2415	2548
226	110	0	0	2331	2300	2342	2441	2575
221	105	0	0	2362	2330	2372	2471	2609
216	100	0	0	2394	2360	2401	2502	2643
211	95	0	0	2432	2396	2437	2541	2686
206	90	0	0	2470	2433	2473	2580	2729
201	85	0	0	2509	2469	2509	2619	2772
196	80	0	0	2547	2506	2545	2658	2815
191	75	0	0	2591	2549	2587	2701	2862
186	70	0	0	2634	2592	2630	2745	2908
181	65	0	0	2678	2634	2672	2789	2954
176	60	0	0	2722	2677	2715	2833	3001
171	55	0	0	2767	2723	2761	2879	3049
166	50	0	0	2813	2768	2807	2926	3096
161	45	0	0	2859	2814	2853	2973	3144
156	40	0	0	2904	2860	2900	3020	3192
151	35	0	0	2947	2903	2944	3067	3241
146	30	0	0	2990	2946	2989	3114	3289
141	25	0	0	3032	2989	3034	3161	3338
136	20	0	0	3075	3033	3079	3208	3387
131	15	0	0	3108	3065	3112	3242	3422

Source: CNEI-0400-26
Prepared by: M.W. Hawes
Revision Number: 306
Date: 11/16/00

UNIT ONE
REACTOR OPERATING DATA
SECTION 5.6
INTEGRAL ROD WORTH IN OVERLAP

Integral Rod Worth in Overlap
HFP, Equilibrium Xenon

Control Bank Position Steps Withdrawn				50 EFPD	150 EFPD	250 EFPD	350 EFPD	450 EFPD
				0 - 100 EFPD	101 - 200 EFPD	201 - 300 EFPD	301 - 400 EFPD	401 - 505 EFPD
Bk A	Bk B	Bk C	Bk D	IRW (PCM)	IRW (PCM)	IRW (PCM)	IRW (PCM)	IRW (PCM)
126	10	0	0	3141	3097	3145	3276	3457
121	5	0	0	3174	3130	3177	3309	3492
116	0	0	0	3207	3162	3210	3343	3527
110	0	0	0	3226	3182	3230	3363	3548
105	0	0	0	3246	3200	3247	3379	3563
100	0	0	0	3265	3219	3264	3395	3578
95	0	0	0	3283	3237	3281	3410	3592
90	0	0	0	3302	3256	3298	3425	3606
85	0	0	0	3320	3274	3315	3441	3620
80	0	0	0	3339	3293	3332	3456	3634
75	0	0	0	3357	3311	3349	3471	3647
70	0	0	0	3375	3329	3366	3486	3661
65	0	0	0	3393	3347	3382	3501	3674
60	0	0	0	3411	3365	3399	3515	3687
55	0	0	0	3428	3382	3416	3531	3700
50	0	0	0	3445	3400	3433	3546	3713
45	0	0	0	3462	3417	3450	3561	3726
40	0	0	0	3479	3435	3467	3576	3739
35	0	0	0	3493	3449	3481	3589	3751
30	0	0	0	3507	3463	3496	3603	3763
25	0	0	0	3522	3477	3510	3617	3775
20	0	0	0	3536	3492	3525	3631	3787
15	0	0	0	3543	3499	3532	3638	3794
10	0	0	0	3550	3506	3540	3645	3800
5	0	0	0	3557	3513	3547	3653	3807
0	0	0	0	3564	3520	3554	3660	3814

Source: CNEI-0400-26
Prepared by: M.W. Hawes
Revision Number: 306
Date: 11/16/00

UNIT ONE
REACTOR OPERATING DATA
SECTION 5.7
TOTAL AVAILABLE ROD WORTH

STEP 1.	Minimum total rod worth available during cycle (HZP, equilibrium xenon):	6502 PCM
STEP 2.	Maximum stuck rod worth during cycle:	1106 PCM
STEP 3.	Total rod worth with highest stuck rod (step 1 – step 2):	5396 PCM
STEP 4.	Less 10% uncertainty (step 3 x 0.9):	4856 PCM

TOTAL AVAILABLE ROD WORTH = 4856 PCM

TRANSIENT FLUX REDISTRIBUTION ALLOWANCE = 271 PCM

Source: CNEI-0400-26
Prepared by: M.W. Hawes
Revision Number: 306
Date: 11/16/00

UNIT ONE
REACTOR OPERATING DATA
SECTION 5.8
INOPERABLE RCCA WORTHS

CRDM NUMBER	CRDM LOCATION	WORTH (PCM)	CRDM NUMBER	CRDM LOCATION	WORTH (PCM)
SA2-1	B-4	40	CA1-2	H-10	819
CB2-1	B-6	191	SE1-3	H-12	446
CC1-2	B-8	38	CC1-3	H-14	38
CB1-2	B-10	191	SB2-4	J-3	250
SA1-2	B-12	40	SB1-3	J-13	250
SD1-1	C-5	863	CB2-4	K-2	191
SB2-1	C-7	250	CC2-4	K-6	738
SB1-2	C-9	250	CA2-2	K-8	819
SC1-2	C-11	863	CC2-3	K-10	738
SA1-1	D-2	40	CB1-3	K-14	191
CD1-1	D-4	863	SD1-4	L-3	863
SE1-2	D-8	446	SC1-3	L-13	863
CD2-1	D-12	863	SA2-4	M-2	40
SA2-2	D-14	40	CD2-2	M-4	863
SC1-1	E-3	863	SE1-4	M-8	446
SD1-2	E-13	863	CD1-2	M-12	863
CB1-1	F-2	191	SA1-3	M-14	40
CC2-1	F-6	738	SC1-4	N-5	863
CA2-1	F-8	819	SB1-4	N-7	250
CC2-2	F-10	738	SB2-3	N-9	250
CB2-2	F-14	191	SD1-3	N-11	863
SB1-1	G-3	250	SA1-4	P-4	40
SB2-2	G-13	250	CB1-4	P-6	191
CC1-1	H-2	38	CC1-4	P-8	38
SE1-1	H-4	446	CB2-3	P-10	191
CA1-1	H-6	819	SA2-3	P-12	40
CD2-3	H-8	819			

NOTE: If more than 1 inoperable rod is known to exist then use the worth of the highest worth inoperable rod from the table above and add **1106 pcm** for each additional known inoperable rod.

Source: CNEI-0400-26
Prepared By: MW Hawes
Revision 306
Date: 11/16/00

Total Power Defect (PCM) as a Function of Power and Cycle Burnup from 0 - 50% FP

POWER (%FP)

BURNUP (EFPD)	0	5	10	15	20	25	30	35	40	45	50
0	0	93	186	279	371	464	550	636	722	808	894
20	0	91	181	272	363	453	538	622	706	791	875
40	0	89	178	267	356	446	529	612	695	778	861
60	0	88	175	263	351	439	521	603	685	767	849
80	0	86	173	259	346	432	513	594	675	756	838
100	0	85	170	255	340	425	505	585	665	745	826
120	0	86	172	258	343	429	510	591	671	752	833
140	0	87	173	260	347	433	515	596	677	758	840
160	0	88	177	265	354	442	524	607	689	772	854
180	0	91	182	273	364	455	539	623	707	792	876
200	0	94	187	281	374	468	554	640	726	812	898
220	0	96	192	288	384	480	568	656	744	832	919
240	0	99	197	296	394	493	583	672	762	851	941
260	0	102	203	305	407	509	600	692	784	876	968
280	0	105	211	316	421	527	622	716	811	906	1001
300	0	109	218	327	436	545	643	740	838	936	1033
320	0	113	225	338	450	563	664	764	865	965	1066
340	0	116	232	349	465	581	685	788	891	995	1098
360	0	120	239	359	479	598	705	811	918	1024	1131
380	0	123	246	369	492	615	724	834	944	1053	1163
400	0	126	253	379	505	631	744	857	970	1082	1195
420	0	130	259	389	518	648	764	880	996	1112	1227
440	0	133	266	399	531	664	783	902	1022	1141	1260
460	0	136	271	407	543	678	800	922	1044	1166	1288
480	0	138	276	414	552	690	815	939	1064	1188	1313
495	0	140	280	420	559	699	826	952	1078	1205	1331
505	0	141	282	423	564	705	833	960	1088	1216	1343

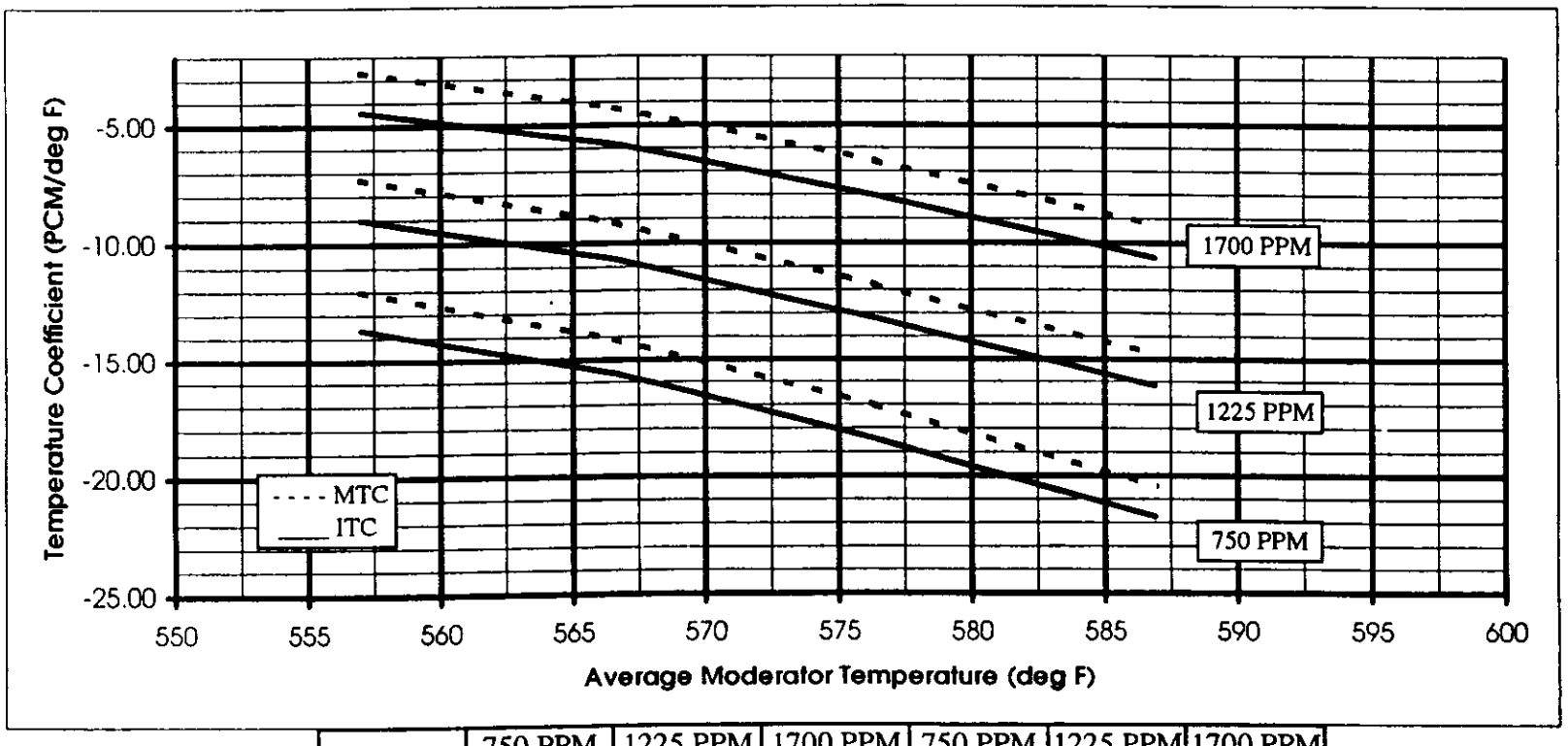
Total Power Defect (PCM) as a Function of Power and Cycle Burnup from 55 - 100% FP

POWER (%FP)

BURNUP (EFPD)	55	60	65	70	75	80	85	90	95	100
0	981	1068	1155	1242	1329	1424	1518	1613	1708	1802
20	960	1046	1131	1216	1302	1394	1487	1580	1673	1766
40	946	1030	1114	1198	1282	1374	1466	1558	1649	1741
60	933	1016	1099	1182	1266	1357	1448	1539	1630	1721
80	920	1002	1084	1167	1249	1339	1430	1520	1611	1701
100	907	988	1070	1151	1233	1322	1412	1501	1591	1681
120	915	997	1079	1161	1243	1334	1425	1515	1606	1697
140	922	1005	1088	1171	1254	1346	1438	1529	1621	1713
160	938	1022	1107	1191	1275	1368	1462	1555	1648	1742
180	962	1048	1134	1220	1306	1401	1497	1592	1688	1783
200	985	1073	1161	1249	1337	1434	1532	1630	1727	1825
220	1009	1099	1188	1278	1368	1467	1567	1667	1767	1867
240	1033	1124	1216	1307	1398	1500	1602	1704	1806	1908
260	1062	1156	1249	1343	1437	1541	1646	1750	1855	1959
280	1097	1193	1290	1386	1483	1590	1698	1805	1913	2021
300	1132	1231	1330	1429	1528	1639	1750	1860	1971	2082
320	1168	1269	1371	1472	1574	1688	1802	1915	2029	2143
340	1203	1307	1411	1516	1620	1737	1853	1970	2087	2204
360	1238	1345	1452	1559	1666	1787	1907	2027	2147	2268
380	1273	1383	1494	1604	1714	1838	1962	2086	2210	2334
400	1309	1422	1535	1648	1762	1889	2017	2145	2272	2400
420	1344	1460	1577	1693	1809	1941	2072	2203	2335	2466
440	1379	1499	1618	1737	1857	1992	2127	2262	2397	2532
460	1410	1533	1655	1777	1899	2038	2176	2315	2453	2592
480	1438	1562	1687	1812	1937	2078	2220	2362	2503	2645
495	1458	1585	1711	1838	1965	2109	2253	2397	2541	2684
505	1471	1600	1728	1856	1984	2129	2275	2420	2565	2711

UNIT ONE
REACTOR OPERATING DATA
SECTION 5.10
MODERATOR AND ISOTHERMAL TEMPERATURE COEFFICIENTS

Source: CNEI-0400-26
Prepared By: M W Hawes
Revision Number: 306
Date: 11/16/00



Temp.	750 PPM ITC	1225 PPM ITC	1700 PPM ITC	750 PPM MTC	1225 PPM MTC	1700 PPM MTC
557	-13.64	-8.99	-4.41	-12.00	-7.29	-2.68
566.6	-15.61	-10.67	-5.82	-14.11	-9.14	-4.25
576.4	-18.48	-13.22	-8.03	-17.06	-11.78	-6.58
586.9	-21.76	-16.16	-10.63	-20.42	-14.79	-9.25

Source: CNEI-0400-26, C1C13 SOR
Prepared By: MW Hawes
Revision Number: 304
Date: 11/2/00

UNIT ONE
REACTOR OPERATING DATA
SECTION 5.11
MINIMUM SHUTDOWN MARGIN BORON

Required Boron Concentration for 1.0% Shutdown Margin as a Function of Temperature and Burnup

CORE AVERAGE TEMPERATURE (°F)

BURNUP (EFPD)	33	68	70	80	90	100	110	120	130	140	150	160	170	180	190	200
0	1324	1313	1312	1310	1307	1305	1303	1301	1298	1296	1294	1292	1290	1287	1285	1282
20	1357	1348	1347	1345	1343	1340	1338	1336	1333	1331	1328	1326	1323	1320	1317	1314
40	1383	1376	1375	1373	1371	1369	1366	1364	1361	1359	1356	1353	1350	1347	1344	1341
60	1404	1397	1397	1394	1392	1390	1388	1385	1383	1380	1378	1375	1372	1369	1366	1363
80	1420	1412	1412	1409	1407	1405	1403	1400	1398	1396	1393	1391	1388	1385	1382	1379
100	1430	1421	1421	1418	1416	1414	1412	1410	1408	1405	1403	1401	1399	1396	1394	1391
120	1434	1424	1424	1422	1420	1417	1415	1414	1412	1410	1408	1406	1404	1402	1400	1398
140	1433	1423	1422	1420	1418	1416	1414	1412	1411	1409	1407	1406	1404	1403	1401	1399
160	1427	1416	1416	1413	1411	1409	1408	1406	1405	1403	1402	1401	1400	1398	1397	1395
180	1416	1406	1405	1403	1401	1399	1398	1396	1395	1394	1392	1391	1390	1389	1388	1386
200	1400	1391	1390	1388	1387	1385	1383	1382	1380	1379	1378	1377	1376	1375	1373	1372
220	1379	1372	1372	1370	1368	1366	1365	1363	1362	1361	1359	1358	1357	1356	1355	1353
240	1355	1349	1349	1347	1345	1344	1342	1341	1339	1338	1336	1335	1334	1333	1331	1330
260	1327	1322	1322	1320	1319	1317	1315	1314	1312	1311	1309	1308	1306	1305	1304	1303
280	1296	1291	1291	1289	1288	1286	1285	1283	1281	1280	1278	1276	1275	1274	1272	1271
300	1262	1257	1257	1255	1254	1252	1250	1248	1247	1245	1243	1242	1240	1239	1237	1236
320	1225	1220	1219	1218	1216	1214	1212	1210	1209	1207	1205	1203	1202	1200	1198	1197
340	1184	1179	1179	1177	1175	1173	1172	1170	1168	1166	1164	1162	1160	1158	1157	1155
360	1141	1135	1135	1133	1131	1129	1127	1125	1123	1121	1119	1117	1115	1113	1111	1110
380	1095	1089	1088	1086	1084	1082	1080	1078	1076	1074	1071	1069	1067	1065	1063	1061
400	1047	1040	1040	1037	1035	1033	1031	1029	1026	1024	1022	1020	1017	1015	1013	1011
420	998	990	989	987	985	982	980	978	975	973	971	968	966	963	961	959
440	947	939	938	936	933	931	928	926	923	921	918	916	913	910	908	905
460	895	887	887	884	882	879	876	874	871	868	865	862	859	857	854	851
480	843	836	835	833	830	827	824	821	818	815	812	809	806	802	799	796
495	804	797	797	794	791	788	785	782	779	775	772	769	765	762	758	755
505	778	772	772	769	766	763	760	756	753	749	746	742	738	735	731	728

NOTE: 1) Tech Spec Refueling boron concentration is 2700 ppmB (per C1C13 COLR)

2) Filled and Vent Boron concentration is 1587 ppmB

UNIT ONE
REACTOR OPERATING DATA
SECTION 5.11
MINIMUM SHUTDOWN MARGIN BORON

Required Boron Concentration for 1.3% Shutdown Margin as a Function of Temperature and Burnup

CORE AVERAGE TEMPERATURE (°F)

BURNUP (EFPD)	200	225	250	275	300	325	350	375	400	425	450	475	500	525	550	557
0	1315	1309	1301	1293	1283	1271	1257	1239	1219	1198	1171	1138	1096	1044	980	960
20	1348	1341	1334	1326	1317	1306	1293	1277	1259	1239	1214	1182	1143	1093	1033	1014
40	1375	1368	1362	1354	1346	1336	1324	1310	1292	1274	1250	1220	1182	1136	1078	1060
60	1397	1391	1385	1378	1371	1362	1351	1337	1321	1303	1280	1252	1216	1170	1115	1097
80	1414	1408	1403	1397	1390	1382	1371	1359	1343	1326	1305	1277	1242	1198	1143	1126
100	1425	1421	1417	1411	1405	1397	1387	1374	1359	1343	1322	1295	1261	1218	1164	1147
120	1431	1428	1425	1420	1414	1407	1397	1384	1369	1354	1333	1307	1273	1230	1177	1160
140	1432	1431	1428	1424	1418	1411	1401	1388	1373	1358	1338	1312	1278	1235	1182	1165
160	1428	1427	1425	1421	1416	1408	1398	1386	1371	1355	1335	1309	1275	1232	1178	1161
180	1419	1418	1416	1412	1407	1399	1389	1377	1361	1345	1325	1299	1264	1221	1166	1149
200	1405	1404	1402	1398	1392	1384	1374	1361	1345	1329	1308	1281	1246	1202	1147	1129
220	1386	1384	1382	1378	1372	1364	1354	1340	1324	1307	1285	1257	1222	1176	1120	1103
240	1362	1361	1358	1353	1347	1339	1328	1314	1297	1280	1257	1228	1191	1145	1088	1070
260	1335	1332	1329	1324	1318	1309	1298	1283	1266	1247	1224	1194	1156	1108	1050	1031
280	1303	1300	1297	1291	1284	1275	1263	1248	1230	1211	1186	1155	1116	1067	1007	988
300	1267	1264	1260	1255	1247	1237	1224	1209	1190	1170	1144	1112	1072	1021	959	939
320	1228	1225	1220	1214	1206	1195	1182	1165	1146	1125	1099	1065	1023	971	907	887
340	1185	1182	1177	1170	1161	1150	1136	1119	1098	1076	1049	1015	971	917	851	830
360	1140	1136	1130	1123	1114	1102	1087	1069	1047	1025	996	961	916	859	790	768
380	1091	1087	1081	1073	1063	1050	1035	1016	993	970	941	904	857	798	725	702
400	1040	1035	1029	1021	1010	997	980	961	937	913	883	845	796	734	659	635
420	988	982	975	966	955	941	924	903	879	854	823	783	733	670	593	568
440	934	928	920	911	899	884	866	845	819	793	760	720	668	605	528	504
460	880	873	864	854	841	826	807	785	759	731	696	655	603	541	467	443
480	825	816	807	796	783	767	747	725	697	667	631	589	538	479	410	389
495	783	774	764	752	738	722	702	679	652	619	582	539	489	434	371	352
505	756	746	735	723	709	692	672	649	621	587	548	505	457	404	347	330

NOTE: 1) Tech Spec Refueling boron concentration is 2700 ppmB (per C1C13 COLR)

2) Fill and Vent Boron concentration is 1587 ppmB.

Boron Concentration (PPMB) for K-eff = 0.99 as a function of
Temperature and Burnup with *Control Banks Only Inserted*

Bounds ARI cases with Highest Worth Bank Withdrawn

NC SYSTEM AVERAGE TEMPERATURE (°F)

BURNUP (EFPD)	325	350	375	400	425	450	475	500	525	550	557
0	1456	1446	1437	1422	1404	1384	1366	1335	1299	1251	1235
20	1483	1475	1467	1454	1438	1419	1403	1374	1340	1295	1281
40	1508	1501	1494	1482	1467	1450	1435	1408	1377	1334	1320
60	1530	1523	1517	1506	1492	1476	1462	1437	1407	1366	1353
80	1554	1548	1542	1531	1519	1504	1491	1467	1438	1398	1384
100	1563	1557	1552	1542	1530	1516	1503	1480	1452	1412	1399
120	1565	1560	1554	1545	1533	1519	1507	1484	1456	1417	1404
140	1559	1553	1548	1538	1527	1513	1501	1478	1449	1410	1397
160	1549	1544	1538	1528	1516	1502	1491	1467	1438	1398	1385
180	1534	1529	1523	1513	1501	1486	1475	1450	1420	1380	1367
200	1514	1509	1502	1492	1479	1464	1452	1427	1396	1355	1342
220	1486	1480	1473	1462	1449	1433	1419	1393	1362	1318	1304
240	1458	1451	1444	1432	1418	1401	1387	1360	1328	1283	1268
260	1426	1419	1411	1399	1384	1366	1351	1323	1289	1242	1227
280	1391	1383	1374	1361	1345	1326	1310	1281	1246	1197	1181
300	1351	1343	1333	1319	1302	1283	1266	1235	1198	1148	1131
320	1305	1295	1285	1270	1252	1231	1213	1180	1141	1088	1071
340	1259	1249	1238	1222	1203	1181	1162	1128	1086	1032	1014
360	1211	1200	1188	1171	1151	1128	1108	1072	1029	972	954
380	1160	1148	1136	1118	1097	1072	1051	1013	969	909	890
400	1107	1094	1081	1062	1039	1013	990	951	905	844	824
420	1046	1033	1018	998	974	947	922	881	833	770	749
440	990	976	960	939	914	885	859	817	767	702	681
460	933	917	901	879	853	823	795	751	700	633	611
480	875	858	841	818	790	759	730	685	633	563	541
495	830	813	796	771	743	711	681	635	581	511	488
505	800	783	765	740	711	679	648	601	547	475	452

UNIT ONE REACTOR OPERATING DATA
SECTION 5.12
MODE 3, 4, AND 5 BORON CONCENTRATION

SOURCE CNEI-0400-26
PREPARED BY M.W.Hawes
REVISION 306
DATE 11/16/00

Boron Concentration (PPMB) for K-eff = 0.99 as a function of
Temperature and Burnup with *Control Banks Only inserted*

Bounds ARI cases with Highest Worth Bank Withdrawn

NC SYSTEM AVERAGE TEMPERATURE (°F)

BURNUP (EFPD)	68	75	100	125	150	175	200	225	250	275	300
0	1506	1505	1501	1497	1493	1488	1484	1479	1474	1471	1464
20	1526	1524	1520	1517	1513	1510	1507	1503	1499	1497	1491
40	1543	1541	1538	1534	1532	1529	1527	1524	1521	1519	1514
60	1557	1556	1552	1550	1548	1545	1544	1542	1540	1539	1535
80	1574	1573	1570	1567	1566	1564	1563	1561	1560	1561	1558
100	1579	1578	1575	1573	1572	1570	1569	1568	1567	1570	1567
120	1578	1577	1574	1572	1571	1570	1569	1568	1568	1571	1569
140	1571	1570	1567	1565	1564	1563	1562	1561	1561	1564	1562
160	1560	1559	1556	1554	1554	1553	1551	1551	1551	1555	1553
180	1545	1544	1541	1539	1539	1538	1537	1536	1536	1540	1538
200	1526	1525	1522	1520	1520	1519	1517	1517	1517	1521	1518
220	1500	1499	1497	1494	1494	1492	1491	1491	1490	1494	1491
240	1474	1473	1470	1468	1467	1466	1465	1464	1463	1466	1463
260	1445	1444	1441	1439	1437	1436	1435	1433	1433	1435	1432
280	1412	1411	1408	1406	1404	1402	1401	1400	1398	1401	1397
300	1376	1375	1372	1369	1367	1366	1364	1362	1361	1362	1358
320	1335	1334	1330	1327	1325	1323	1321	1319	1317	1317	1312
340	1294	1292	1289	1285	1283	1281	1278	1276	1273	1273	1267
360	1250	1249	1245	1241	1239	1236	1233	1230	1227	1227	1220
380	1204	1202	1198	1195	1192	1188	1185	1182	1178	1177	1170
400	1155	1154	1150	1146	1142	1139	1135	1131	1127	1125	1117
420	1100	1099	1094	1090	1086	1082	1078	1073	1068	1066	1058
440	1049	1048	1043	1038	1034	1030	1025	1020	1014	1012	1002
460	997	995	991	986	981	976	971	965	959	956	946
480	944	942	938	933	928	922	916	910	903	899	888
495	903	902	897	892	887	881	875	868	861	856	844
505	876	875	870	865	859	853	847	840	832	827	815

SOURCE CNEI-0400-26
PREPARED BY M.W.Hawes
REVISION 306
DATE 11/16/00

UNIT ONE REACTOR OPERATING DATA
SECTION 5.13
SHUTDOWN FISSION PRODUCT CORRECTION

Time (hours)	Time (days)	Correction (ppm)	Time (hours)	Time (days)	Correction (ppm)	Time (hours)	Time (days)	Correction (ppm)
0	0.00	0.0	240	10.00	49.0	1056	44.00	55.3
6	0.25	2.7	246	10.25	49.0	1080	45.00	55.4
12	0.50	5.5	252	10.50	49.1	1104	46.00	55.6
18	0.75	9.3	258	10.75	49.2	1128	47.00	55.7
24	1.00	13.0	264	11.00	49.2	1152	48.00	55.8
30	1.25	15.7	270	11.25	49.3	1176	49.00	55.9
36	1.50	18.4	276	11.50	49.3	1200	50.00	56.1
42	1.75	21.1	282	11.75	49.4	1224	51.00	56.2
48	2.00	23.7	288	12.00	49.4	1248	52.00	56.3
54	2.25	26.3	312	13.00	49.7	1272	53.00	56.5
60	2.50	28.9	336	14.00	49.9	1296	54.00	56.6
66	2.75	31.6	360	15.00	50.1	1320	55.00	56.7
72	3.00	34.2	384	16.00	50.3	1344	56.00	56.8
78	3.25	35.1	408	17.00	50.6	1368	57.00	57.0
84	3.50	36.1	432	18.00	50.8	1392	58.00	57.1
90	3.75	37.1	456	19.00	51.0	1416	59.00	57.2
96	4.00	38.0	480	20.00	51.2	1440	60.00	57.4
102	4.25	39.0	504	21.00	51.5	1464	61.00	57.3
108	4.50	39.9	528	22.00	51.7	1488	62.00	57.3
114	4.75	40.8	552	23.00	51.9	1512	63.00	57.2
120	5.00	41.7	576	24.00	52.2	1536	64.00	57.2
126	5.25	42.1	600	25.00	52.4	1560	65.00	57.2
132	5.50	42.5	624	26.00	52.6	1680	70.00	57.0
138	5.75	42.8	648	27.00	52.8	1800	75.00	56.8
144	6.00	43.2	672	28.00	53.1	1920	80.00	56.7
150	6.25	43.6	696	29.00	53.3	2040	85.00	56.5
156	6.50	43.9	720	30.00	53.5	2160	90.00	56.3
162	6.75	44.3	744	31.00	53.6	2280	95.00	56.2
168	7.00	44.6	768	32.00	53.8	2400	100.00	56.0
174	7.25	45.0	792	33.00	53.9	2520	105.00	55.8
180	7.50	45.4	816	34.00	54.0	2640	110.00	55.6
186	7.75	45.7	840	35.00	54.2	2760	115.00	55.5
192	8.00	46.1	864	36.00	54.3	2880	120.00	55.3
198	8.25	46.5	888	37.00	54.4	3000	125.00	55.1
204	8.50	46.8	912	38.00	54.5	3120	130.00	54.9
210	8.75	47.2	936	39.00	54.7	3240	135.00	54.7
216	9.00	47.5	960	40.00	54.8	3360	140.00	54.5
222	9.25	47.9	984	41.00	54.9	3480	145.00	54.3
228	9.50	48.3	1008	42.00	55.0	3600	150.00	54.1
234	9.75	48.6	1032	43.00	55.2			

CATAWBA
INITIAL LICENSE EXAMINATION
JOB PERFORMANCE MEASURE

JPM 3S/ADMIN

Complete Technical Specification Evaluation and TSAIL Entry

CANDIDATE _____

EXAMINER _____

CATAWBA
INITIAL LICENSE EXAMINATION
JOB PERFORMANCE MEASURE

Task:

Complete Technical Specification Evaluation and TSAIL Entry.

Alternate Path:

N/A

Facility JPM #:

JPM 1S/ADMIN

K/A Rating(s):

GKA 2.1.12 (2.9/4.0)

Task Standard:

Complete Technical Specification Evaluation and TSAIL Entry.

Preferred Evaluation Location:

Simulator ____ In-Plant _X____

Preferred Evaluation Method:

Perform __X__ Simulate _____

References:

Validation Time: 15 min. **Time Critical:** No

==========

Candidate: _____ Time Start : _____
NAME Time Finish: _____

Performance Rating: SAT _____ UNSAT _____ Performance Time _____

Examiner: _____ _____/_____
NAME SIGNATURE DATE

==========

COMMENTS

_____

_____

_____

Tools/Equipment/Procedures Needed:

Computer with TSAIL software loaded
CNS Tech Specs
VX System Design Basis Document

READ TO OPERATOR

DIRECTION TO TRAINEE:

I will explain the initial conditions, and state the task to be performed. All control room steps shall be performed for this JPM, including any required communications. I will provide initiating cues and reports on other actions when directed by you. Ensure you indicate to me when you understand your assigned task. To indicate that you have completed your assigned task return the handout sheet I provided you.

INITIAL CONDITIONS:

Unit 1 is in Mode 1. You are the Control Room SRO. You were informed 15 minutes ago that during surveillance testing of the 1B Containment Air Return Fan that the fan started 7 minutes and 33 seconds following receipt of the start signal. Work Request 99101201 was written.

The auxiliary building rounds NLO now reports that CPCS transmitter 1NSLP-5160 (CPCS Channel 1) on the Train A CPCS Control Cabinet is failed low. IAE has verified that the channel is inoperable and has written Work Request 99101301.

INITIATING CUE:

Evaluate plant status in accordance with Technical Specifications, based upon the data provided and complete the required TSAIL entries.

JPM OVERALL STANDARD:

Candidate determines that both trains of VX are inoperable and the unit meets the conditions for entry into Technical Specification 3.0.3.

KA 2.1.12 (2.9/4.0)

STEP 1: Determine that Containment Air Return Fan 1B is inoperable. STANDARD: Declares Containment Air Return Fan 1B inoperable per Technical Specification 3.6.11 due to Surveillance Requirement 3.6.11.1 not being met. COMMENTS:	**CRITICAL STEP** ___SAT ___UNSAT
STEP 2 Determine that failure of Train A Channel 1 CPCS transmitter (1NSLP-5160 from Design Basis Document) renders Containment Air Return Fan 1A inoperable. STANDARD: Declares Containment Air Return Fan 1A inoperable per Technical Specification 3.3.2 Function 9 Condition P. COMMENTS:	**CRITICAL STEP** ___SAT ___UNSAT
STEP 3 Determine required action for both Containment Air Return Fans being inoperable. STANDARD: Candidate determines that Technical Specification 3.0.3 is applicable. COMMENTS:	**CRITICAL STEP** ___SAT ___UNSAT

STEP 4 Complete the required TSAIL entries. STANDARD: Candidate determines that TSAIL entries are required for VX Trains 1A and 1B. The following items are critical for each entry: • Unit • Train • System • Component Refer to the attached TSAIL printout. **EXAMINER'S CUE: When candidate is prompted to enter SRO name tell the candidate that the SRO declaring the equipment inoperable is Garmon Clements and the SRO performing the Independent Verification is Ed Fritz.** **EXAMINER'S CUE: When candidate is prompted to update the WMS R-11 Screen, inform him that the WMS R-11 screen will be Updated by another SRO.** COMMENTS:	**CRITICAL STEP** ___SAT ___UNSAT
This JPM is complete.	

TIME STOP: _____

CANDIDATE CUE SHEET
(TO BE RETURNED TO EXAMINER UPON COMPLETION OF TASK)

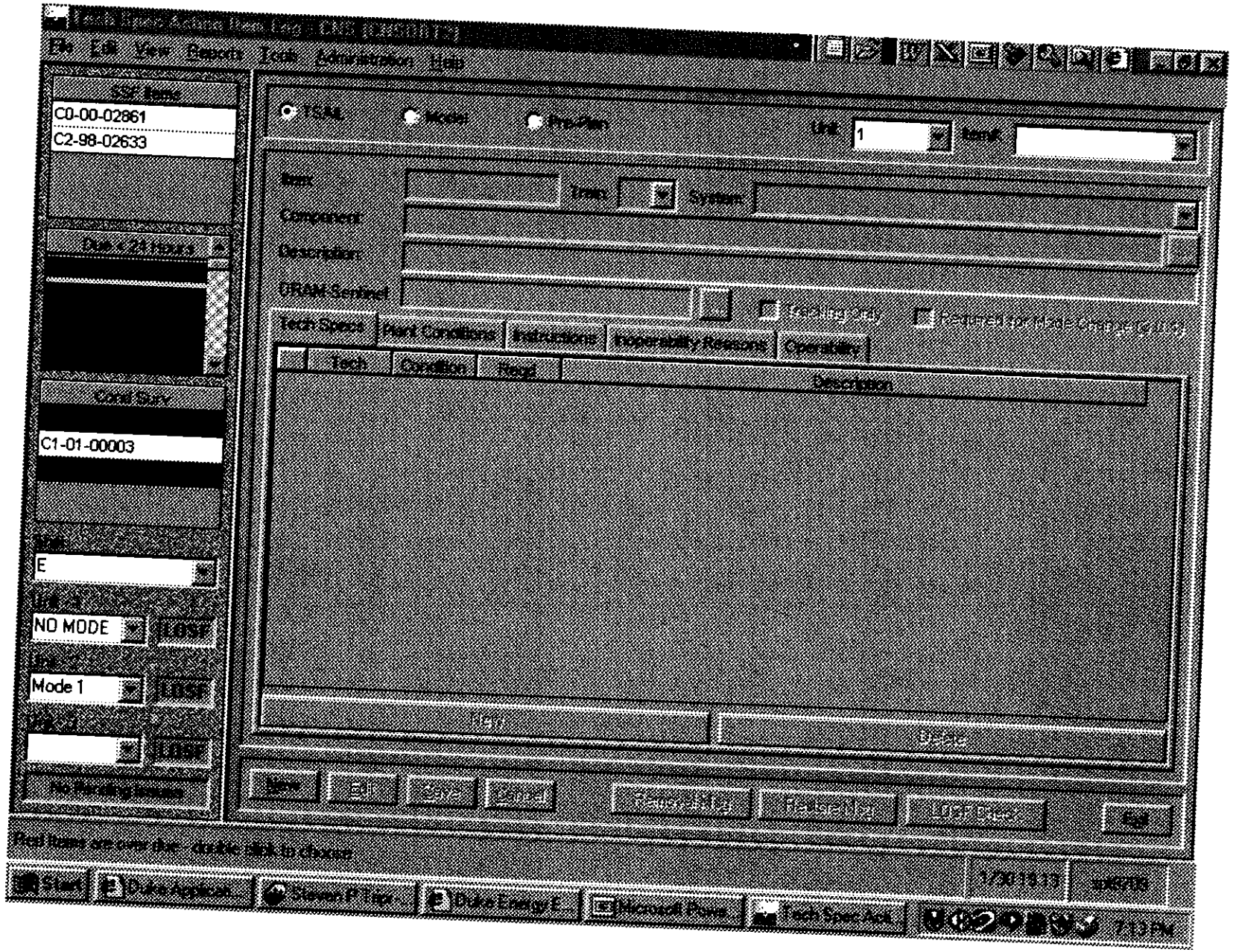
INITIAL CONDITIONS:

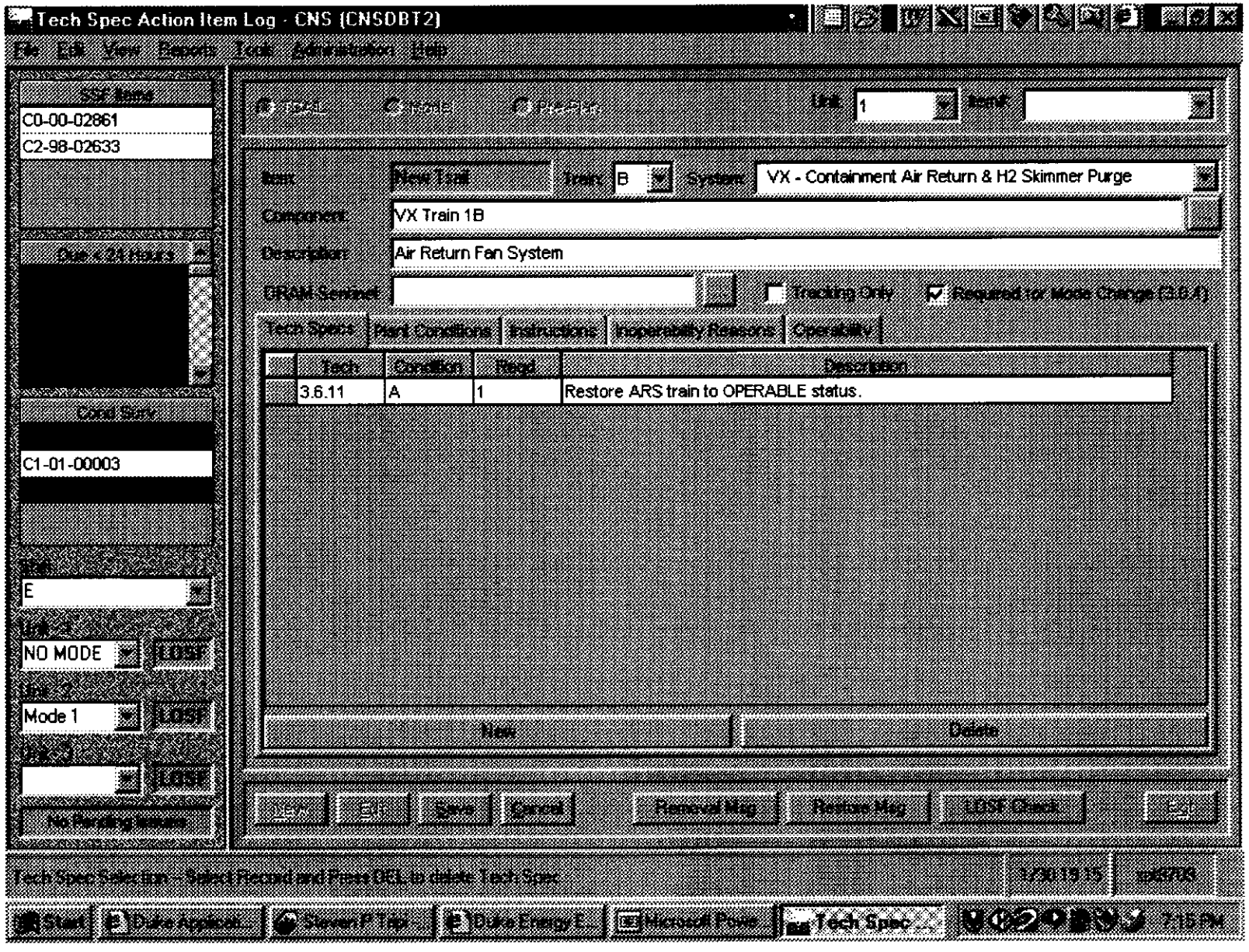
Unit 1 is in Mode 1. You are the Control Room SRO. You were informed 15 minutes ago that during surveillance testing of the 1B Containment Air Return Fan that the fan started 7 minutes and 33 seconds following receipt of the start signal. Work Request 99101201 was written.

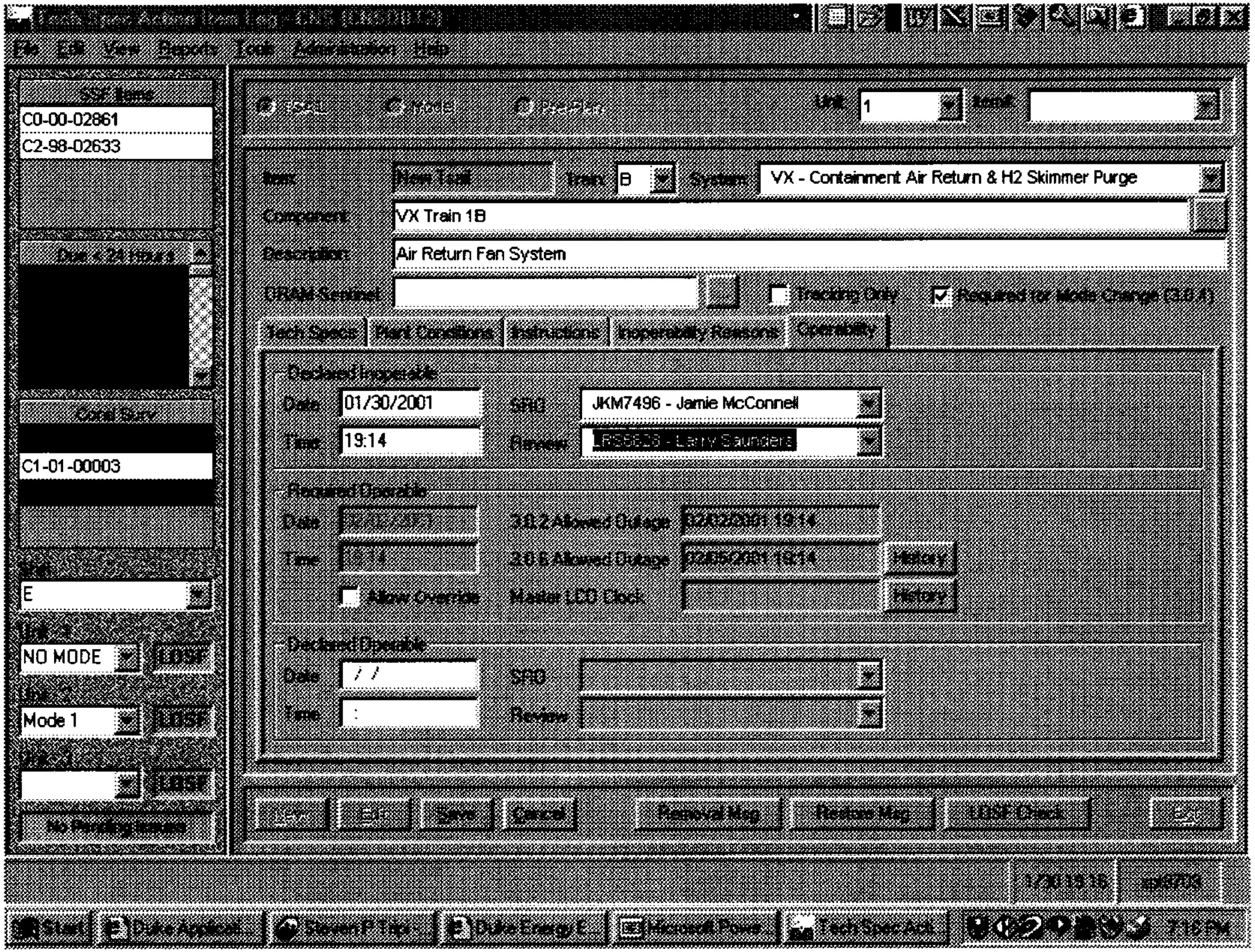
The auxiliary building rounds NLO now reports that CPCS transmitter 1NSLP-5160 (CPCS Channel 1) on the Train A CPCS Control Cabinet is failed low. IAE has verified that the channel is inoperable and has written Work Request 99101301.

INITIATING CUE:

Evaluate plant status in accordance with Technical Specifications, based upon the data provided and complete the required TSAIL entries.


File Edit View Report Tools Administration Help
SSC Items
C0-00-02861
C2-98-02633
Due < 24 Hours
Cold Surv
C1-01-00003
E
NO MODE
LOSF
Mode 1
LOSF
LOSF
No Pending Issues
TS All
Model
Pre-Plan
Unit
1
Rank
Item
Train
System
Component
Description
ORAM Sentinel
Tech Specs
Plant Conditions
Instructions
Inoperability Reasons
Operability
Tech
Condition
Regd
Description
New
Delete
New
Edit
Save
Cancel
Remove Row
Restore Row
Undo Chgs
Exit
Start
1/30/2013
7:13 PM


Tech Spec Action Item Log - CNS (CNSDBT2)
File Edit View Reports Tools Administration Help
SSF Items
C0-00-02861
C2-98-02633
Due < 24 Hours
Cond Sys
C1-01-00003
E
NO MODE
LOSF
Mode 1
LOSF
LOSF
No Pending Issues
Unit 1
Item: New Test
Train: B
System: VX - Containment Air Return & H2 Skimmer Purge
Component: VX Train 1B
Description: Air Return Fan System
DRAM Sentinel
Tracking Only
Required for Mode Change (3.0.4)
Tech Specs
Plant Conditions
Instructions
Inoperability Reasons
Operability
Tech
Condition
Reqd
Description
3.6.11
A
1
Restore ARS train to OPERABLE status.
New
Delete
Save
Cancel
Removal Msg
Restore Msg
LOSF Check
Exit
Tech Spec Selection - Select Record and Press DEL to delete Tech Spec
Start
Tech Spec
7:15 PM



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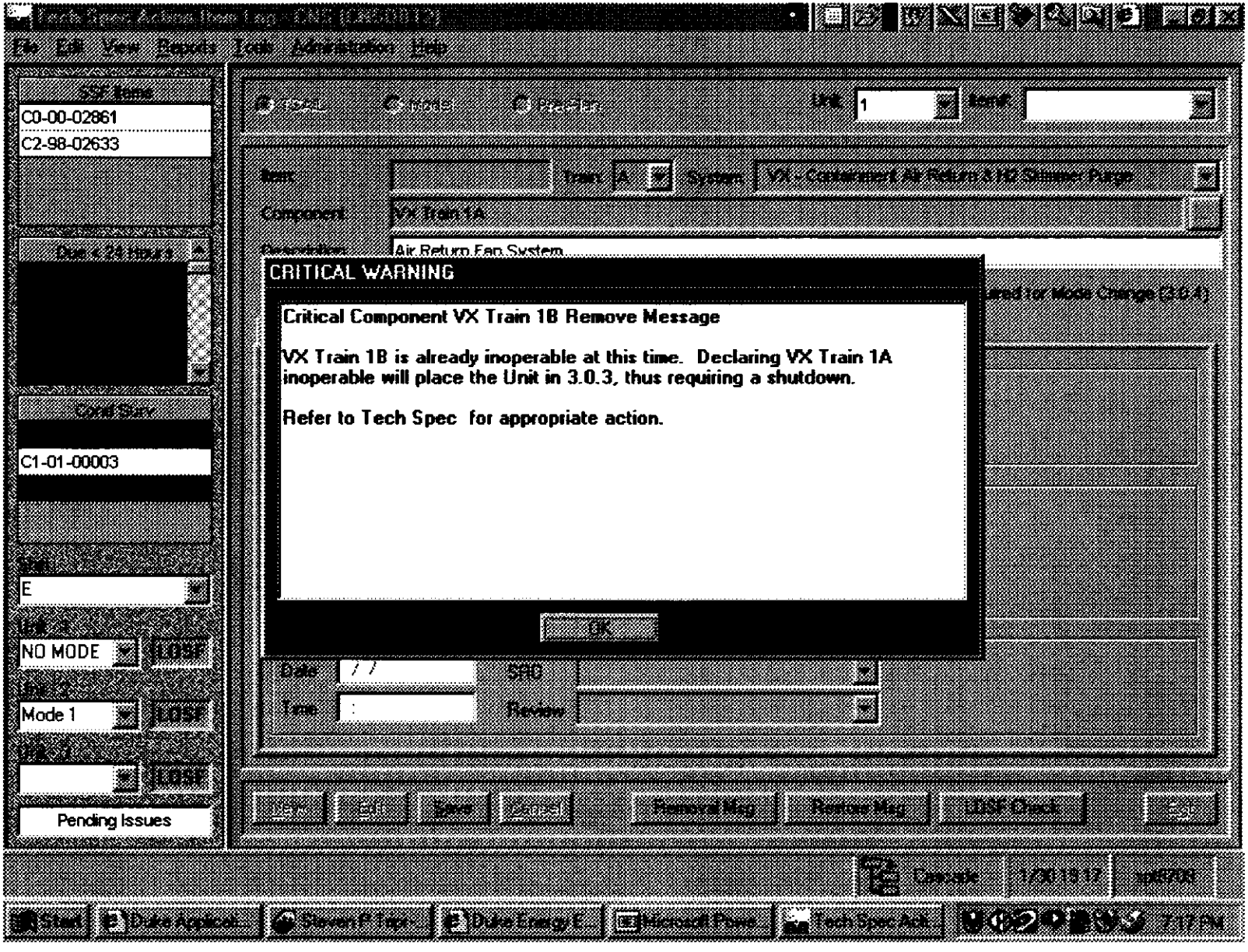
SSF Items
C0-00-02861
C2-98-02633
C1-01-00003
E
NO MODE
LOSF
Mode 1
LOSF
LOSF
Unit 1
Train B
System VX - Containment Air Return & H2 Skimmer Purge
Component VX Train 1B
Description Air Return Fan System
Tracking Only
Tech Specs
Plant Conditions
Instructions
Inoperability Reasons
Operability
Declared Inoperable
Date 01/30/2001
SRO JKM7496 - Jamie McConnell
Time 19:14
Review
Required Operable
Date
Time
History
History
Allow Override
Master LCO Clock
Declared Operable
Date / /
SRO
Time :
Review
Save
Cancel
Removal Msg
Restore Msg
LOSF Check
Start
Tech Spec Act...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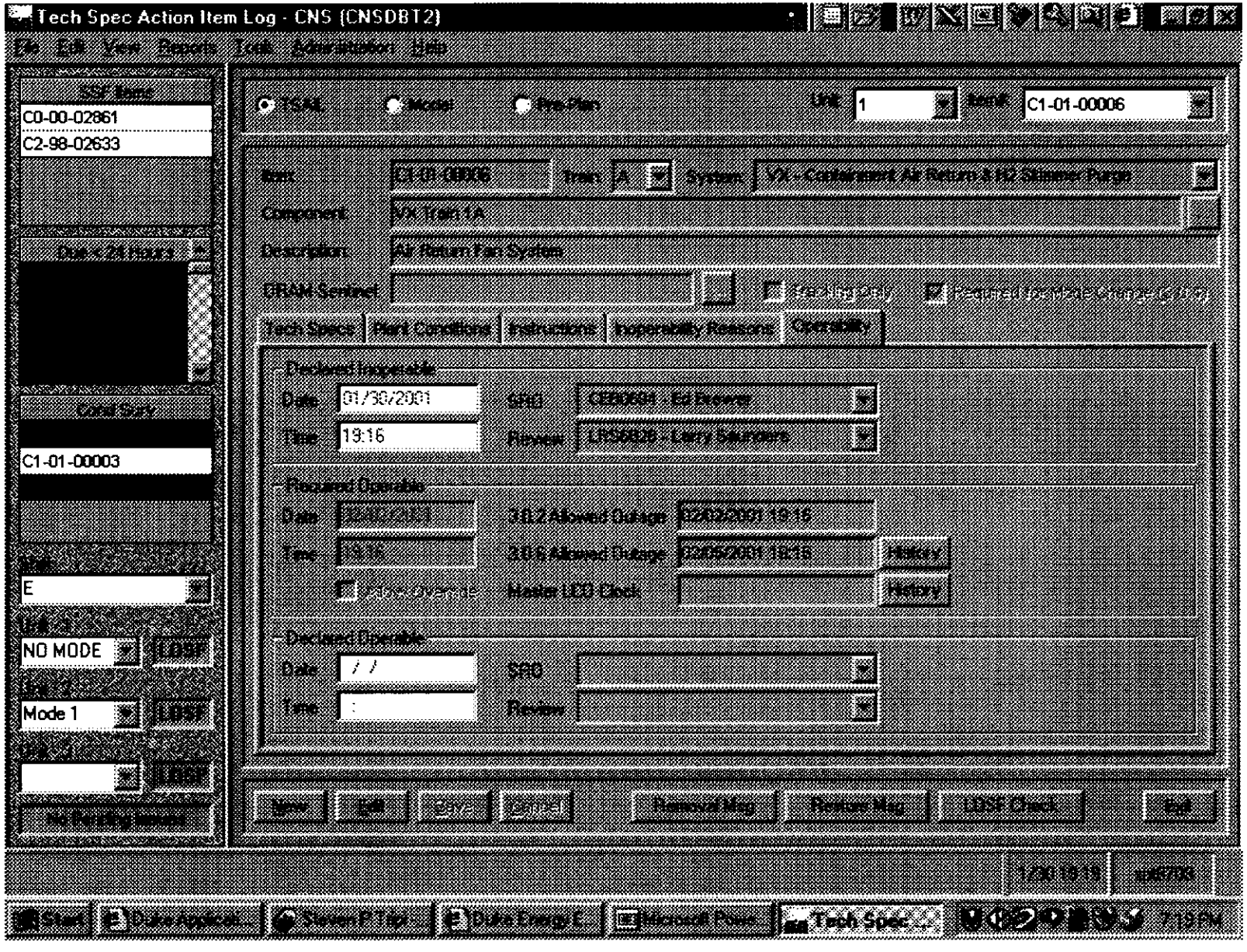
SSF Items
C0-00-02861
C2-98-02633
Due < 24 hours
Cond Sum
C1-01-00003
Shift
E
Unit 1
NO MODE
LOSF
Unit 2
Mode 1
LOSF
Unit 3
LOSF
Pending Issues
Unit
1
Item
Train
A
System
VX - Containment Air Return & H2 Skimmer Purge
Component
VX Train 1A
Description
Air Return Fan System
CRITICAL WARNING
Critical Component VX Train 1B Remove Message
VX Train 1B is already inoperable at this time. Declaring VX Train 1A inoperable will place the Unit in 3.0.3, thus requiring a shutdown.
Refer to Tech Spec for appropriate action.
OK
Date
SRO
Time
Reviewer
New
Edit
Save
Cancel
Removal Msg
Restore Msg
LOSF Check
Exit
Console
Start
Duke Applicat...
Steven P Tapp...
Duke Energy E...
Microsoft Powe...
Tech Spec Ack...
7:17 PM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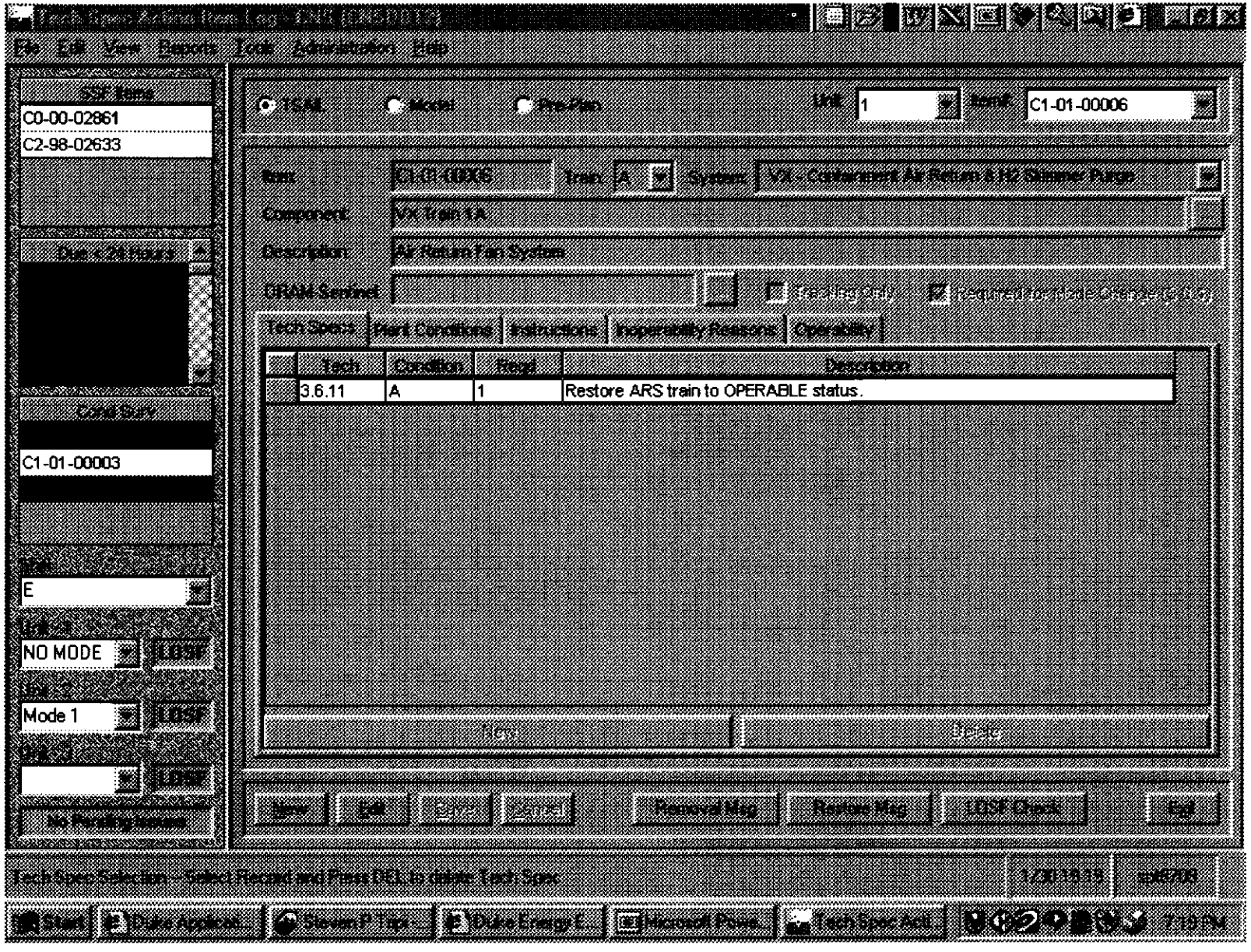
C2-98-02633
Due < 24 Hours
Cond Surv
C1-01-00003
E
NO MODE
LOSF
Mode 1
LOSF
LOSF
No Pending Items
TSAIL
Model
Pre-Plan
Unit 1
Item C1-01-00006
Item C1-01-00006 Train A System VX - Containment Air Return & H2 Skimmer Purge
Component VX Train 1A
Description Air Return Fan System
DRAM Sentinel
Tracking Only
Required for Mode 3 from 24-16-07
Tech Specs
Plant Conditions
Instructions
Inoperability Reasons
Operability
Declared Inoperable
Date 01/30/2001
Time 19:16
SRO CE80691 - Ed Brewer
Reviewer LNS6828 - Larry Saunders
Required Operable
Date
Time
3.8.2 Allowed Outage 02/02/2001 19:16
3.8.6 Allowed Outage 02/05/2001 19:16
History
Master LED Clock
History
Declared Operable
Date / /
Time :
SRO
Reviewer
New
Edit
Save
Cancel
Removal Msg
Restore Msg
LOSF Check
Exit
1/30 19:19
Start
Duke Applicat...
Steven P Tay...
Duke Energy E...
Microsoft Powe...
Tech Spec...
7:19 PM


File Edit View Reports Tools Administration Help
SSF Items
C0-00-02861
C2-98-02633
Due < 24 Hours
Cond Sum
C1-01-00003
E
NO MODE
Mode 1
TSAIL
Model
Pre-Plan
Unit 1
Item# C1-01-00006
Item C1-01-00XS
Train A
System VX - Containment Air Return & H2 Skimmer Purge
Component VX Train 1A
Description Air Return Fan System
DRAM Sentinel
Tracking Only
Required for Mode Change to (1,2)
Tech Specs
Plant Conditions
Instructions
Inoperability Reasons
Operability
Tech
Condition
Read
Description
3.6.11
A
1
Restore ARS train to OPERABLE status.
New
Edit
Save
Cancel
Removal Msg
Restore Msg
LDSF Check
Exit
Tech Spec Selection - Select Record and Press DEL to delete Tech Spec
Start
Duke Applicat...
Steven P Tipt...
Duke Energy E...
Microsoft Powe...
Tech Spec Acti...
7:19 PM

3.6 CONTAINMENT SYSTEMS

3.6.11 Air Return System (ARS)

LCO 3.6.11 Two ARS trains shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One ARS train inoperable.	A.1 Restore ARS train to OPERABLE status.	72 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3. AND B.2 Be in MODE 5.	6 hours 36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.6.11.1 Verify each ARS fan starts on an actual or simulated actuation signal, after a delay of $\geq$ 8.0 minutes and $\leq$ 10.0 minutes, and operates for $\geq$ 15 minutes.	92 days

(continued)

Table 3.3.2-1 (page 5 of 5)
Engineered Safety Feature Actuation System Instrumentation

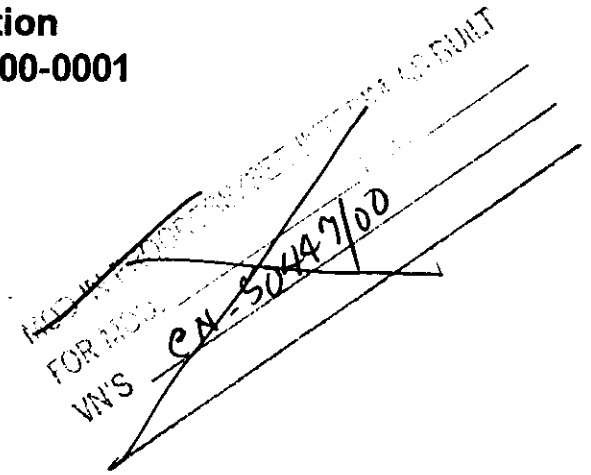
FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS	SURVEILLANCE REQUIREMENTS	ALLOWABLE VALUE	TRIP SETPOINT
8. ESFAS Interlocks						
a. Reactor Trip, P-4	1,2,3	1 per train, 2 trains	F	SR 3.3.2.8	NA	NA
b. Pressurizer Pressure, P-11	1,2,3	3	O	SR 3.3.2.5 SR 3.3.2.9	≥ 1944 and ≤ 1966 psig	1955 psig
c. T_{avg} - Low Low, P-12	1,2,3	1 per loop	O	SR 3.3.2.5 SR 3.3.2.9	≥ 550°F	≥ 553°F
9. Containment Pressure Control System						
a. Start Permissive	1,2,3,4	4 per train	P	SR 3.3.2.1 SR 3.3.2.7 SR 3.3.2.9	≤ 0.45 psid	≤ 0.4 psid
b. Termination	1,2,3,4	4 per train	P	SR 3.3.2.1 SR 3.3.2.7 SR 3.3.2.9	≥ 0.25 psid	≥ 0.3 psid
10. Nuclear Service Water Suction Transfer - Low Pit Level	1,2,3,4	3 per pit	Q,R	SR 3.3.2.1 SR 3.3.2.9 SR 3.3.2.11	≥ El. 555.4 ft	≥ El. 557.5 ft

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
O. One channel inoperable.	O.1 Verify interlock is in required state for existing unit condition. OR O.2.1 Be in MODE 3. AND O.2.2 Be in MODE 4.	1 hour 7 hours 13 hours
P. One or more Containment Pressure Control System channel(s) inoperable.	P.1 Declare affected supported system inoperable.	Immediately
Q. One Nuclear Service Water Suction Transfer-Low Pit Level channel in one or more pits inoperable.	Q.1 ----------NOTE---------- The inoperable channel may be bypassed for up to 2 hours for surveillance testing of other channels. ---------- Place channel in trip. OR Q.2.1 Be in MODE 3. AND Q.2.2 Be in MODE 5.	 4 hours 10 hours 40 hours

(continued)

Containment Air Return & Hydrogen Skimmer System (VX) Design Basis Specification
Spec. CNS-1557.VX-00-0001
Rev. 7



May 25, 1994

Duke Power Company
Catawba Nuclear Station
Units 1 and 2

Revision Log

Revision 1	8/25/94
Revision 2	2/21/95
Revision 3	8/19/97
Revision 4	3/18/98
Revision 5	3/23/99
Revision 6	6/4/99
Revision 7	5/10/00

VERIFICATION OF SPECIFICATION

Station and Unit Number: Catawba Nuclear Station, Units 1 and 2

Title of Specification: Containment Air Return & Hydrogen Skimmer System (VX) Design Basis Specification

Specification Number: CNS-1557.VX-00-0001

Revision: 7

This document specifies items related to **QA CONDITION** 1. In accordance with established procedures, its quality has been assured. Signatures certify that the above specification was originated, checked, approved and inspected (or waived) as noted.

Signature also certifies that a review for determining potential impact to work performed per previous revisions was conducted for this revision.

Previous Work Impacted by this revision: ___ Yes, See Attachment X No

Prepared By: Jeffrey Rose Date: 5/30/00

Checked By: R. Monichello Date: 6/15/00

Approved By: TV Moon Date: 6/19/00

Inspection Waived by Sponsor and Other Teams

Inspection Waived By: TV Moon Date: 6/19/00

For

Location/Team	CNS / CEN	Location/Team	
Location/Team	NGO / Nucl. Engr.	Location/Team	
Location/Team		Location/Team	
Location/Team		Location/Team	
Location/Team		Location/Team	

Form 02548, Rev.6

Inspected by Other Teams:

Location/Team	CNS/MSE	Inspected By/Date	{Provided by Preparer}
Location/Team	CNS/Mod PSE	Inspected By/Date	Dwayne Tumbleson/6-19-00
Location/Team		Inspected By/Date	
Location/Team		Inspected By/Date	
Location/Team		Inspected By/Date	
Location/Team		Inspected By/Date	
Location/Team		Inspected By/Date	
Location/Team		Inspected By/Date	
Location/Team		Inspected By/Date	

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(FOR ASME CODE ITEMS)

Group: _____ Date: _____
Engineering

This is to certify that the above specification has been reviewed by me, the undersigned, and is correct, complete, and in compliance with _____ Edition including the _____ Addendum of ASME Code, Section III, Paragraph _____ .

(SEAL)

Signature: _____
Name: _____
Professional Engineer

No. & State: _____

Form 02548, Rev 6

Document Revision Description

Form 170.1 Rev.1

REVISION NO.	PAGES or SECTIONS REVISED AND DESCRIPTION
0	Initial Issue
1	Revised Section 20.5.1.1 per NSM CN-21321/00 to reflect additional CPCS interlock on Containment Air Return Fans. Revised Section 32.3.2.1 per NSM CN-21321/00 to reflect additional CPCS interlock on Containment Air Return Fans and to remove Open Item concerning PIR 0-C91-0117.
2	Revised section 20.5.1.1 per NSM CN-11321/00 to reflect additional CPCS interlock on Containment Air Return Fans. Revised Section 31.3.2.1 per NSM CN-11321/00 to reflect additional CPCS interlock on Containment Air Return Fans and to remove Open Item concerning PIR 0-C91-0117.
3	Revised Sections 20.1.4.1, 20.1.4.2, 31.1.3.2, 31.3.2.1, 32.1.3.2, and 32.3.2.1 per Minor Mod CE-8849.
4	Revised Section 20.4.2.2 per Minor Mod CE-9170.
5	Revised Section 20.1.4.1 per Minor Mod CE-10195.
6	Revised Sections 20.1.4.1, 20.1.4.3, 20.6.2, 31.3.2.1 and 32.3.2.1 per Minor Mod CE-10202, Sections 31.3.2.3 and 32.3.2.3 per Minor Mod CE-9665, and Sections 31.1.2.1, 31.1.2.4, 31.3.2.4, 31.3.2.5, 32.1.2.1, 32.1.2.4, 32.3.2.4, 32.3.2.5 and added Reference 20.6.3.2.6 per Minor Mod CE-10338.
7	Revised Sections 31.1.2.4 and 32.1.2.4 and Deleted Reference 20.6.3.2.6 per Minor Mod CE-70080.

Contents

10. INTRODUCTION

10.1 SYSTEM BOUNDARY AND SCOPE

This specification documents the system and equipment design bases for the Containment Air Return & Hydrogen Skimmer System (VX). The major components of the VX System are fans, ductwork, dampers and controls. The arrangement of these components is depicted on flow diagrams CN-1557-1.0 (Unit 1) and CN-2557-1.0 (Unit 2). It should be noted that each of the two reactor units at Catawba Nuclear Station has a separately functioning VX System and that both are monitored from a single control room. A VX System designation is assigned to the equipment and components covered by this specification.

The VX System interfaces with:

Diesel Load Sequencing System (EQB)
Containment Pressure Control System (CPCS)
600 VAC Essential Auxiliary Power (EPE)
120 VAC Essential Power System (EPY)
208/120 VAC Blackout Auxiliary Power (ETE)
240/120 VAC Auxiliary Control Power System (EPF)
120/ VAC Vital Instrumentation and Control Power (EPG)
208/120 VAC Station Normal Auxiliary Power (ETA)
Instrument Air System (VI)

This document will consider the interfaces only as they directly act on the VX System. For example, the EQB System interface will be considered only after a signal has been received by VX. How the signal is generated is covered in other documents.

10.2 SYSTEM PURPOSE

10.2.1 GENERAL

The Containment Air Return & Hydrogen Skimmer System (VX) consist of two sub-systems, the Containment Air Return sub-system and the Hydrogen Skimmer sub-system.

The purpose of the Containment Air Return sub-system is to assure a rapid return of air from upper containment to lower containment following a Loss Of Coolant Accident (LOCA) or a Main Steam Line Break (MSLB). This system also provides post-accident recirculation of air through the ice condenser.

The purpose of the Hydrogen Skimmer sub-system is to insure adequate mixing of the containment atmosphere to prevent excessive hydrogen build-up in isolated pockets and dead-ended spaces following a LOCA.

10.2.2 VX SYSTEM ROLE IN PLANT OPERATIONS

This system does not provide any normal ventilation function and operates only during accident conditions. This system is required to be in an OPERABLE condition during plant Modes 1, 2, 3 and 4 (Power Operation, Startup, Hot Standby and Hot Shutdown respectively).

10.3 SPECIFICATION FORMAT AND USE

This specification serves as the basis for development of all future VX System design documents. Any time an evaluation determines that a condition exists which violates a requirement set forth in this specification, a problem resolution process shall be invoked.

Throughout this specification, the terms "shall" and "should " are used to denote requirements and recommendations, respectively.

Section 20, "DESIGN BASIS AND CRITERIA" on page 3 states system and equipment design basis. Section 30, "SYSTEM DESIGN FEATURES" on page 21 states those additional features that have been provided to meet various codes, standards, or good engineering practices but are not required for the systems design basis. Sections 31, "UNIT 1 SYSTEM AND EQUIPMENT DESCRIPTION" on page 25 and 32, "UNIT 2 SYSTEM AND EQUIPMENT DESCRIPTION" on page 41 are Unit 1 and Unit 2 System Descriptions, respectively. The description sections document how the system functions in general in meeting the requirements of Section 20, "DESIGN BASIS AND CRITERIA" on page 3.

20. DESIGN BASIS AND CRITERIA

System functional design basis is addressed in Section 20.1, "SYSTEM FUNCTIONAL DESIGN BASIS." System generic design criteria are addressed in Section 20.2, "SYSTEM GENERIC DESIGN CRITERIA" on page 6. System specific design criteria are addressed in Section 20.3, "SYSTEM SPECIFIC DESIGN CRITERIA" on page 10. System and equipment design basis are addressed in Section 20.4, "EQUIPMENT DESIGN BASES" on page 12. Design basis references are listed in Section 20.6, "DESIGN BASIS REFERENCES" on page 17.

20.1 SYSTEM FUNCTIONAL DESIGN BASIS

The design basis function of the Containment Air Return & Hydrogen Skimmer System (VX) is to:

1. provide sufficient circulation of air and steam to allow the ice condenser to maintain containment pressures less than the design pressure of 15 psig, and
2. provide sufficient mixing of hydrogen from isolated pockets and dead-ended spaces to allow the Hydrogen Recombiners to reduce the concentration of hydrogen to less than 4% volume

Containment pressures are reduced by rapidly moving air from upper containnment to lower containment upon receipt of the required permissives (Containment Air Return System). Hydrogen concentrations are reduced by pulling air from dead-ended spaces in lower containment and discharging near the Hydrogen Recombiners.

20.1.1 CONTAINMENT AIR RETURN SYSTEM

Following a High Energy Line Break (HELB) in Containment, the Containment Air Return Fans will provide for a return of air from upper Containment to lower Containment. The recirculation of Containment air shall enhance the ice condenser and Containment Spray System (NS) removal of heat (for HELB) and removal of fission products (LOCA only) per references 20.6.1.7.9, "Catawba FSAR Section 6.2.1.1.3.1, Loss of Coolant Accident" and 20.6.1.7.10, "Catawba FSAR Section 6.2.1.1.3.3, Steam Line Break."

20.1.2 HYDROGEN SKIMMER SYSTEM

Systems to control fission products, hydrogen, oxygen and other substances which may be released into Containment shall be provided as necessary to reduce (consistent with the functioning of other associated systems), the concentration and quantity of fission products released to the environment following postulated accidents, and to control the concentration of hydrogen or oxygen or other substances in the containment atmosphere following postulated accidents to assure that containment integrity is maintained (Reference 20.6.1.1.7, "10CFR50, Appendix A, General Design Criterion 41, Containment Atmosphere Cleanup").

Consistent with that requirement, hydrogen pocketing in Containment is prevented through use of the VX System.

20.1.3 NORMAL OPERATION

During normal power operation, this system is in a standby mode and does not perform any function. The Containment Air Return & Hydrogen Skimmer System (VX) shall be operable and capable of performing its nuclear safety related function in plant modes 1, 2, 3 and 4 (Power Operation, Startup, Hot Standby and Hot Shutdown, respectively).

20.1.4 DESIGN BASIS EVENTS

20.1.4.1 Containment Air Return System

The function of the Containment Air Return System is to mitigate the consequences of a HELB. This function shall be performed during injection and recirculation (if recirculation is necessary). The system shall be capable of performing this function with only on-site power available during and following the event.

The Containment Air Return Fans shall be utilized following a HELB to return air from upper Containment to lower Containment after peak containment pressure has been reached to provide mixing of containment atmosphere during the long term pressure peak. After the initial containment pressure peak has been reduced, the ice condenser and NS System are capable of maintaining containment pressure below the containment design pressure with the assumption of steam generation by residual energy until the ice bed is melted. If steam generation is assumed after ice melt, the NS System maintains the pressure below the containment design pressure with the Containment Air Return Fans circulating air in Containment.

One 40,000 cfm Containment Air Return Fan is assumed operable following a HELB per assumptions made in References 20.6.1.7.9, "Catawba FSAR Section 6.2.1.1.3.1, Loss of Coolant Accident," 20.6.1.7.18, "Catawba FSAR Section 15.4.8.4, Spectrum of Rod Control Assembly Ejection Accidents," and 20.6.1.7.19, "Catawba FSAR Section 15.6.5.3, LOCA - Radiological Consequences." One 40,000 cfm Containment Air Return Fan is assumed operable following a MSLB for heat removal per assumptions made in reference 20.6.1.7.10, "Catawba FSAR Section 6.2.1.1.3.3, Steam Line Break." Both Containment Air Return Fans (80,000 cfm total) are assumed operating per asumptions made in reference 20.6.1.7.11, "Catawba FSAR Section 6.2.1.5, Minimum Containment Pressure Pressure Analysis for Performance Capability Studies of Emergency Core Cooling System."

The Containment Air Return Fans start after a 9 +/-1 minute time delay provided several permissives have been satisfied. The first permissive is received from the Containment Pressure Control System (CPCS) when containment pressure is greater than 0.4 psig. The Diesel Generator (D/G) sequencer load group 11 permissive must also be present for a fan start. The fans will continue to run until containment pressure is less than or equal to 0.25 psig. 0.4 psig and 0.25 psig will be used as fan on and off respectively. Per Reference 20.6.2.1.4, "Catawba Technical Specification Section 3.3.2, Engineered Safety Features Actuation System (ESFAS) Instrumentation, Table 3.3.2-1 (Item 9)," the CPCS start permissive setpoint is 0.4 psig and the termination setpoint is 0.3 psig. 0.3 psig is used for reset to insure the fan is off before the 0.25 psig Technical Specification allowable value is reached. 0.4 psig is used to insure the fan starts up prior to reaching the 0.45 psig Technical Specification allowable value. The extra margin between the Tech. Spec. trip setpoints and the allowable values are provided to compensate for instrument drift between successive calibrations.

The normally closed Containment Air Return Fan isolation damper will open following a 10 second time delay after receipt of the Sp (Containment High- High pressure) signal. Several permissives must also be present to allow the damper to reposition. The first permissive is a signal from the CPCS that containment pressure is greater than 0.4 psig. 0.4 psig is used to insure the damper opens prior to reaching the 0.45 psig Technical Specification allowable value. The second is a signal from a differential pressure switch which

verifies the differential pressure across the damper is less than 0.5 psig. The D/G load sequencer load group 1 permissive must also be present for the damper to open. After the 10 second time delay and these permissives are present, the Containment Air Return Fan isolation damper starts to open. The Containment Air Return Fan isolation damper does not automatically close when the pressure decreases to the 0.30 psig CPCS setpoint. The isolation damper must be manually closed from the control room.

The containment Pressure Control System (CPCS) is described in Reference 20.6.3.1.10, "CNS-1563.NS-00-0001, Design Basis Specification for the Containment Spray (NS) System." The following VX System equipment is INOPERABLE if the loop is removed from service:

INSTRUMENT LOOP	EQUIPMENT
NSLP5160	VX Air Return Fan A
NSLP5170	VX Air Return Fan A and Air Return Fan A Motor Operated Isolation Damper
NSLP5240	VX Air Return Fan B
NSLP5250	VX Air Return Fan B and Air Return Fan B Motor Operated Isolation Damper

The Containment Air Return Fans start time delay is referenced in DPC-1552.08-00-0160, Rev 0, "McGuire/Catawba GOTHIC Ice Condenser Containment Base Model", which is used in Catawba's nuclear safety analyses calculations. Initially during a design basis accident LOCA or HELB, natural circulation forces steam and air flow from lower containment through the ice condenser to upper containment. Hydrogen accumulation is not a major concern, and adequate mixing of the containment atmosphere occurs (Reference 20.6.3.2.5). Therefore, the Containment Air Return Fans are not required until approximately 10 minutes after the design basis accident. The fan start time delay allows the upper and lower containment pressure to equalize and minimize the differential pressure.

The basis for opening the Containment Air Return Fan isolation damper this early in the event comes from the NSSS vendor accident analysis. This analysis indicates that a pressure reversal between the upper and lower containments, with upper positive with respect to lower containment, will occur as early as 16 seconds into the event for some accident scenarios. The pressure reversal is caused by the volume of air removed from lower containment through the ice condenser to upper containment. Opening the isolation damper provides an assured flow path for pressure equalization between the upper and lower containments during this period of the initial blow down.

In letter Duke-3100, N.J. Lipuralo and C.G. Tinkler (Westinghouse) to S.K. Blackley (Duke), Westinghouse requested the fan isolation damper be open 15 seconds after receipt of a Containment Hi-Hi pressure signal in response to the Reverse Pressure Differential Analysis. The decision was made within Duke Power to open the damper in 10 seconds +/-1 second to insure compliance with Westinghouse request. Figure 6-16 of the FSAR is a graphical representation of the Peak Reverse Differential Pressure Transient.

20.1.4.2 Hydrogen Skimmer System

The function of the Hydrogen Skimmer System is to mitigate the consequences of a LOCA. This function shall be performed during injection and recirculation (if recirculation is necessary). The system shall be capable of performing this function with only on-site power available during and following the event.

Hydrogen production in Containment can be the product of several sources. The possible sources of hydrogen are the zirconium-water reaction, evolution of dissolved hydrogen in the Reactor coolant, corrosion of plant materials, and the radiolysis of core and sump water. Reference 20.6.1.1.11, "10CFR50, Section 50.44, Standards for Combustible Gas Control Systems in Light Water Cooled Power Reactors"

requires the capability to provide mixing of the containment environment and controlling combustible gas concentrations in containment following a LOCA to insure minimal hydrogen pocketing.

The hydrogen skimmer fans will start after 9 +/-1 minutes have elapsed from the receipt of the Sp signal provided several permissives have been satisfied. The diesel generator load sequencer load group 11 permissive must be present and the isolation damper 'open' permissive must be present.

The Hydrogen Skimmer Fans start time delay is referenced in CNC-1552.08-00-0194, "Reanalysis of the Catawba Hydrogen Skimmer System Flow Requirements." Based on safety analysis calculations, hydrogen accumulation is not a major concern, and the LOCA blowdown will provide adequate mixing of the containment atmosphere in the first ten minutes.

20.1.4.3 Electric Hydrogen Recombiners

The function of the recombiners is to mitigate the consequences of a LOCA. These are safety related devices and shall be capable of functioning with only on-site power following the event. The electric hydrogen recombiners also remove hydrogen from the containment atmosphere. They are designed to process a capacity such that the containment hydrogen concentration does not exceed 4% by volume.

Each electric recombiner is capable of processing a maximum of 100 scfm of Containment atmosphere. Flow through recombiners is due to natural circulation and is limited by flow orifices internal to the device. There are two recombiners per unit and each recombiner has a 100% capacity. Units are controlled manually following a LOCA to control hydrogen concentration. Power and controls for the hydrogen recombiners are located outside of containment.

Reference 20.6.2.1.3, "Catawba Technical Specification Section 3.6.7, Hydrogen Recombiners" requires the recombiners to be demonstrated operable at least once every 18 months. This is done by measuring the internal heater sheath temperature after 90 minutes and insuring the temperature is greater than or equal to 700°F. After reaching 700°F, the power setting is increased to maximum. After 2 minutes the power meter should read greater than or equal to 60 kilowatts.

The hydrogen recombiners are not part of the VX System. Their operation is independent of the operation of the VX System but have been included here due to their parallel function of hydrogen control. Also, since the recombiners do not have a system designation, the VX System design basis is a convenient and logical place to define their design parameters.

20.2 SYSTEM GENERIC DESIGN CRITERIA

20.2.1 Single Failure

The guidelines for the application of the single failure criterion are documented in Reference 20.6.3.1.1, "CNS-1465.00-00-0001, Plant Design Basis Specification for Systems Single Failure." The VX System shall be designed against the consequences of any single active or passive failure without loss of capability of the system to perform its intended safety functions in mitigating the consequences of a design basis initiating event.

Active components shall be designated per the definition presented in Reference 20.6.3.1.1, "CNS-1465.00-00-0001, Plant Design Basis Specification for Systems Single Failure."

20.2.2 System Class

The Containment Air Return & Hydrogen Skimmer System (VX) is a QA 1 Engineered Safeguards System. The guidelines for the selection of dampers and ductwork are documented in Reference 20.6.3.1.18, "CNS-1211.00-00-0005, Supplement No. 6, Heating, Ventilating and Air Conditioning; Reactor Building." Guidelines for selection of fans are documented in Reference 20.6.3.1.20, "CNS-1211.00-00-0006, Vane Axial Fan Motor Systems Related to Nuclear Safety."

The VX System is classified as a Safety Class 2 system. Imbedded piping is non-safety. Exposed piping and valves in lower containment compartments where the the HSF take suction is class 'F', seismic. This will insure the piping and valves remain in place following a seismic event. These valves are not missile protected in that a missile strike to a small number of these valves will not compromise the ability of the system to perform its design function.

20.2.3 Containment Penetrations

The VX System has no containment penetrations.

20.2.4 Seismic

Per Reference 20.6.1.1.1, "10CFR50, Appendix A, General Design Criterion 2, Design Bases for Protection Against Natural Phenomena," safety related systems, structures, and components are required to be protected from the effects of earthquakes. Compliance with this requirement is documented in Reference 20.6.1.7.1, "Catawba FSAR Section 3.2, Classification of Structures, Systems, and Components."

For information pertaining to seismic design criteria see Reference 20.6.3.1.7, "CNS-1465.00-00-0007, Plant Design Basis Specification for Seismic Design."

The VX System and the structures which house this system (Reactor Building) are designed to withstand the effects of a Seismic Event without loss of capability of the system to perform its safety function.

Nuclear safety related (QA 1) mechanical equipment shall be qualified in accordance with the guideline set forth in Reference 20.6.1.7.5, "Catawba FSAR Section 3.9.2.2, Seismic Qualification of Safety Related Mechanical Equipment." Nuclear safety related instrumentation and electrical equipment shall be seismically qualified in accordance with the guidelines set forth in Reference 20.6.1.7.6, "Catawba FSAR Section 3.10, Seismic Qualification of Seismic Category I Instrumentation and Electrical Equipment."

20.2.5 Tornado/Wind

Per Reference 20.6.1.1.1, "10CFR50, Appendix A, General Design Criterion 2, Design Bases for Protection Against Natural Phenomena," safety related systems, components, and structures are required to be protected from the effects of a tornado. Compliance with this requirement is documented in Reference 20.6.1.7.2, "Catawba FSAR Section 3.3, Wind and Tornado Loadings." Tornado/Wind analysis is also addressed in Reference 20.6.3.1.15, "CNS-1108.02-00-0001, Catawba Structural Design Specification." For information pertaining to Tornado/Wind design criteria see Reference 20.6.3.1.8, "CNS-1465.00-00-0008, Plant Design Basis Specification for Tornado/Wind."

All Category I structures, except those structures not exposed to wind, are designed to withstand the effects of wind and tornado loadings, without loss of capability of the structure to perform its safety function. The

nuclear safety related portions of the VX System are housed entirely within the Reactor Building, which is a Category I structure, and therefore, the VX System is protected from the effects of tornado/wind.

20.2.6 Missiles

Per Reference 20.6.1.1.2, "10CFR50, Appendix A, General Design Criterion 4, Environmental and Dynamic Effects Design Bases," safety related systems, components, and structures are required to be protected from the effects of tornado generated missiles and other selected missiles (i.e., turbine blade). Compliance with this requirement is documented in Reference 20.6.1.7.4, "Catawba FSAR Section 3.5, Missile Protection." Missile protection is also discussed in Reference 20.6.3.1.15, "CNS-1108.02-00-0001, Catawba Structural Design Specification."

Per reference 20.6.3.3.2, "CNM-1211.00-2326, Missle Penetration Calculations - Joy Technologies Fans, Inc.," neither the Containment Air Return nor the Hydrogen Skimmer Fans will produce a missile capable of penetrating the fan housing in the event of a rotor failure.

The structures which contain the VX System (Reactor Buildings) are designed to withstand the effects of tornado generated missiles and internally generated missiles.

20.2.7 Pipe Rupture

The VX System is required to mitigate the consequences of a pipe rupture (HELB) and the subsequent containment pressurization.

In accordance with Reference 20.6.3.1.19, "Environmental Qualification Criteria Manual (EQCM)," all safety related VX Equipment is located within the Reactor Building which is protected against postulated effects from flooding.

Reactor Building floor curbs (4" high) direct water that falls on the operating floor, away from the Containment Air Return Fan pits and is designed to limit flooding of the fan pits from internal sources (pipe rupture and/or NS System actuation) per Reference 20.6.3.1.14, "CNS-1144.00-00-0010, Design Basis Specification for The Reactor Building Structures" Section 30.2.3.9.1.. Six inch angle iron dams have also been provided around the VX fan pits to assist in minimizing fan pit flooding.

20.2.8 Equipment Qualification

All VX System safety related equipment shall be reviewed to determine if it is located in a harsh environment. Any equipment identified as being in such an environment shall be evaluated to determine its environmental qualification requirements and be qualified in accordance with Reference 20.6.1.1.12, "10CFR50, Section 50.49, Environmental Qualification of Electric Equipment Important to Safety For Nuclear Power Plants."

Compliance with this requirement is documented in Reference 20.6.1.7.7, "Catawba FSAR Section 3.11, Environmental Design of Mechanical and Electrical Equipment" and Reference 20.6.1.6.1, "Duke Power Company - Catawba Nuclear Station - Response to NUREG 0588 (H. B. Tucker letter to H. R. Denton, dated February 8, 1984)." The requirements to maintain the environmental qualification of nuclear safety related equipment are identified in Reference 20.6.3.1.16, "CNLT-1780-03.01, Environmental Qualification Master List (EQML)" and Reference 20.6.3.1.17, "EQMM-1393.01, Environmental Qualification Maintenance Manual (EQMM)." The environmental conditions used to qualify equipment are identified in Reference 20.6.3.1.19, "Environmental Qualification Criteria Manual (EQCM)."

20.2.9 Electrical Separation

The VX System design shall incorporate complete physical and electrical separation between redundant trains of safety related wiring and equipment and between either train and non-safety related wiring and equipment, per References 20.6.1.7.13, "Catawba FSAR Section 7.1.2.2, Instrumention & Controls - Independence of Redundant Controls," 20.6.1.7.17, "Catawba FSAR Section 8.3.1.4, AC Power Systems - Independence of Redundant Systems," and 20.6.3.5.1, "Electrical Design Manual."

20.2.10 Flood

Per Reference 20.6.1.1.1, "10CFR50, Appendix A, General Design Criterion 2, Design Bases for Protection Against Natural Phenomena," safety related systems, components, and structures shall be protected from the effects of a flood. Compliance with this requirement is documented in Reference 20.6.1.7.3, "Catawba FSAR Section 3.4, Water Level (Flood) Design."

For information pertaining to flood design criteria see Reference 20.6.3.1.6, "CNS-1465.00-00-0011, Plant Design Basis Specification for Flooding From External Sources."

20.2.11 Loss of Instrument Air

The guidelines for incorporating Loss of Instrument Air in the Catawba design are outlined in Reference 20.6.3.1.3, "CNS-1465.00-00-0004. Plant Design Basis Specification for Loss of Instrument Air."

Bypass dampers used for air return fan testing use instrument air, however, components required for accident mitigation do not use the Instrument Air System and are not affected by this criteria.

20.2.12 Radiation Protection

The VX System is not a source of Design Basis Radiation.

20.2.13 Fire Protection

Mechanical systems shall be designed in accordance with fire protection requirements established in References 20.6.1.3.1, "NUREG 0800, Standard Review Plan, July 1981," 20.6.3.1.5, "CNS-1465.00-00-0006, Plant Design Basis Specification for Fire Protection," and 20.6.3.1.9, "CNS-1435.00-00-0002, Design Basis Specification for Post Fire Safe Shutdown."

The VX System is not designed to mitigate the consequences of a fire. All fire protection criteria related to this system are considered to be design features and are described in Section 30, "SYSTEM DESIGN FEATURES" on page 21.

In some cases, equipment for both trains is located in the same fire area. Unit shutdown is assured for a fire in those areas per Reference 20.6.3.1.9, "CNS-1435.00-00-0002, Design Basis Specification for Post Fire Safe Shutdown."

20.2.14 Loss Of Control Room

The VX System is not required to bring the station to a prompt hot shutdown and subsequent cold shutdown condition during this event.

20.3 SYSTEM SPECIFIC DESIGN CRITERIA

20.3.1 STANDARD REVIEW PLAN

The design of the Containment Air Return & Hydrogen Skimmer System (VX) shall conform to the General Design Criteria as described in Section 3.2.1 Siesmic Classification, 3.2.2 System Quality Group Classification, 6.2.1 Containment Functional Design, 6.2.5 Combustible Gas Control in Containment, 6.5.1 ESF Atmospheric Cleanup Systems, 7.1 Instrumentation and Controls of the Standard Review Plan, and Reference 20.6.1.3.2, "NUREG 0954, Safety Evaluation Report related to the operation of Catawba Nuclear Station, Units 1 and 2."

1. Reference 20.6.1.1.1, "10CFR50, Appendix A, General Design Criterion 2, Design Bases for Protection Against Natural Phenomena," as it applies to systems and components being designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, etc.

   Response

   This requirement and compliance references are addressed in Sections 20.2.4, "Seismic" and 20.2.5, "Tornado/Wind."

2. Reference 20.6.1.1.2, "10CFR50, Appendix A, General Design Criterion 4, Environmental and Dynamic Effects Design Bases," with respect to structures housing the system being capable of withstanding the effects of external missiles and internally generated missiles, pipe whip, and jet impingement forces associated with pipe breaks.

   Response

   This requirement and compliance references are addressed in Sections 20.2.6, "Missiles" and 20.2.7, "Pipe Rupture."

3. Reference 20.6.1.1.3, "10CFR50, Appendix A, General Design Criterion 16, Containment Design," as it relates to systems being provided to establish barriers against the uncontrolled release of radioactivity to the environment.

   Response

   This criterion requires in part, that systems be provided to assure that containment design conditions important to safety are not exceeded. The VX System, in conjunction with other supporting systems (CPCS, NS), is capable of rapidly reducing containment pressure following a LOCA, and maintaining them at acceptable levels.

4. Reference 20.6.1.1.4, "10CFR50, Appendix A, General Design Criterion 38, Containment Heat Removal Systems," as it applies to systems being provided to remove heat and control pressure and temperature following a LOCA.

   Response

   This requirement and compliance references are addressed in Section 20.1.4, "DESIGN BASIS EVENTS." Inadvertent operation of the Containment Air Return Fans and opening of the Containment Air Return Fan Isolation Dampers could result in a pressure reduction which could possibly exceed the containment lower design limit of -1.5 psig.

5. Reference 20.6.1.1.7, "10CFR50, Appendix A, General Design Criterion 41, Containment Atmosphere Cleanup," as it applies to controlling fission products within containment and released to the environment.

6. Reference 20.6.1.1.8, "10CFR50, Appendix A, General Design Criterion 42, Inspection of Containment Atmosphere Cleanup Systems," for permitting appropriate periodic inspection of atmospheric cleanup systems.

7. Reference 20.6.1.1.9, "10CFR50, Appendix A, General Design Criterion 43, Testing of Containment Atmosphere Cleanup Systems," for permitting appropriate testing of atmospheric systems.

Response

In meeting GDC 41, 42, and 43 requirements, the following provisions are made:

- Hydrogen Control - The VX System is designed such that hydrogen concentrations will be maintained below 4%. The Hydrogen Skimmer System draws from the dead-ended spaces in lower containment and discharges near the Hydrogen Recombiners. The ARFs provide for hydrogen dilution by mixing the hydrogen with containment atmosphere and distributing throughout containment. The Electric Hydrogen Recombiners function to reduce hydrogen concentrations in containment. They are manually started following a LOCA.
- Testing - VX sytem components are tested to insure proper function. Such tests include verification of fan performance, verification of fan start on receipt of proper signal, and proper damper/valve positioning. Each test is also required by CNS Technical Specification.
- Technical Specification - Technical Specifications specify appropiate limiting conditions for operation, tests, and inspections to insure systems are capable of performing its design function when required.

8. Reference 20.6.1.1.10, "10CFR50, Appendix A, General Design Criterion 50, Containment Design Basis" as it relates to systems being provided to insure the containment and its internal structures can accomodate the pressure and temperature conditions resulting from a LOCA.

Response

This requirement and compliance references are addressed in Section 20.1.4, "DESIGN BASIS EVENTS"

20.3.2 SYSTEM FLOW REQUIREMENTS

20.3.2.1 Containment Air Return System

Upon actuation by an Engineered Safety Feature (ESF) signal, receipt of a Diesel Generator Load Sequencer (EQB) signal, and satisfied permissives, the Containment Air Return Fans start. Each train has a 100% capacity fan with a nominal design flow of 40,000 cfm (which includes approximately 10% margin).

20.3.2.2 Hydrogen Skimmer System

Upon actuation by an Engineered Safety Feature (ESF) signal, receipt of a Diesel Generator Load Sequencer (EQB) signal, and satisified permissives, the Hydrogen Skimmer Fans start. Each train has a 100% capacity fan with a nominal design flow of 4260 cfm.

Reference 20.6.3.2.5, "CNC-1552.08-00-0194, Reanalysis of the Catawba Hydrogen Skimmer System Flow Requirements" documents the required flowrates from the dead ended spaces to maintain hydrogen concentrations below 4%. The fowrates are as follows:

Compartment	Flowrate
Rx Vessel Compartment	99 cfm
In-Core Instrument Room	8 cfm
S/G Enclosure(4)	1 cfm (each S/G)
Accumulator A Compartment	6 cfm
Accumulator B Compartment	6 cfm
Pressurizer Enclosure	165 cfm

20.3.2.3 Electric Hydrogen Recombiners

The electric hydrogen recombiners are actuated manually. Upon actuation, each train functions by natural circulation and is limited to a maximum flow of 100 scfm.

20.4 EQUIPMENT DESIGN BASES

The VX System equipment design bases are described in this section. The system consists of two sub-systems, the Containment Air Return Fan and the Hydrogen Skimmer Fan sub-systems. Each sub-system consists of two (2) 100% redundant, independent, and separately located trains. Associated with each Containment Air Return Fan train is one 100% capacity fan, three bypass test dampers, one isolation damper and one backdraft damper. Associated with each Hydrogen Skimmer Fan train is one 100% capacity fan, one isolation damper, and 13 flow control valves.

Test Acceptance Criteria (TAC) sheets have been developed for components requiring Design Engineering initiated test acceptance criteria. A Unit 2 TAC sheet exists for each of the Unit 1 TACs listed. The following table provides guidance for locating system test acceptance criteria:

Drawing	Title
CNTC-1557-VX.M001-01	Hydrogen Skimmer Fans
CNTC-1557-VX.M002-01	Containment Air Return Fans
CNTC-1557-VX.M003-01	Containment Air Return Fan Isolation Dampers
CNTC-1557-VX.M004-01	Containment Air Return Fan Check Dampers
CNTC-1557-VX.M005-01	Hydrogen Skimmer Fan Isolation Dampers
CNTC-1557-VX.M006-01	Electric Hydrogen Recombiners

20.4.1 MECHANICAL EQUIPMENT

20.4.1.1 Containment Air Return Fans 1/2A and 1/2B

Active:	Yes	1E Power:	Yes
ESF:	Yes	ESF Response Time:	9+/-1 minute

Each fan's design capacity is 40,000 CFM. Both fans of the same unit start following receipt of the necessary permissives (ie. Sp signal following HELB blowdown, differential pressure permissive, etc.). The Containment Air Return Fans have sufficient head to overcome the divider barrier differential pressure (per Reference 20.6.1.7.8, "Catawba FSAR Section 6.2.1, Containment Functional Design") resulting from steam flow and fan air flow entering the ice condenser through the lower inlet doors.

20.4.1.2 Hydrogen Skimmer Fans 1/2A and 1/2B

Active:	Yes	1E Power:	Yes
ESF:	Yes	ESF Response Time:	9+/-1 minute

Each fan's design capacity is 4260 CFM. Both fans of the same unit start following receipt of the necessary permissives (ie. Sp signal following HELB blowdown, suction valve open, etc.).

20.4.1.3 Electric Hydrogen Recombiners

Active:	Yes	1E Power:	Yes
ESF:	No	ESF Response Time:	N/A

The hydrogen recombiners are limited to 100 scfm air flow. There are two recombiners per unit, each with a 100% capacity. The units are started manually following a HELB.

20.4.2 DUCTWORK AND DAMPERS

20.4.2.1 Ductwork

The ductwork for the Containment Air Return sub-system is redundant (i.e., each train of the Containment air return sub-system has its own independent supply header) and is configured in separated headers. Ductwork is considered a passive, safety-related component.

Ductwork for the hydrogen skimmer system is actually piping. Piping is used instead of ductwork to eliminate a possible rupture of the ductwork which would provide a leak path from upper containment to lower containment. Embedded portions of the hydrogen skimmer piping is class 'H', non-safety related. Piping inside rooms where this system takes suction is class 'F'. Piping from the crane wall to the inlet connection to each fan is class 'B'.

20.4.2.2 Dampers

All dampers shall be QA Condition I, Seismically Qualified. In addition actuators for the dampers are required to be QA Condition I, Seismically qualified.

1. Containment Air Return Fan Isolation Dampers (1/2ARF-D-2,4)

   The isolation dampers shall be Low Leakage Design (Category I) as defined in ANSI N509-1976 and shall fail as-is.

2. Containment Air Return Fan Check (Backdraft) Dampers (1/2ARF-D-1,3)

   The check dampers prevent back flow from lower containment to upper containment through the ARF's when the isolation dampers are open.

3. Containment Air Return Fan Bypass Test Dampers (1/2ARF-D-5 through 10)

   The bypass test dampers are Low Leakage Design (Category III) as defined by ANSI N509-1976 and shall fail in the closed position. These dampers are used only during testing of the Containment Air Return Fans.

4. Hydrogen Skimmer Fan Isolation Dampers (1/2VX1A, 2B)

The isolation dampers (valves used as dampers) shall be ASME Section III, class 2 and shall fail as-is. These provide isolation between upper and lower containment. These are IWV Category B, active valves.

20.5 INSTRUMENTATION AND CONTROLS

Safety related instrumentation requirements are addressed in this section. The system description portion of this specification provides a complete listing of the instrumentation and controls provided to meet the requirements set forth in this section. This section does not provide a complete list of all system instrumentation.

20.5.1.1 Containment Air Return Fans and Isolation Dampers

Specific requirements for the Containment Air Return Fan system are listed in Reference 20.6.1.3.1, "NUREG 0800, Standard Review Plan, July 1981." As required by item II.1 in Section 6.2.2 of the subject reference, each completely redundant train of the Containment Air Return Fan system is provided with safety-related controls, powered from Class 1E power sources, thus assuring the capability to withstand a single failure without loss of function of the entire Containment Air Return System. As required by Item II.8 of Section 6.2.2 of the subject reference, safety-related indication of the status of the fans and dampers is provided on the main control board in order to determine the operational status of the system. As required by item II.7 of Section 6.2.2 and item II.4 of Section 6.2.1.1.B of the subject reference, the controls for the Containment Air Return Fans and isolation dampers have been designed to facilitate testing of the system. A test panel has been installed which allows testing of the Containment Air Return Fans, isolation dampers, hydrogen skimmer fans, and isolation valves. Although designed to permit testing by exclusive use of this panel, current procedures use a combination of electrical jumpers and the test circuitry associated with this panel. For a description of the test panel operating procedures, see Sections 31.3.2.6, "VX and VP Test Panel (1RB-ECP-2)" on page 36 and 32.3.2.6, "VX and VP Test Panel (2RB-ECP-2)" on page 52. Provisions for testing the Containment Pressure Control System permissives are discussed below.

In accordance with Reference 20.6.1.3.1, "NUREG 0800, Standard Review Plan, July 1981," Item II.5, each Containment Air Return Fan and Isolation Damper is interlocked with the Containment Pressure Control System (CPCS) in order to prevent any inadvertent actuation of the VX System which may cause the containment structure to exceed the negative design limits. The CPCS permissives inhibit operation of the air return fans and isolation dampers below 0.25 psig. Specifically, the CPCS consists of two train related cabinets, CPCC1 and CPCC2, for Train A and B, respectively. Each cabinet accepts inputs from four separate pressure transmitters. Two of these transmitters are used to generate permissives for the air return fan and isolation damper. The circuitry for each of these permissives is separated inside the CPCS cabinets using the same criteria for separation between two safety trains. Additionally, the cables from the sensors to the cabinets and from the cabinets to the fan and damper circuits are also separated according to standard separation criteria. By separating the permissive circuits, a single failure cannot affect both permissives simultaneously. One permissive is dedicated solely to the air return fan while the other permissive operates both the damper and fan. Providing two permissives on the fan is necessary due to the damper permissive not possessing the capability to automatically close the damper. Without damper closure, design against inadvertent actuation per the above reference requires two independent permissives be available to stop the fans. With this design, no single failure can allow the containment air return system (fans and dampers) to operate concurrently to depressurize containment. Details of the implementation of these interlocks within the fan and damper control circuits is discussed in Sections 31.3.2.1, "Containment Air Return Fans," 31.3.2.2, "Containment Air Return Fan Isolation Dampers," 32.3.2.1, "Containment Air Return Fans," and 32.3.2.2, "Containment Air Return Fan Isolation Dampers." The Containment Pressure Control System

and its associated separation requirements is discussed in Reference 20.6.3.1.10, "CNS-1563.NS-00-0001, Design Basis Specification for the Containment Spray (NS) System."

20.5.1.2 Hydrogen Skimmer Fans and Inlet Isolation Valves

In order to meet the requirements of Reference 20.6.1.3.1, "NUREG 0800, Standard Review Plan, July 1981" items II.c and II.6 of Section 6.2.5, each completely redundant train of hydrogen skimmer fans and isolation valves is provided with safety-related controls and powered form Class 1E power sources, thus assuring the capability to withstand a single failure without loss of function. As required by Items II.11 and III.5 of the subject reference, indication of the operational status of the fans and the position of the isolation valves is provided via safety-grade indicating lights on the main control board. The required redundancy and alarm capability is provided by either monitor light alarms or Operator Aid Computer digital alarms, both of which provide indication and alarms in the control room.

As required by Item II.10 of the subject reference, the controls for the skimmer fans and isolation valves have been designed to facilitate testing of the system. Test Panel RB-ECP-2 allows testing of the skimmer fans and isolation valves. Although designed to permit testing by exclusive use of this panel, current procedures use a combination of electrical jumpers and the test circuitry associated with this panel. For a description of the test panel operating procedures, see Sections 31.3.2.6, "VX and VP Test Panel (1RB-ECP-2)" on page 36 and 32.3.2.6, "VX and VP Test Panel (2RB-ECP-2)" on page 52.

20.5.1.3 Electric Hydrogen Recombiners

In order to meet the requirements of Reference 20.6.1.3.1, "NUREG 0800, Standard Review Plan, July 1981" items II.c and II.6 of Section 6.2.5, each completely redundant train of hydrogen recombiners is provided with safety-related controls, powered from Class 1E power sources, thus assuring the capability to withstand a single failure without loss of function. The requirements of Items II.11 and III.5 are complied with by indicating lights on the Hydrogen Recombiner Control Panel and by the temperature indication provided by the Hydrogen Recombiner Heater Temperature Monitor Panel. Additionally, Item II.10 of the subject reference is complied with by utilizing the Hydrogen Recombiner Heater Temperature Monitor Panel to verify proper recombiner temperature are achieved when started for testing.

20.5.1.4 Bypass and Inoperable Status Indication

As required by Reference 20.6.1.2.1, "Regulatory Guide 1.47, Bypassed and Inoperable Status Indication for Nuclear Power Plant Safety Systems," status lights are provided on a train related basis to indicate a condition in which the safety function of the VX system is either bypassed or inoperable. The logic for each light is as follows:

"VX Train A Bypassed"

VX CPCS Train A Circuit Loss of Power

OR

VX CPCS Train A Circuit in Test Mode

OR

VX Test Switch Train A in Test Mode

OR

Isolation Damper ARF-D-2 Loss of Power

OR

Hydrogen Skimmer Fan HSF-1(2)A Loss of Power

OR

Containment Air Return Fan ARF-1(2)A Loss of Power

OR

Inlet Isolation Valve VX1A Closed or Intermediate Position Concurrent with Loss of Power

OR

Control Logic Circuitry Loss of Power

OR

Diesel Generator A or Sequencer A Bypassed

OR

Selector Switch for ARF-1(2)A in OFF Position

OR

Selector Switch for HSF-1(2)A in OFF Position

OR

1.47 Panel Master Test Actuation

"VX Train B Bypassed"

VX CPCS Train B Circuit Loss of Power

OR

VX CPCS Train B Circuit in Test Mode

OR

VX Test Switch Train B in Test Mode

OR

Isolation Damper ARF-D-4 Loss of Power

OR

Hydrogen Skimmer Fan HSF-1(2)B Loss of Power

OR

Containment Air Return Fan ARF-1(2)B Loss of Power

OR

Inlet Isolation Valve VX2B Closed or Intermediate Position Concurrent with Loss of Power

OR

Control Logic Circuitry Loss of Power

OR

Diesel Generator B or Sequencer A Bypassed

OR

Selector Switch for ARF-1(2)B in OFF Position

OR

Selector Switch for HSF-1(2)B in OFF Position

OR

1.47 Panel Master Test Actuation

20.6 DESIGN BASIS REFERENCES

20.6.1 LICENSING

20.6.1.1 Title 10, Code of Federal Regulations, Part 50, "Domestic Licensing of Production and Utilization Facilities, "NRC, through current update

20.6.1.1.1 10CFR50, Appendix A, General Design Criterion 2, Design Bases for Protection Against Natural Phenomena

20.6.1.1.2 10CFR50, Appendix A, General Design Criterion 4, Environmental and Dynamic Effects Design Bases

20.6.1.1.3 10CFR50, Appendix A, General Design Criterion 16, Containment Design

20.6.1.1.4 10CFR50, Appendix A, General Design Criterion 38, Containment Heat Removal Systems

20.6.1.1.5 10CFR50, Appendix A, General Design Criterion 39, Inspection of Containment Heat Removal Systems

20.6.1.1.6 10CFR50, Appendix A, General Design Criterion 40, Testing of Containment Heat Removal Systems

20.6.1.1.7 10CFR50, Appendix A, General Design Criterion 41, Containment Atmosphere Cleanup

20.6.1.1.8 10CFR50, Appendix A, General Design Criterion 42, Inspection of Containment Atmosphere Cleanup Systems

20.6.1.1.9 10CFR50, Appendix A, General Design Criterion 43, Testing of Containment Atmosphere Cleanup Systems

20.6.1.1.10 10CFR50, Appendix A, General Design Criterion 50, Containment Design Basis

20.6.1.1.11 10CFR50, Section 50.44, Standards for Combustible Gas Control Systems in Light Water Cooled Power Reactors

20.6.1.1.12 10CFR50, Section 50.49, Environmental Qualification of Electric Equipment Important to Safety For Nuclear Power Plants

20.6.1.1.13 10CFR50, Appendix R, Fire Protection Program for Nuclear Power Facilities

20.6.1.2 Regulatory Guides

20.6.1.2.1 Regulatory Guide 1.47, Bypassed and Inoperable Status Indication for Nuclear Power Plant Safety Systems

20.6.1.3 NUREG'S

20.6.1.3.1 NUREG 0800, Standard Review Plan, July 1981

20.6.1.3.2 NUREG 0954, Safety Evaluation Report related to the operation of Catawba Nuclear Station, Units 1 and 2

20.6.1.4 Branch Technical Positions

N/A

20.6.1.5 Codes and Standards

20.6.1.5.1 ANSI N509. Nuclear Power Plant Air Cleaning Units and Components, 1980

20.6.1.5.2 SMACNA High Velocity Duct Construction Standards, 1969

20.6.1.5.3 ASME Section IX, Article IWV

20.6.1.6 Miscellaneous

20.6.1.6.1 Duke Power Company - Catawba Nuclear Station - Response to NUREG 0588 (H. B. Tucker letter to H. R. Denton, dated February 8, 1984)

20.6.1.6.2 CNSD-0010-10, Electrical System Description for the 240/120 VAC Auxiliary Control Power System

20.6.1.6.3 CNSD-0010-12, Electrical System Description for the 208/120 VAC Normal Auxiliary Power System

20.6.1.6.4 Design Study CNDS-107, VX Controls/Test Circuitry Review

20.6.1.7 Catawba FSAR

20.6.1.7.1 Catawba FSAR Section 3.2, Classification of Structures, Systems, and Components

20.6.1.7.2 Catawba FSAR Section 3.3, Wind and Tornado Loadings

20.6.1.7.3 Catawba FSAR Section 3.4, Water Level (Flood) Design

20.6.1.7.4 Catawba FSAR Section 3.5, Missile Protection

20.6.1.7.5 Catawba FSAR Section 3.9.2.2, Seismic Qualification of Safety Related Mechanical Equipment

20.6.1.7.6 Catawba FSAR Section 3.10, Seismic Qualification of Seismic Category I Instrumentation and Electrical Equipment

20.6.1.7.7 Catawba FSAR Section 3.11, Environmental Design of Mechanical and Electrical Equipment

20.6.1.7.8 Catawba FSAR Section 6.2.1, Containment Functional Design

20.6.1.7.9 Catawba FSAR Section 6.2.1.1.3.1, Loss of Coolant Accident

20.6.1.7.10 Catawba FSAR Section 6.2.1.1.3.3, Steam Line Break

20.6.1.7.11 Catawba FSAR Section 6.2.1.5, Minimum Containment Pressure Pressure Analysis for Performance Capability Studies of Emergency Core Cooling System

20.6.1.7.12 Catawba FSAR Section 6.2.5, Combustible Gas Control in Containment

20.6.1.7.13 Catawba FSAR Section 7.1.2.2, Instrumention & Controls - Independence of Redundant Controls

20.6.1.7.14 Catawba FSAR Section 7.3, Instrumentation & Controls for ESF Actuation System

20.6.1.7.15 Catawba FSAR Section 7.6.4, Instrumentation & Controls for Containment Pressure Control System

20.6.1.7.16 Catawba FSAR Section 7.6.10, Instrumentation & Controls for Containment Air Return, Hydrogen Skimmer and Hydrogen Recombiner System

20.6.1.7.17 Catawba FSAR Section 8.3.1.4, AC Power Systems - Independence of Redundant Systems

20.6.1.7.18 Catawba FSAR Section 15.4.8.4, Spectrum of Rod Control Assembly Ejection Accidents

20.6.1.7.19 Catawba FSAR Section 15.6.5.3, LOCA - Radiological Consequences

20.6.2 CATAWBA TECHNICAL SPECIFICATION

20.6.2.1.1 Catawba Technical Specification Section 3.6.11, Air Return System (ARS)

20.6.2.1.2 Catawba Technical Specification Section 3.6.8, Hydrogen Skimmer System (HSS)

20.6.2.1.3 Catawba Technical Specification Section 3.6.7, Hydrogen Recombiners

20.6.2.1.4 Catawba Technical Specification Section 3.3.2, Engineered Safety Features Actuation System (ESFAS) Instrumentation, Table 3.3.2-1 (Item 9)

20.6.3 ENGINEERING DOCUMENTS

20.6.3.1 Design Basis Specifications and Manuals

20.6.3.1.1 CNS-1465.00-00-0001, Plant Design Basis Specification for Systems Single Failure

20.6.3.1.2 CNS-1465.00-00-0002, Plant Design Basis Specification for System Class

20.6.3.1.3 CNS-1465.00-00-0004. Plant Design Basis Specification for Loss of Instrument Air

20.6.3.1.4 CNS-1465.00-00-0005, Plant Design Basis Specification for Design Basis Events

20.6.3.1.5 CNS-1465.00-00-0006, Plant Design Basis Specification for Fire Protection

20.6.3.1.6 CNS-1465.00-00-0011, Plant Design Basis Specification for Flooding From External Sources

20.6.3.1.7 CNS-1465.00-00-0007, Plant Design Basis Specification for Seismic Design

20.6.3.1.8 CNS-1465.00-00-0008, Plant Design Basis Specification for Tornado/Wind

20.6.3.1.9 CNS-1435.00-00-0002, Design Basis Specification for Post Fire Safe Shutdown

20.6.3.1.10 CNS-1563.NS-00-0001, Design Basis Specification for the Containment Spray (NS) System

20.6.3.1.11 CNS-1559.VY-00-0001, Design Basis Specification for the Containment Hydrogen Sample and Purge System

20.6.3.1.12 CNS-112.01-EPE-0001, Design Basis Specification for the EPE System

20.6.3.1.13 CNS-106.01-EPY-0001, Design Basis Specification for the EPY System

20.6.3.1.14 CNS-1144.00-00-0010, Design Basis Specification for The Reactor Building Structures

20.6.3.1.15 CNS-1108.02-00-0001, Catawba Structural Design Specification

20.6.3.1.16 CNLT-1780-03.01, Environmental Qualification Master List (EQML)

20.6.3.1.17 EQMM-1393.01, Environmental Qualification Maintenance Manual (EQMM)

20.6.3.1.18 CNS-1211.00-00-0005, Supplement No. 6, Heating, Ventilating and Air Conditioning; Reactor Building

20.6.3.1.19 Environmental Qualification Criteria Manual (EQCM)

20.6.3.1.20 CNS-1211.00-00-0006, Vane Axial Fan Motor Systems Related to Nuclear Safety

20.6.3.2 Calculations

20.6.3.2.1 CNC-1211.00-00-0015, Air Return Fans Static and Total Pressure Calculation

20.6.3.2.2 CNC-1211.00-00-0030, Hydrogen Skimmer System Static Pressure and Fan Selection

20.6.3.2.3 CNC-1211.00-00-0057, Hydrogen Skimmer Fan Seismic Verification

20.6.3.2.4 CNC-1211.00-00-0058, Seismic Qualification of the Hydrogen Recombiner

20.6.3.2.5 CNC-1552.08-00-0194, Reanalysis of the Catawba Hydrogen Skimmer System Flow Requirements

20.6.3.3 Vendor Documents

20.6.3.3.1 CNM-1211.00-0446, System VX Controls

20.6.3.3.2 CNM-1211.00-2326, Missle Penetration Calculations - Joy Technologies Fans, Inc.

20.6.3.4 Correspondence

20.6.3.4.1 Letter from Hal B. Tucker to Harold R. Denton of the USNRC dated April 14, 1983

20.6.3.5 Other

20.6.3.5.1 Electrical Design Manual

30. SYSTEM DESIGN FEATURES

This section contains a description of the Containment Air Return & Hydrogen Skimmer System design features. These are aspects of the systems design and construction that are provided to satisfy various codes, standards, or good engineering practices but are not required by the systems design basis requirements.

30.1 SYSTEM GENERIC DESIGN FEATURES

The Containment Air Return Fans are designed for the following general parameters:

PARAMETER	MINIMUM	MAXIMUM
Containment Air Return Fan Flow	40,000 cfm	N/A
Power Supply Voltage[1]	80%	113%
Power Supply Frequency	98%	102%
Control Power Voltage	90%	110%
Control Power Frequency	95%	105%
Radiation	0	1×10^9

The Hydrogen Skimmer Fans are designed for the following general parameters:

PARAMETER	MINIMUM	MAXIMUM
Hydrogen Skimmer Fan Flow	4260 cfm	N/A
Power Supply Voltage[1]	80%	113%
Power Supply Frequency	98%	102%
Control Power Voltage	90%	110%
Control Power Frequency	95%	105%
Radiation	0	1×10^9

30.2 SYSTEM SPECIFIC DESIGN FEATURES

None

30.3 EQUIPMENT DESIGN FEATURES

[1] Equipment is specified to start at 80% of nameplate voltage. However steady state operation parameters are 90%.

30.3.1 MECHANICAL EQUIPMENT DESIGN FEATURES

30.3.1.1 Containment Air Return System Fans

The Containment Air Return fans are direct drive, vane-axial fans, supplied by Joy Technologies Inc. with a design flow rate of 40,000 cfm developing a total pressure of 6.42 inwg at design air density of 0.11 lbm/cu.ft. The fans are driven by 60 hp electric motors with nominal voltage requirements of 575 VAC/3ph/60hz.

PARAMETER	MINIMUM	MAXIMUM
Influent Temperature	50°F	250°F
Influent Flow	N/A	N/A
Influent Humidity	N/A	100% R.H.
Power Supply Voltage	540 VAC	675 VAC
Power Supply Frequency	58.8 hz	61.2 hz

30.3.1.2 Hydrogen Skimmer System Fans

The Hydrogen Skimmer fans are direct drive, centrifugal blower fans supplied by Joy Manufacturing Company with a design flow rate of 4260 cfm developing a fan static pressure of 55.72 inwg at design air density of 0.11 lbm/cu.ft. The fans are driven by 75 hp electric motors with nominal voltage requirements of 575 VAC/3ph/60 hz.

PARAMETER	MINIMUM	MAXIMUM
Influent Temperature	50°F	250°F
Influent Flow	N/A	N/A
Influent Humidity	0% R.H.	100% R.H.
Power Supply Voltage	540 VAC	675 VAC
Power Supply Frequency	58.8 hz	61.2 hz

30.3.1.3 Electric Hydrogen Recombiners

The recombiners are static devices relying on natural convection to circulate containment atmosphere through these devices. They are supplied by Westinghouse. Flow is limited to 100 scfm by an internal flow limiting orifice.

PARAMETER	MINIMUM	MAXIMUM
Influent Temperature	50°F	250°F
Influent Flow	0	100 scfm
Influent Humidity	0% R.H.	100% R.H.
Power Supply Voltage	540 VAC	575 VAC
Power Supply Frequency	58.8 hz	61.2 hz

30.3.2 DUCTWORK AND DAMPERS

30.3.2.1 Ductwork

Ductwork is constructed in accordance with SMACNA guidelines from 16 gauge 304 stainless steel. Reference Construction Specification CNS-1211.00-00-0005, Supplement No. 6 for details.

30.3.2.2 Dampers (and valves used as dampers)

Isolation Dampers

The Containment Air Return fan isolation dampers (1/2 ARF-D-2,D-4) are single blade dampers with fail as-is electric motor actuators.

The hydrogen skimmer fan isolation dampers (1/2 VX1A,2B) are butterfly valves with fail as-is electric motor actuators.

Check Dampers

The Containment Air Return fan check dampers (1/2 ARF-D-1,3) are two bladed counterbalanced, backdraft type. counterbalanced, backdraft type.

Bypass Test Dampers

The Containment Air Return fan bypass test dampers (1/2 ARF-D-5 through 10) are parallel blade, low leakage design with fail closed pneumatic actuators.

Throttle Valves

Hydrogen Skimmer Fan throttle valves (1/2VX3 through 28) are manually operated butterfly valves positioned for flow balance and locked in position.

31. UNIT 1 SYSTEM AND EQUIPMENT DESCRIPTION

This section contains a description of the Unit 1 VX System and documents how the system functions to meet the requirements set forth in Section 20, "DESIGN BASIS AND CRITERIA" on page 3. Where Train related information is given, Train A information such as tag numbers will be shown with Train B information in parentheses.

31.1 SYSTEM DESCRIPTION AND FUNCTION

31.1.1 FUNCTIONAL DESCRIPTION

The Containment Air Return & Hydrogen Skimmer System (VX) consists of two sub-systems, the Containment Air Return System and Hydrogen Skimmer System. The purpose of the Containment Air Return System is to assure rapid return of air from upper to lower containment after initial HELB blowdown. The Hydrogen Skimmer System assures adequate mixing of containment atmosphere to prevent excessive hydrogen build-up from occuring in isolated pockets and dead-ended spaces in lower containment. This system does not operate to provide any normal ventilation requirements.

31.1.1.1 Containment Air Return System

The Unit 1 Containment Air Return System consist of two 100% capacity independent ventilation trains. Each ventilation train consists of a fan, ductwork, dampers and instrumentation. Following a Unit 1 HELB, each train functions to enhance ice condenser removal of heat and fission products by maintaining forced convection flow through the ice condenser.

The Containment Air Return System function is accomplished by returning air which was displaced from lower containment by the high energy line break through the ice condenser into upper containment back to lower containment. Fan flow is discharged to lower containment through ports in the fan room crane wall. These ports provide for equalization of pressure between the lower containment and dead ended spaces. After discharge into lower containment, air flows together with steam leaving the break through the lower inlet doors into the ice condenser compartment where the steam portion is condensed. The air flow returns to upper containment through the intermediate and upper doors of the ice condenser. The fan runs continuously after actuation, circulating air through the containment volume; provided that containment pressure is above the CPCS (Containment Pressure Control System) termination permissive. The fans are cycled on and off as needed to maintain containment pressure by CPCS.

The Containment Air Return Fans also have sufficient head to overcome the divider barrier differential pressure resulting from steam flow and fan air flow entering the ice condenser through the lower inlet doors.

31.1.1.2 Hydrogen Skimmer System

The Hydrogen Skimmer System consists of two 100% capacity independent ventilation trains. Valves are used instead of dampers and stainless steel piping is used instead of ductwork. Piping is utilized to eliminate a possible rupture of the ductwork that could provide a path bypassing the ice condenser during high energy line breaks. Following a Unit 1 LOCA, each train functions to remove hydrogen concentrations from dead-ended spaces in lower containment. The Hydrogen Skimmer System takes suction in dead-ended lower containment areas and discharges near the Hydrogen Recombiners. The Containment Air Return Fans provide mixing which dilutes the hydrogen concentration below acceptable limits. This dilution is only a

temporary solution to the hydrogen concentration problem. The Hydrogen Recombiners are required for long term hydrogen concentration reduction. To insure proper flows from each dead-ended space, flow control valves (butterfly valves) in the suction header located in these spaces were positioned for flow balance and locked in position. The flow balance insures adequate atmosphere turnover in these spaces to maintain hydrogen concentrations below 4 %. The Containment Air Return Fans provide mixing which dilutes the hydrogen concentration below acceptable limits. Required flowrates from dead ended spaces to maintain hydrogen concentrations below 4% are documented in Reference 20.6.3.2.5, "CNC-1552.08-00-0194, Reanalysis of the Catawba Hydrogen Skimmer System Flow Requirements."

In the event of a LOCA the VX System will start automatically upon initiation by Sp (Containment High-High Pressure) signal provided two permissive signals are received (CPCS and EQB-Diesel Generator Load Sequencing System). The VX System can also be activated manually from the Control Room by turning the RUN-OFF-AUTO key lock selector switch located on MC4 to the RUN position.

31.1.1.3 Electric Hydrogen Recombiners

Following a LOCA, the recombiners are manually started to reduce the hydrogen concentration. The hydrogen recombiners use electric resistance heaters to heat the air entering the recombiner to the hydrogen-oxygen reaction temperatures. There are two recombiners per unit provided with diesel backed power. Each recombiner has a maximum process capacity of 100 scfm. Operation of the recombiners insures containment atmosphere remains below 4% hydrogen. The recombiners are not used with atmospheres above 6% hydrogen concentration. Station Management must be consulted for recommendations on how to reduce hydrogen concentration when above 6% due to the potential for significant pressure rise if a hydrogen burn results.

The control/power panel for the recombiners is located in the Auxiliary Building which remains accessible after a LOCA. The system is interlocked such that operation is possible if an Sp signal is not present and Load Group 11 has been loaded by the sequencer.

31.1.2 SYSTEM OPERATION

31.1.2.1 HELB OPERATION

Upon receipt of the Sp (Containment High-High Pressure) signal from the Solid State Protection System (SSPS), a 10 second time delay is actuated for the Containment Air Return Fan isolation damper. The damper will open if two permissives have been satisfied. The first permissive is received from the CPCS when containment pressure is 0.4 psig or greater. This is to prevent an inadvertent signal from opening the damper. The second permissive comes from a differential pressure switch which requires the pressure differential between upper and lower containment to be less than 0.5 psig, with the lower containment pressure positive with respect to upper containment. This prevents an overload of the isolation damper actuator. The opening of the damper provides a path for pressure relief when a reversal of containment pressure occurs between upper and lower containment.

Upon receipt of the Sp signal from the SSPS, a 9 +/-1 minute time delay is energized allowing the Containment Air Return Fan to start provided two additional permissives are received. One permissive is from the EQB System. The other permissive signal is received from CPCS when pressure inside containment is 0.4 psig. When pressure inside containment falls below 0.25 psig, the pressure permissive signal is de-energized and the Containment Air Return Fan is de-energized. The isolation damper remains open. The fans will automatically restart on a CPCS signal of 0.4 psig.

Upon receipt of the Sp signal from the SSPS, a 9+/-1 minute time delay is energized for each Hydrogen Skimmer Fan isolation valve (used as a damper). The valve(s) will start opening after a EQB Load Group 1 permissive and the time delay.

Upon receipt of the Sp signal from the SSPS, a 9+/-1 minute time delay is energized for each Hydrogen Skimmer Fan. The fan(s) will start after the time delay provided two additional permissives are received. The first permissive is from EQB Load Group 11. The second permissive is from the isolation valve (valve not closed signal) switch pack.

The electric hydrogen recombiners are started manually from a control panel located in the Auxiliary Building. They are typically started within 24 hours of a LOCA and remain in operation until manually terminated. Air is drawn into the recombiner by natural convection and passes into the preheater section. Preheating is accomplished by convection heating from the heater section. The warmed air is passed through an orifice plate which limits flow to 100 scfm and into the heater section. The air is heated to approximately 1100-1400°F which precipitates the hydrogen-oxygen recombination. Water vapor is the product.

For information on indications and alarms see Sections 31.3.3, "INDICATORS" on page 37 and 31.3.6, "SYSTEM ALARMS" on page 38 respectively.

31.1.2.2 POST-HELB OPERATION

During Post HELB operations, the VX system will continue to run provided the 0.25 psig containment permissive is still present.

31.1.2.3 OPERATING INDICATIONS

31.1.2.4 PERIODIC TESTING

In accordance with Catawba Technical Specifications, the Containment Air Return & Hydrogen Skimmer System is periodically tested to verify system performance and availability. Operation of the system in Modes 1-4 requires that testing activities not affect system performance without appropriate entrance into the Technical Specification LCO or implementation of compensatory measures.

Surveillance tests are conducted to ensure that:

1. Containment Air Return & Hydrogen Skimmer Fans start automatically on a Containment High-High pressure test signal.
2. Proper Containment Air Return Fan operation with the isolation damper closed and bypass dampers open.
3. Proper Hydrogen Skimmer Fan operation with the motor operated inlet valve closed.
4. Motor operated Containment Air Return Fan isolation damper opens on a Containment High-High Pressure test signal with the Air Return Fan off.
5. The Containment Air Return Fan check damper opens with the Air Return Fan operating.
6. The Containment Air Return Fan check damper is closed when the Containment Air Return Fan is off.
7. That the motor operated Hydrogen Skimmer Fan inlet valve opens automatically and the Hydrogen Skimmer Fans receive a start permissive signal.

Engineered Safety Features (ESF) Actuation System Response Times are periodically tested. The Containment Air Return and Hydrogen Skimmer Fan response time is 600 seconds. The ESF Response Times are documented in UFSAR Table 7-15. The ESF Response Time for VX System operation is verified using the Response Time Test for ESF and RPS Loops procedures, the ESFAS periodic test procedure, and the VX System quarterly performance test procedures. The 600 seconds response time represents the time that the Hydrogen Skimmer System suction valves start opening and the Hydrogen Skimmer Fan starts operating.

31.1.2.5 MAINTENANCE ACTIVITIES

****LATER****

31.1.3 SYSTEM LIMITS AND PRECAUTIONS

31.1.3.1 Containment Air Return Fans

Containment Air return fans shall not be operated with the isolation dampers (1ARF-D-2,1ARF-D-4) open.

31.1.3.2 Isolation Damper

Isolation damper (1ARF-D-2,1ARF-D-4) actuator add-on switch pack is periodically verified to be in proper working order after refueling outages.

31.2 UNIT 1 EQUIPMENT DESCRIPTION

Design information for significant equipment, valves (used as dampers), fans and dampers is specified in this section. Safety-related equipment functions are described in Section 20.4, "EQUIPMENT DESIGN BASES" on page 12.

31.2.1 Fans (ARF-1A and 1B)

The Containment Air Return Fans consist of the following:

Type: Vane-Axial Drive:'Direct
Manufacturer: Joy Manufacturing Co.

31.2.2 Fans (HSF-1A and 1B)

The Hydrogen Skimmer Fans consist of the following:

Type: Centrifugal Blower Drive: Direct
Manufacturer: Joy Manufacturing Co.

31.2.3 Electric Hydrogen Recombiners

Manufacturer: Westinghouse
Type: Electric
Quantity: 2 per unit

31.2.4 Motor Operated Dampers (and valves used as dampers)

31.2.4.1 Containment Air Return Fan Isolation Dampers (1ARF-D-2,4)

The isolation dampers consist of the following:

Single blade construction w/ Rotork Operator
Fail As-is

31.2.4.2 Hydrogen Skimmer Fan Inlet Valves (1VX1A, 2B)

The suction inlet valves consist of the following:

Fisher Butterfly Valves w/ Limitorque Operator
Fail As-is

31.2.5 Containment Air Return Fan Check Dampers (1ARF-D-1, 3)

The check dampers consist of the following:

Two Blade Counterbalanced

31.2.6 Containment Air Return Fan Bypass Dampers (1ARF-D-5 through 10)

The bypass dampers consist of the following:

Parallel blade, Low leakage w/ Pneumatic Actuator
Spring closed, Fail closed

31.2.7 Hydrogen Skimmer Fan Throttle Valves (1VX3 through 28)

The throttle valves consist of the following:

BIF butterfly valves w/ manual operators
locked in position

31.3 INSTRUMENTATION AND CONTROLS

This section documents system Instrumentation and Controls. The information presented in this section should be used in conjunction with the I&C List, I&C Details, Electrical Elementaries, etc., for a complete understanding of system Instrumentation and Controls operations.

31.3.1 INSTRUMENTATION

31.3.1.1 Containment Air Return Fan Isolation Damper Differential Pressure

Differential pressure switches 1VXPS5100 (Train A) and 1VXPS5110 (Train B) measure the differential pressure across the pressure boundary between upper and lower containments. Contact output from the switches are used to provide interlocks for preventing dampers 1ARF-D-2 (Train A) and 1ARF-D-4 (Train B) from opening against high differential pressure across the dampers, thus preventing possible overloading to the damper actuator. Additionally, a high differential pressure condition may be simulated via test switches located on the VX Test Panel (1RB-ECP-2). The test switches energize solenoid valves 1VXEP3 or 1VXEP4, for 1ARF-D-2 and 1ARF-D-4, respectively, which in turn admits instrument air at system pressure to the high pressure port of the switch. This was intended to be used to ensure the dampers remained closed during testing of the fans; however, it is not currently used. Instead, the damper breaker is opened to prevent inadvertent damper actuation during testing.

31.3.1.2 Hydrogen Skimmer Fan Temperature and Suction Pressure

The stator temperature of each Hydrogen Skimmer Fan is monitored by individual thermocouples which provide analog inputs to the Operator Aid Computer (OAC). The suction pressure of each fan is monitored between the fan inlet isolation valve (1VX1A, 1VX2B) and the fan suction and is available as analog inputs on the OAC for response time testing.

31.3.1.3 Containment Air Return Fan Discharge Pressure

The discharge pressure of each Containment Air Return Fan is measured between the discharge of the fan and the check damper (1ARF-D-1, 1ARF-D-3) and is available as analog inputs on the OAC for response time testing.

31.3.1.4 Hydrogen Recombiner Heater Temperature Monitor Panels

As described in Section 31.3.2.7, "Elèctric Hydrogen Recombiner System" on page 36, each hydrogen recombiner has three chromel-alumel thermocouples imbedded in heater bank #3. The Hydrogen Recombiner Control Panel was originally supplied with instrumentation for monitoring these thermocouples. However, at the time this equipment was installed, there were no chromel-alumel electrical penetrations available. Consequently, a heated reference junction termination box was added inside containment. The reference junction box converts the chromel and alumel thermocouple leads to copper leads at a controlled reference junction temperature. By controlling the reference junction temperature, the need for active compensation of the thermocouple readings is eliminated. An RTD is also provided for external monitoring of the reference junction temperature. The three thermocouple readings and the reference junction temperature reading are then sent via copper wire to the train-related Hydrogen Recombiner Heater Temperature Monitor Panels located in the Electrical Penetration Rooms. A digital temperature indicator and selector switch is provided on the monitor panel for displaying any one of the three thermocouple readings. The indicator is calibrated for chromel-alumel thermocouple at a fixed reference junction temperature corresponding to the controlled temperature of the reference junction box. Indication of the actual reference junction temperature is also provided for detecting actual deviations from the controlled reference junction temperature which would affect calibration of the thermocouples.

31.3.2 CONTROLS

31.3.2.1 Containment Air Return Fans

Containment Air Return Fans ARF-1A and ARF-1B use automatic control as the primary mode of operation with manual control provided as a backup. Each fan is operated by a three position (RUN-OFF-AUTO) key-lock selector switch located on main control board 1MC4. The selector switch is normally placed in automatic with the key removed to lock the switch in position. The operational status of the fans are provided by status lights located directly above the key-lock selector switch on the main control board. Refer to Figure 1 for the following discussion of the air return fan controls and interlock logic.

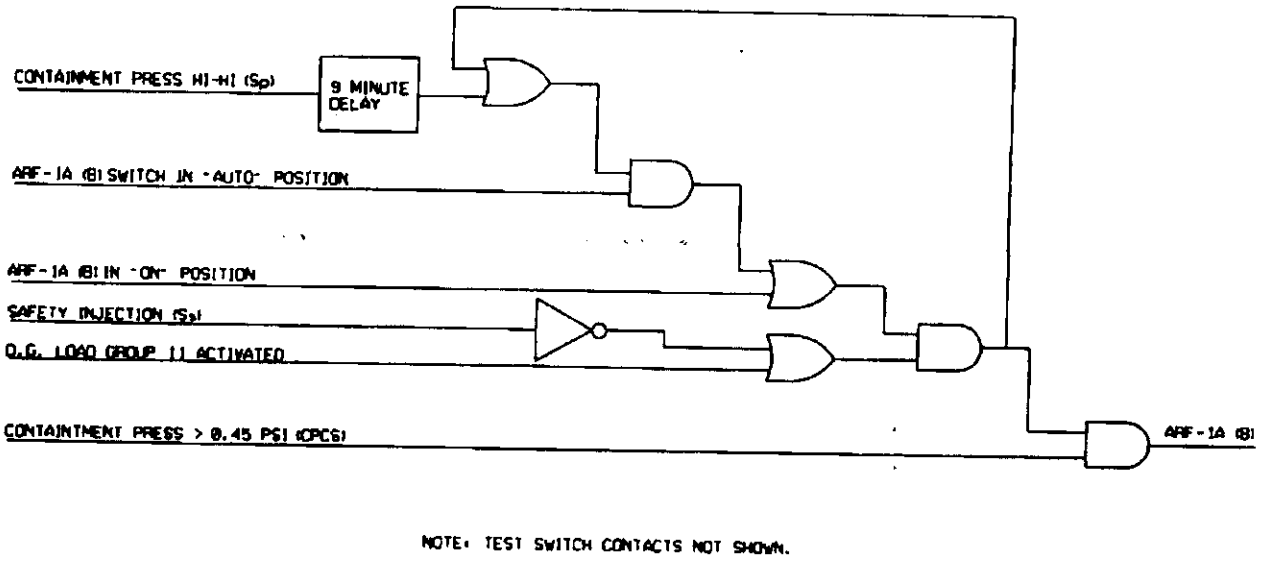

Figure 1.

Each fan is interlocked with the CPCS to prevent operation below a containment pressure of 0.25 psig. Inadvertent operation of the air return system could pressurize lower containment with respect to upper containment, resulting in the ice condenser doors opening to equalize pressure. The circulation of air through the ice condenser and subsequent ice melt could result in a pressure reduction which could possibly exceed the lower design limit. Unlike the Containment Spray Pumps, however, each Air Return Fan utilizes two channels of CPCS interlocks. The fans were originally designed to use one channel dedicated to the fans. However, due to difficulties in maintaining separation requirements of Reference 20.6.3.1.10, "CNS-1563.NS-00-0001, Design Basis Specification for the Containment Spray (NS) System," the CPCS interlocks for the air return fans were not placed directly in the fan control circuit but were implemented by using the CPCS permissive to control a second contactor for the fans. This secondary contactor is electrically located between the primary fan contactor and the fan motor and therefore overrides any and all fan controls and interlocks discussed below. When energized, the secondary contactor simply allows the primary contactor and control circuit to function as normal. This configuration provided one CPCS channel to control the fans while a separate channel controlled the dampers. However, the damper logic was later modified to remove the CPCS interlock with the M/C circuit such that the damper will not automatically close upon receiving the appropriate CPCS signal. Since the air return dampers are not automatically closed by the CPCS upon reaching 0.25 psig decreasing, termination of the air return system became totally dependent upon the CPCS permissive for the air return fan. Assuming a single failure which prohibits the CPCS from terminating fan operation at 0.25 psig, the fans could continue to operate with the dampers open. Thus, in order to meet the single failure criteria for the CPCS, a second interlock was added to the

fans. The interlock originates from the same channel as the damper interlock. It is physically located in the primary contactor circuit and is separated from the other CPCS interlock located in the secondary contactor according to the separation criteria defined in Reference 20.6.3.1.10, "CNS-1563.NS-00-0001, Design Basis Specification for the Containment Spray (NS) System." The CPCS interlocks may be bypassed for testing purposes via test switches on the CPCS cabinets. See Reference 20.6.3.1.10, "CNS-1563.NS-00-0001, Design Basis Specification for the Containment Spray (NS) System," for a detailed description of the CPCS including special requirements for the CPCS circuitry and cables.

The containment air return fans are assigned to Diesel Load Sequencer Group 11. As such, each fan is interlocked with the Diesel Generator Load Sequencer such that upon receipt of a safety injection signal (Ss), the fan is load shed and operation is inhibited until Load Group 11 is sequenced on the Diesel Generator. This interlock will take precedence over both manual and automatic operation and cannot be defeated.

Manual and automatic control is selected via the key-lock selector switch. Both are subject to the above interlocks. Manual operation of the fans is continuous once selected. Automatic operation is initiated by an Sp signal and is processed through a 9 +/- 1 minute time delay. If the signal is still active after the time delay, an automatic start signal is generated and sealed-in. Once sealed-in, the automatic start signal can only be reset by positioning the selector switch to the OFF position. The CPCS interlock can defeat both the automatic and manual signal, and thus allows the CPCS to cycle the Containment Air Return Fans as required to maintain containment pressure below 0.45 psig.

PIR 0-C91-0090 (PIP 0-C91-0305) identified a problem of potential cycling of the Containment Air Return Fans around the CPCS permissive setpoints. The Containment air Return Fans were declared OPERABLE since they would have already performed their intended safety function by the time containment pressure decreased to the CPCS setpoints. Engineering determined that rapid cycling of the fans around the CPCS setpoints was not a credible concern because the heat sources necessary to cause cycling of the fans are not present in the long term stages of any transient after containment pressure is reduced below 0.3 psig (Reference PIP 0-C97-1027).

Control room annunciator alarms are provided to alert the operator of high fan vibration, Containment Air Return Fan running with the corresponding isolation damper closed, Hydrogen Skimmer Fan running with the corresponding suction valve closed, and control circuit power failure. Digital computer points are provided to indicate the status of the CPCS interlock for the fans.

31.3.2.2 Containment Air Return Fan Isolation Dampers

Containment air return fan dampers 1ARF-D-2 and 1ARF-D-4 use automatic control as the primary mode of operation with manual control provided as a backup. The dampers are operated via momentary pushbutton operators (OPEN-CLOSE) located on main control board 1MC4. The position of each damper is indicated by position indicating lights integral to the pushbutton operator.

The control logic for opening the dampers in both automatic and manual modes is interlocked with the following signals in a logical OR function: 1) an ECCS Sp signal, 2) the train-related Containment Air Return Fan control switch in the ON position, or 3) the train related Hydrogen Skimmer Fan control switch in the ON position. Manual opening of the dampers is dependent only upon satisfying one of the above interlocks. The automatic control logic incorporates a 10 second time delay, after which, the interlock signal is sealed-in. Once sealed-in, two additional interlocks must be satisfied for automatic opening: 1) the permissive from the CPCS must be present (containment pressure greater than .45 psig), and 2) the differential pressure across the damper must be less than 0.5 psig. Refer to Figure 2 for a logic diagram of the damper M/O logic circuit.

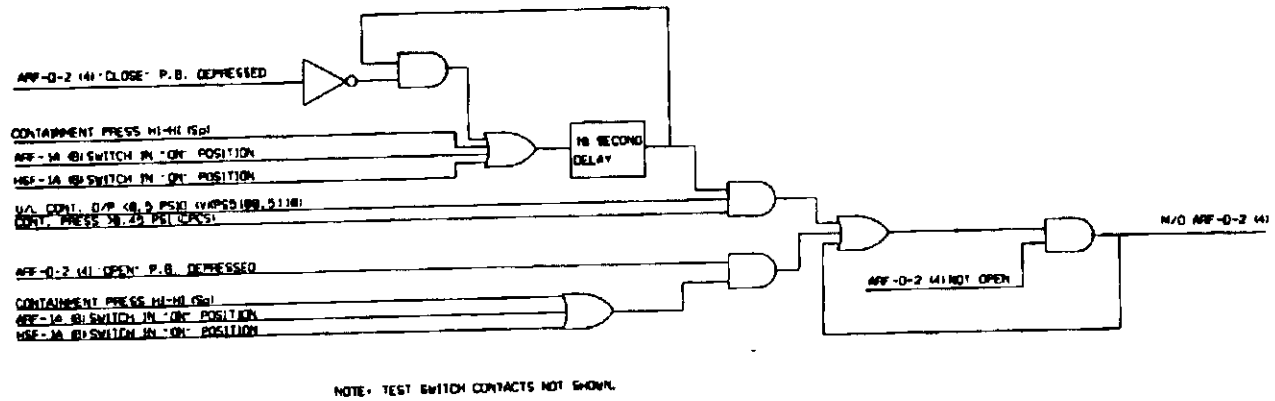

Figure 2.

The control logic for closing the dampers in manual mode is direct, with no intervening interlocks. However, once closed, if the control logic discussed above for automatic opening of the dampers is satisfied, the damper will immediately reopen. There is no automatic control for closing the dampers due to the limitation of the environmental qualification of pressure switches 1VXPS5100 and 1VXPS5110. These switches prevent the damper from opening against a high differential pressure across the damper and thus protect the damper actuator from possible overload. However, they are only qualified to operate 5 minutes under accident conditions, after which the mechanical integrity of the switches may become degraded. This requires the switches to be electrically isolated from the class 1E control circuit once the dampers open and remain isolated indefinitely. This is accomplished by wiring the switches in series with damper limit switches. Since closing the damper would close the limit switches and reconnect the pressure switches to the control circuit, automatic closure of the damper is not provided. Refer to Figure 3 for a logic diagram of the damper M/C logic circuit.

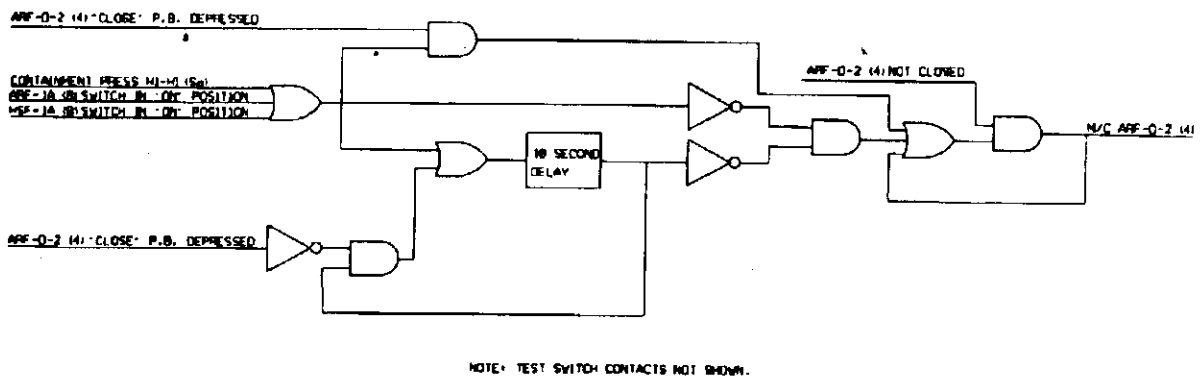

Figure 3.

31.3.2.3 Containment Air Return Fan Bypass Test Dampers

Dampers 1ARF-D-5, 1ARF-D-6, and 1ARF-D-7 are provided to allow testing of Containment Air Return Fan ARF-1A while 1ARF-D-8, 1ARF-D-9, and 1ARF-D-10 allow testing of Containment Air Return Fan ARF-1B. These dampers are controlled by a single solenoid valve, 1VXEP1 and 1VXEP2 for Train A and B, respectively. The solenoid valves are energized during performance testing only. Originally designed to be operated in conjunction with the VX Test Panel (1RB-ECP-2) the solenoid valves and corresponding bypass test dampers are presently operated by placing electrical jumpers in the appropiate termination cabinets.

31.3.2.4 Hydrogen Skimmer Fans

Hydrogen Skimmer Fans HS-1A and HS-1B use automatic control as the primary mode of operation with manual control provided as a backup. Each fan is operated by a three position (RUN-OFF-AUTO) key-lock selector switch located on main control board 1MC4. The selector switch is normally placed in automatic with the key removed to lock the switch in position. The operational status of the fans are provided by status lights located directly above the key-lock selector switch on the main control board. Refer to Figure 4 for the following discussion of the hydrogen skimmer fan controls and interlock logic.

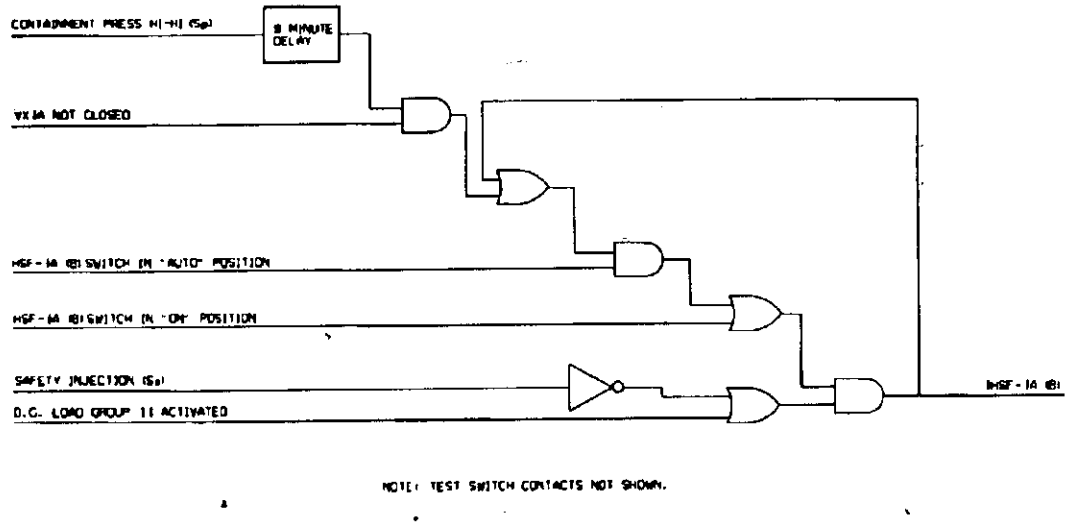

Figure 4.

The hydrogen skimmer fans are assigned to Diesel Load Sequencer Group 11. As such, each fan is interlocked with the Diesel Generator Load Sequencer such that upon receipt of a safety injection signal (Ss), the fan is load shed and operation is inhibited until Load Group 11 is sequenced on the Diesel Generator. This interlock will take precedence over both manual and automatic operation and cannot be defeated.

Manual operation is subject only to the above interlock and is continuous once selected. Automatic operation is initiated by an Sp signal (Hi-Hi Containment Pressure or Manual Spray Actuation) through a 9+/-1 minute time delay and is interlocked with the respective inlet isolation valve (1VX1A, 1VX2B) such that the inlet valve must start opening before an automatic start is generated. If the Sp signal is still present after the time delay expires and the respective inlet valve is opening, an automatic start signal is generated and sealed-in. Once generated, the automatic start signal can only be reset by moving the selector switch to the OFF position.

Train related control room annunciator alarms are provided to alert the operator if the Hydrogen Skimmer Fan is being operated with the corresponding inlet valve closed.

31.3.2.5 Hydrogen Skimmer Fan Inlet Valves (1VX1A, 2B)

Hydrogen Skimmer Fan Inlet Valves 1VX1A and 1VX2B use automatic control as the primary method of operation with manual control provided as a backup. The valves are operated via momentary pushbutton operators (OPEN-CLOSE) located on main control board 1MC4. The position of each valve is indicated by position indicating lights integral to the pushbutton operator.

The control logic for opening the inlet valves in both automatic and manual modes is interlocked with the following signals in a logical OR function: 1) an ECCS Sp signal, 2) the train-related Containment Air Return Fan control switch in the ON position, or 3) the train-related Hydrogen Skimmer Fan control switch in the ON position. Manual opening of the inlet valves is dependent only upon satisfying one of the above interlocks. The automatic control logic incorporates a 9+/-1 minute time delay, after which, the interlock signal is sealed-in and the valves start opening. Refer to Figure 5 for a logic diagram of the valve M/O logic circuit.

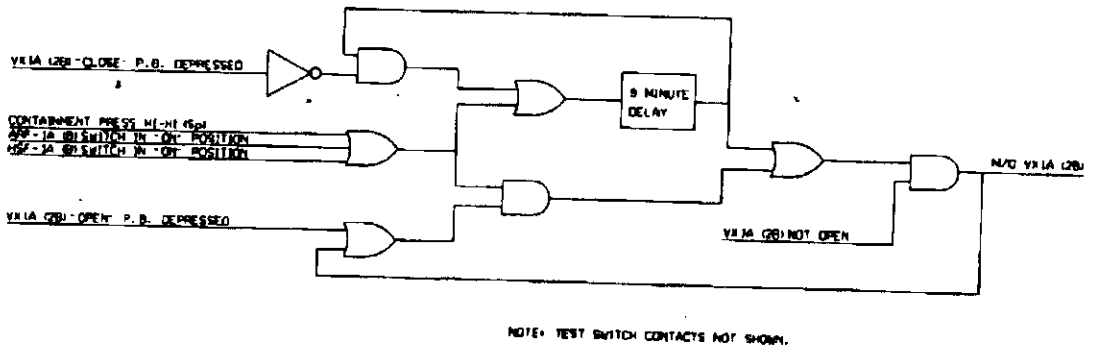

Figure 5.

The control logic for closing the inlet valves in manual mode is direct, with no intervening interlocks. However, once closed, if the control logic discussed above for automatic opening of the inlet valves is satisfied, the valve will immediately reopen. There is no automatic control for closing the valves. Refer to Figure 6 for a logic diagram of the valve M/C logic circuit.

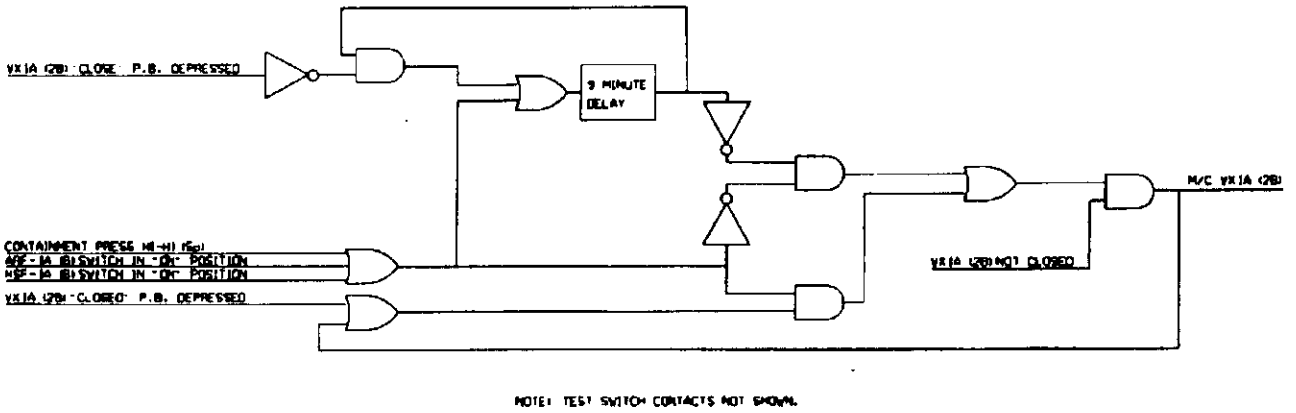

Figure 6.

31.3.2.6 VX and VP Test Panel (1RB-ECP-2)

Test Panel 1RB-ECP-2 provides a means to test the Containment Air Return Fans, isolation dampers, hydrogen skimmer fans, and inlet isolation valves and verify the time-delay logic associated with each. The test panel is not currently used; however, individual parts of the circuitry associated with the panel are used in conjunction with external electrical jumpers for testing. A detailed description of the test panel operating procedures can be found in Reference 20.6.1.6.4, "Design Study CNDS-107, VX Controls/Test Circuitry Review," Attachment 3. For actual testing, refer to the appropriate performance test procedures.

31.3.2.7 Electric Hydrogen Recombiner System

The Electric Hydrogen Recombiner System (EHRS) is a natural convection flameless, thermal reactor-type hydrogen/oxygen recombiner. In its basic operation, it heats a continuous stream of air/hydrogen mixture to a temperature sufficient for spontaneous recombination of the hydrogen with the oxygen in the air to form water vapor. The system consists of two independent recombination units, each of which contains the electric heater banks, a power supply panel that contains the equipment for powering the heaters, and a power control panel to the heaters.

The recombination units are located inside containment in the vicinity of the discharge of the Hydrogen Skimmer Fans. It consists of an inlet preheater section, a heater-recombination section, and a mixing chamber. The heater-recombination section contains four banks of heaters. Each bank contains 60 individual, U-type heating elements connected in series-parallel arrangements as required to obtain the power rating for each bank. Heater bank #3 in each recombination unit has three chromel-alumel thermocouples mechanically fastened and welded to the heater sheaths. These thermocouples are provided to verify heater operation and to indicate plate temperature for performance testing.

The power supply panel is located in the Auxiliary Building and contains all the necessary electrical equipment to provide the power required by the heaters in the recombination unit. It is a self-supporting, floor-mounted cabinet.

The control panel is located in the Auxiliary Building next to the power supply panel and contains all the control and monitoring equipment required for operating the recombination unit. It contains a master ON-OFF switch, a control potentiometer for adjusting the amount of power supplied to the recombination

units, and a wattmeter for indication of the power supplied. The system as purchased also provided a display for monitoring any one of the three thermocouples imbedded in heater bank #3 and a selector switch for selecting between the three. However, due to lack of chromel-alumel electrical penetrations at the time of equipment installation, a different method of monitoring the thermocouples has been provided via the Hydrogen Recombiner Heater Temperature Monitor Panel described in Section 31.3.1.4, "Hydrogen Recombiner Heater Temperature Monitor Panels" on page 30. The display and controls on the Hydrogen Recombiner Control Panel have been abandoned in place.

The master control switch on the control panel is interlocked such that the system can be operated only if an Ss signal is not present or after Diesel Load Sequencer Load Group 11 has been cycled onto the bus. This interlock essentially prevents operation of the Hydrogen Recombiner between the initial receipt of a Ss and when Load Group 11 is activated. This is also the same interlock as is used on the Containment Air Return Fans described in Section 31.3.2.1, "Containment Air Return Fans" on page 31, and the Hydrogen Skimmer Fans described in Section 31.3.2.4, "Hydrogen Skimmer Fans" on page 34.

31.3.3 INDICATORS

None.

31.3.4 RECORDERS

None.

31.3.5 STATUS INDICATION

31.3.5.1 Status Lights

The following status lights provide information concerning the VX System but are actually part of the Containment Spray (NS) System. For additional information, refer to reference 20.6.3.1.10, "CNS-1563.NS-00-0001, Design Basis Specification for the Containment Spray (NS) System."

VX SYS CPCS TRAIN A INHIBIT

VX SYS CPCS TRAIN B INHIBIT

31.3.5.2 Monitor Lights

Group I

AIR RETURN FAN ARF-A RUNNING

AIR RETURN FAN ARF-B RUNNING

HYDROGEN SKIMMER FAN HSF-A RUNNING

HYDROGEN SKIMMER FAN HSF-B RUNNING

ARF ISOL DAMPER ARF-D-2 OPEN

ARF ISOL DAMPER ARF-D-4 OPEN

HSF INLET ISOLATION VLV VX1 OPEN

HSF INLET ISOLATION VLV VX2 OPEN

31.3.5.3 1.47 Panel Bypass Lights

See Section 20.5.1.4, "Bypass and Inoperable Status Indication" on page 15 for a list of 1.47 Bypass Lights.

31.3.6 SYSTEM ALARMS

31.3.6.1 Annunciators

VX TRAIN A TROUBLE

VX TRAIN B TROUBLE

31.3.6.2 Computer Inputs

31.3.6.2.1 Analog Inputs

HSF A MTR STATOR TEMP

HSF B MTR STATOR TEMP

31.3.6.2.2 Digital Inputs

HYDROGEN SKIMMER FAN A SUCT PRESS	LO, NOT LO
HYDROGEN SKIMMER FAN B SUCT PRESS	LO, NOT LO
CONTAINMENT AIR RETURN FAN A DISCH PRESS	LO, NOT LO
CONTAINMENT AIR RETURN FAN B DISCH PRESS	LO, NOT LO
VLV VX1A HYDROGEN SKIMMER FAN A ISOL	OPEN, NOT OPEN
VLV VX1A HYDROGEN SKIMMER FAN A ISOL	CLOSED, NOT CLOSED
VLV VX2B HYDROGEN SKIMMER FAN B ISOL	OPEN, NOT OPEN
VLV VX2B HYDROGEN SKIMMER FAN B ISOL	CLOSED, NOT CLOSED
DAMPER ARF-D-2 CONT AIR RETURN FAN A ISOL	OPEN, NOT OPEN
DAMPER ARF-D-2 CONT AIR RETURN FAN A ISOL	CLOSED, NOT CLOSED
DAMPER ARF-D-4 CONT AIR RETURN FAN B ISOL	OPEN, NOT OPEN
DAMPER ARF-D-4 CONT AIR RETURN FAN B ISOL	CLOSED, NOT CLOSED
CPCS BLOCK OF VX CONT AIR RET FAN A OPR	ENGAGED, NOT ENGAGED
CPCS BLOCK OF VX CONT AIR RET FAN B OPR	ENGAGED, NOT ENGAGED

31.4 POWER SOURCES

The following equipment is supplied with essential 600 VAC, 3 phase, 60 Hz. power. For the design basis and a detailed description of the system providing this power, see Reference 20.6.3.1.12, "CNS-112.01-EPE-0001, Design Basis Specification for the EPE System."

Equipment	MCC (600 VAC)	Compt./Bkr.
Containment Air Return Fan ARF-1A	1EMXK	F11A
Power Lockout Contactor ARF-1A	1EMXM	F01A
Containment Air Return Fan ARF-1B	1EMXL	F11A
Power Lockout Contactor ARF-1B	1EMX	F01A
Hydrogen Skimmer Fan 1HSF-1A	1EMXK	F11B
Hydrogen Skimmer Fan 1HSF-1B	1EMXL	F11B
Containment Air Return Fan Damper 1ARF-D-2	1EMXK	F10A
Containment Air Return Fan Damper 1ARF-D-4	1EMXL	F10A
Hydrogen Skimmer Fan Inlet Isol. Valve 1VX001A	1EMXK	F06A
Hydrogen Skimmer Fan Inlet Isol. Valve 1VX002B	1EMXL	F06A
Hydrogen Recombiner Panel 1A	1EMXK	F07C
Hydrogen Recombiner Panel 1B	1EMXL	F07C

Low voltage instrumentation and control circuits are powered from various systems. Design basis information and system description information for the safety-related systems and system description information for the non-safety systems can be found in the following references.

1. Reference 20.6.3.1.13, "CNS-106.01-EPY-0001, Design Basis Specification for the EPY System"
2. Reference 20.6.1.6.2, "CNSD-0010-10, Electrical System Description for the 240/120 VAC Auxiliary Control Power System"
3. Reference 20.6.1.6.3, "CNSD-0010-12, Electrical System Description for the 208/120 VAC Normal Auxiliary Power System"

31.5 DESIGN DOCUMENT CROSS REFERENCE

31.5.1 DUKE DRAWINGS .

Flow Diagram:	CN-1557-1.0
Summary Flow Diagram:	CNSF-1557-VX.01
Instrument Details:	CN-1499-VX Series
Electrical Elementaries:	CNEE-0165-01 Series
Connection and Outline Diagrams:	CN-1735-01 Series
Piping Isometrics:	CN-1491-VX Series
Test Acceptance Criteria:	CNTC-1557-VX Series

31.5.2 VENDOR DRAWINGS

For information on VX System Euipment, use DPCo. Equipment and Valve Data Base Files.

32. UNIT 2 SYSTEM AND EQUIPMENT DESCRIPTION

This section contains a description of the Unit 2 VX System and documents how the system functions to meet the requirements set forth in Section 20, "DESIGN BASIS AND CRITERIA" on page 3. Where Train related information is given, Train A information such as tag numbers will be shown with Train B information in parentheses.

32.1 SYSTEM DESCRIPTION AND FUNCTION

32.1.1 FUNCTIONAL DESCRIPTION

The Containment Air Return & Hydrogen Skimmer System (VX) consists of two sub-systems, the Containment Air Return System and Hydrogen Skimmer System. The purpose of the Containment Air Return System is to assure rapid return of air from upper to lower containment after initial HELB blowdown. The Hydrogen Skimmer System assures adequate mixing of containment atmosphere to prevent excessive hydrogen build-up from occuring in isolated pockets and dead-ended spaces in lower containment. This system does not operate to provide any normal ventilation requirements.

32.1.1.1 Containment Air Return System

The Unit 2 Containment Air Return System consist of two 100% capacity independent ventilation trains. Each ventilation train consists of a fan, ductwork, dampers and instrumentation. Following a Unit 2 HELB, each train functions to enhance ice condenser removal of heat and fission products by maintaining forced convection flow through the ice condenser.

The Containment Air Return System function is accomplished by returning air which was displaced from lower containment by the high energy line break through the ice condenser into upper containment back to lower containment. Fan flow is discharged to lower containment through ports in the fan room crane wall. These ports provide for equalization of pressure between the lower containment and dead ended spaces. After discharge into lower containment, air flows together with steam leaving the break through the lower inlet doors into the ice condenser compartment where the steam portion is condensed. The air flow returns to upper containment through the intermediate and upper doors of the ice condenser. The fan runs continuously after actuation, circulating air through the containment volume, provided that containment pressure is above the CPCS (Containment Pressure Control System) termination permissive. The fans are cycled on and off as needed to maintain containment pressure by CPCS.

The Containment Air Return Fans also have sufficient head to overcome the divider barrier differential pressure resulting from steam flow and fan air flow entering the ice condenser through the lower inlet doors.

32.1.1.2 Hydrogen Skimmer System

The Hydrogen Skimmer System consists of two 100% capacity independent ventilation trains. Valves are used instead of dampers and stainless steel piping is used instead of ductwork. Piping is utilized to eliminate a possible rupture of the ductwork that could provide a path bypassing the ice condenser during high energy line breaks. Following a Unit 2 LOCA, each train functions to remove hydrogen concentrations from dead-ended spaces in lower containment. The Hydrogen Skimmer System takes suction in dead-ended lower containment areas and discharges near the inlet of the Containment Air Return Fans. The Containment Air Return Fans provide mixing which dilutes the hydrogen concentration below acceptable limits. This dilution

is only a temporary solution to the hydrogen concentration problem. The Hydrogen Recombiners are required for long term hydrogen concentration reduction. To insure proper flows dead-ended space, flow control valves (butterfly valves) in the suction header located in these spaces were positioned for flow balance and locked in position. The flow balance insures adequate atmosphere turnover in these spaces to maintain hydrogen concentrations below 4 %. The Containmnet Air Return Fans provide mixing which dilutes the hydrogen concentration below acceptable limits. Required flowrates from dead ended spaces to maintain hydrogen concentrations below 4% are documented in Reference 20.6.3.2.5, "CNC-1552.08-00-0194, Reanalysis of the Catawba Hydrogen Skimmer System Flow Requirements."

In the event of a HELB the VX System will start automatically upon initiation by Sp (Containment High-High Pressure) signal provided two permissive signals are received (CPCS and EQB-Diesel Generator Load Sequencing System). The VX System can also be activated manually from the Control Room by turning the RUN-OFF-AUTO key lock selector switch located on MC4 to the RUN position.

32.1.1.3 Electric Hydrogen Recombiners

Following a LOCA, the recombiners are manually started to reduce the hydrogen concentration. The hydrogen recombiners use electric resistance heaters to heat the air entering the recombiner to the hydrogen-oxygen reaction temperatures. There are two recombiners per unit provided with diesel backed power. Each recombiner has a maximum process capacity of 100 scfm. Operation of the recombiners insures containment atmosphere remains below 4% hydrogen. The recombiners are not used with atmospheres above 6% hydrogen concentration. Station Management must be consulted for recommendations on how to reduce hydrogen concentration when above 6% due to the potential for significant pressure rise if a hydrogen burn results.

The control/power panel for the recombiners is located in the Auxiliary Building which remains accessible after a LOCA. The system is interlocked such that operation is possible if an Sp signal is not present and Load Group 11 has been loaded by the sequencer.

32.1.2 SYSTEM OPERATION

32.1.2.1 HELB OPERATION

Upon receipt of the Sp signal from the Solid State Protection System (SSPS), a 10 second time delay is actuated for the Containment Air Return Fan isolation damper. The damper will open if two permissives have been satisfied. The first permissive is received from the CPCS when containment pressure is 0.4 psig or greater. This is to prevent an inadvertent signal from opening the damper. The second permissive comes from a differential pressure switch which requires the pressure differential between upper and lower containment to be less than 0.5 psig with the lower containment positive with respect to upper containment. This prevents an overload of the isolation damper actuator. The opening of the damper provides a path for pressure relief when a reversal of containment pressure occurs.

Upon receipt of the Sp signal from the SSPS, a 9 + /-1 minute time delay is energized allowing the Containment Air Return Fan to start provided two additional permissives are received. One permissive is from the EQB System. The other permissive signal is received from CPCS when pressure inside containment is 0.4 psig. When pressure inside containment falls below 0.25 psig, the pressure permissive signal is de-energized and the Containment Air Return Fan is de-energized. The isolation damper remains open. The fans will automatically restart on a CPCS signal of 0.4 psig.

Upon receipt of the Sp signal from the SSPS, a 9+/-1 minute time delay is energized for each Hydrogen Skimmer Fan isolation valve (used as damper). The valve(s) will start opening after a EQB Load Group 1 permissive and the time delay.

Upon receipt of the Sp signal from the SSPS, a 9+/-1 minute time delay is energized for each Hydrogen Skimmer Fan. The fan(s) will start after the time delay provided two additional permissives are received. The first permissive is from EQB Load Group 11. The second permissive is from the isolation valve (valve not closed signal) switch pack.

The electric hydrogen recombiners are started manually from a control panel located in the Auxiliary building. They are typically started within 24 hours of a LOCA and remain in operation until manually terminated. Air is drawn into the recombiner by natural convection and passes into the preheater section. Preheating is accomplished by convection heating from the heater section.. The warmed air is passed through an orifice plate which limits flow to 100 scfm and into the heater section. The air is heated to approximately 1100-1400°F which precipitates the hydrogen-oxygen recombination. Water vapor is the product.

For information on indications and alarms see Sections 32.3.3, "INDICATORS" on page 53 and 32.3.6, "SYSTEM ALARMS" on page 54 respectively.

32.1.2.2 POST-HELB OPERATION

During Post HELB operations, the VX system will continue to run provided the 0.25 psig containment permissive is still present.

32.1.2.3 OPERATING INDICATIONS

32.1.2.4 PERIODIC TESTING

In accordance with Catawba Technical Specifications, the Containment Air Return & Hydrogen Skimmer System is periodically tested to verify system performance and availability. Operation of the system in Modes 1-4 requires that testing activities not affect system performance without appropriate entrance into the Technical Specification LCO or implementation of compensatory measures.

Surveillance tests are conducted to ensure that:

1. Containment Air Return & Hydrogen Skimmer Fans start automatically on a Containment High-High pressure test signal.
2. Proper Containment Air Return Fan operation with the isolation damper closed and bypass dampers open.
3. Proper Hydrogen Skimmer Fan operation with the motor operated inlet valve closed.
4. Motor operated Containmnet Air Return Fan isolation damper opens on a Containment High-High Pressure test signal with the Containment Air Return Fan off.
5. The Containment Air Return Fan check damper opens with the Containment Air Return Fan operating.
6. The Containment Air Return Fan check damper is closed when the Containmnet Air Return Fan is off.
7. That the motor operated Hydrogen Skimmer Fan inlet valve opens automatically and the Hydrogen Skimmer Fans receive a start permissive signal.

Engineered Safety Features (ESF) Actuation System Response Times are periodically tested. The Containment Air Return and Hydrogen Skimmer Fan response time is 600 seconds. The ESF Response Times are documented in UFSAR Table 7-15. The ESF Response Time for VX System operation is verified using the Response Time Test for ESF and RPS Loops procedures, the ESFAS periodic test procedure, and the VX System quarterly performance test procedures. The 600 seconds response time represents the time that the Hydrogen Skimmer System suction valves start opening and the Hydrogen Skimmer Fan starts operating.

32.1.2.5 MAINTENANCE ACTIVITIES

****LATER****

32.1.3 SYSTEM LIMITS AND PRECAUTIONS

32.1.3.1 Containment Air Return Fans

Containment Air return fans shall not be operated with the isolation dampers (2ARF-D-2,2ARF-D-4) open.

32.1.3.2 Isolation Damper

Isolation damper (2ARF-D-2,2ARF-D-4) actuator add-on switch pack is periodically verified to be in proper working order after refueling outages.

32.2 UNIT 2 EQUIPMENT DESCRIPTION

Design information for significant equipment, valves (used as dampers), fans and dampers is specified in this section. Safety-related equipment functions are described in Section 20.4, "EQUIPMENT DESIGN BASES" on page 12.

32.2.1 Fans (2ARF-1A and 1B)

The Containment Air Return Fans consist of the following:

Type: Vane-Axial Drive: Direct
Manufacturer: Joy Manufacturing Co.

32.2.2 Fans (2HSF-1A and 1B)

The Hydrogen Skimmer Fans consist of the following:

Type: Centrifugal Blower Drive: Direct
Manufacturer: Joy Manufacturing Co.

32.2.3 Electric Hydrogen Recombiners

Manufacturer: Westinghouse
Type: Electric
Quantity: 2 per unit

32.2.4 Motor Operated Dampers (and valves used as dampers)

32.2.4.1 Containment Air Return Fan Isolation Dampers (2ARF-D-2,4)

The isolation dampers consist of the following:

Single blade construction w/ Limitorque Operator
Fail As-is

32.2.4.2 Hydrogen Skimmer Fan Inlet Valves (2VX1A, 2B)

The suction inlet valves consist of the following:

Fisher Butterfly Valves w/ Rotork Operator
Fail As-is

32.2.5 Containment Air Return Fan Check Dampers (2ARF-D-1, 3)

The check dampers consist of the following:

Two Blade Counterbalanced

32.2.6 Containment Air Return Fan Bypass Dampers (2ARF-D-5 through 10)

The bypass dampers consist of the following:

Parallel blade, Low leakage w/ Pneumatic Actuator
Spring closed, Fail closed

32.2.7 Hydrogen Skimmer Fan Throttle Valves (2VX3 through 28)

The throttle valves consist of the following:

BIF butterfly valves w/ manual operators
locked in position

32.3 INSTRUMENTATION AND CONTROLS

This section documents system Instrumentation and Controls. The information presented in this section should be used in conjunction with the I&C List, I&C Details, Electrical Elementaries, etc., for a complete understanding of system Instrumentation and Controls operations.

32.3.1 INSTRUMENTATION

32.3.1.1 Containment Air Return Fan Isolation Damper Differential Pressure

Differential pressure switches 2VXPS5100 (Train A) and 2VXPS5110 (Train B) measure the differential pressure across the pressure boundary between upper and lower containment. Contact outputs from the switches are used to provide interlocks for preventing dampers 2ARF-D-2 (Train A) and 2ARF-D-4 (Train B) from opening against high differential pressure across the dampers, thus preventing possible overloading to the damper actuator. Additionally, a high differential pressure condition may be simulated via test switches located on the VX Test Panel (2RB-ECP-2). The test switches energize solenoid valves 2VXEP3 or 2VXEP4, for 2ARF-D-2 and 2ARF-D-4, respectively, which in turn admits instrument air at system pressure to the high pressure port of the switch. This was intended to be used to ensure the dampers remained closed during testing of the fans; however, it is not currently used. Instead, the damper breaker is opened to prevent inadvertent damper actuation during testing.

32.3.1.2 Hydrogen Skimmer Fan Temperature and Suction Pressure

The stator temperature of each Hydrogen Skimmer Fan is monitored by individual thermocouples which provide analog inputs to the Operator Aid Computer (OAC). The suction pressure of each fan is monitored between the fan inlet isolation valve (2VX1A, 2VX2B) and the fan inlet and is available as an analog input on the OAC for response time testing.

32.3.1.3 Containment Air Return Fan Discharge Pressure

The discharge pressure of each Containment Air Return Fan is measured between the discharge of the fan and the check damper (2ARF-D-1, 2ARF-D-3) and is available as analog inputs on the OAC for response time testing.

32.3.1.4 Hydrogen Recombiner Heater Temperature Monitor Panels

As described in Section 32.3.2.7, "Electric Hydrogen Recombiner System" on page 52, each hydrogen recombiner has three chromel-alumel thermocouples imbedded in heater bank #3. The Hydrogen Recombiner Control Panel was originally supplied with instrumentation for monitoring these thermocouples. However, at the time this equipment was installed, there were no chromel-alumel electrical penetrations available. Consequently, a heated reference junction termination box was added inside containment. The reference junction box converts the chromel and alumel thermocouple leads to copper leads at a controlled reference junction temperature. By controlling the reference junction temperature, the need for active compensation of the thermocouple readings is eliminated. An RTD is also provided for external monitoring of the reference junction temperature. The three thermocouple readings and the reference junction temperature reading are then sent via copper wire to the train-related Hydrogen Recombiner Heater Temperature Monitor Panels located in the Electrical Penetration Rooms. A digital temperature indicator and selector switch is provided on the monitor panel for displaying any one of the three thermocouple readings. The indicator is calibrated for chromel-alumel thermocouple at a fixed reference junction temperature corresponding to the controlled temperature of the reference junction box. Indication of the actual reference junction temperature is also provided for detecting actual deviations from the controlled reference junction temperature which would affect calibration of the thermocouples.

32.3.2 CONTROLS

32.3.2.1 Containment Air Return Fans

Containment Air Return Fans ARF-2A and ARF-2B use automatic control as the primary mode of operation with manual control provided as a backup. Each fan is operated by a three position (RUN-OFF-AUTO) key-lock selector switch located on main control board 2MC4. The selector switch is normally placed in automatic with the key removed to lock the switch in position. The operational status of the fans are provided by status lights located directly above the key-lock selector switch on the main control board. Refer to Figure 7 for the following discussion of the Containment Air Return Fan controls and interlock logic.

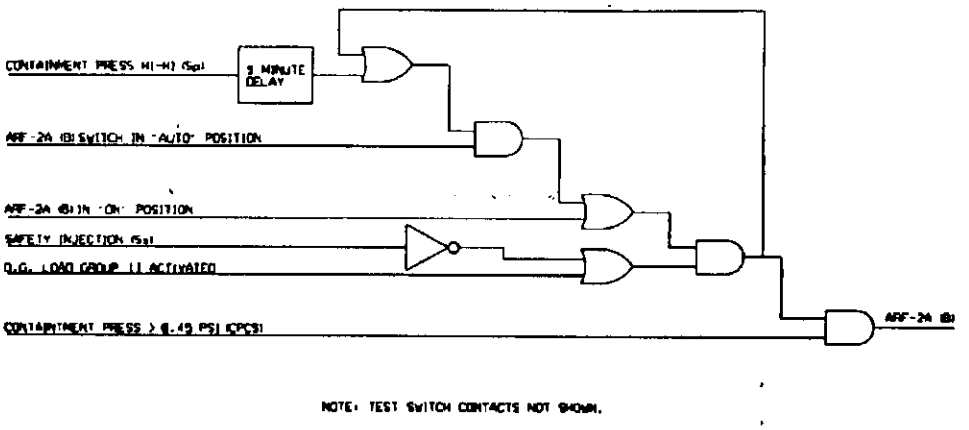

Figure 7.

Each fan is interlocked with the Containment Pressure Control System (CPCS) to prevent operation below a containment pressure of 0.25 psig. Inadvertent operation of the air return system could pressurize lower containment with respect to upper containment, resulting in the ice condenser doors opening to equalize pressure. The circulation of air through the ice condenser and subsequent ice melt could result in a pressure reduction which could possibly exceed the lower design limit. Unlike the Containment Spray Pumps, however, each Air Return Fan utilizes two channels of CPCS interlocks. The fans were originally designed to use one channel dedicated to the fans. However, due to difficulties in maintaining the separation requirements of 20.6.3.1.10, "CNS-1563.NS-00-0001, Design Basis Specification for the Containment Spray (NS) System," the CPCS interlocks for the air return fans were not placed directly in the fan control circuit but were implemented by using the CPCS permissive to control a second contactor for the fans. This secondary contactor is electrically located between the primary fan contactor and the fan motor and therefore overrides any and all fan controls and interlocks discussed below. When energized, the secondary contactor simply allows the primary contactor and control circuit to function as normal. This configuration provided one CPCS channel to control the fans while a separate channel controlled the dampers. However, the damper logic was later modified to remove the CPCS interlock with the M/C circuit such that the damper will not automatically close upon receiving the appropriate CPCS signal. Since the air return dampers are not automatically closed by the CPCS upon reaching 0.25 psig decreasing, termination of the air return system became totally dependent upon the single CPCS permissive for the air return fan. Assuming a single failure which prohibits the CPCS permissive from terminating fan operating at 0.25 psig, the fans could continue to operate with the dampers open. Thus, in order to meet the single failure criteria for the CPCS, a second interlock was added to the fans. This interlock originates from the same channel as the damper interlock. It is physically located in the primary contactor circuit and is separated from the other CPCS

interlock located in the secondary contactor according the separation criteria defined in Reference 20.6.3.1.10, "CNS-1563.NS-00-0001, Design Basis Specification for the Containment Spray (NS) System." The CPCS interlocks may be bypassed for testing purposes via test switches on the CPCS cabinets. See Reference 20.6.3.1.10, "CNS-1563.NS-00-0001, Design Basis Specification for the Containment Spray (NS) System" for a detailed description of the CPCS including special separation requirements for the CPCS circuitry and cables.

The Containment Air Return Fans are assigned to Diesel Load Sequencer Group 11. As such, each fan is interlocked with the Diesel Generator Load Sequencer such that upon receipt of a safety injection signal (Ss), the fan is load shed and operation is inhibited until Load Group 11 is sequenced on the Diesel Generator. This interlock will take precedence over both manual and automatic operation and cannot be defeated.

Manual and automatic control is selected via the key-lock selector switch. Both are subject to the above interlocks. Manual operation of the fans is continuous once selected. Automatic operation is initiated by an Sp signal and is processed through a 9 +/- 1 minute time delay. If the signal is still active after the time delay, an automatic start signal is generated and sealed-in. Once sealed-in, the automatic start signal can only be reset by positioning the selector switch to the OFF position. The CPCS interlock can defeat both the automatic and manual signal, and thus allows the CPCS to cycle the Containment Air Return Fans as required to maintain containment pressure below 0.45 psig.

PIR 0-C91-0090 (PIP 0-C91-0305) identified a problem of potential cycling of the Containment Air Return Fans around the CPCS permissive setpoints. The Containment Air Return fans were declared OPERABLE since they would have already performed their intended safety function by the time containment pressure decreased to the CPCS setpoints. Engineering determined that rapid cycling of the fans around the CPCS setpoints was not a credible concern because the heat sources necessary to cause cycling of the fans are not present in the long term stages of any transient after containment pressure is reduced below 0.3 psig (Reference PIP 0-C97-1027).

Control room annunciator alarms are provided to alert the operator of high fan vibration, Containment Air Return Fan running with the corresponding isolation damper closed, Hydrogen Skimmer Fan running with the corresponding suction valve closed, and control circuit power failure. Digital computer points are provided to indicate the status of the CPCS interlock for the fans.

32.3.2.2 Containment Air Return Fan Isolation Dampers

Containment Air Return Fan dampers 2ARF-D-2 and 2ARF-D-4 use automatic control as the primary mode of operation with manual control provided as a backup. The dampers are operated via momentary pushbutton operators (OPEN-CLOSE) located on main control board 2MC4. The position of each damper is indicated by position indicating lights integral to the pushbutton operator.

The control logic for opening the dampers in both automatic and manual modes is interlocked with the following signals in a logical OR function: 1) an ECCS Sp signal, 2) the train-related Containment Air Return Fan control switch in the ON position, or 3) the train related Hydrogen Skimmer Fan control switch in the ON position. Manual opening of the dampers is dependent only upon satisfying one of the above interlocks. The automatic control logic incorporates a 10 second time delay, after which, the interlock signal is sealed-in. Once sealed-in, two additional interlocks must be satisfied for automatic opening: 1) the permissive frrom the CPCS must be present (containment pressure greater than .45 psig), and 2) the differential pressure across the damper must be less than 0.5 psig. Refer to Figure 8 for a logic diagram of the damper M/O logic circuit.

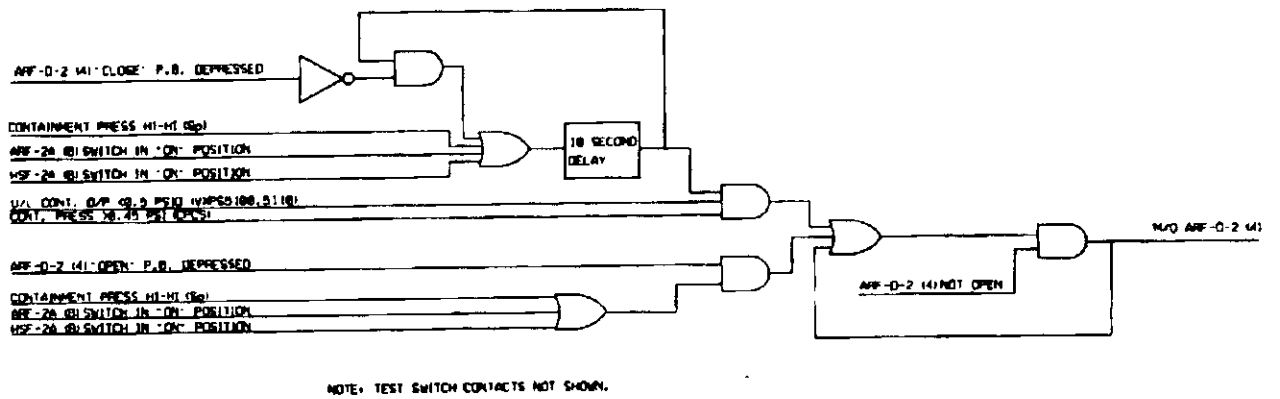

Figure 8.

The control logic for closing the dampers in manual mode is direct, with no intervening interlocks. However, once closed, if the control logic discussed above for automatic opening of the dampers is satisfied, the damper will immediately reopen. There is no automatic control for closing the dampers due to the limitation of the environmental qualification of pressure switches 2VXPS5100 and 2VXPS5110. These switches prevent the damper from opening against a high differential pressure across the damper and thus protect the damper actuator from possible overload. However, they are only qualified to operate 5 minutes under accident conditions, after which the mechanical integrity of the switches may become degraded. This requires the switches to be electrically isolated from the class 1E control circuit once the dampers open and remain isolated indefinitely. This is accomplished by wiring the switches in series with damper limit switches. Since closing the damper would close the limit switches and reconnect the pressure switches to the control circuit, automatic closure of the damper is not provided. Refer to Figure 9 for a logic diagram of the damper M/C logic circuit.

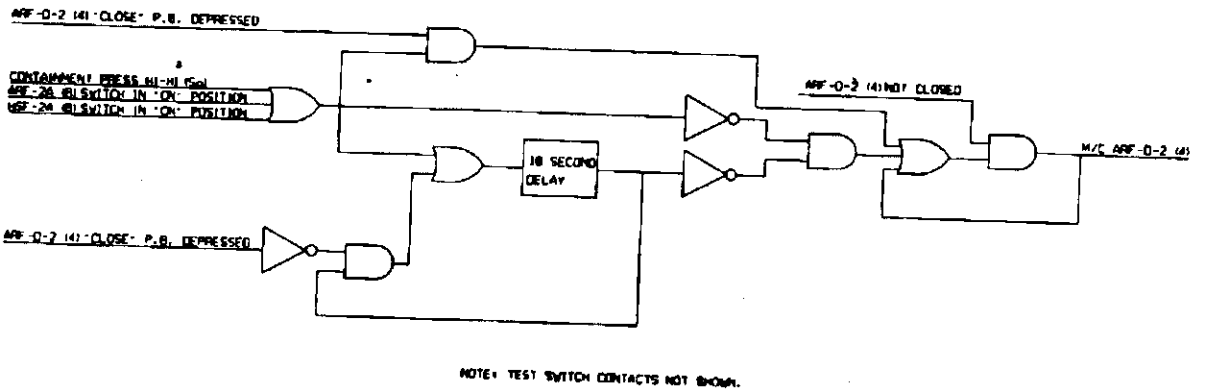

Figure 9.

32.3.2.3 Containment Air Return Fan Bypass Test Dampers

Dampers 2ARF-D-5, 2ARF-D-6, and 2ARF-D-7 are provided to allow testing of Containment Air Return Fan ARF-2A while 2ARF-D-8, 2ARF-D-9, and 2ARF-D-10 allow testing of Containment Air Return Fan ARF-2B. These dampers are controlled by a single solenoid valve, 2VXEP1 and 2VXEP2 for Train A and B, respectively. The solenoid valves are energized during performance testing only. Originally designed to be operated in conjunction with the VX Test Panel (2RB-ECP-2) the solenoid valves and corresponding bypass test dampers are presently operated by placing electrical jumpers in the appropiate termination cabinets.

32.3.2.4 Hydrogen Skimmer Fans

Hydrogen Skimmer Fans HS-2A and HS-2B use automatic control as the primary mode of operation with manual control provided as a backup. Each fan is operated by a three position (RUN-OFF-AUTO) key-lock selector switch located on main control board 2MC4. The selector switch is normally in automatic with the key removed to lock the switch in position. The operational status of the fans are provided by status lights located directly above the key-lock selector switch on the main control board. Refer to Figure 10 for the following discussion of the hydrogen skimmer fan controls and interlock logic.

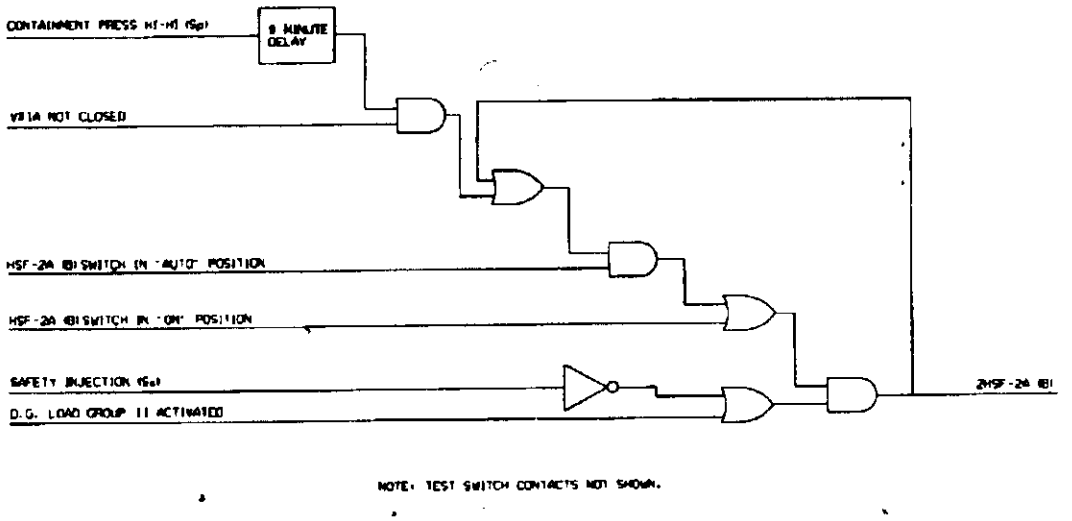

Figure 10.

The hydrogen skimmer fans are assigned to Diesel Load Sequencer Group 11. As such, each fan is interlocked with the Diesel Generator Load Sequencer such that upon receipt of a safety injection signal (Ss), the fan is load shed and operation is inhibited until Load Group 11 is sequenced on the Diesel Generator. This interlock will take precedence over both manual and automatic oper ation and cannot be defeated.

Manual operation is subject only to the above interlock and is continuous once selected. Automatic operation is initiated by an Sp signal (Hi-Hi Containment Pressure or Manual Spray Actuation) through a 9+/-1 minute time delay and is interlocked with the respective inlet isolation valve (2VX1A, 2VX2B) such that the inlet valve must start opening before an automatic start signal is generated. If the Sp signal is still present after the time delay expires and the respective inlet valve is opening, an automatic start signal is generated and sealed-in. Once generated, the automatic start signal can only reset by moving the selector switch to the OFF position.

Train related control room annunciator alarms are provided to alert the operator if the Hydrogen Skimmer Fan is being operated with the corresponding inlet valve closed.

32.3.2.5 Hydrogen Skimmer Fan Inlet Valves (2VX1A, 2B)

Hydrogen Skimmer Fan Inlet Valves 2VX1A and 2VX2B use automatic control as the primary method of operation with manual control provided as a backup. The valves are operated via momentary pushbutton operators (OPEN-CLOSE) located on main control board 2MC4. The position of each valve is indicated by position indicating lights integral to the pushbutton operator.

The control logic for opening the inlet valves in both automatic and manual modes is interlocked with the following signals in a logical OR function: 1) an ECCS Sp signal, 2) the train-related Containment Air Return Fan control switch in the ON position, or 3) the train-related Hydrogen Skimmer Fan control switch in the ON position. Manual opening of the inlet valves is dependent only upon satisfying one of the above interlocks. The automatic control logic incorporates a 9+/-1 minute time delay, after which, the interlock signal is sealed-in and the valves start opening. Refer to Figure 11 for a logic diagram of the valve M/O logic circuit.

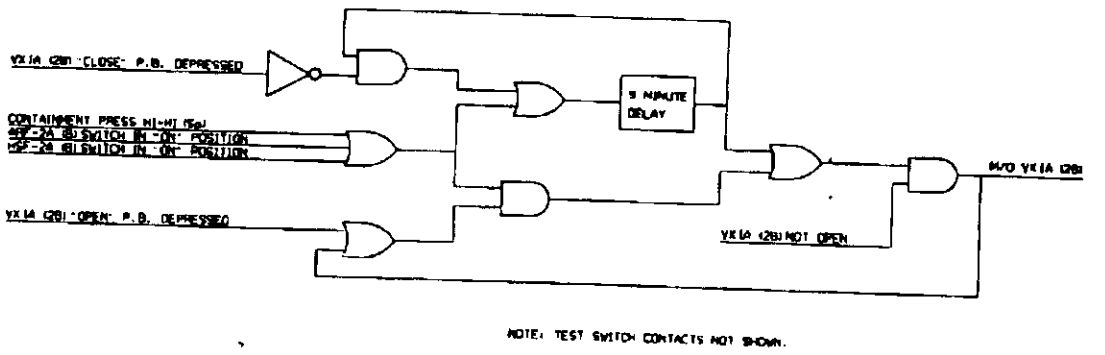

Figure 11.

The control logic for closing the inlet valves in manual mode is direct, with no intervening interlocks. However, once closed, if the control logic discussed above for automatic opening of the inlet valves is satisfied, the valve will immediately reopen. There is no automatic control for closing the valves. Refer to Figure 12 for a logic diagram of the valve M/C logic circuit.

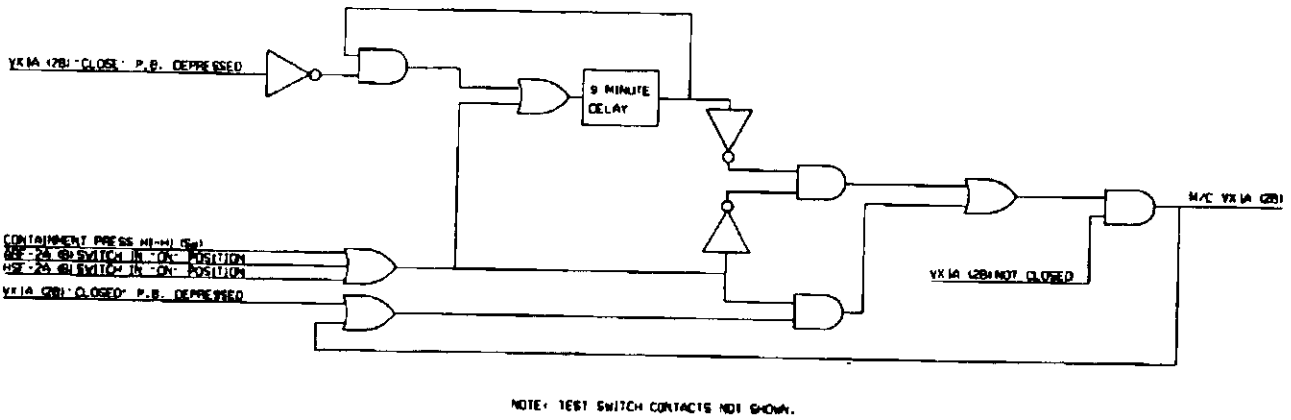

Figure 12.

32.3.2.6 VX and VP Test Panel (2RB-ECP-2)

Test Panel 2RB-ECP-2 provides a means to test the Containment Air Return Fans, isolation dampers, hydrogen skimmer fans, and inlet isolation valves and verify the time-delay logic associated with each. The test panel is not currently used; however, individual parts of the circuitry associated with the panel are used in conjunction with external electrical jumpers for testing. A detailed description of the test panel operating procedures can be found in Reference 20.6.1.6.4, "Design Study CNDS-107, VX Controls/Test Circuitry Review," Attachment 3. For actual testing, refer to the appropriate performance test procedures.

32.3.2.7 Electric Hydrogen Recombiner System

The Electric Hydrogen Recombiner System (EHRS) is a natural convection flameless, thermal reactor-type hydrogen/oxygen recombiner. In its basic operation, it heats a continuous stream of air/hydrogen mixture to a temperature sufficient for spontaneous recombination of the hydrogen with the oxygen in the air to form water vapor. The system consists of two independent recombination units, each of which contains the electric heater banks, a power supply panel that contains the equipment for powering the heaters, and a power control panel to the heaters.

The recombination units are located inside containment in the vicinity of the discharge of the Hydrogen Skimmer Fans. It consists of an inlet preheater section, a heater-recombination section, and a mixing chamber. The heater-recombination section contains four banks of heaters. Each bank contains 60 individual, U-type heating elements connected in series-parallel arrangements as required to obtain the power rating for each bank. Heater bank #3 in each recombination unit has three chromel-alumel thermocouples mechanically fastened and welded to the heater sheaths. These thermocouples are provided to verify heater operation and to indicate plate temperature for performance testing.

The power supply panel is located in the Auxiliary Building and contains all the necessary electrical equipment to provide the power required by the heaters in the recombination unit. It is a self-supporting, floor-mounted cabinet.

The control panel is located in the Auxiliary Building next to the power supply panel and contains all the control and monitoring equipment required for operating the recombination unit. It contains a master

ON-OFF switch, a control potentiometer for adjusting the amount of power supplied to the recombination units, and a wattmeter for indication of the power supplied. The system as purchased also provided a display for monitoring any one of the three thermocouples imbedded in heater bank #3 and a selector switch for selecting between the three. However, due to lack of chromel-alumel electrical penetrations at the time of equipment installation, a different method of monitoring the thermocouples has been provided via the Hydrogen Recombiner Heater Temperature Monitor Panel described in Section 32.3.1.4, "Hydrogen Recombiner Heater Temperature Monitor Panels" on page 46. The display and controls on the Hydrogen Recombiner Control Panel have been abandoned in place.

The master control switch on the control panel is interlocked such that the system can be operated only if an Ss signal is not present or after Diesel Load Sequencer Load Group 11 has been cycled onto the bus. This interlock essentially prevents operation of the Hydrogen Recombiner between the initial receipt of a Ss and when Load Group 11 is activated. This is also the same interlock as is used on the Containment Air Return Fans described in Section 32.3.2.1, "Containment Air Return Fans" on page 47, and the Hydrogen Skimmer Fans described in Section 32.3.2.4, "Hydrogen Skimmer Fans" on page 50.

32.3.3 INDICATORS

None.

32.3.4 RECORDERS

None.

32.3.5 STATUS INDICATION

32.3.5.1 Status Lights

The following status lights provide information concerning the VX System but are actually part of the Containment Spray (NS) System. For additional information, refer to reference 20.6.3.1.10, "CNS-1563.NS-00-0001, Design Basis Specification for the Containment Spray (NS) System."

VX SYS CPCS TRAIN A INHIBIT

VX SYS CPCS TRAIN B INHIBIT

32.3.5.2 Monitor Lights

Group I

AIR RETURN FAN ARF-A RUNNING

AIR RETURN FAN ARF-B RUNNING

HYDROGEN SKIMMER FAN HSF-A RUNNING

HYDROGEN SKIMMER FAN HSF-B RUNNING

ARF ISOL DAMPER ARF-D-2 OPEN

ARF ISOL DAMPER ARF-D-4 OPEN

HSF INLET ISOLATION VLV VX1 OPEN

HSF INLET ISOLATION VLV VX2 OPEN

32.3.5.3 1.47 Panel Bypass Lights

See Section 20.5.1.4, "Bypass and Inoperable Status Indication" on page 15 for a list of 1.47 Bypass Lights.

32.3.6 SYSTEM ALARMS

32.3.6.1 Annunciators

VX TRAIN A TROUBLE

VX TRAIN B TROUBLE

32.3.6.2 Computer Inputs

32.3.6.2.1 Analog Inputs

HSF A MTR STATOR TEMP

HSF B MTR STATOR TEMP

32.3.6.2.2 Digital Inputs

HYDROGEN SKIMMER FAN A SUCT PRESS	LO, NOT LO
HYDROGEN SKIMMER FAN B SUCT PRESS	LO, NOT LO
CONTAINMENT AIR RETURN FAN A DISCH PRESS	LO, NOT LO
CONTAINMENT AIR RETURN FAN B DISCH PRESS	LO, NOT LO
VLV VX1A HYDROGEN SKIMMER FAN A ISOL	OPEN, NOT OPEN
VLV VX1A HYDROGEN SKIMMER FAN A ISOL	CLOSED, NOT CLOSED
VLV VX2B HYDROGEN SKIMMER FAN B ISOL	OPEN, NOT OPEN
VLV VX2B HYDROGEN SKIMMER FAN B ISOL	CLOSED, NOT CLOSED
DAMPER ARF-D-2 CONT AIR RETURN FAN A ISOL	OPEN, NOT OPEN
DAMPER ARF-D-2 CONT AIR RETURN FAN A ISOL	CLOSED, NOT CLOSED
DAMPER ARF-D-4 CONT AIR RETURN FAN B ISOL	OPEN, NOT OPEN
DAMPER ARF-D-4 CONT AIR RETURN FAN B ISOL	CLOSED, NOT CLOSED
CPCS BLOCK OF VX CONT AIR RET FAN A OPR	ENGAGED, NOT ENGAGED
CPCS BLOCK OF VX CONT AIR RET FAN B OPR	ENGAGED, NOT ENGAGED

32.4 POWER SOURCES

The following equipment is supplied with essential 600 VAC, 3 phase, 60 Hz. power. For the design basis and a detailed description of the system providing this power, see Reference 20.6.3.1.12, "CNS-112.01-EPE-0001, Design Basis Specification for the EPE System."

Equipment	MCC (600 VAC)	Compt./Bkr.
Containment Air Return Fan ARF-2A	2EMXK	F11A
Power Lockout Contactor ARF-2A	2EMXM	F01A
Containment Air Return Fan ARF-2B	2EMXL	F11A
Power Lockout Contactor ARF-2B	2EMX	F01A
Hydrogen Skimmer Fan 1HSF-2A	2EMXK	F11B
Hydrogen Skimmer Fan 1HSF-2B	2EMXL	F11B
Containment Air Return Fan Damper 2ARF-D-2	2EMXK	F10A
Containment Air Return Fan Damper 2ARF-D-4	2EMXL	F10A
Hydrogen Skimmer Fan Inlet Isol. Valve 2VX001A	2EMXK	F06A
Hydrogen Skimmer Fan Inlet Isol. Valve 2VX002B	2EMXL	F06A
Hydrogen Recombiner Panel 2A	2EMXK	F07C
Hydrogen Recombiner Panel 2B	2EMXL	F07C

Low voltage instrumentation and control circuits are powered from various systems. Design basis information and system description information for the safety-related systems and system description information for the non-safety systems can be found in the following references.

1. Reference 20.6.3.1.13, "CNS-106.01-EPY-0001, Design Basis Specification for the EPY System"
2. Reference 20.6.1.6.2, "CNSD-0010-10, Electrical System Description for the 240/120 VAC Auxiliary Control Power System"
3. Reference 20.6.1.6.3, "CNSD-0010-12, Electrical System Description for the 208/120 VAC Normal Auxiliary Power System"

32.5 DESIGN DOCUMENT CROSS REFERENCE

32.5.1 DUKE DRAWINGS .

Flow Diagram:	CN-2557-1.0
Summary Flow Diagram:	CNSF-2557-VX.01
Instrument Details:	CN-2499-VX Series
Electrical Elementaries:	CNEE-0265-01 Series
Connection and Outline Diagrams:	CN-2735-01 Series
Piping Isometrics:	CN-2491-VX Series
Test Acceptance Criteria:	CNTC-2557-VX Series

32.5.2 VENDOR DRAWINGS

For information on VX System Euipment, use DPCo. Equipment and Valve Data Base Files.

CATAWBA
INITIAL LICENSE EXAMINATION
JOB PERFORMANCE MEASURE

JPM 4S ADMIN

Review and Authorize a Gaseous Waste Release Document

CANDIDATE _____

EXAMINER _____

CATAWBA
INITIAL LICENSE EXAMINATION
JOB PERFORMANCE MEASURE

Task:

Review and authorize a Gaseous Waste Release document.

Alternate Path:

N/A

Facility JPM #:

NEW

K/A Rating(s):

103 000 G.13

Task Standard:

The GWR is reviewed/authorized with errors identified and corrected.

Preferred Evaluation Location:

Simulator ____ In-Plant __X__

Preferred Evaluation Method:

Perform __X__ Simulate _____

References:

OP/1/A/6450/017 (Containment Air Release and Addition System) Rev.49
HP/0/B/1004/005

Validation Time: N/A Minutes **Time Critical:** No

==========

Candidate: _____ Time Start : _____
NAME Time Finish: _____

Performance Rating: SAT _____ UNSAT _____ Question Grade _____ Performance Time _____

Examiner: _____ _____/_____
NAME SIGNATURE DATE

==========

COMMENTS

_____

_____

_____

Tools/Equipment/Procedures Needed:

Clean copy of OP/1/A/6450/017 Enclosure 4.2 for each candidate.
Copy of HP/0/B/1004/005 Enclosure 5.1 for each candidate.
Copy of Gaseous Waste Release Permit Report for each candidate.

READ TO OPERATOR

DIRECTION TO TRAINEE:

I will explain the initial conditions, and state the task to be performed. All control room steps shall be performed for this JPM, including any required communications. I will provide initiating cues and reports on other actions when directed by you. Ensure you indicate to me when you understand your assigned task. To indicate that you have completed your assigned task return the handout sheet I provided you.

INITIAL CONDITIONS:

A Unit #1 Gaseous Waste Release from (GWR) has been brought to the Control Room for authorization to release.

INITIATING CUES:

Reviewed and authorize the Gaseous Waste Release form.

This wording presumes no problems. Is leading

What position is the applicant? SRO?

START TIME: _____

TEP 1: Reviews the GWR for appropriate Unit. STANDARD: Provide candidate with the GWR Paperwork for UNIT #2. STANDARD: Determines GWR paperwork is designated for Unit #2 and should be for Unit #1. *****CUE:** If the candidate returns the paperwork without further review, instruct candidate to identify all errors.* COMMENTS:	**CRITICAL STEP** ___ SAT ___ UNSAT
STEP 2: Reviews the Expected range of EMF Trip 1, and Trip 2 setpoints. STANDARD: Determines the setpoint for the Trip 2 setpoint is less than the Trip 1 setpoint. COMMENTS:	**CRITICAL STEP** ___ SAT ___ UNSAT
*****CUE: Once all errors have been identified, retrieve the paperwork. Inform the candidate that all mistakes were corrected and another SRO approved the paperwork. The release has now been accomplished and you are to complete the release form by calculating the volume released from containment using OP/1/A/6450/017 (Containment Air Addition and Release) step 2.18. The VQ flow integrator is inoperable.***	
STEP 3: Determines from Enclosure 5.1 of HP/0/B/1004/005 that release was in progress for 109 minutes. STANDARD: Correctly determines time of release. COMMENTS:	**CRITICAL STEP** ___ SAT ___ UNSAT

*****Italicized Cues Are To Be Used Only If JPM Performance Is Being Simulated.***

STEP 4: Multiplies 109 minutes by 300 cfm to obtain a total volume released of 32,700 cubic feet and enters this value on form. TANDARD: Candidate determines correct volume released using OP/1/A/6450/017 Enclosure 4.2 step 2.18.3 and records value on form. COMMENTS:	**CRITICAL STEP** _____SAT ____UNSAT
This JPM is complete.	

TIME STOP: _____

Add 2 more interim releases so applicant will have to calculate each volume as well as total. Also change the highest EMF reading for each release. I would expect to highest EMF reading and total volume to be entered as part of JPM ⇒ 7 need JPM steps. Also in signature/date/time for authorizing release (per our cue) step for final SRO review?

***Italicized Cues Are To Be Used Only If JPM Performance Is Being Simulated.**

CANDIDATE CUE SHEET
(TO BE RETURNED TO EXAMINER UPON COMPLETION OF TASK)

INITIAL CONDITIONS:

A Unit #1 Gaseous Waste Release from (GWR) has been brought to the Control Room for authorization to release.

INITIATING CUES:

Reviewed and authorize the Gaseous Waste Release form.

***Italicized Cues Are To Be Used Only If JPM Performance Is Being Simulated.**

VQ/VP Release Rate Determination Form - Catawba Nuclear Station

Shift Supervisor Authorizing Release or Designee _____
Signature

_____
Date/Time

VQ RELEASE RECORD/MANUAL CALCULATIONS

VQ RELEASE ON GWR# 2001-003

Date/Time Release Initiated (Notify RP)	Initial Integrator Reading	Final Integrator Reading	EMF Operable/ Source Checked * I.V. for Setpoints	Highest EMF Reading	EMF ** Setpoints Reset	Date/Time Release Terminated (Notify RP)	Volume *** (Final Integrator × 10)	Control Room Operator
0849	N/A	N/A	(I.V.) Eric Matson (I.V.) Gary Rhyne	150	Eric Matson	1036	32,700	
			(I.V.) (I.V.)					
			(I.V.) (I.V.)					
			(I.V.) (I.V.)					
			(I.V.) (I.V.)					
			(I.V.) (I.V.)					
			(I.V.) (I.V.)					

Highest EMF Reading During Release:_____ Total VQ Volume Released:_____

* EMF chart recorder should be stamped at the start of each release and at the completion of each release. Whenever several releases are made on the same GWR, use the VQ Release Record. Determine EMF operability immediately before initiating release.

** Reset EMF setpoints to non-release setpoints when VQ System is not in service and enter in EMF Setpoint Logbook.

*** Volume for each release = **Final Integrator Reading** × **10**.

Completion of Release Acknowledged by
Shift Supervisor or Designee _____

THIS COPY HAS BEEN COMPARED WITH THE CONTROL COPY AND IS VERIFIED CORRECT.
INITIAL WJD DATE 1-6-0 TIME 0845

#9 MJ

(R06-97)

Duke Power Company
PROCEDURE PROCESS RECORD

(1)ID No. OP/1/A/6450/017
Revision No. 49

PREPARATION

(2) Station CATAWBA NUCLEAR STATION

(3) Procedure Title CONTAINMENT AIR RELEASE AND ADDITION SYSTEM

(4) Prepared By _____ Date 9-28-99

(5) Requires 10CFR50.59 evaluation?
- ☒ Yes (New procedure or revision with major changes)
- ☐ No (Revision with minor changes)
- ☐ No (To incorporate previously approved changes)

(6) Reviewed By _____ (QR) Date 09-29-99

Cross-Disciplinary Review By _____ (QR) NA _____ Date 10/13/99

Reactivity Mgmt. Review By _____ (QR) NA _____ Date _____

(7) Additional Reviews

Reviewed By _____ Date 10/13/99

Reviewed By _____ Date _____

(8) Temporary Approval *(if necessary)*

By _____ (SRO/QR) Date _____

By _____ (QR) Date _____

(9) Approved By _____ Date 10/14/99

PERFORMANCE (Compare with control copy every 14 calendar days while work is being performed.)

(10) Compared with Control Copy _____ Date _____

Compared with Control Copy _____ Date _____

Compared with Control Copy _____ Date _____

(11) Date(s) Performed _____

Work Order Number (WO#) _____

COMPLETION

(12) Procedure Completion Verification

- ☐ Yes ☐ N/A Check lists and/or blanks properly initialed, signed, dated, or filled in N/A, as appropriate?
- ☐ Yes ☐ N/A Listed enclosures attached?
- ☐ Yes ☐ N/A Data sheets attached, completed, dated, and signed?
- ☐ Yes ☐ N/A Charts, graphs, etc. attached, dated, identified, and marked?
- ☐ Yes ☐ N/A Procedure requirements met?

Verified By _____ Date _____

(13) Procedure Completion Approved _____ Date _____

14) Remarks *(attach additional pages, if necessary)*

T

INFORMATION ONLY
Multiple Use

Duke Power Company Catawba Nuclear Station **Containment Air Release and Addition System** **Multiple Use**	Procedure No. OP/1/A/6450/017 Revision No. 049 Electronic Reference No. CN005FME

Containment Air Release and Addition System

1. Purpose

To outline the proper operation of the Containment Air Release and Addition System.

2. Limits and Precautions

2.1 Do **NOT** exceed Containment Pressure Limits of -0.08 psig and +0.25 psig. Tech Spec Containment Pressure Limits are -0.1 psig to +0.3 psig.

2.2 When manually operating any motor operated valve, minimize the torque applied to the handwheels.

2.3 After manual operation, maintenance or packing adjustment of any motor operated Safety Related valve, it shall be cycled electrically to ensure reliable automatic operation.

2.4 Pressure switches for valve operation should **NOT** be manually overridden since ice condenser doors are very sensitive to over or under pressure conditions.

2.5 When Containment Air Release Filter unit pre-filter or absolute filter differential pressure reaches 2.5 inches H_2O, the standby fan should be placed in service and action initiated to replace the dirty filter(s).

2.6 A new Gaseous Waste Release (GWR) sample is required if:

- 24 hours has elapsed since the last sample.
- VQ release is automatically terminated due to a valid controlling EMF actuation. If actuation is due to an EMF spike, the release may be re-attempted twice before a new sample is required.

2.7 A VP, VQ or Unit Vent Sample is required if:

- Rx Trip or Startup occurs.
- Rated Thermal Power change of $\geq$ 15% in one hour occurs followed by a Thermal Power Stabilization (power level constant at desired power level).

2.8 If 1EMF-37 or 1EMF-40 has reached the Trip 1 setpoint, RP should be notified to change the cartridge before a release is attempted.

3. Procedures

Refer to Section 4 (Enclosures).

4. Enclosures

4.1 Air Addition Mode

4.2 Air Release Mode

4.3 Initiation and Termination of a GWR Permit Report

4.4 Auxiliary Building Valve Checklist

4.5 Reactor Building Valve Checklist

4.6 Auxiliary Building Separate Verification Valve Checklist

4.7 Reactor Building Separate Verification Valve Checklist

1. Initial Conditions

_____ 1.1 Review the Limits and Precautions.

_____ 1.2 Verify containment pressure is decreasing and ≤ -0.03 psig.

2. Procedure

_____ 2.1 Ensure the following enclosures are complete:

- ☐ Enclosure 4.4 (Auxiliary Building Valve Checklist)
- ☐ Enclosure 4.5 (Reactor Building Valve Checklist)
- ☐ Enclosure 4.6 (Auxiliary Building Separate Verification Valve Checklist)
- ☐ Enclosure 4.7 (Reactor Building Separate Verification Valve Checklist)

_____ 2.2 Open the following valves to allow air to be drawn into the containment (rear of 1MC5):

- ☐ 1VQ-15B (Cont Air Add Cont Isol)
- ☐ 1VQ-16A (Cont Air Add Cont Isol)

_____ 2.3 Open 1VQ-13 (Cont Air Add Inlt) by pressing the "AUTO" button (rear of 1MC5).

NOTE: The start date/time for the VQ addition is when the first containment isolation valve (1VQ-15B or 1VQ-16A) is opened.

_____ 2.4 Notify Radiation Protection that VQ addition has been started and give the start time.
Person notified _____

_____ 2.5 **WHEN** containment pressure increases to approximately 0.0 psig, verify that 1VQ-13 (Cont Air Add Inlt) closes.

_____ 2.6 Press the "CLOSE" button for 1VQ-13 (Cont Air Add Inlt).

_____ 2.7 Close the following valves:

- ☐ 1VQ-15B (Cont Air Add Cont Isol)
- ☐ 1VQ-16A (Cont Air Add Cont Isol)

NOTE: The termination date/time for the VQ addition is when both containment isolation valves (1VQ-15B and 1VQ-16A) are closed.

_____ 2.8 Notify Radiation Protection that VQ addition has been terminated and give termination time.
Person notified _____

2.9 Do **NOT** file this enclosure in the Control Copy folder of this procedure.

1. Initial Conditions

_____ 1.1 Review the Limits and Precautions.

_____ 1.2 Verify Containment Pressure > 0.09 psig.

_____ 1.3 Verify CR SRO has signed and dated the VQ RELEASE RECORD authorizing releases.

_____ 1.4 Verify Containment pressure increase is **NOT** due to a LOCA or steam line break.

_____ 1.5 Review the "SPECIAL INSTRUCTIONS FOR RELEASE" section on the GWR Permit Report.

2. Procedure

_____ 2.1 Ensure the following enclosures are complete:

- ☐ Enclosure 4.4 (Auxiliary Building Valve Checklist)
- ☐ Enclosure 4.5 (Reactor Building Valve Checklist)
- ☐ Enclosure 4.6 (Auxiliary Building Separate Verification Valve Checklist)
- ☐ Enclosure 4.7 (Reactor Building Separate Verification Valve Checklist)

2.2 Perform the following to sign off the "EMF Operable/Source Checked I.V. for Setpoints" blank on the VQ RELEASE RECORD:

2.2.1 **IF** 1EMF-39 (low range) is operable, perform the following:

_____ 2.2.1.1 Verify 1EMF-39 is specified for use on the GWR Permit Report.

_____ 2.2.1.2 Verify 1EMF-39 is operable per SLC 16.11-7 using OP/0/A/6500/080 (EMF RP86A Output Modules).

_____ 2.2.1.3 Set 1EMF-39 (low range) setpoints to the value specified on the GWR Permit Report using OP/0/A/6500/080 (EMF RP86A Output Modules).

NOTE: The person performing the following step shall **NOT** be the same as in Step 2.2.1.3.

_____ 2.2.1.4 Verify trip setpoints are set to the values as specified on the GWR Permit Report using OP/0/A/6500/080 (EMF RP86A Output Modules).

_____ 2.2.2 **IF** 1EMF-39 (low range) is inoperable **AND** 1EMF-36 (low range) is to be used to monitor this release, perform the following:

☐ 2.2.2.1 Verify 1EMF-36 is specified for use on the GWR Permit Report.

☐ 2.2.2.2 Verify 1EMF-36 is operable using OP/0/A/6500/080 (EMF RP86A Output Modules).

NOTE: 1EMF-36 (low range) trip setpoints are pre-established for offsite dose.

☐ 2.2.2.3 Verify trip setpoints are set to the values as specified on the GWR Permit Report using OP/0/A/6500/080 (EMF RP86A Output Modules).

☐ 2.2.2.4 N/A the "IV" blank on the VQ RELEASE RECORD.

_____ 2.2.3 **IF** 1EMF-39 **AND** 1EMF-36 are both inoperable, perform the following:

☐ 2.2.3.1 Verify EMF-39 and EMF-36 are both N/Aed on the GWR Permit Report.

☐ 2.2.3.2 Notify RP to take grab samples per HP/0/B/1004/005 (Containment Air Release And Addition (VQ) And Containment Purge Ventilation (VP) System Release).
Person notified _____

☐ 2.2.3.3 N/A the "EMF Operable/Source Checked IV for Setpoints" blanks on the VQ RELEASE RECORD.

☐ 2.2.3.4 N/A Step 2.3.

_____ 2.3 Set up EMF Chart recorder as follows:

2.3.1 Ensure the paper drive is on for the applicable EMF chart recorder:

- 1MICR6640 if 1EMF-39 (L) is used
- 1MICR6650 if 1EMF-36 (L) is used

2.3.2 Stamp and record the following on the chart paper:

- Date
- Time
- GWR #
- Initials

SV ____ 2.4 Adjust "1VQ-10 VQ Fans Disch To Unit Vent" manual loader (1MC5) to ≤ the "Recommended Release Rate (cfm)" on the GWR Permit Report.

2.5 Record the following on the VQ RELEASE RECORD.

2.5.1 **IF** the totalizer is operable, reset it and enter "0" in the "Initial Integrator Reading" blank

2.5.2 **IF** the totalizer is inoperable, N/A the "Initial Integrator Reading" blank.

____ 2.6 Open the following valves (1MC5):

☐ 1VQ-2A (VQ Fan Suct From Cont Isol)
☐ 1VQ-3B (VQ Fan Suct From Cont Isol)

2.7 Place one VQ train in service as follows (1MC5):

____ 2.7.1 To place A train in service, perform the following:

☐ 2.7.1.1 Place "VQ Filt Htr A" in the "AUTO" position.

☐ 2.7.1.2 Start "Cont Air Rel Fan 1A".

____ 2.7.2 To place B train in service, perform the following:

☐ 2.7.2.1 Place "VQ Filt Htr B" in the "AUTO" position.

☐ 2.7.2.2 Start "Cont Air Rel Fan 1B".

NOTE: The start date/time for the VQ release is when the first containment isolation valve (1VQ-2A or 1VQ-3B) was opened.

____ 2.8 Notify RP that the VQ release has been started and give start time.
Person notified _____

____ 2.9 Record the VQ start date/time on VQ RELEASE RECORD.

NOTE: Containment pressure shall be monitored to ensure 1VQ-10 (VQ Fans Disch To Unit Vent) closes at 0 psig to prevent a negative pressure inside containment.

_____ 2.10 **IF** the OAC **OR** Computer Point C1P1112 (Average Containment Pressure, best) is out of service, record containment pressure as read on 1VQP5040 (Containment Pressure) on 1MC5 every 30 minutes in the Control Room Log for the duration of the VQ Release. {PIP 93-0074}

_____ 2.11 **IF** the VQ fan does **NOT** automatically shutdown at approximately 0 psig, perform the following:

- N/A Step 2.12.
- Perform Step 2.13.

_____ 2.12 **WHEN** Containment pressure decreases to approximately 0 psig, verify that "1VQ-10 VQ Fans Disch To Unit Vent" closes, by no flow indicated on the manual loader (black needle).

_____ SV 2.13 Reset "1VQ-10 VQ Fans Disch To Unit Vent" by adjusting the manual loader demand position (red needle) to zero cfm.

2.14 Secure the VQ train placed in service in Step 2.7 as follows:

_____ 2.14.1 To secure A train, perform the following:

☐ 2.14.1.1 Ensure "Cont Air Rel Fan 1A" has stopped.

☐ 2.14.1.2 Place "VQ Filt Htr A" in the "OFF" position.

_____ 2.14.2 To secure B train, perform the following:

☐ 2.14.2.1 Ensure "Cont Air Rel Fan 1B" has stopped.

☐ 2.14.2.2 Place "VQ Filt Htr B" in the ""OFF" position.

_____ 2.15 Close the following valves:

☐ 1VQ-2A (VQ Fan Suct From Cont Isol)
☐ 1VQ-3B (VQ Fan Suct From Cont Isol)

_____ 2.16 Stamp and record the following on the chart paper:

- Date
- Time
- GWR #
- Initials

> **NOTE:** The terminated time for the VQ release is when both containment isolation valves (1VQ-2A and 1VQ-3B) are closed.

_____ 2.17 Notify RP that the VQ release has been terminated and give termination time.
Person notified _____

2.18 Record the following on the VQ RELEASE RECORD:

2.18.1 Enter the "Date/Time Release Terminated".

2.18.2 **IF** the totalizer is operable, perform the following:

2.18.2.1 Record totalizer value in "Final Integrator Reading" blank.

2.18.2.2 Enter the volume released in the "Volume" blank.
* Volume = final integrator reading X 10.

2.18.3 **IF** the totalizer is inoperable, perform the following:

2.18.3.1 N/A the "Final Integrator Reading" blank.

2.18.3.2 Enter the volume released in the "Volume" blank.

- Volume = 300 CFM X Release Time (in minutes).
- Release Time = Date/Time initiated - Date/Time terminated.

2.18.4 Enter the "Highest EMF Reading" during the release as read on the chart recorder.

2.18.5 Initial the "Control Room Operator" blank.

NOTE: If any trip setpoint is greater than 1000 cpm, round down to the nearest 100 prior to entering to ensure the entered setpoint remains conservative.

2.19 **IF** 1EMF-39 was used for this release, reset 1EMF-39 (low range) trip setpoints using OP/0/A/6500/080 (EMF RP86A Output Modules):

_____ 2.19.1 **IF** in Mode 5 or 6, the trip setpoints shall be as follows:

- Trip 2 = 17,400 cpm + Existing reading, Rounded down to the nearest 100 cpm
- Trip 1 = Trip 2 X .70

_____ 2.19.2 **IF** in Mode 1, 2, 3 or 4, the trip setpoints shall be set as follows:

- Trip 2 = 3 X Containment Atmosphere Activity (sampled at all three locations) as indicated by EMF allowing about 15 minutes for indication to stabilize.
- Trip 1 = Trip 2 X .70.

2.19.3 Signoff "EMF Setpoints Reset" blank on the VQ RELEASE RECORD.

NOTE: The person performing the following step shall **NOT** be the same as in Step 2.19.3.

_____ 2.19.4 Verify trip setpoints are reset as described in Step 2.19.1 or 2.19.2 using OP/0/A/6500/080 (EMF RP86A Output Modules).

2.20 **IF** 1EMF-36 was used for this release, N/A the "EMF Setpoints Reset" blank on the VQ RELEASE RECORD.

2.21 Do **NOT** file this enclosure in the Control Copy folder of this procedure.

Information Use

1. Initial Conditions

1.1 Review the Limits and Precautions.

1.2 Verify Radiation Protection has taken a sample and has issued a new GWR Permit Report.

2. Procedure

2.1 Request the CR SRO sign and date the VQ RELEASE RECORD authorizing releases.

NOTE: At this point, the GWR Permit Report for the VQ System is valid. The VQ System can be started and stopped as often as desired as long as the GWR Permit Report remains valid. Subsequent steps in this section will terminate the GWR Permit Report when Radiation Protection declares the GWR Permit Report invalid.

2.2 The following steps are to aid the operator in terminating the GWR Permit Report:

2.2.1 Add all values in the "Volume" column. Record total in "Total VQ Volume Released" blank.

2.2.2 Enter the highest value from "Highest EMF Reading" column in "Highest EMF Reading During Release" blank.

2.2.3 Ensure the CR SRO performs the following:

2.2.3.1 Sign the "Completion of Release Acknowledged by CR SRO" blank.

2.2.3.2 Place the completed VQ GWR Permit Report in the completed release box.

VALVE NO.	VALVE	LOCATION	POSITION	DATE INITIAL
	CONTROL ROOM (1MC5)			
	NOTE: Valve position should be determined by use of Control Room indicating lights.			
1VQ-3B	VQ Fan Suct From Cont Isol	572/318A HH-JJ,51-52	Closed	
1VQ-10	VQ Fans Disch To Unit Vent	551/217 JJ-52	Closed	
1VQ-13	Cont Air Add Inlt	550/217 EE-52	Closed	
1VQ-15B	Cont Air Add Cont Isol	553/217 EE-52	Closed	
	AUX BLDG			
1VQ-5	VQ Intake Test Vent	572/318 HH-52	Closed	
1VQ-14	Cont Air Addition Test Vent	557/217 EE-52	Closed	
1VQ-21	Cont Air Addition Vent	547/217 EE-52	Closed	
1VQ-22	Cont Air Addition Vent	548/217 EE-52	Closed	
1VQ-6	1A VQ Fan Suct	549/200 GG-57	Open	
1VQ-7	1A VQ Fan Disch	549/200 GG-57	Open	
1VQ-8	1B VQ Fan Suct	549/200 FF-57	Open	
1VQ-9	1B VQ Fan Disch	549/200 FF-57	Open	

VALVE NO.	VALVE	LOCATION	POSITION	DATE INITIAL
	CONTROL ROOM (1MC5)			
	NOTE: Valve position should be determined by use of Control Room indicating lights.			
1VQ-2A	VQ Fan Suct From Cont Isol	636 53'268°	Closed	
1VQ-16A	Cont Air Add Cont Isol	559 50'165°	Closed	
	REACTOR BLDG			
1VQ-1	VQ Intake Test Vent	637 45'268°	Closed	
1VQ-4	VQ Intake From Cont	636 - 46'268°	Open	
1VQ-17	Cont Air Addition Test Vent	558 48'167°	Closed	
1VQ-18	Cont Air Addition Outlet	558 48'167°	Open	

Auxiliary Building Separate Verification
Valve Checklist

VALVE NO.	VALVE	LOCATION	POSITION	DATE INITIAL
	CONTROL ROOM (1M5)			
	NOTE: Valve position should be determined by use of Control Room indicating lights.			
1VQ-10	VQ Fans Disch To Unit Vent	551/217 JJ-52	Closed	
1VQ-3B	VQ Fan Suct From Cont Isol	572/318A HH-JJ,51-52	Closed	
1VQ-15B	Cont Air Add Cont Isol	555/217 EE-52	Closed	

Reactor Building Separate Verification Valve Checklist

VALVE NO.	VALVE	LOCATION	POSITION	DATE INITIAL
	CONTROL ROOM (1MC5)			
	NOTE: Valve position should be determined by use of Control Room indicating lights.			
1VQ-2A	VQ Fan Suct From Cont Isol	636 53' 268°	Closed	
1VQ-16A	Cont Air Add Cont Isol	559 50' 165°	Closed	

GASEOUS WASTE RELEASE PERMIT REPORT

COPY

GWR Number: 2001003
Release ID: Unit 2 Cont Air Release & Addition(VQ)

=== ALLOWABLE FLOWRATES (cfm) ===

	1 Unit Releasing 2/2 Station Limit (U=1)	2 Units Releasing 1/2 Station Limit (U=2)
Total body dose release rate (cfm)	2.76E+07	1.38E+07
Skin and Gamma air dose release rate (cfm)	7.89E+07	3.94E+07
Food, Ground, Inhalation dose release rate (cfm)	5.73E+07	2.86E+07

Most restrictive release rate (cfm)	1.38E+07
Recommended release rate (cfm)	3.00E+02

=== MULTIPLE RELEASE CALCULATION ===

Sum of calculated release rate divided by allowable release rate for all concurrent releases	1.41E-04

=== SETPOINT DATA ===

EMF39L Monitor Operable?	Yes
EMF39L Entered Background (cpm)	5.90E+01
EMF39L Expected CPM	7.37E+01
EMF36L Monitor Operable?	NA
EMF36L Entered Background (cpm)	NA
EMF36L Expected CPM	NA
Entered Unit Vent Flowrate (cfm)	NA
Xe-133 Equivalence (uCi/cc)	5.44E-07
Trip 1 Setpoint (cpm)	~~4.19E+02~~ 5.99E+02 #
Trip 2 Setpoint (cpm)	~~5.99E+02~~ 4.19E+02 #

Performed by: JS Dowell Date: 1-6-01

Verified by: JKeen Date: 1-6-01

=== SPECIAL INSTRUCTIONS FOR RELEASE ===

GWR INSTRUCTION FOR 24 HOUR PERIODS FOR 2 VQ:
THIS GWR MAY BE USED FOR CONSECUTIVE 24 HOUR PERIODS WITH RP APPROVAL. ALIGN 2EMF38, 39,40 TO U/C DURING RELEASES AND TO ALL AREAS DURING NON-RELEASE PERIODS. RP MAY REQUEST ALTERNATE EMF ALIGNMENTS. **NOTIFY RP OF ANY HIGH RADIATION ALARMS**

STUDENT COPY WILL BE CLEAN ORIGINAL WILL HAVE NUMBERS INDICATED IN RED AS ACTUAL NUMBERS.

GASEOUS WASTE RELEASE PERMIT REPORT

COPY

GWR Number: 2001003
Release ID: Unit 2 Cont Air Release & Addition(VQ)
Release Mode: Batch
Permit Status: P - Pre-Release
Comments:

=== RELEASE DATA ==========
EMF39L Monitor In Service ..... YES

=== NUCLIDE DATA - INITIAL SAMPLE ==========

Nuclide	uCi/cc	EC	EC Ratio
AR-41	1.72E-07	1.00E-08	1.72E+01
XE-133	4.01E-08	5.00E-07	8.02E-02
TOTAL NOBLE GASES	2.12E-07		1.73E+01
H-3	5.12E-07	1.00E-07	5.12E+00
TOTAL H-3	5.12E-07		5.12E+00
TOTAL ACTIVITY:	7.24E-07		2.24E+01

CATAWBA
INITIAL LICENSE EXAMINATION
JOB PERFORMANCE MEASURE

JPM5S/ADMIN

Classify an Event and Complete the Emergency Notification Form

CANDIDATE _____

EXAMINER _____

CATAWBA
INITIAL LICENSE EXAMINATION
JOB PERFORMANCE MEASURE

Task:

Classify an Event and Complete the Emergency Notification Form per RP/0/A/5000/001 (Classification of Emergency) and RP/0/A/5000/006A) (Notification of the States and Counties From the Control Room)

Alternate Path:

N/A

Facility JPM #:

NEW

K/A Rating(s):

GKA 2.4.41 (2.3/4.1)

Task Standard:

The operator accurately classifies the event and completes the initial Emergency Notification Form within 15 minutes of event declaration.

Preferred Evaluation Location:

Simulator _____ In-Plant __X___

Preferred Evaluation Method:

Perform __X___ Simulate _____

References:

RP/0/A/5000/001 (Classification of Emergency) Rev. 13
RP/0/A/5000/006A (Notification of the States and Counties From the Control Room) Rev. 13

Validation Time: 10 min. **Time Critical:** Yes

==========

Candidate: _____ Time Start : _____
NAME Time Finish: _____

Performance Rating: SAT _____ UNSAT _____ Question Grade _____ Performance Time _____

Examiner: _____ _____/_____
NAME SIGNATURE DATE

==========

COMMENTS

_____

_____

_____

Tools/Equipment/Procedures Needed:

Enough copies of RP/0/A/5000/001 and RP/0/A/5000/006A,and the Emergency Notification Form for each SRO candidate.

READ TO OPERATOR

DIRECTIONS TO TRAINEE:

I will explain the initial conditions, and state the task to be performed. All control room steps shall be performed for this JPM, including any required communications. I will provide initiating cues and reports on other actions when directed by you. Ensure you indicate to me when you understand your assigned task. To indicate that you have completed your assigned task return the handout sheet I provided you.

INITIAL CONDITIONS:

You are the OSM and the Emergency Coordinator.

Unit 2 was operating at 100% power.

2 EMF-33 and the steam line monitor for 2A steam generator have exceeded the Trip 2 setpoint.

Both NV pumps are in service and letdown has been isolated.

FWST level is 93%.

The reactor was manually tripped and safety injection was manually initiated.

Primary system leakage was estimated to be 190 gpm prior to the trip and safety injection.

INITIATING CUES:

Classify the event and complete the initial Emergency Notification Form. This JPM is time critical ~~once the event is declared.~~

STET

START TIME: _____

STEP 1: Obtain a copy of the appropriate procedure. STANDARD: Operator obtains a copy of RP/0/A/5000/001. **EXAMINER'S CUE: When the candidate locates the appropriate procedures, give him/her copies and tell him/her that they are current and complete.** COMMENTS: Need to add step to evaluate operating mode prior to event and to evaluate plant conditions affect fission product barriers. Good guidance!	___ SAT * ___ UNSAT
EXAMINER's NOTE: The Fission Product Barriers may be evaluated in any order.	
STEP 2: Determine that the Containment Barrier is lost due to a S/G secondary side release with primary to secondary leakage. STANDARD: Candidate refers to Encl. 4.1 of RP/001 and determines based on EMF-33 and primary to secondary leak rate that ~~the~~ Containment Barrier ~~is lost~~. Candidate records 3 points on the worksheet (page 2 of 6) in Enclosure 4.1 for loss of the Containment Barrier. COMMENTS: Step 2: Evaluate the "Containment Barrier" column (4.1.C) of Enclosure 4.1 for any Potential Loss or Loss of that barrier	**CRITICAL STEP** ___ SAT ___ UNSAT
STEP 3: Determine that there is a potential of the NCS Barrier due to primary to secondary leakage exceeding the capacity of one charging pump with letdown isolated. STANDARD: Candidate refers to Encl. 4.1 of RP/001 and determines based on leak rate that a potential loss of the NCS Barrier exists. Candidate records 4 points on the worksheet (Page 3 of 6) in Enclosure 4.1 for loss of the NCS Barrier. COMMENTS: Use same format as Step 2 above	**CRITICAL STEP** ___ SAT ___ UNSAT

Need to add a step for Fuel Clad Barrier. *

(due to item 4 (page 4 of 6)) (there is a Loss of the)

TEP 4:	Classify the event ~~as a Site Area Emergency~~	**CRITICAL STEP**
STANDARD:	Operator calculates a total of 7 points on the work sheet (page 2 of 6) in RP/001, Enclosure 4.1 and declares a Site Area Emergency.	___ SAT
COMMENTS:		___ UNSAT
	~~Using Evaluate the table on page 6 of Enclosure 4.1, conduct~~ determine	
STEP 5:	Determine from RP/001 Enclosure 4.1 page 1 of 6 that preprinted notification sheet 4.1.S.3 applies.	**CRITICAL STEP**
STANDARD:	Candidate determines that there is a potential loss of the NCS Barrier and a loss of the Containment Barrier.	___ SAT
COMMENTS:	~~Determine~~ Select the Event number that best fits the loss of barrier descriptions and select the appropriate preprinted Notification Form.	___ UNSAT
STEP 6:	Complete Emergency Notification Form for event 4.1.S.3 (RP/006A, Step 2.1)	**CRITICAL STEP**
STANDARD:	Candidate gets a copy of the form and fills out lines 1 – 2, and 5 – 16.	___ SAT
	EXAMINER'S CUE: When candidate locates the proper form, give them a blank copy of the Emergency Notification Form 4.1.S.3.	___ UNSAT
COMMENTS:	Need to provide grading criteria for form. How close to answer key will be acceptable?	
	This JPM is complete.	

STOP TIME: _____ What leaves one item blank. How grade? Unsat?

Why aren't lines 11 & 14 at least partially filled in?

We can provide cues in response to inquiries

CANDIDATE CUE SHEET
(TO BE RETURNED TO EXAMINER UPON COMPLETION OF TASK)

INITIAL CONDITIONS:

You are the OSM and the Emergency Coordinator.

Unit 2 was operating at 100% power.

2 EMF-33 and the steam line monitor for 2A steam generator have exceeded the Trip 2 setpoint.

Both NV pumps are in service and letdown has been isolated.

FWST level is 93%.

The reactor was manually tripped and safety injection was manually initiated.

Primary system leakage was estimated to be 190 gpm prior to the trip and safety injection.

INITIATING CUES:

Classify the event and complete the initial Emergency Notification Form. This JPM is time critical once the event is declared.

NOTE: If a barrier is affected, it has a single point value based on a "potential loss" or a "loss". "Not Applicable" is included in the table as a place holder only, and has no point value assigned.

Barrier	Points (1-5)	Potential Loss (X)	Loss (X)	Total Points	Classification
Containment	3	1	3	1 – 3	Unusual Event
NCS	4	4	5	4 – 6	Alert
Fuel Clad	0	4	5	7 – 10	Site Area Emergency
Total Points	7			11 - 13	General Emergency

1. Compare plant conditions against the Fission Barrier Matrix on pages 3 through 6 of 6.
2. Determine the "potential loss" or "loss" status for each barrier (Containment, NCS and Fuel Clad) based on the EAL symptom description.
3. For each barrier, write the highest single point value applicable for the barrier in the "Points" column and mark the appropriate "loss" column.
4. Add the points in the "Points" column and record the sum as "Total Points".
5. Determine the classification level based on the number of "Total Points".
6. In the table on page 1 of 6, under the "classification" column, select the event number (e.g. 4.1.A.1 for Loss of Nuclear Coolant System) that best fits the loss of barrier descriptions.
7. Using the number (e.g. 4.1.A.1) select the preprinted notification form and complete the required information for Emergency Coordinator approval and transmittal.

Enclosure 4.1

Fission Barrier Matrix

Use EALs to determine Fission Product Barrier status (Intact, Potential Loss, or Loss). Add points for all 3 barriers. Classify according to the table below.

Note 1: This table is only applicable in Modes 1-4.

Note 2: Also, an event (or multiple events) could occur which results in the conclusion that exceeding the Loss or Potential Loss thresholds is IMMINENT (i.e., within 1-3 hours). In this IMMINENT LOSS situation, use judgement and classify as if the thresholds are exceeded.

Note 3: When determining Fission Product Barrier status, the Fuel Clad Barrier should be considered to be lost or potentially lost if the conditions for the Fuel Clad Barrier loss or potential loss EALs were met previously during the event, even if the conditions do not currently exists.

Note 4: Critical Safety Function (CSF) indications are not meant to include transient alarm conditions which may appear during the start-up of engineered safeguards equipment. A CSF condition is satisfied when the alarmed state is valid and sustained.

#	Unusual Event 1 – 3 pts	#	Alert 4 – 6 pts	#	Site Area Emergency 7 – 10 pts	#	General Emergency 11 – 13 pts
4.1.U.1	Potential Loss of Containment	4.1.A.1	Loss or Potential Loss of Nuclear Coolant System	4.1.S.1	Loss of Both Fuel Clad and Nuclear Coolant System	4.1.G.1	Loss of All Three Fission Barriers
4.1.U.2	Loss of Containment	4.1.A.2	Loss or Potential Loss of Fuel Clad	4.1.S.2	Potential Loss of Both Fuel Clad and Nuclear Coolant System	4.1.G.2	Loss of Any Two Fission Barriers with the Potential Loss of the Third
				4.1.S.3	Potential Loss of Either Fuel Clad or Nuclear Coolant System and Loss of Any Other Barrier		

4.1.C CONTAINMENT BARRIER	
POTENTIAL LOSS - (1 Point)	LOSS (3 Points)
3. Containment Isolation Valves Status After Containment Isolation Actuation	
• Not applicable	• Containment isolation is incomplete and a release path from containment exists
4. SG Secondary Side Release With Primary-to-Secondary Leakage	
• Not applicable	• Release of secondary side to atmosphere with primary to secondary leakage GREATER THAN Tech Spec allowable

CONTINUED

4.1.N NCS BARRIER	
POTENTIAL LOSS - (4 Points)	LOSS (5 Points)
3. SG Tube Rupture	
• Primary-to-Secondary leak rate exceeds the capacity of one charging pump in the normal charging mode with letdown isolated.	• Indication that a SG is Ruptured and has a Non-Isolable secondary line fault • Indication that a SG is ruptured and a prolonged release of contaminated secondary coolant is occurring from the affected SG to the environment
4. Containment Radiation Monitoring	
• Not applicable	• Not applicable

CONTINUED

4.1.F FUEL CLAD BARRIER	
POTENTIAL LOSS - (4 Points)	LOSS - (5 Points)
3. Containment Radiation Monitoring	
• Not applicable	• Containment radiation monitor 53 A or 53 B reading >117 R/hr
4. Emergency Coordinator/EOF Director Judgement	
• Any condition, including inability to monitor the barrier, that in the opinion of the Emergency Coordinator/EOF Director indicates **LOSS** or **POTENTIAL LOSS** of the fuel clad barrier.	

END

containment conditions. Therefore, this situation represents a potential loss of containment integrity.

Rapid unexplained loss of pressure (i.e., not attributable to containment spray or condensation effects) following an initial pressure increase indicates a loss of containment integrity.

Containment pressure and sump levels should increase as a result of the mass and energy release into containment from a Loss of Coolant Accident (LOCA). Thus, sump level or containment pressure not increasing indicates an interfacing systems LOCA which is a containment bypass and a loss of containment integrity, or some other containment pressure boundary failure.

4.1.C.3 Containment Isolation Valve Status After Containment Isolation Actuation

Failure to isolate those containment pathways which would allow containment atmosphere to be released from containment is a loss of the containment barrier.

There is no "Potential Loss" EAL associated with this item.

4.1.C.4 Steam Generator (SG) Secondary Side Release With Primary To Secondary Leakage

Secondary side releases to atmosphere include those from the condenser air ejector, SG Power Operated Relief Valves (PORVs), atmospheric dump valves, faulted steam lines, and main steam safety valves. Steam releases, in combination with primary to secondary leakage, constitute a bypass of the containment and, therefore, a loss of the containment barrier.

The appropriate classification can be determined in combination with the SG Tube Rupture EAL under the Reactor Coolant System (NCS) barrier.

There is no "Potential Loss" EAL associated with this item.

4.1.C.5 Significant Radioactive Inventory in Containment

These values indicate significant fuel damage well in excess of the EALs associated with both loss of Fuel Clad and loss of NCS Barriers. NUREG-1228, *Source Estimations During Incident Response to Severe Nuclear Power Plant Accidents*, indicates that such conditions do not exist when the amount of clad damage is less

EMERGENCY NOTIFICATION FORM

1. [A] THIS IS A DRILL [B] ACTUAL EMERGENCY [X] INITIAL [ ] FOLLOW-UP MESSAGE NUMBER 1

SITE: Catawba Nuclear Site UNIT: 2 REPORTED BY: ?

3. TRANSMITTAL TIME/DATE: ____ (Eastern) ____ / ____ / ____ mm dd yy CONFIRMATION PHONE NUMBER: (803) 831-8185 Control Room

4. AUTHENTICATION (If Required): ____ (Number) ____ (Codeword)

5. EMERGENCY CLASSIFICATION:

[A] NOTIFICATION OF UNUSUAL EVENT [B] ALERT [■] SITE AREA EMERGENCY [D] GENERAL EMERGENCY

6. [■] Emergency Declaration At: [B] Termination At: TIME/DATE: ____ (Eastern) ____ / ____ / ____ mm dd yy (If B, go to item 16.)

How does this do anything, we need to

7. **EMERGENCY DESCRIPTION/REMARKS:** **EAL # 4.1.S.3 - Potential Loss of Either Nuclear Coolant System or Fuel Clad and Loss of Any Other Barrier. This EAL poses no threat to the safety of plant personnel or the general public.**

8. PLANT CONDITION: [A] IMPROVING [X] STABLE [C] DEGRADING

9. REACTOR STATUS: [X] SHUTDOWN TIME/DATE: Current (Eastern) / ____ mm / ____ dd / ____ yy [B] ____ % POWER

10. EMERGENCY RELEASE(S):

[A] NONE (Go to item 14.) [B] POTENTIAL (Go to item 14.) [X] IS OCCURRING [D] HAS OCCURRED

**11. TYPE OF RELEASE: [ ] ELEVATED [ ] GROUND LEVEL

[A] AIRBORNE: Started: ____ Time(Eastern) ____ / ____ / ____ Date Stopped: ____ Time(Eastern) ____ / ____ / ____ Date

[B] LIQUID: Started: ____ Time(Eastern) ____ / ____ / ____ Date Stopped: ____ Time(Eastern) ____ / ____ / ____ Date

**12. RELEASE MAGNITUDE: [ ] CURIES PER SEC. [ ] CURIES NORMAL OPERATING LIMITS: [ ] BELOW [ ] ABOVE

[A] NOBLE GASES ____ [B] IODINES ____

[C] PARTICULATES ____ [D] OTHER ____

**13. ESTIMATE OF PROJECTED OFFSITE DOSE: [ ] NEW [ ] UNCHANGED PROJECTION TIME: ____ (Eastern)

	TEDE mrem	Thyroid CDE mrem
SITE BOUNDARY		
2 MILES		
5 MILES		
10 MILES		

ESTIMATED DURATION: ____ HRS.

**14. METEOROLOGICAL DATA: [A] WIND DIRECTION (from) ____ ° [B] SPEED (mph) ____

[C] STABILITY CLASS ____ [D] PRECIPITATION (type) ____

15. RECOMMENDED PROTECTIVE ACTIONS:

[■] NO RECOMMENDED PROTECTIVE ACTIONS

[B] EVACUATE ____

[C] SHELTER IN-PLACE ____

[D] OTHER ____

16. APPROVED BY: Signature (Name) Emergency Coordinator (Title) TIME/DATE: Current (Eastern) / ____ mm / ____ dd / ____ yy

* If items 8-14 have not changed, only items 1-7 and 15-16 are required to be comp eted.

** Information may not be available on initial notifications.

GOVERNMENT AGENCIES NOTIFIED

Record the name, date, time and agencies notified:

1. (name) York County
   (date) (time) (agency) Sel. Sig. 513 Bell Line (803) 329-1110
2. (name) Mecklenburg County
   (date) (time) (agency) Sel. Sig. 116 Bell Line (704) 943-6200
3. (name) Gaston County
   (date) (time) (agency) Sel. Sig. 112 Bell Line (704) 866-3300
4. (name) South Carolina WP/EOC
   (date) (time) (agency) Sel. Sig. 518 Bell Line (803) 737-8500
5. (name) North Carolina WP/EOC
   (date) (time) (agency) Sel. Sig. 314 Bell Line (919) 733-3300
6. (name)
   (date) (time) (agency)
7. (name)
   (date) (time) (agency)

(R08-97)

Duke Power Company
PROCEDURE PROCESS RECORD

(1)ID No. RP/0/A/5000/001

Revision No. 013

PREPARATION

(2) Station Catawba Nuclear Station

(3) Procedure Title Classification of Emergency

(4) Prepared By E. J. Bradley Date 4/26/2000

(5) Requires 10CFR50.59 evaluation?

- [X] Yes (New procedure or reissue with major changes)
- [ ] No (Revision with minor changes)
- [ ] No (To incorporate previously approved changes)

(6) Reviewed By B. R. Allen (QR) Date 4/26/00

Cross-Disciplinary Review By M T Reese (QR) NA ____ Date 4/26/00

Reactivity Mgmt. Review By ____ (QR) NA BRS Date 4/26/00

(7) Additional Reviews

Reviewed By ____ Date ____

Reviewed By ____ Date ____

(8) Temporary Approval *(if necessary)*

By ____ (SRO/QR) Date ____

By ____ (QR) Date ____

(9) APPROVED BY Richard L Swigart Date 4/27/00

PERFORMANCE (Compare with control copy at least once every 14 calendar days while work is being performed)

(10) Compared with Control Copy ____ Date ____

Compared with Control Copy ____ Date ____

Compared with Control Copy ____ Date ____

(11) Dates(s) Performed ____

Work Order Number (W/O #) ____

COMPLETION

(12) Procedure Completion Verification

- [ ] Yes [ ] N/A Check lists and/or blanks properly initialed, signed, dated, or filled in NA, as appropriate?
- [ ] Yes [ ] N/A Listed enclosures attached?
- [ ] Yes [ ] N/A Data sheets attached, completed, dated and signed?
- [ ] Yes [ ] N/A Charts, graphs, etc. attached and properly dated, identified and marked?
- [ ] Yes [ ] N/A Procedure requirements met?

Verified By ____ Date ____

(13) Procedure Completion Approved ____ Date ____

(14) Remarks *(attach additional pages, if necessary)*

Classification of Emergency

1. Symptoms

1.1 Notification of Unusual Event

1.1.1 Events are in process or have occurred which indicate a potential degradation of the level of safety of the plant.

1.1.2 No releases of radioactive material requiring offsite response or monitoring are expected unless further degradation of safety occurs.

1.2 Alert

1.2.1 Events are in process or have occurred which involve an actual or potential substantial degradation of the level of safety of the plant.

1.2.2 Any releases are expected to be limited to small fractions of the EPA Protective Action Guideline exposure levels.

1.3 Site Area Emergency

1.3.1 Events are in process or have occurred which involve actual or likely major failures of plant functions needed for protection of the public.

1.3.2 Any releases are not expected to exceed EPA Protective Action Guideline exposure levels except near the site boundary.

1.4 General Emergency

1.4.1 Events are in process or have occurred which involve actual or imminent substantial core degradation or melting with potential for loss of containment integrity.

1.4.2 Releases can be reasonably expected to exceed EPA Protective Action Guidelines exposure levels offsite for more than the immediate site area.

2. Immediate Actions

____ 2.1 Determine operating mode that existed at the time the event occurred prior to any protection system or operator action initiated in response of the event.

____ 2.2 IF the plant was in Mode 1-4 and a valid condition affects fission product barriers, proceed to Enclosure 4.1.

____ 2.3 **IF** a General Emergency is **NOT** declared in Step 2.2 **OR** the condition does not affect fission product barriers, review the listing of enclosures to determine if the event is applicable to one the categories shown.

____ 2.4 Compare actual plant conditions to the Emergency Action Levels listed, then declare the appropriate Emergency Class as indicated.

____ 2.5 Implement the applicable Emergency Response Procedure (RP) for that classification and continue with subsequent steps of this procedure.

Notification of Unusual Event	RP/0/A/5000/002
Alert	RP/0/A/5000/003
Site Area Emergency	RP/0/A/5000/004
General Emergency	RP/0/A/5000/005

3 Subsequent Actions

____ 3.1 To escalate, de-escalate, or terminate the Emergency, compare plant conditions to the Initiating Conditions of Enclosures 4.1 through 4.7.

____ 3.2 Refer to enclosure 4.9, Emergency Declaration Guidelines, as needed.

4 Enclosures

4.1 Fission Product Barrier Matrix
4.2 System Malfunctions
4.3 Abnormal Rad Levels/Radiological Effluent
4.4 Loss of Shutdown Functions
4.5 Loss of Power
4.6 Fires/Explosions and Security Events
4.7 Natural Disasters, Hazards and Other conditions Affecting Plant Safety
4.8 Definitions/Acronyms
4.9 Emergency Declaration Guidelines
4.10 Radiation Monitor Reading for Enclosure 4.3 EALs

Enclosure 4.1

Fission Barrier Matrix

Use EALs to determine Fission Product Barrier status (Intact, Potential Loss, or Loss). Add points for all 3 barriers. Classify according to the table below.

Note 1: This table is only applicable in Modes 1-4.

Note 2: Also, an event (or multiple events) could occur which results in the conclusion that exceeding the Loss or Potential Loss thresholds is IMMINENT (i.e., within 1-3 hours). In this IMMINENT LOSS situation, use judgement and classify as if the thresholds are exceeded.

Note 3: When determining Fission Product Barrier status, the Fuel Clad Barrier should be considered to be lost or potentially lost if the conditions for the Fuel Clad Barrier loss or potential loss EALs were met previously during the event, even if the conditions do not currently exists.

Note 4: Critical Safety Function (CSF) indications are not meant to include transient alarm conditions which may appear during the start-up of engineered safeguards equipment. A CSF condition is satisfied when the alarmed state is valid and sustained.

#	Unusual Event 1 – 3 pts	#	Alert 4 – 6 pts	#	Site Area Emergency 7 – 10 pts	#	General Emergency 11 – 13 pts
4.1.U.1	Potential Loss of Containment	4.1.A.1	Loss or Potential Loss of Nuclear Coolant System	4.1.S.1	Loss of Both Fuel Clad and Nuclear Coolant System	4.1.G.1	Loss of All Three Fission Barriers
4.1.U.2	Loss of Containment	4.1.A.2	Loss or Potential Loss of Fuel Clad	4.1.S.2	Potential Loss of Both Fuel Clad and Nuclear Coolant System	4.1.G.2	Loss of Any Two Fission Barriers with the Potential Loss of the Third
				4.1.S.3	Potential Loss of Either Fuel Clad or Nuclear Coolant System and Loss of Any Other Barrier		

Enclosure 4.1

Fission Barrier Matrix

NOTE: If a barrier is affected, it has a single point value based on a "potential loss" or a "loss". "Not Applicable" is included in the table as a place holder only, and has no point value assigned.

Barrier	Points (1-5)	Potential Loss (X)	Loss (X)	Total Points	Classification
Containment		1	3	1 – 3	Unusual Event
NCS		4	5	4 – 6	Alert
Fuel Clad		4	5	7 – 10	Site Area Emergency
Total Points				11 - 13	General Emergency

1. Compare plant conditions against the Fission Barrier Matrix on pages 3 through 6 of 6.
2. Determine the "potential loss" or "loss" status for each barrier (Containment, NCS and Fuel Clad) based on the EAL symptom description.
3. For each barrier, write the highest single point value applicable for the barrier in the "Points" column and mark the appropriate "loss" column.
4. Add the points in the "Points" column and record the sum as "Total Points".
5. Determine the classification level based on the number of "Total Points".
6. In the table on page 1 of 6, under the "classification" column, select the event number (e.g. 4.1.A.1 for Loss of Nuclear Coolant System) that best fits the loss of barrier descriptions.
7. Using the number (e.g. 4.1.A.1) select the preprinted notification form and complete the required information for Emergency Coordinator approval and transmittal

Enclosure 4.1

Fission Barrier Matrix

4.1.C CONTAINMENT BARRIER		4.1.N NCS BARRIER		4.1.F FUEL CLAD BARRIER	
POTENTIAL LOSS - (1 Point)	LOSS (3 Points)	POTENTIAL LOSS - (4 Points)	LOSS - (5 Points)	POTENTIAL LOSS - (4 Points)	LOSS - (5 Points)
1. Critical Safety Function Status		**1. Critical Safety Function Status**		**1. Critical Safety Function Status**	
• Containment-RED	• Not applicable	• NCS Integrity-Red • Heat Sink-Red	• Not applicable	• Core Cooling-Orange • Heat Sink-Red	• Core Cooling-Red
2. Containment Conditions		**2. NCS Leak Rate**		**2. Primary Coolant Activity Level**	
• Containment Pressure > 15 PSIG • H2 concentration > 9% • Containment pressure greater than 3 psig with less than one full train of NS and a VX-CARF operating.	• Rapid unexplained decrease in containment pressure following initial increase • Containment pressure or sump level response not consistent with LOCA conditions.	• Unisolable leak exceeding the capacity of one charging pump in the normal charging mode with letdown isolated.	• GREATER THAN available makeup capacity as indicated by a loss of NCS subcooling.	• Not applicable	• Coolant Activity GREATER THAN 300 µCi/cc Dose Equivalent Iodine (DEI) I-131
CONTINUED		CONTINUED		CONTINUED	

Enclosure 4.1

Fission Barrier Matrix

4.1.C CONTAINMENT BARRIER		4.1.N NCS BARRIER		4.1.F FUEL CLAD BARRIER	
POTENTIAL LOSS - (1 Point)	LOSS (3 Points)	POTENTIAL LOSS - (4 Points)	LOSS (5 Points)	POTENTIAL LOSS - (4 Points)	LOSS - (5 Points)
3. Containment Isolation Valves Status After Containment Isolation Actuation		**3. SG Tube Rupture**		**3. Containment Radiation Monitoring**	
• Not applicable	• Containment isolation is incomplete and a release path from containment exists	• Primary-to-Secondary leak rate exceeds the capacity of one charging pump in the normal charging mode with letdown isolated.	• Indication that a SG is Ruptured and has a Non-Isolable secondary line fault • Indication that a SG is ruptured and a prolonged release of contaminated secondary coolant is occurring from the affected SG to the environment	• Not applicable	• Containment radiation monitor 53 A or 53 B reading >117 R/hr
4. SG Secondary Side Release With Primary-to-Secondary Leakage		**4. Containment Radiation Monitoring**		**4. Emergency Coordinator/EOF Director Judgement**	
• Not applicable	• Release of secondary side to atmosphere with primary to secondary leakage GREATER THAN Tech Spec allowable	• Not applicable	• Not applicable	• Any condition, including inability to monitor the barrier, that in the opinion of the Emergency Coordinator/EOF Director indicates **LOSS** or **POTENTIAL LOSS** of the fuel clad barrier.	

CONTINUED

CONTINUED

END

Enclosure 4.1

Fission Barrier Matrix

4.1.C CONTAINMENT BARRIER		4.1.N NCS BARRIER		4.1.F FUEL CLAD BARRIER	
POTENTIAL LOSS - (1 Point)	LOSS (3 Points)	POTENTIAL LOSS - (4 Points)	LOSS - (5 Points)	POTENTIAL LOSS - (4 Points)	LOSS - (5 Points)
5. Significant Radioactive Inventory In Containment • Containment Rad Monitor EMF53A or 53B Reading @ time since shutdown > 470 R/hr @ 0 - 0.5 hr > 170 R/hr @ 0.5 - 2 hr > 125 R/hr @ 2 - 4 hr > 90 R/hr @ 4 - 8 hr > 53 R/hr @ > 8 hr	• Not applicable	**5. Emergency Coordinator/EOF Director Judgement** • Any condition, including inability to monitor the barrier, that in the opinion of the Emergency Coordinator /EOF Director indicates **LOSS** or **POTENTIAL LOSS** of the NCS barrier. **END**			
6. Core Cooling • Core cooling - RED path is indicated for > 15 min.	• Not applicable				

CONTINUED

Enclosure 4.1

Fission Barrier Matrix

4.1.C CONTAINMENT BARRIER		4.1.N NCS BARRIER		4.1.F FUEL CLAD BARRIER	
POTENTIAL LOSS - (1 Point)	LOSS (3 Points)	POTENTIAL LOSS - (4 Points)	LOSS (5 Points)	POTENTIAL LOSS - (4 Points)	LOSS – (5 Points)
7. <u>Emergency Coordinator /EOF Director Judgement</u> • Any condition, including inability to monitor the barrier, that in the opinion of the Emergency Coordinator/EOF Director indicates **LOSS** or **POTENTIAL LOSS** of the containment barrier **<u>END</u>**					

Enclosure 4.2

System Malfunctions

UNUSUAL EVENT

4.2.U.1 Inability to Reach Required Shutdown Within Technical Specification Limits.

OPERATING MODE: 1, 2, 3, 4

4.2.U.1-1 Plant is not brought to required operating mode within Technical Specifications LCO Action Statement Time.

4.2.U.2 Unplanned Loss of Most or All Safety System Annunciation or Indication in the Control Room for Greater Than 15 Minutes.

OPERATING MODE: 1, 2, 3, 4

4.2.U.2-1 The following conditions exist:

Unplanned loss of most (>50%) annunciators associated with safety systems for greater than 15 minutes

AND

In the opinion of the Operations Shift Manager/Emergency Coordinator/EOF Director, the loss of the annunciators or indicators requires additional personnel (beyond normal shift compliment) to safely operate the unit.

CONTINUED

ALERT

4.2.A.1 Unplanned Loss of Most or All Safety System Annunciation or Indication in Control Room With Either (1) a Significant Transient in Progress, or (2) Compensatory Non-Alarming Indicators Unavailable.

OPERATING MODE: 1, 2, 3, 4

4.2.A.1-1 The following conditions exist:

Unplanned loss of most (>50%) annunciators associated with safety systems for greater than 15 minutes

AND

In the opinion of the Operations Shift Manager/Emergency Coordinator/EOF Director, the loss of the annunciators or indicators requires additional personnel (beyond normal shift compliment) to safely operate the unit.

AND

EITHER of the following:

- **A significant plant transient** is in progress
- Loss of the OAC.

END

SITE AREA EMERGENCY

4.2.S.1 Inability to Monitor a Significant Transient in Progress.

OPERATING MODE: 1, 2, 3, 4

4.2.S.1-1 The following conditions exist:

Loss of most (>50%) Annunciators associated with safety systems.

AND

A significant plant transient is in progress.

AND

Loss of the OAC.

AND

Inability to provide manual monitoring of any of the following Critical Safety Functions:

- subcriticality
- core cooling
- heat sink
- containment.

END

GENERAL EMERGENCY

END

UNUSUAL EVENT

ALERT

SITE AREA EMERGENCY

GENERAL EMERGENCY

4.2.U.3 Fuel Clad Degradation.

OPERATING MODE: 1, 2, 3*

4.2.U.3-1 Dose Equivalent I-131 greater than the Technical Specifications allowable limit. (*Mode 3 with TAV >500° F)

4.2.U.4 Reactor Coolant System (NCS) Leakage.

OPERATING MODE: 1, 2, 3, 4

4.2.U.4-1 Unidentified leakage ≥ 10 gpm.

4.2.U.4-2 Pressure boundary leakage ≥ 10 gpm.

4.2.U.4-3 Identified leakage ≥ 25 gpm

4.2.U.5 Unplanned Loss of All Onsite or Offsite Communications.

OPERATING MODE: ALL

4.2.U.5-1 Loss of all onsite communications capability (internal phone system, PA system, onsite radio system) affecting the ability to perform routine operations.

4.2.U.5-2 Loss of all offsite communications capability (Selective Signaling, NRC FTS lines, offsite radio system, commercial phone system) affecting the ability to communicate with offsite authorities

END

Enclosure 4.3

Abnormal Rad Levels/Radiological Effluent

UNUSUAL EVENT

4.3.U.1 Any Unplanned Release of Gaseous or Liquid Radioactivity to the Environment that Exceeds Two Times the SLC Limits for 60 Minutes or Longer.

OPERATING MODE: ALL

4.3.U.1-1 A valid Trip 2 alarm on radiation monitor EMF-49L or EMF-57 for ≥ 60 minutes or will likely continue for ≥ 60 minutes which indicates that the release may have exceeded the initiating condition and indicates the need to assess the release with procedure HP/0/B/1009/014.

4.3.U.1-2 A valid indication on radiation monitor EMF- 36L of ≥ 3.00E+04 cpm for ≥ 60 minutes or will likely continue for 60 minutes, which indicates that the release may have exceeded the initiating condition and indicates the need to assess the release with procedure SH/0/B/2005/001.

(Continued)

ALERT

4.3.A.1 **Any Unplanned Release of Gaseous or Liquid Radioactivity to the Environment that Exceeds 200 Times the SLC limits for 15 Minutes or Longer.**

OPERATING MODE: ALL

4.3.A.1-1 A valid indication on radiation monitor EMF- 49L or EMF-57 of ≥ 1.2E+05 cpm for ≥ 15 minutes or will likely continue for 15 minutes, which indicates that the release may have exceeded the initiating condition and indicates the need to assess the release with procedure HP/0/B/1009/014.

(Continued)

SITE AREA EMERGENCY

4.3.S.1 **Boundary Dose Resulting from an Actual or Imminent Release of Radioactivity Exceeds 100 mRem TEDE or 500 mRem CDE Adult Thyroid for the Actual or Projected Duration of the Release.**

OPERATING MODE: ALL

4.3.S.1-1 A valid indication on radiation monitor EMF-36L of ≥ 2.7E+06 cpm sustained for ≥ 15 minutes.

4.3.S.1-2 Dose assessment team calculations indicate dose consequences greater than 100 mRem TEDE or 500 mRem CDE Adult Thyroid at the site boundary.

(Continued)

GENERAL EMERGENCY

4.3.G.1 **Boundary Dose Resulting from an Actual or Imminent Release of Radioactivity that Exceeds 1000 mRem TEDE or 5000 mRem CDE Adult Thyroid for the Actual or Projected Duration of the Release.**

OPERATING MODE: ALL

4.3.G.1-1 A valid indication on radiation monitor EMF-36H of ≥ 8.3E+03 cpm sustained for ≥ 15 minutes.

4.3.G.1-2 Dose assessment team calculations indicate dose consequences greater than 1000 mRem TEDE or 5000 mRem CDE Adult Thyroid at the site boundary.

(Continued)

Abnormal Rad Levels/Radiological Effluent

UNUSUAL EVENT

4.3.U.1-3 Gaseous effluent being released exceeds two times SLC 16.11-6 for ≥ 60 minutes as determined by RP procedure.

4.3.U.1-4 Liquid effluent being released exceeds two times SLC 16.11-1 for ≥ 60 minutes as determined by RP procedure.

Note: If the monitor reading is sustained for the time period indicated in the EAL AND the required assessments (procedure calculations) cannot be completed within this time period, declaration must be made based on the valid radiation monitor reading.

(Continued)

ALERT

4.3.A.1-2 A valid indication on radiation monitor EMF-361 of ≥ 5.4E+05 cpm for ≥ 15 minutes or will likely continue for 15 minutes, which indicates that the release may have exceeded the initiating condition and indicates the need to assess the release with procedure SH/0/B/2005/001.

4.3.A.1-3 Gaseous effluent being released exceeds 200 times the level of SLC 16.11-6 for ≥ 15 minutes as determined by RP procedure.

4.3.A.1-4 Liquid effluent being released exceeds 200 times the level of SLC 16.11-1 for ≥ 15 minutes as determined by RP procedure.

Note: If the monitor reading is sustained for the time period indicated in the EAL AND the required assessments (procedure calculations) cannot be completed within this time period, declaration must be made based on the valid radiation monitor reading.

(Continued)

SITE AREA EMERGENCY

4.3.S.1-3 Analysis of field survey results or field survey samples indicates dose consequences greater than 100 mRem TEDE or 500 mRem CDE Adult Thyroid at the site boundary.

Note 1: These EMF readings are calculated based on average annual meteorology, site boundary dose rate, and design unit vent flow rate. Calculations by the dose assessment team use actual meteorology, release duration, and unit vent flow rate. Therefore, these EMF readings should not be used if dose assessment team calculations are available.

Note 2: If dose assessment team calculations cannot be completed in 15 minutes, then valid monitor reading should be used for emergency classification.

END

GENERAL EMERGENCY

4.3.G.1-3 Analysis of field survey results or field survey samples indicates dose consequences greater than 1000 mRem TEDE or 5000 mRem CDE Adult Thyroid at the site boundary.

Note 1: These EMF readings are calculated based on average annual meteorology, site boundary dose rate, and design unit vent flow rate. Calculations by the dose assessment team use actual meteorology, release duration, and unit vent flow rate. Therefore, these EMF readings should not be used if dose assessment team calculations are available.

Note 2: If dose assessment team calculations cannot be completed in 15 minutes, then valid monitor reading should be used for emergency classification.

END

Enclosure 4.3

Abnormal Rad Levels/Radiological Effluent

UNUSUAL EVENT

4.3.U.2 Unexpected Increase in Plant Radiation or Airborne Concentration.

OPERATING MODE: ALL

4.3.U.2-1 Indication of uncontrolled water level decrease of greater than 6 inches in the reactor refueling cavity with all irradiated fuel assemblies remaining covered by water.

4.3.U.2-2 Uncontrolled water level decrease of greater than 6 inches in the spent fuel pool and fuel transfer canal with all irradiated fuel assemblies remaining covered by water

4.3.U.2-3 Unplanned valid area EMF reading increases by a factor of 1000 over normal levels as shown in Enclosure 4.10.

END

ALERT

4.3.A.2 Major Damage to Irradiated Fuel or Loss of Water Level that Has or Will Result in the Uncovering of Irradiated Fuel Outside the Reactor Vessel.

OPERATING MODE: ALL

4.3.A.2-1 An unplanned valid trip II alarm on any of the following radiation monitors:

Spent Fuel Building
Refueling Bridge
1EMF-15
2EMF-4

Spent Fuel Pool
Ventilation
1EMF-42
2EMF-42

Reactor Building
Refueling Bridge
1EMF-17
2EMF-2

Containment Noble Gas
Monitor
1EMF-39
2EMF-39

(Continued)

SITE AREA EMERGENCY

GENERAL EMERGENCY

Abnormal Rad Levels/Radiological Effluent

UNUSUAL EVENT	ALERT	SITE AREA EMERGENCY	GENERAL EMERGENCY
	4.3.A.2-2 Plant personnel report that water level drop in reactor refueling cavity, spent fuel pool, or fuel transfer canal has or will exceed makeup capacity such that any irradiated fuel will become uncovered.		
	4.3.A.2-3 NC system wide range level <95% after initiation of NC system make-up.		
	AND		
	Any irradiated fuel assembly not capable of being lowered into spent fuel pool or reactor vessel.		
	4.3.A.2-4 Spent Fuel Pool or Fuel Transfer Canal level decrease of >2 feet after initiation of makeup.		
	AND		
	Any irradiated fuel assembly not capable of being fully lowered into the spent fuel pool racks or transfer canal fuel transfer system basket.		

(Continued)

Enclosure 4.3

Abnormal Rad Levels/Radiological Effluent

UNUSUAL EVENT | ALERT | SITE AREA EMERGENCY | GENERAL EMERGENCY

4.3.A.3 **Release of Radioactive Material or Increases in Radiation Levels Within the Facility That Impedes Operation of Systems Required to Maintain Safe Operations or to Establish or Maintain Cold Shutdown.**

OPERATING MODE: ALL

4.3.A.3-1 Valid reading on EMF-12 greater than 15 mR/hr in the Control Room.

4.3.A.3-2 Valid indication of radiation levels greater than 15 mR/hr in the Central Alarm Station (CAS) or Secondary Alarm Station (SAS).

4.3.A.3-3 Valid radiation monitor reading exceeds the levels shown in Enclosure 4.10.

END

Enclosure 4.4

Loss of Shutdown Functions

UNUSUAL EVENT

END

ALERT

4.4.A.1 **Failure of Reactor Protection System Instrumentation to Complete or Initiate an Automatic Reactor Trip Once a Reactor Protection System Setpoint Has Been Exceeded and Manual Trip Was Successful.**

OPERATING MODE: 1, 2, 3

4.4.A.1-1 The following conditions exist:

Valid reactor trip signal received or required and automatic reactor trip was not successful.

AND

Manual reactor trip from the control room is successful and reactor power is less than 5% and decreasing.

(Continued)

SITE AREA EMERGENCY

4.4.S.1 **Failure of Reactor Protection System Instrumentation to Complete or Initiate an Automatic Reactor Trip Once a Reactor Protection System Setpoint Has Been Exceeded and Manual Trip Was NOT Successful.**

OPERATING MODE: 1

4.4.S.1-1 The following conditions exist:

Valid reactor trip signal received or required and automatic reactor trip was not successful.

AND

Manual reactor trip from the control room was not successful in reducing reactor power to less than 5% and decreasing

(Continued)

GENERAL EMERGENCY

4.4.G.1 **Failure of the Reactor Protection System to Complete an Automatic Trip and Manual Trip was NOT Successful and There is Indication of an Extreme Challenge to the Ability to Cool the Core.**

OPERATING MODE: 1

4.4.G.1-1 The following conditions exist:

Valid reactor trip signal received or required and automatic reactor trip was not successful.

AND

Manual reactor trip from the control room was not successful in reducing reactor power to less than 5% and decreasing.

AND

EITHER of the following conditions exist:

- Core Cooling CSF-RED
- Heat Sink CSF-RED.

END

Enclosure 4.4

Loss of Shutdown Functions

UNUSUAL EVENT

ALERT

4.4.A.2 Inability to Maintain Plant in Cold Shutdown.

OPERATING MODE: 5, 6

4.4.A.2-1 Total loss of ND and/or RN and/or KC.

AND

One of the following:

- Inability to maintain reactor coolant temperature below 200°F
- Uncontrolled reactor coolant temperature rise to >180°F.

END

SITE AREA EMERGENCY

4.4.S.2 Complete Loss of Function Needed to Achieve or Maintain Hot Shutdown.

OPERATING MODE: 1, 2, 3, 4

4.4.S.2-1 Subcriticality CSF-RED.

4.4.S.2-2 Heat Sink CSF-RED.

4.4.S.3 Loss of Water Level in the Reactor Vessel That Has or Will Uncover Fuel in the Reactor Vessel.

OPERATING MODE: 5, 6

4.4.S.3-1 Failure of heat sink causes loss of cold shutdown conditions.

AND

Lower range Reactor Vessel Level Indication System (RVLIS) decreasing after initiation of NC system makeup.

4.4.S.3-2 Failure of heat sink causes loss of cold shutdown conditions.

AND

Reactor Coolant (NC) system narrow range level less than 11% and decreasing after initiation of NC system makeup.

(Continued)

GENERAL EMERGENCY

UNUSUAL EVENT	ALERT	SITE AREA EMERGENCY	GENERAL EMERGENCY
		4.4.S.3-3 Failure of heat sink causes loss of cold shutdown conditions. AND Either train ultrasonic level indication less than 7.25% and decreasing after initiation of NC system makeup. END	

Enclosure 4.5

Loss of Power

UNUSUAL EVENT

4.5.U.1 Loss of All Offsite Power to Essential Busses for Greater Than 15 Minutes.

OPERATING MODE: 1, 2, 3, 4

4.5.U.1-1 The following conditions exist:

Loss of offsite power to essential buses ETA and ETB for greater than 15 minutes.

AND

Both emergency diesel generators are supplying power to their respective essential busses.

OPERATING MODE: 5, 6, No Mode

(Continued)

ALERT

4.5.A.1 Loss of All Offsite Power and Loss of All Onsite AC Power to Essential Busses During Cold Shutdown Or Refueling Mode.

OPERATING MODE: 5, 6, No Mode

4.5.A.1-1 Loss of all offsite and onsite AC power as indicated by:

Loss of power on essential buses ETA and ETB.

AND

Failure to restore power to at least one essential bus within 15 minutes.

(Continued)

SITE AREA EMERGENCY

4.5.S.1 Loss of All Offsite Power and Loss of All Onsite AC Power to Essential Busses.

OPERATING MODE: 1, 2, 3, 4

4.5.S.1-1 Loss of all offsite and onsite AC power as indicated by:

Loss of power on essential buses ETA and ETB.

AND

Failure to restore power to at least one essential bus within 15 minutes.

4.5.S.2 Loss of All Vital DC Power.

OPERATING MODE: 1, 2, 3, 4

(Continued)

GENERAL EMERGENCY

4.5.G.1 Prolonged Loss of All (Offsite and Onsite) AC Power.

OPERATING MODE: 1, 2, 3, 4

4.5.G.1-1 Prolonged loss of all offsite and onsite AC power as indicated by:

Loss of power on essential buses ETA and ETB for greater than 15 minutes.

AND

Standby Shutdown Facility (SSF) fails to supply NC pump seal injection **OR** CA supply to Steam Generators.

AND

At least one of the following conditions exist:

- Restoration of at least one essential bus within 4 hours is *NOT* likely

(Continued)

Loss of Power

UNUSUAL EVENT

4.5.U.1-2 The following conditions exist:
Loss of offsite power to essential buses ETA and ETB for greater than 15 minutes.

AND

One emergency diesel generator is supplying power to its respective essential bus

4.5.U.2 **Unplanned Loss of Required DC Power During Cold Shutdown or Refueling Mode for Greater than 15 Minutes.**

OPERATING MODE: 5, 6

4.5.U.2-1 The following conditions exist:

Unplanned loss of both unit related busses EBA and EBD both <112 VDC, and EBB and EBC both <109 VDC.

AND

Failure to restore power to at least one required DC bus within 15 minutes from the time of loss

END

ALERT

4.5.A.2 **AC power to essential busses reduced to a single power source for greater than 15 minutes such that an additional single failure could result in station blackout.**

OPERATING MODE: 1, 2, 3, 4

4.5.A.2-1 The following condition exists:

AC power capability has been degraded to one essential bus powered from a single power source for > 15 min. due to the loss of all but one of:

SATA	SATB
ATC	ATD
D/G A	D/G B.

END

SITE AREA EMERGENCY

4.5.S.2-1 The following conditions exist:

Unplanned loss of both unit related busses: EBA and EBD both <112 VDC, and EBB and EBC both <109 VDC

AND

Failure to restore power to at least one required DC bus within 15 minutes from the time of loss.

END

GENERAL EMERGENCY

- Indication of continuing degradation of core cooling based on Fission Product Barrier monitoring.

END

Enclosure 4.6

Fire/Explosion and Security Events

UNUSUAL EVENT

4.6.U.1 **Fire Within Protected Area Boundary Not Extinguished Within 15 Minutes of Detection OR Explosion Within the Protected Area Boundary.**

OPERATING MODE: ALL

4.6.U.1-1 **Fire** in any of the following areas not extinguished within 15 minutes of control room notification or verification of a control room fire alarm.

- Reactor Building
- Auxiliary Building
- Diesel Generator Rooms
- Control Room
- RN Pumphouse
- SSF
- CAS
- SAS
- Doghouses
- FWST
- Turbine Building
- Service Building
- Interim Radwaste Building
- Equipment Staging Building
- Monitor Tank Building

(Continued)

ALERT

4.6.A.1 **Fire or Explosion Affecting the Operability of Plant Safety Systems Required to Establish or Maintain Safe Shutdown.**

OPERATING MODE: 1, 2, 3, 4, 5, 6

4.6.A.1-1 The following conditions exist:
Fire or explosion in any of the following areas:

- Reactor Building
- Auxiliary Building
- Diesel Generator Rooms
- Control Room
- RN Pumphouse
- SSF
- CAS
- SAS
- FWST
- Doghouses (Applies in Mode 1, 2, 3, 4 only).

AND

One of the following:

- Affected safety system parameter indications show degraded performance

(Continued)

SITE AREA EMERGENCY

4.6.S.1 **Security Event in a Plant Vital Area.**

OPERATING MODE: ALL

4.6.S.1-1 Intrusion into any of the following plant areas by a hostile force:

- Reactor Building
- Auxiliary Building
- Diesel Generator Rooms
- Control Room
- RN Pumphouse
- SSF
- Doghouses
- CAS
- SAS.

4.6.S.1-2 Security confirmed **bomb** discovered/exploded in a vital area.

4.6.S.1-3 Security confirmed **sabotage** in a plant vital area.

END

GENERAL EMERGENCY

4.6.G.1 **Security Event Resulting in Loss Of Ability to Reach and Maintain Cold Shutdown.**

OPERATING MODE: ALL

4.6.G.1-1 Loss of physical control of the control room due to security event.

4.6.G.1-2 Loss of physical control of the SSF and ASP due to security event.

END

Fire/Explosion and Security Events

UNUSUAL EVENT

4.6.U.1-2 Report by plant personnel of an unanticipated **explosion** within protected area boundary resulting in visible **damage** to permanent structure or equipment

4.6.U.2 **Confirmed Security Event Which Indicates a Potential Degradation in the Level of Safety of the Plant.**

OPERATING MODE: All

4.6.U.2-1 Security confirmed bomb device discovered within plant **Protected Area** and outside Vital Areas.

4.6.U.2-2 **Hostage** situation/extortion

4.6.U.2-3 A **violent civil disturbance** within the owner controlled area

END

ALERT

- Plant personnel report **visible damage** to permanent structures or equipment within the specified area.

Note: Only one train of a system needs to be affected or damaged in order to satisfy this condition.

4.6.A.2 **Fire or Explosion Affecting the Operability of Plant Safety Systems Required to Establish or Maintain Safe Shutdown.**

OPERATING MODE: No Mode

4.6.A.2-1 The following conditions exist:

Fire or **explosion** in any of the following areas:

- Spent Fuel Pool
- Auxiliary Building
- RN Pumphouse

AND

One of the following:

- Spent Fuel Pool level and/or temperature show degraded performance

(Continued)

SITE AREA EMERGENCY

GENERAL EMERGENCY

UNUSUAL EVENT	ALERT	SITE AREA EMERGENCY	GENERAL EMERGENCY
	• Plant personnel report **visible damage** to permanent structures or equipment supporting spent fuel pool cooling.		
	4.6.A.3 **Security Event in a Plant Protected Area.**		
	OPERATING MODE: ALL		
	4.6.A.3-1 **Intrusion into plant Protected Area by a hostile force.**		
	END		

Enclosure 4.7

Natural Disasters, Hazards, And Other Conditions Affecting Plant Safety

UNUSUAL EVENT

4.7.U.1 Natural and Destructive Phenomena Affecting the Protected Area.

OPERATING MODE: ALL

4.7.U.1-1 Tremor felt and valid alarm on the "strong motion accelerograph".

4.7.U.1-2 Tremor felt and valid alarm on the "Peak shock annunciator".

4.7.U.1-3 Report by plant personnel of tornado striking within protected area boundary

4.7.U.1-4 Vehicle crash into plant structures or systems within protected area boundary

4.7.U.1-5 Report of turbine failure resulting in casing penetration or damage to turbine or generator seals.

(Continued)

ALERT

4.7.A.1 Natural and Destructive Phenomena Affecting the Plant Vital Area.

OPERATING MODE: ALL

4.7.A.1-1 Valid "OBE Exceeded" Alarm on IAD-4,B/8

4.7.A.1-2 Tornado or high winds:

Tornado striking plant structures within the vital area:

- Reactor Building
- Auxiliary Building
- FWST
- Diesel Generator Rooms
- Control Room
- RN Pumphouse
- SSF
- Doghouses
- CAS
- SAS.

OR

sustained winds ≥ 74 mph for > 15 minutes.

(Continued)

SITE AREA EMERGENCY

4.7.S.1 Control Room Evacuation Has Been Initiated and Plant Control Cannot Be Established.

OPERATING MODE: ALL

4.7.S.1-1 The following conditions exist:

Control Room evacuation has been initiated per AP/1(2)/A/5500/017

AND

Control of the plant cannot be established from the ASP or the SSF within 15 minutes.

4.7.S.2 Other Conditions Existing Which In the Judgement of the Emergency Coordinator/EOF Director Warrant Declaration of Site Area Emergency.

OPERATING MODE: ALL

4.7.S.2-1 Other conditions exist which in the Judgement of the Emergency Coordinator/EOF Director indicate actual or likely major failures of plant functions needed for protection of the public.

END

GENERAL EMERGENCY

4.7.G.1 Other Conditions Existing Which In the Judgement of the Emergency Coordinator/EOF Director Warrant Declaration of General Emergency.

OPERATING MODE: ALL

4.7.G.1-1 Other conditions exist which in the Judgement of the Emergency Coordinator/EOF Director indicate:

(1) actual or imminent substantial core degradation with potential for loss of containment

OR

(2) potential for uncontrolled radionuclide releases. These releases can reasonably be expected to exceed Environmental Protection Agency Protective Action Guideline levels outside the site boundary.

END

Natural Disasters, Hazards, And Other Conditions Affecting Plant Safety

UNUSUAL EVENT

4.7.U.2 Release of Toxic or Flammable Gases Deemed Detrimental to Safe Operation of the Plant.

OPERATING MODE: ALL

4.7.U.2-1 Report or detection of toxic or flammable gases that could enter within the site area boundary in amounts that can affect safe operation of the plant.

4.7.U.2-2 Report by Local, County or State Officials for potential evacuation of site personnel based on offsite event.

4.7.U.3 Other Conditions Existing Which in the Judgement of the Emergency Coordinator/EOF Director Warrant Declaration of an Unusual Event.

OPERATING MODE: ALL

4.7.U.3-1 Other conditions exist which in the judgement of the Emergency Coordinator/EOF Director indicate a potential degradation of the level of safety of the plant

END

ALERT

4.7.A.1-3 Turbine failure generated missiles, vehicle crashes or other catastrophic events causing visible structural damage on any of the following plant structures:

- Reactor Building
- Auxiliary Building
- FWST
- Diesel Generator Rooms
- Control Room
- RN Pumphouse
- SSF
- Doghouses
- CAS
- SAS

(Continued)

SITE AREA EMERGENCY

GENERAL EMERGENCY

UNUSUAL EVENT | ALERT | SITE AREA EMERGENCY | GENERAL EMERGENCY

4.7.A.2 Release of Toxic or Flammable Gases Within a Facility Structure Which Jeopardizes Operation of Systems Required to Maintain Safe Operations or to Establish or Maintain Cold Shutdown.

OPERATING MODE: ALL

4.7.A.2-1 Report or detection of toxic gases within a Facility Structure in concentrations that will be life threatening to plant personnel.

4.7.A.2-2 Report or detection of flammable gases within a Facility Structure in concentrations that will affect the safe operation of the plant.

Structures for the above EALs:

- Reactor Building
- Auxiliary Building
- Diesel Generator Rooms
- Control Room
- RN Pumphouse
- SSF
- CAS
- SAS

(Continued)

UNUSUAL EVENT | ALERT | SITE AREA EMERGENCY | GENERAL EMERGENCY

4.7.A.3 Control Room Evacuation Has Been Initiated.

OPERATING MODE: ALL

4.7.A.3-1 Control Room evacuation has been initiated per AP/1(2)/A/5500/017.

4.7.A.4 Other Conditions Existing Which In the Judgement of the Emergency Coordinator/EOF Director Warrant Declaration of an Alert.

OPERATING MODE: ALL

4.7.A.4-1 Other conditions exist which in the Judgement of the Emergency Coordinator/EOF Director indicate that plant safety systems may be degraded and that increased monitoring of plant functions is warranted.

END

ALERT- Events are in process or have occurred which involve an actual or potential substantial degradation of the level of safety of the plant. Any releases are expected to be limited to small fractions of the EPA protective action guideline exposure levels.

ALL (As relates to Operating Mode Applicability) – Modes 1,2,3,4,5,6 and No Mode (Defueled)

BOMB- A fused explosive device.

CARF – Containment Air Return Fan.

CIVIL DISTURBANCE - A group of ten (10) or more people violently protesting station operations or activities at the site. A civil disturbance is considered to be violent when force has been used in an attempt to injure site personnel or damage plant property.

EPA PAG – Environmental Protection Agency Protective Action Guidelines for exposure to a release of radioactive material.

EXPLOSION - A rapid, violent unconfined combustion, or a catastrophic failure of pressurized equipment that imparts energy of sufficient force to potentially damage permanent structures, systems or components.

EXTORTION - An attempt to cause an action at the site by threat of force.

FIRE - Combustion characterized by heat and light. Sources of smoke such as slipping drive belts or overheated electrical equipment do not constitute fires. Observation of flames is preferred but is NOT required if large quantities of smoke and heat are observed.

FUNCTIONAL – A component is fully capable of meeting its design function. It would be declared INOPERABLE if unable to meet Technical Specifications.

GENERAL EMERGENCY- Events are in process or have occurred which involve actual or imminent substantial core degradation or melting with potential for loss of containment integrity. Releases can be reasonably expected to exceed EPA protective action guideline exposure levels outside the Site Boundary.

HOSTAGE - A person or object held as leverage against the site to ensure demands will be met by the site.

HOSTILE FORCE - One of more individuals present in a protected area without authorization that may have or have threatened to use force in an attempt to injure site personnel or damage plant property.

IMMINENT - Expected to occur within 1-3 hours.

INOPERABLE – A component does not meet Technical Specifications. The component may be functional, capable of meeting its design.

INABILITY TO DIRECTLY MONITOR - Operational Aid Computer data points are unavailable or gauges/panel indications are not readily available to the operator.

INTRUSION/INTRUDER - Suspected hostile individual present in a protected area without authorization.

LOSS - A component is INOPERABLE and not FUNCTIONAL.

PROLONGED - a duration beyond normal limits, defined as "greater than 15 minutes" or as determined by the judgement of the emergency Coordinator.

PROTECTED AREA - Encompasses all owner controlled areas within the security perimeter fence.

RUPTURED (As relates to Steam Generator) - Existence of primary to secondary leakage of a magnitude sufficient to require or cause a reactor trip and safety injection.

SABOTAGE - Deliberate damage, misalignment, or misoperation of plant equipment with the intent to render the equipment unavailable.

SIGNIFICANT TRANSIENT- An unplanned event involving one or more of the following: (1) Automatic turbine runback >25% thermal reactor power, (2) Electrical load rejection >25% full electrical load; (3) Reactor Trip, (4) Safety Injection, (5) Thermal power oscillations >10%.

SITE AREA EMERGENCY - Events are in process or have occurred which involve actual or likely major failures of plant functions needed for the protection of the public. Any releases are NOT expected to result in exposure levels which exceed EPA protective action guideline exposure levels outside the Site Boundary.

SITE BOUNDARY - That area, including the protected area, in which Duke Power Company has the authority to control all activities, including exclusion or removal of personnel and property.

SLC - Selected Licensee Commitments.

SECURITY EVENT - A security related emergency situation for which prompt response by the Security Force, immediate action by plant personnel, and/or assistance from offsite agencies may be required to apprehend intruders and mitigate the effects of or prevent radiological sabotage.

SUSTAINED - A duration of time long enough to confirm that the CSF is valid (not momentary).

TERMINATION - Exiting the emergency condition.

TOTAL EFFECTIVE DOSE EQUIVALENT (TEDE) - The sum of external dose exposure to radioactive plume, to radionuclides deposited on the ground by the plume, and the internal exposure inhaled radionuclides deposited in the body.

TOXIC GAS - A gas that is dangerous to life or health by reason of inhalation or skin contact (e.g. chlorine).

UNCONTROLLED - Event is not the result of planned actions by the plant staff.

UNPLANNED - An event or action is UNPLANNED if it is not the expected result of normal operations, testing, or maintenance. Events that result in corrective or mitigative actions being taken in accordance with abnormal or emergency procedures are UNPLANNED.

UNUSUAL EVENT- Events are in process or have occurred which indicate a potential degradation of the level of safety of the plant. No releases of radioactive material requiring offsite response or monitoring are expected unless further degradation of safety systems occurs.

VALID - An indication or report or condition is considered to be VALID when it is conclusively verified by: (1) an instrument channel check, or (2) indications on related or redundant instrumentation, or (3) by direct observation by plant personnel such that doubt related to the instrument's operability, the condition's existence or the report's accuracy is removed. Implicit in this definition is the need for timely assessment.

VIOLENT - Force has been used in an attempt to injure site personnel or damage plant property.

VISIBLE DAMAGE - Damage to equipment or structure that is readily observable without measurements, testing, or analyses. Damage is sufficient to cause concern regarding the continued operability or reliability of affected safety structure, system, or component. Example damage: deformation due to heat or impact, denting, penetration, rupture, cracking, paint blistering.

VITAL AREA - Areas within the PROTECTED AREA that house equipment important for nuclear safety. Access to a VITAL AREA is allowed only if an individual has been authorized to be in that area.

THE FOLLOWING GUIDANCE IS TO BE USED BY THE EMERGENCY COORDINATOR IN ASSESSING EMERGENCY CONDITIONS.

- The Emergency Coordinator shall review all applicable initiating events to ensure proper classification

- The BASIS Document (located in Section D of the Catawba Nuclear Site Emergency Plan) is available for review if any questions arise over proper classification

- If an event occurs on more than one unit concurrently, the event with the higher classification will be classified on the emergency notification form. Information relating to the problem on the other unit will be captured on the emergency notification form

- If an event occurs, and a lower or higher plant operating mode is reached before the classification can be made, the classification shall be based on the mode that existed at the time the event occurred

- The fission product barrier matrix is applicable only to those events that occur at (Mode 1-4) hot shutdown or higher. An event that is recognized at cold shutdown or lower (Mode 5 or 6) shall not be classified using the fission product barrier matrix. Reference would be made to the additional enclosures that provide emergency action levels for specific events (e.g. severe weather, fire, security)

- If a transient event should occur, the following guidance is provided.

    1. Some emergency action levels specify a specific duration. For these EALs, the classification is made when the Emergency Coordinator assessment concludes that the specified duration is exceeded or will be exceeded (i.e. condition cannot be reasonably corrected before the duration elapses), whichever is sooner.

    2. If a plant condition exceeding EAL criteria is corrected before the specified duration time is exceeded, the event is **NOT** classified by that EAL. Lower Severity EALs, if any, shall be reviewed for possible applicability in these cases.

    3. If a plant condition exceeding EAL criteria is not recognized at the time of occurrence, but is identified well after the condition has occurred (e.g. as a result of routine log or record review) and the condition no longer exists, an emergency shall **NOT** be declared. Reporting under 10CFR50.72 may be required. Such a condition could occur, for example, if a follow-up evaluation of an abnormal condition uncovers evidence that the condition was more severe than earlier believed.

4. If an emergency classification was warranted, but the plant condition has been corrected prior to declaration and notification, the Emergency Coordinator must consider the potential that the initiating condition (e.g. Failure of Reactor Protection System) may have caused plant damage that warrants augmenting the on-shift personnel via activation of the Emergency Response Organization. The following are applicable:

   a. For UNUSUAL EVENTS, the condition shall be reported. The event may be terminated in the same notification or in a follow-up notification.

   b. For ALERT, SITE AREA EMERGENCY, and GENERAL EMERGENCY, the event shall be declared and the emergency response organization activated.

DETERMINATION OF "EVENT TIME" (TIME THE 15 MINUTE CLOCK STARTS)

1. If plant conditions require implementation of EP/1 or 2/A/5000/E-0 (Reactor Trip or Safety Injection), increased emphasis shall be given to evaluation of plant conditions for determination of EAL(s) when "kickout" of the diagnostic procedure occurs. "Event Time" is the time at which the EAL(s) is determined.

2. If plant conditions do not require implementation of EP/1 or 2/A/5000/E-0 (Reactor Trip or Safety Injection), and conditions of a specific EAL are met, the "Event Time" is the time at which the EAL(s) is determined.

3. The time the event is classified shall be entered on the initial emergency notification form.

MOMENTARY ENTRY INTO A HIGHER CLASSIFICATION

If, while in an emergency classification, the specified EALs of a higher classification are met momentarily, and in the judgment of the Emergency Coordinator are not likely to recur, the entry into the higher classification must be acknowledged. Acknowledgment is performed as follows:

> If this condition occurs prior to the initial notification to the emergency response organization and off site agencies, the initial message should note that the site is currently in the lower classification, but had momentarily met the criteria for the higher classification. It should also be noted that plant conditions have improved and stabilized to the point that the criteria for the higher classification are not expected to be repeated.

Enclosure 4.10

Radiation Monitor Readings for Enclosure 4.3

Note: These values are not intended to apply to anticipated temporary increases due to planned events (e.g. incore detector movement, radwaste container movement, depleted resin transfers, etc.)

Detector	Elevation	Column	Identifier	Unusual Event mRad/hr	Alert mRad/hr
1EMF-1	522'	FF, 57	Auxiliary Building Corridor	500	5000
1EMF-3	543'	GG, 55	Unit 1 Charging Pump Area	100	5000
1EMF-4	543'	GG, 59	Unit 2 Charging Pump Area	100	5000
1EMF-7	560'	NN, 55	Unit 1 Auxiliary Building Corridor	1500	5000
1EMF-8	560'	NN, 59	Unit 2 Auxiliary Building Corridor	500	5000
1EMF-9	577'	LL, 55	Unit 1 Aux. Building Filter Hatch	100	5000
1EMF-10	577'	LL, 58	Unit 2 Aux. Building Filter Hatch	100	5000
1EMF-22	594'	KK, 53	Containment Purge Filter Area	100	5000
2EMF-9	594'	KK, 61	Containment Purge Filter Area	100	5000

D. EMERGENCY CLASSIFICATION SYSTEM

Regulatory Guide 1.101, Rev. 3, August 1992, approved the guidance provided by NUMARC/NESP-007, Revision 2, as an alternative methodology for the development of Emergency Action Levels. Catawba Nuclear Site will use the NUMARC guidance for the development of initiating conditions and emergeny action levels.

The emergency classification system utilizes four categories for classification of emergency events.

D.1.a UNUSUAL EVENT

Events are in process or have occurred which indicate a potential degradation of the level of safety of the plant. No releases of radioactive material requiring offsite response or monitoring are expected unless further degradation of safety systems occurs.

The purpose of this class is to provide notification of the emergency to the station staff, State and Local Government representatives, and the NRC.

Specific initiating conditions and their corresponding emergency action levels are provided in the Basis Document beginning on page D-4.

D.1.b ALERT

Events are in process or have occurred which involve an actual or potential substantial degradation of the level of safety of the plant. Any releases are expected to be limited to small fractions of the EPA Protective Action Guideline exposure levels.

The purpose of this class is to assure that emergency personnel are readily available to:

1. Activate the onsite response centers

2. Respond if the situation becomes more serious or to perform confirmatory radiation monitoring if required

3. Provide offsite authorities current status information

Specific initiating conditions and their corresponding emergency action levels are provided in the Basis Document beginning on page D-4.

D.1.c. SITE AREA EMERGENCY

Events are in process or have occurred which involve actual or likely major failures of plant functions needed for protection of the public. Any releases are not expected to result in exposure levels which exceed EPA Protective Action Guideline exposure levels except near the site boundary.

The purpose of the Site Area Emergency is to:

1. Activate the offsite response centers

2. Assure that monitoring teams are mobilized

3. Assure that personnel required for taking protective actions of near site areas are at duty stations should the situation become more serious.

4. Provide current information to the public and be available for consultation with offsite authorities

Specific initiating conditions and their corresponding emergency action levels are provided in the Basis Document beginning on page D-4.

D.1.d. GENERAL EMERGENCY

Events are in process or have occurred which involve actual or imminent substantial core degradation or melting with potential for loss of containment integrity. Releases can be reasonably expected to exceed EPA Protective Action Guideline exposure levels offsite for more than the immediate site area.

The purpose of the General Emergency is to:

1. Initiate predetermined protective actions for the public

2. Provide continuous assessment of information from onsite and offsite measurements

3. Initiate additional measures as indicated by event releases or potential releases

4. Provide current information to the public and be available for consultation with offsite authorities

Specific initiating conditions and their corresponding emergency action levels are provided in the Basis Document beginning on page D-4.

D.2. INITIATING CONDITIONS

The initiating conditions and their corresponding emergency actions levels are contained in the BASIS document beginning on page D-4. A classification procedure (RP/0/A/5000/01) will be used to classify events as they occur. Specific response procedures are in place which delineate the required response during the appropriate classification.

ENCLOSURE 4.1
BASIS INFORMATION FOR
FISSION PRODUCT BARRIER REFERENCE TABLE

CONTAINMENT BARRIER EALs: (C. 1 or C. 2 or C. 3 or C. 4 or C. 5 or C. 6 or C. 7)

The Containment Barrier includes the containment building, its connections up to and including the outermost containment isolation valves. This barrier also includes the main steam, feedwater, and blowdown line extensions outside the containment building up to and including the outermost secondary side isolation valve.

Critical Safety Function (CSF) indications are not meant to include transient alarm conditions which may appear during the start-up of engineered safeguards equipment. A CSF condition is satisfied when the alarmed state is valid and sustained.

4.1.C.1 Critical Safety Function Status

Containment - RED indicates containment conditions which may challenge the containment integrity. Therefore, this condition represents a potential loss of the containment barrier.

There is no "Loss" EAL associated with this item.

4.1.C.2 Containment Conditions

Containment pressure above 15 psig (the design pressure) indicates that the containment or its heat removal systems are not functioning as intended. This degradation of containment pressure control represents a potential loss of containment integrity.

A containment hydrogen concentration of 9 volume percent is sufficient to expect that any ignition would result in complete combustion of the hydrogen in containment and a significant pressure rise. At some initial containment pressures, this pressure rise may exceed the capacity of the containment. Therefore, this level of hydrogen in the containment represents a potential loss of containment integrity.

Containment heat removal systems are actuated at the high-high containment pressure setpoint of 3 psig. At least one train of Containment Spray (NS) and one Containment Air (VX) Return Fan (CARF) should be actuated at that time (the CARF with a 9 minute delay). A failure to actuate the design basis heat removal capability or assure proper containment mixing represents a degradation in the control of the

containment conditions. Therefore, this situation represents a potential loss of containment integrity.

Rapid unexplained loss of pressure (i.e., not attributable to containment spray or condensation effects) following an initial pressure increase indicates a loss of containment integrity.

Containment pressure and sump levels should increase as a result of the mass and energy release into containment from a Loss of Coolant Accident (LOCA). Thus, sump level or containment pressure not increasing indicates an interfacing systems LOCA which is a containment bypass and a loss of containment integrity, or some other containment pressure boundary failure.

4.1.C.3 Containment Isolation Valve Status After Containment Isolation Actuation

Failure to isolate those containment pathways which would allow containment atmosphere to be released from containment is a loss of the containment barrier.

There is no "Potential Loss" EAL associated with this item.

4.1.C.4 Steam Generator (SG) Secondary Side Release With Primary To Secondary Leakage

Secondary side releases to atmosphere include those from the condenser air ejector, SG Power Operated Relief Valves (PORVs), atmospheric dump valves, faulted steam lines, and main steam safety valves. Steam releases, in combination with primary to secondary leakage, constitute a bypass of the containment and, therefore, a loss of the containment barrier.

The appropriate classification can be determined in combination with the SG Tube Rupture EAL under the Reactor Coolant System (NCS) barrier.

There is no "Potential Loss" EAL associated with this item.

4.1.C.5 Significant Radioactive Inventory in Containment

These values indicate significant fuel damage well in excess of the EALs associated with both loss of Fuel Clad and loss of NCS Barriers. NUREG-1228, *Source Estimations During Incident Response to Severe Nuclear Power Plant Accidents*, indicates that such conditions do not exist when the amount of clad damage is less

than 20%. This amount of activity in containment, if released, could have such severe consequences that it is prudent to treat this as a potential loss of containment.

By treating the radioactive inventory in containment as a potential loss, a General Emergency will be declared when the conditions of the fuel clad and NCS barriers are included in the evaluation. This will allow the appropriate protective actions to be recommended.

There is no "Loss" EAL associated with this item.

NOTE: If EMF-53A and EMF-53B are unavailable, readings can be calculated from procedure HP/0/B/1009/06, "Alternative Method for Determining Dose Rates within the Reactor Building."

4.1.C.6 Core Cooling

Core Cooling - RED for greater than 15 minutes in this potential loss EAL represents imminent core damage that, if not terminated, could lead to reactor vessel failure and an increased potential for containment failure. The potential for containment challenge as a result of events at reactor vessel failure makes it prudent to consider an unmitigated core damage condition as a potential loss of the containment barrier.

Severe accident analyses (e.g., NUREG-1150) have concluded that function restoration procedures can arrest core degradation within the reactor vessel in a significant fraction of the core damage scenarios, and that the likelihood of containment failure is very small in these events. Given this, it is appropriate to provide a reasonable period to allow function restoration procedures to arrest the core melt sequence. Whether or not the procedures will be effective should be apparent within 15 minutes. The Emergency Coordinator/EOF Director should make the declaration as soon as it is determined that the procedures have been, or will be, ineffective.

There is no "Loss" EAL associated with this item.

4.1.C.7 Emergency Coordinator/EOF Director Judgment

This EAL addresses any other factors that are to be used by the Emergency Coordinator/EOF Director in determining whether the containment barrier is lost or potentially lost. In addition, the inability to monitor the barrier should also be incorporated in this EAL as a factor in Emergency Coordinator/EOF Director judgment that the barrier may be considered lost or potentially lost.

REACTOR COOLANT SYSTEM (NCS) BARRIER EALs: (N.1 or N. 2 or N. 3 or N.4 or N.5)

The NCS Barrier includes the NCS primary side and its connections up to and including the pressurizer safety and relief valves, and other connections up to and including the primary isolation valves.

4.1.N.1 Critical Safety Function Status

NCS Integrity - RED indicates NCS pressure and temperature conditions which may challenge the Reactor Vessel integrity. Heat Sink - RED indicates the ultimate heat sink function is under extreme challenge. Either of these conditions indicate a potential loss of the NCS Barrier.

There is no "Loss" EAL associated with this item.

4.1.N.2 NCS Leak Rate

Small leaks may result in the inability to maintain normal liquid inventory within the NCS by operation of the Chemical and Volume Control System, which is considered as one centrifugal charging pump discharging to the charging header with the letdown line isolated. If letdown cannot be isolated, and a second charging pump is required, this is still considered a potential loss of the NCS barrier. The need for compensatory action to maintain normal liquid inventory is an indication of a degraded NCS barrier and is considered to be a potential loss of the barrier.

The loss of subcooling is the fundamental indication that the inventory loss from the primary system exceeds the capacity of the inventory control systems. If the loss of subcooling is indicated, the NCS barrier is considered lost.

4.1.N.3 SG Tube Rupture

Small Steam Generator tube leaks may result in the inability to maintain normal liquid inventory within the Reactor Coolant System (NCS) by operation of the Chemical and Volume Control System, which is considered as one centrifugal charging pump discharging to the charging header with the letdown line isolated. If letdown cannot be isolated, and a second charging pump is required, this is still considered a potential loss of the NCS barrier. The need for compensatory action to maintain normal liquid inventory is an indication of a degraded NCS barrier and is considered to be a potential loss of the barrier.

A tube rupture with an unisolable secondary line fault is generally indicated by a reduction in primary coolant inventory, increased secondary radiation levels, and an uncontrolled or complete depressurization of the ruptured SG. This set of conditions represents a loss of the NCS and containment fission product barriers. In conjunction with containment barrier loss #4, this condition will result in the declaration of a Site Area Emergency. Escalation to a General Emergency would be indicated by at least a potential loss of the fuel clad barrier.

Secondary radiation increases should be observed via radiation monitoring of Condenser Air Ejector Discharge, SG Blowdown, Main Steam, and/or SG Sampling System. Determination of the "uncontrolled" depressurization of the ruptured SG should be based on indication that the pressure decrease in the ruptured steam generator is not a function of operator action. This should prevent declaration based on a depressurization that results from an EOP induced cooldown of the NCS that does not involve the prolonged release of contaminated secondary coolant from the affected SG to the environment. This EAL should encompass steam breaks, feed breaks, and stuck open safety or relief valves. These conditions represents a loss of the NCS and containment fission product barriers.

4.1.N.5 Emergency Coordinator/EOF Director Judgment

This EAL addresses any other factors that are to be used by the Emergency Coordinator/EOF Director in determining whether the NCS barrier is lost or potentially lost. In addition, the inability to monitor the barrier should also be incorporated in this EAL as a factor in Emergency Coordinator/EOF Director judgment that the barrier may be considered lost or potentially lost.

FUEL CLAD BARRIER EALs: (F.1 or F. 2 or F. 3 or F. 4)

The Fuel Clad Barrier is the zircalloy tubes that contain the fuel pellets.

4.1.F.1 Critical Safety Function Status

Core Cooling - ORANGE indicates subcooling has been lost and that some clad damage may occur. Heat Sink - RED indicates the ultimate heat sink function is under extreme challenge. Either of these conditions indicate a potential loss of the Fuel Clad Barrier.

Core Cooling - RED indicates significant reactor coolant superheating and core uncovery. Clad damage under these conditions is likely; therefore, this is indication of loss of the Fuel Clad Barrier.

4.1.F.2 Primary Coolant Activity Level

The value of 300 µCi/cc I_{131} equivalent coolant activity is well above that expected for iodine spikes and corresponds to about 2% to 5% fuel clad damage. This amount of clad damage indicates significant clad damage and thus the Fuel Clad Barrier is considered lost.

There is no equivalent "Potential Loss" EAL for this item.

4.1.F.3 Containment Radiation Monitoring

A reading of 117 R/hr on EMF-53A or 53B is a value which indicates the release of reactor coolant, with elevated activity indicative of fuel damage, into the containment. Reactor coolant concentrations of this magnitude are several times larger than the maximum concentrations (including iodine spiking) allowed within technical specifications and are therefore indicative of fuel damage (approximately 5% clad failure depending on core inventory and NCS volume). This EAL indicates a loss of both the fuel clad barrier and a loss of NCS barrier.

There is no "Potential Loss" EAL associated with this item.

NOTE: If EMF-53A and EMF-53B are unavailable, readings can be calculated from procedure HP/0/B/1009/06, "Alternative Method for Determining Dose Rates within the Reactor Building."

4.1.F.4 Emergency Coordinator/~~EOF~~ Director Judgment

This EAL addresses any other factors that are to be used by the Emergency Coordinator/EOF Director in determining whether the Fuel Clad barrier is lost or potentially lost. In addition, the inability to monitor the barrier should also be incorporated in this EAL as a factor in Emergency Coordinator/EOF Director judgment that the barrier may be considered lost or potentially lost.

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, BASIS INFORMATION FOR TABLE 4

ENCLOSURE 4.2
SYSTEM MALFUNCTION

UNUSUAL EVENT

4.2.U.1 Inability to Reach Required Shutdown Within Technical Specification Limits.

OPERATING MODE APPLICABILITY: **Mode 1 (Power Operation)**
Mode 2 (Startup)
Mode 3 (Hot Standby)
Mode 4 (Hot Shutdown)

EMERGENCY ACTION LEVEL:

4.2.U.1-1 Plant is not brought to required operating mode within Technical Specifications LCO Action Statement Time.

BASIS:

Limiting Conditions of Operation (LCOs) require the plant to be brought to a required shutdown mode when the Technical Specification required configuration cannot be restored. Depending on the circumstances, this may or may not be an emergency or precursor to a more severe condition. In any case, the initiation of plant shutdown required by the site Technical Specifications requires a one hour report under 10 CFR 50.72 (b) Non-emergency events. The plant is within its safety envelope when being shut down within the allowable action statement time in the Technical Specifications. An immediate Notification of an Unusual Event is required when the plant is not brought to the required operating mode within the allowable action statement time in the Technical Specifications. **Declaration of an Unusual Event is based on the time at which the LCO-specified action statement time period elapses under the site Technical Specifications and is not related to how long a condition may have existed.** Other required Technical Specification shutdowns that involve precursors to more serious events are addressed by other System Malfunction, Hazards, or Fission Product Barrier Degradation ICs.

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, SU2

SYSTEM MALFUNCTION

UNUSUAL EVENT

4.2.U.2 Unplanned Loss of Most or All Safety System Annunciation or Indication in the Control Room for Greater Than 15 Minutes.

OPERATING MODE APPLICABILITY: Mode 1 (Power Operation)
Mode 2 (Startup)
Mode 3 (Hot Standby)
Mode 4 (Hot Shutdown)

EMERGENCY ACTION LEVEL:

4.2.U.2-1 The following conditions exist:

a. Unplanned loss of most (>50%) annunciators associated with safety systems for greater than 15 minutes.

AND

b. In the opinion of the Operations Shift Manager/Emergency Coordinator/EOF Director, the loss of the annunciators or indicators requires additional personnel (beyond normal shift compliment) to safely operate the unit.

BASIS:

This Initiating Condition (IC) and its associated EAL are intended to recognize the difficulty associated with monitoring changing plant conditions without the use of a major portion of the annunciation or indication equipment. "Unplanned" loss of annunciators or indicator excludes scheduled maintenance and testing activities. Quantification of "most" is arbitrary; however, this judgment is supported by the specific opinion of the Operations Shift Manager/Emergency Coordinator/EOF Director that additional operating personnel will be required to provide increased monitoring of system operation to safely operate the unit. Fifteen minutes was selected as a threshold to exclude transient or momentary power losses.

This Unusual Event will be escalated to an Alert if a transient is in progress during the loss of annunciation or indication.

Due to the limited number of safety systems in operation during cold shutdown, refueling, and defueled modes, no IC is indicated during these modes of operation.

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, SU3

SYSTEM MALFUNCTION

UNUSUAL EVENT

4.2.U.3 Fuel Clad Degradation.

OPERATING MODE APPLICABILITY: **Mode 1 (Power Operation)**
Mode 2 (Startup)
Mode 3 (Hot Standby) *

*Mode 3 with Tave > 500 F

EMERGENCY ACTION LEVEL:

4.2.U.3-1 Dose Equivalent I-131 greater than the Technical Specification allowable limit.

BASIS:

This IC is included as an Unusual Event because it is considered to be a potential degradation in the level of safety of the plant and a potential precursor of more serious problems. The EAL addresses coolant samples exceeding coolant technical specifications for iodine spike. Escalation of this IC to the Alert level is via the Fission Product Barrier Degradation Monitoring ICs. This EAL applies in Modes 1, 2, and 3, only because the Technical Specification applies only in these modes.

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, SU4

SYSTEM MALFUNCTION

UNUSUAL EVENT

4.2.U.4 Reactor Coolant System (NCS) Leakage.

OPERATING MODE APPLICABILITY: **Mode 1 (Power Operation)**
Mode 2 (Startup)
Mode 3 (Hot Standby)
Mode 4 (Hot Shutdown)

EMERGENCY ACTION LEVELS:

4.2.U.4-1 Unidentified leakage $\geq$ 10 gpm

4.2.U.4-2 Pressure boundary leakage $\geq$ 10 gpm

4.2.U.4-3 Identified leakage $\geq$ 25 gpm

BASIS:

This IC is included as an Unusual Event because it may be a precursor of more serious conditions and result, is considered to be a potential degradation of the level of safety of the plant. The 10 gpm value the unidentified and pressure boundary leakage was selected as it is observable with normal control room indications. Lesser values must generally be determined through time-consuming surveillance tests (e.g., mass balances). The EAL for identified leakage is set at a higher value due to the lesser significance of identified leakage in comparison to unidentified or pressure boundary leakage. In either case, escalation of this IC to the Alert level is via Fission Product Barrier Degradation ICs or IC, "Inability to Maintain Plant in Cold Shutdown."

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, SU5

SYSTEM MALFUNCTION

UNUSUAL EVENT

4.2.U.5 Unplanned Loss of All Onsite or Offsite Communications.

OPERATING MODE APPLICABILITY: All

EMERGENCY ACTION LEVELS:

4.2.U.5-1 Loss of all onsite communications capability (internal phone system, PA system, onsite radio system) affecting the ability to perform routine operations.

4.2.U.5-2 Loss of all offsite communications capability (Selective Signaling, NRC FTS lines, offsite radio system, commercial phone system) affecting the ability to communicate with offsite authorities.

BASIS:

The purpose of this IC and its associated EALs is to recognize a loss of communications capability that either defeats the plant operations staff ability to perform routine tasks necessary for plant operations or the ability to communicate problems with offsite authorities. The loss of offsite communications ability is expected to be significantly more comprehensive than the condition addressed by 10 CFR 50.72.

This EAL is intended to be used only when extraordinary means are being utilized to make communications possible (relaying of information from radio transmissions, individuals being sent to offsite locations, etc.).

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, SU6

SYSTEM MALFUNCTION

ALERT

4.2.A.1 Unplanned Loss of Most or All Safety System Annunciation or Indication in Control Room With Either (1) a Significant Transient in Progress, or (2) Compensatory Non-Alarming Indicators Unavailable.

OPERATING MODE APPLICABILITY: **Mode 1 (Power Operation)**
Mode 2 (Startup)
Mode 3 (Hot Standby)
Mode 4 (Hot Shutdown)

EMERGENCY ACTION LEVEL:

4.2.A.1-1 The following conditions exist:

a. Unplanned loss of most (>50%) annunciators associated with safety systems for greater than 15 minutes.

AND

b. In the opinion of the Operations Shift Manager/Emergency Coordinator/EOF Director, the loss of the annunciators or indicators requires additional personnel (beyond normal shift compliment) to safely operate the unit.

AND

c. Either of the following:

- A significant plant transient is in progress.
- Loss of the Operator Aid Computer (OAC).

BASIS:

This IC and its associated EAL are intended to recognize the difficulty associated with monitoring changing plant conditions without the use of a major portion of the annunciation or indication equipment during a transient. Quantification of "Most" is arbitrary; however, this judgment is supported by the specific opinion of the Operations Shift Manager/Emergency Coordinator/EOF Director that additional operating personnel will be required to provide increased monitoring of system operation to safely operate the unit. Fifteen minutes was selected as a threshold to exclude transient or momentary power losses.

Refer to Operations Procedure OP/1(2)/A/6700/03, "Operating with OAC Out of Service."

"Significant Transient" includes response to automatic or manually initiated functions such as reactor trips, runbacks involving greater than 25% thermal power change, ECCS injections, or thermal power oscillations of 10% or greater.

Significant indication is available from the OAC. Loss of the OAC in conjunction with the loss of other indications would further impair the ability to monitor plant parameters.

Due to the limited number of safety systems in operation during cold shutdown, refueling and defueled modes, no IC is indicated during these modes of operation.

This Alert will be escalated to a Site Area Emergency if the operating crew cannot monitor the transient in progress.

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, SA4

SYSTEM MALFUNCTION

SITE AREA EMERGENCY

4.2.S.1 Inability to Monitor a Significant Transient in Progress.

OPERATING MODE APPLICABILITY: **Mode 1 (Power Operation)**
Mode 2 (Startup)
Mode 3 (Hot Standby)
Mode 4 (Hot Shutdown)

EMERGENCY ACTION LEVEL:

4.2.S.1-1 The following conditions exist:

a. Loss of most (>50%) annunciators associated with safety systems.

AND

b. A significant plant transient is in progress.

AND

c. Loss of the OAC.

AND

d. Inability to provide manual monitoring of any of the following Critical Safety Functions:
   - subcriticality
   - core cooling
   - heat sink
   - containment

BASIS:

This IC and its associated EAL are intended to recognize the inability of the control room staff to monitor the plant response to a transient. A Site Area Emergency is considered to exist if the control room staff cannot monitor safety functions needed for protection of the public.

"Significant Transient" includes response to automatic or manually initiated functions such as trips, runbacks involving greater than 25% thermal power change, ECCS injections, or thermal power oscillations of 10% or greater.

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, SS6

ENCLOSURE 4.3
ABNORMAL RAD LEVELS/RADIOLOGICAL EFFLUENT

UNUSUAL EVENT

4.3.U.1 Any Unplanned Release of Gaseous or Liquid Radioactivity to the Environment that Exceeds Two Times the SLC Limits for 60 Minutes or Longer.

OPERATING MODE APPLICABILITY: All

EMERGENCY ACTION LEVELS:

4.3.U.1-1 A valid Trip 2 alarm on radiation monitor EMF-49L or EMF-57 for ≥ 60 minutes or will likely continue for ≥60 minutes which indicates that the release may have exceeded the initiating condition and indicates the need to assess the release with procedure HP/0/B/1009/14.

4.3.U.1-2 A valid indication on radiation monitor EMF-36L of ≥ 5.4E+03 cpm for ≥ 60 minutes or will likely continue for ≥60 minutes which indicates that the release may have exceeded the initiating condition and indicates the need to assess the release with procedure HP/0/B/1009/25.

4.3.U.1-3 Gaseous effluent being released exceeds two times SLC 16.11-1 for ≥ 60 minutes as determined by Radiation Protection (RP) procedure.

4.3.U.1-4 Liquid effluent being released exceeds two times SLC 16.11-6 for ≥ 60 minutes as determined by RP procedure.

NOTE: If monitor reading is sustained for the time period indicated in the EAL **and** the required assessments (procedure calculations) cannot be completed within this time period, declaration must be made based on the valid radiation monitor reading.

BASIS:

The term "Unplanned", as used in this context, includes any release for which a liquid waste release (LWR) or gaseous waste release (GWR) package was not prepared, or a release that exceeds the conditions (e.g., minimum dilution flow, maximum discharge flow, alarm set points) on the applicable package.

Valid means that a radiation monitor reading has been confirmed to be correct.

Unplanned releases in excess of two times the site Selected Licensee Commitments (SLC) that continue for 60 minutes or longer represent an uncontrolled situation and hence, a potential degradation in the level of safety. It is not intended that the release be averaged over 60 minutes. The event should be declared as soon as it is determined that the release duration has or will likely exceed 60 minutes.

The gaseous release rate SLC are based on limiting gaseous release rates to the SITE BOUNDARY to 500 mr/year total body.

The liquid release rate SLC are based on limiting liquid release rates to the UNRESTRICTED AREA to 10 times the Effluent Concentration (EC) valves given in 10CFR20.1001-20.2401, Appendix B, Table 2, Column 2. Radiation Protection will use HP/0/B/1009/14, "Radiation Protection Actions Following An Uncontrolled Release of Liquid Radioactive Material" to quantify a release.

Monitor setpoints are based on the methodology of the site Offsite Dose Calculation Manual (ODCM) using annual average meteorology dispersion coefficient of 3.51E-5 sec/m^3. Radiation Protection will use HP/0/B/1009/25, "Emergency Response Off-Site Dose Projections" to quantify a release.

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, AU1

ABNORMAL RAD LEVELS/RADIOLOGICAL EFFLUENT

UNUSUAL EVENT

4.3.U.2 Unexpected Increase in Plant Radiation or Airborne Concentration.

OPERATING MODE APPLICABILITY: All

EMERGENCY ACTION LEVELS:

4.3.U.2-1 Indication of uncontrolled water level decrease of greater than 6 inches in the reactor refueling cavity with all irradiated fuel assemblies remaining covered by water.

4.3.U.2-2 Uncontrolled water level decrease of greater than 6 inches in the spent fuel pool and fuel transfer canal with all irradiated fuel assemblies remaining covered by water.

4.3.U.2-3 Unplanned **valid** area radiation monitor (EMF) reading increases by a factor of 1000 over normal levels, as shown in Enclosure 4.10 of RP/0/A/5000/01.

BASIS:

Valid means that a radiation monitor reading has been confirmed to be correct.

All of the above events tend to have long lead times relative to potential for radiological release outside the site boundary; thus, impact to public health and safety is very low.

In light of reactor cavity seal failure incidents, explicit coverage of these types of events via EALs 1 and 2 is appropriate given their potential for increased doses to plant staff. A threshold value of 6 inches is used to allow time for mitigating actions to successfully terminate the inventory loss. Credit should not be taken for inventory additions to maintain level above the 6 inch threshold. Classification as an Unusual Event is warranted as a precursor to a more serious event.

EAL 3 addresses unplanned increases in in-plant radiation levels that represent a degradation in the control of radioactive material, and represent a potential degradation in the level of safety of the plant. The EMF readings for an Unusual Event are 1000 times the normal value. Enclosure 4.10 of RP/0/A/5000/01 will provide the actual readings for these monitors. This EAL escalates to an Alert if the increases impair safe operation.

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, AU2

ABNORMAL RAD LEVELS/RADIOLOGICAL EFFLUENT

ALERT

4.3.A.1 Any Unplanned Release of Gaseous or Liquid Radioactivity to the Environment that Exceeds 200 Times the SLC limits for 15 Minutes or Longer.

OPERATING MODE APPLICABILITY: All

EMERGENCY ACTION LEVELS:

4.3.A.1-1 A valid indication on radiation monitor EMF-49L or EMF-57 of ≥ 1.2E+05 cpm for ≥15 minutes or will likely continue for ≥15 minutes which indicates that the release may have exceeded the initiating condition and indicates the need to assess the release with procedure HP/0/B/1009/14.

4.3.A.1-2 A valid indication on radiation monitor EMF-36L of ≥ 5.4E+05 cpm for ≥ 15 minutes or will likely continue for ≥15 minutes which indicates that the release may have exceeded the initiating condition and indicates the need to assess the release with procedure HP/0/B/1009/25.

4.3.A.1-3 Gaseous effluent being released exceeds 200 times the level of SLC 16.11-1 for ≥ 15 minutes as determined by RP procedure.

4.3.A.1-4 Liquid effluent being released exceeds 200 times the level of SLC 16.11-6 for ≥ 15 minutes as determined by RP procedure.

NOTE: If monitor reading is sustained for the time period indicated in the EAL **and** the required assessments (procedure calculations) cannot be completed within this time period, declaration must be made based on the valid radiation monitor reading.

BASIS:

The term "Unplanned", as used in this context, includes any release for which a liquid waste release (LWR) or gaseous waste release (GWR) package was not prepared, or a release that exceeds the conditions (e.g., minimum dilution flow, maximum discharge flow, alarm set points) on the applicable package.

Valid means that a radiation monitor reading has been confirmed to be correct.

This event escalates from the Unusual Event by escalating the magnitude of the release by a factor of 100.

It is not intended that the release be averaged over 15 minutes. The event should be declared as soon as it is determined that the release duration has or will likely exceed 15 minutes.

The gaseous release rate SLC are based on limiting gaseous release rates to the SITE BOUNDARY to 500 mr/year total body.

The liquid release rate SLC are based on limiting liquid release rates to the UNRESTRICTED AREA to 10 times the Effluent Concentration (EC) valves given in 10CFR20.1001-20.2401, Appendix B, Table 2, Column 2. Radiation Protection will use HP/0/B/1009/14, "Radiation Protection Actions Following An Uncontrolled Release of Liquid Radioactive Material" to quantify a release.

Monitor setpoints are based on the methodology of the site Offsite Dose Calculation Manual (ODCM) using annual average meteorology dispersion coefficient of 3.51E-5 sec/m^3. Radiation Protection will use HP/0/B/1009/25, "Emergency Response Off-Site Dose Projections" to quantify a release.

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, AA1

ABNORMAL RAD LEVELS/RADIOLOGICAL EFFLUENT

ALERT

4.3.A.2 Major Damage to Irradiated Fuel or Loss of Water Level that Has or Will Result in the Uncovering of Irradiated Fuel Outside the Reactor Vessel.

OPERATING MODE APPLICABILITY: All

EMERGENCY ACTION LEVELS:

4.3.A.2-1 An unplanned valid trip II alarm on any of the following radiation monitors:

a. Spent Fuel Building Refueling Bridge
   1EMF-15
   2EMF-4

b. Spent Fuel Pool Ventilation
   1EMF-42
   2EMF-42

c. Reactor Building Refueling Bridge
   1EMF-17
   2EMF-2

d. Containment Noble Gas Monitors
   1EMF-39
   2EMF-39

4.3.A.2-2 Plant personnel report that water level drop in reactor refueling cavity, spent fuel pool, or fuel transfer canal has or will exceed makeup capacity such that any irradiated fuel will become uncovered.

4.3.A.2-3 NC system wide range level < 95 % after initiation of NC system make-up

AND

Any irradiated fuel assembly not capable of being lowered into spent fuel pool or reactor vessel.

4.3.A.2-4 **Spent Fuel Pool or Fuel Transfer Canal level decrease of >2 feet after initiation of** make-up

AND

Any irradiated fuel assembly not capable of being fully lowered into the spent fuel pool racks or transfer canal fuel transfer system basket.

BASIS:

This IC applies to spent fuel requiring water coverage. There is time available to take corrective actions, and there is little potential for substantial fuel damage. Thus, an Alert Classification for this event is appropriate. Escalation, if appropriate, would occur via Abnormal Rad Level/Radiological Effluent or Emergency Coordinator/EOF Director Judgment.

EAL 2: Due to concerns for ALARA and personnel safety, personnel should not remain in the area to observe that irradiated fuel is uncovered. Personnel should exit the area as quickly as possible and report the occurrence to the Control Room.

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, AA2

ABNORMAL RAD LEVELS/RADIOLOGICAL EFFLUENT

ALERT

4.3.A.3 Release of Radioactive Material or Increases in Radiation Levels Within the Facility That Impedes Operation of Systems Required to Maintain Safe Operations or to Establish or Maintain Cold Shutdown.

OPERATING MODE APPLICABILITY: All

EMERGENCY ACTION LEVELS:

4.3.A.3-1 Valid reading on EMF-12 greater than 15 mR/hr in the Control Room.

4.3.A.3-2 Valid indication of radiation levels greater than 15 mR/hr in the Central Alarm Station (CAS) or Secondary Alarm Station (SAS).

4.3.A.3-3 Valid radiation monitor reading exceeds the limits shown in Enclosure 4.10 of RP/0/A/5000/01.

BASIS:

Valid means that a radiation monitor reading has been confirmed to be correct.

This initiating condition (IC) addresses increased radiation levels that impede necessary access to operating stations, or other areas containing equipment that must be operated manually, in order to maintain safe operation or perform a safe shutdown. It is this impaired ability to operate the plant that results in the actual or potential substantial degradation of the level of safety of the plant. This situation is indicative of a significant radiological problem that warrants additional resources to assess and mitigate.

This IC is not intended to apply to anticipated temporary increases due to planned events (e.g., incore detector movement, radwaste container movement, depleted resin transfers, etc.)

The Control Room, CAS, and SAS are areas that require continuous occupancy. The value of 15 mR/hr is derived from the GDC 19 value of 5 Rem in 30 days with adjustment for expected occupancy times.

Catawba has chosen to use a generic emergency action level of greater than or equal to 5000 mRad/hr for areas in the plant that are normally accessible as low dose rate areas that have equipment installed, operated, and used for safe operation or safe shutdown of the unit. Radiation levels at or above this range may make it difficult to complete tasks necessary for safe operation of the plant or to establish or maintain cold shutdown without exceeding normal occupational dose limits of 5 Rem per year TEDE. Enclosure 4.10 of RP/0/A/5000/01 provides the monitor number and the location of the area monitor.

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, AA3

ABNORMAL RAD LEVELS/RADIOLOGICAL EFFLUENT

SITE AREA EMERGENCY

4.3.S.1 Boundary Dose Resulting from an Actual or Imminent Release of Radioactivity Exceeds 100 mRem TEDE or 500 mRem CDE Adult Thyroid for the Actual or Projected Duration of the Release.

OPERATING MODE APPLICABILITY: All

EMERGENCY ACTION LEVELS:

4.3.S.1-1 A valid indication on radiation monitor EMF-36L ≥ 2.7E+06 cpm sustained for ≥15 minutes.

4.3.S.1-2 Dose assessment team calculations indicate dose consequences greater than 100 mRem TEDE or 500 mRem CDE Adult Thyroid at the site boundary.

4.3.S.1-3 Analysis of field survey results or field survey samples indicates dose consequences greater than 100 mRem TEDE or 500 mRem CDE Adult Thyroid at the site boundary.

NOTE 1: These EMF readings are calculated based on average annual meteorology, site boundary dose rate, and design unit vent flow rate. Calculations by the dose assessment team use actual meteorology, release duration, and unit vent flow rate. Therefore, these EMF readings should not be used if dose assessment team calculations are available.

NOTE 2: If dose assessment team calculations cannot be completed in 15 minutes, then valid monitor readings should be used for emergency classification.

BASIS:

Valid means that a radiation monitor reading has been confirmed to be correct.

The 100 mRem integrated dose in this initiating condition is based on 10 CFR 20 annual average population exposure. This value also provides a desirable gradient (one order of magnitude) between the Alert, Site Area Emergency, and General Emergency classes. These values are 10% of the EPA Protective Action Guide (PAG) values given in EPA-400-R-92-001.

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, AS1

ABNORMAL RAD LEVELS/RADIOLOGICAL EFFLUENT

GENERAL EMERGENCY

4.3.G.1 Boundary Dose Resulting from an Actual or Imminent Release of Radioactivity that Exceeds 1000 mRem TEDE or 5000 mRem CDE Adult Thyroid for the Actual or Projected Duration of the Release.

OPERATING MODE APPLICABILITY: All

EMERGENCY ACTION LEVELS:

4.3.G.1-1 A valid indication on radiation monitor EMF-36H ≥ 8.3E+03 cpm sustained for ≥15 minutes.

4.3.G.1-2 Dose assessment team calculations indicate dose consequences greater than 1000 mRem TEDE or 5000 mRem CDE Adult Thyroid at the site boundary.

4.3.G.1-3 Analysis of field survey results or field survey samples indicates dose consequences greater than 1000 mRem TEDE or 5000 mRem CDE Adult Thyroid at the site boundary.

NOTE 1: These EMF readings are calculated based on average annual meteorology, site boundary dose rate, and design unit vent flow rate. Calculations by the dose assessment team use actual meteorology, release duration, and unit vent flow rate. Therefore, these EMF readings should not be used if dose assessment team calculations are available.

NOTE 2: If dose assessment team calculations cannot be completed in 15 minutes, then valid monitor readings should be used for emergency classification.

BASIS:

Valid means that a radiation monitor reading has been confirmed to be correct.

The 1000 mRem TEDE and 5000 mRem CDE thyroid integrated doses are based on the EPA PAG values given in EPA-400-R-92-001, which indicates that public protective actions are indicated if doses exceed these values. This is consistent with the emergency class description of a general emergency.

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, AG1

ENCLOSURE 4.4
LOSS OF SHUTDOWN FUNCTIONS

ALERT

4.4.A.1 Failure of Reactor Protection System Instrumentation to Complete or Initiate an Automatic Reactor Trip Once a Reactor Protection System Setpoint Has Been Exceeded and Manual Trip Was Successful.

OPERATING MODE APPLICABILITY: **Mode 1 (Power Operation)**
Mode 2 (Startup)
Mode 3 (Hot Standby)

EMERGENCY ACTION LEVEL:

4.4.A.1-1 The following conditions exist:

a. Valid reactor trip signal received or required and automatic reactor trip was not successful.

AND

b. Manual reactor trip from the control room is successful in reducing reactor power.

BASIS:

This condition indicates failure of the automatic protection system to trip the reactor. This condition is more than a potential degradation of a safety system in that a front line automatic protection system did not function in response to a plant transient and thus the plant safety has been compromised, and design limits of the fuel may have been exceeded. An Alert is indicated because conditions exist that lead to potential loss of fuel clad or NCS. Reactor protection system setpoint being exceeded (rather than limiting safety system setpoint being exceeded) is specified here because failure of the automatic protection system is the issue. A manual trip is any set of actions by the reactor operator(s) at the reactor control console which causes control rods to be RAPIDLY inserted into the core and brings the reactor subcritical. Operator action to drive rods does NOT constitute a reactor trip, i.e. does not meet the rapid insertion criterion.

Failure of manual trip would escalate the event to a Site Area Emergency.

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, SA2

LOSS OF SHUTDOWN FUNCTIONS

ALERT

4.4.A.2 Inability to Maintain Plant in Cold Shutdown.

OPERATING MODE APPLICABILITY: **Mode 5 (Cold Shutdown)**
Mode 6 (Refueling)

EMERGENCY ACTION LEVELS:

4.4.A.2-1 Total loss of Residual Heat Removal (ND) **and/or**
Nuclear Service Water (RN) **and/or**
Component Cooling (KC)

AND

One of the following:

- Inability to maintain reactor coolant temperature below 200°F.
- Uncontrolled reactor coolant temperature rise to >180°F

BASIS:

This EAL addresses loss of functions required for core cooling during cold shutdown and refueling conditions. This IC and associated EALs are based on concerns raised by Generic Letter 88-17, "Loss of Decay Heat Removal." A number of phenomena such as pressurization, vortexing, steam generator U-tube draining, NCS level differences when operating at a mid-loop condition, decay heat removal system design, and level instrumentation problems can lead to conditions where decay heat removal is lost and core uncovery can occur. NRC analyses show that sequences that can cause core uncovery in 15 to 20 minutes and severe core damage within an hour after decay heat removal is lost.

Escalation to the Site Area Emergency is by, "Loss of Water Level in the Reactor Vessel That Has or Will Uncover Fuel in the Reactor Vessel," or by Abnormal Rad Levels/Radiological Effluent ICs.

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, SA3

LOSS OF SHUTDOWN FUNCTIONS

SITE AREA EMERGENCY

4.4.S.1 Failure of Reactor Protection System Instrumentation to Complete or Initiate an Automatic Reactor Trip Once a Reactor Protection System Setpoint Has Been Exceeded and Manual Trip WAS NOT Successful.

OPERATING MODE APPLICABILITY: **Mode 1 (Power Operation)**
Mode 2 (Startup)

EMERGENCY ACTION LEVEL:

4.4.S.1-1 The following conditions exist:

a. Valid reactor trip signal received or required and automatic reactor trip was not successful.

AND

b. Manual reactor trip from the control room was not successful in reducing reactor power.

BASIS:

Automatic and manual trip are not considered successful if action away from the reactor control console is required to trip the reactor. This EAL is equivalent to the Subcriticality CSF-RED.

Under these conditions, the reactor is producing more heat than the maximum decay heat load for which the safety systems are designed. A Site Area Emergency is indicated because conditions exist that lead to imminent loss or potential loss of both fuel clad and NCS. Although this IC may be viewed as redundant to the Fission Product Barrier Degradation IC, its inclusion is necessary to better assure timely recognition and emergency response. Escalation of this event to a General Emergency would be via Fission Product Barrier Degradation or Emergency Coordinator/EOF Director Judgment ICs.

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, SS2

LOSS OF SHUTDOWN FUNCTIONS

SITE AREA EMERGENCY

4.4.S.2 Complete Loss of Function Needed to Achieve or Maintain Hot Shutdown.

OPERATING MODE APPLICABILITY: **Mode 1 (Power Operation)**
Mode 2 (Startup)
Mode 3 (Hot Standby)
Mode 4 (Hot Shutdown)

EMERGENCY ACTION LEVELS:

4.4.S.2-1 Subcriticality CSF RED

4.4.S.2-2 Heat Sink CSF-RED

BASIS:

This EAL addresses complete loss of functions, including ultimate heat sink and reactivity control, required for hot shutdown with the reactor at pressure and temperature. Under these conditions, there is an actual major failure of a system intended for protection of the public. Thus, declaration of a Site Area Emergency is warranted. Escalation to General Emergency would be via Abnormal Rad Levels/Radiological Effluent, Emergency Coordinator/EOF Director Judgment, or Fission Product Barrier Degradation ICs.

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, SS4

LOSS OF SHUTDOWN FUNCTIONS

SITE AREA EMERGENCY

4.4.S.3 Loss of Water Level in the Reactor Vessel That Has or Will Uncover Fuel in the Reactor Vessel.

OPERATING MODE APPLICABILITY: Mode 5 (Cold Shutdown)
Mode 6 (Refueling)

EMERGENCY ACTION LEVELS:

4.4.S.3-1 a. Failure of heat sink causes loss of cold shutdown conditions.

AND

b. Lower range Reactor Vessel Level Indication System (RVLIS) decreasing after initiation of NC system makeup.

4.4.S.3-2 a. Failure of heat sink causes loss of cold shutdown conditions.

AND

b. Reactor Coolant (NC) system narrow range level less than 11% and decreasing after initiation of NC system makeup.

4.4.S.3-3 a. Failure of heat sink causes loss of cold shutdown conditions.

AND

b. Either train ultrasonic level indication less than 7.25% and decreasing after initiation of NC system makeup.

BASIS:

Under the conditions specified by this IC, severe core damage may be imminent due to prolonged boiling following loss of decay heat removal.

Thus, declaration of a Site Area Emergency is warranted under the conditions specified by the IC. Escalation to a General Emergency is via radiological effluent IC.

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, SS5

ENCLOSURE 4.5
LOSS OF POWER

UNUSUAL EVENT

4.5.U.1 Loss of All Offsite Power to Essential Busses for Greater Than 15 Minutes.

EMERGENCY ACTION LEVEL:

4.5.U.1-1 OPERATING MODE APPLICABILITY: **Mode 1 (Power Operation)**
Mode 2 (Startup)
Mode 3 (Hot Standby)
Mode 4 (Hot Shutdown)

The following conditions exist:

a. Loss of offsite power to essential buses ETA and ETB for greater than 15 minutes.

AND

b. Both emergency diesel generators are supplying power to their respective essential busses.

4.5.U.1-2 OPERATING MODE APPLICABILITY: **Mode 5 (Cold Shutdown)**
Mode 6 (Refueling)
No Mode (Defueled)

The following conditions exist:

a. Loss of offsite power to essential buses ETA and ETB for greater than 15 minutes.

AND

b. One emergency diesel generator is supplying power to its respective essential bus.

BASIS:

Prolonged loss of AC power reduces required redundancy and potentially degrades the level of safety of the plant by rendering the plant more vulnerable to a complete Loss of AC Power (Station Blackout). When in cold shutdown, refueling, or defueled mode the event can be classified as an Unusual Event, because of the significantly reduced decay heat, lower temperature and pressure, increasing the time to restore one of the essential busses, relative to that specified for the Alert EAL. The event will escalate to an Alert in these modes if both essential busses are lost. Fifteen minutes was selected as a threshold to exclude transient or momentary power losses.

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, SU1

LOSS OF POWER

UNUSUAL EVENT

4.5.U.2 Unplanned Loss of Required DC Power During Cold Shutdown or Refueling Mode for Greater than 15 Minutes.

OPERATING MODE APPLICABILITY: **Mode 5 (Cold Shutdown)**
Mode 6 (Refueling)

EMERGENCY ACTION LEVEL:

4.5.U.2-1 The following conditions exist:

a. Unplanned loss of both unit related busses: EBA and EBD both < 112 VDC, and EBB and EBC both < 109 VDC.

AND

b. Failure to restore power to at least one required DC bus within 15 minutes from the time of loss.

BASIS:

The purpose of this IC and its associated EALs is to recognize a loss of DC power compromising the ability to monitor and control the removal of decay heat during Cold Shutdown or Refueling operations. This EAL is intended to be anticipatory in as much as the operating crew may not have necessary indication and control of equipment needed to respond to the loss.

"Unplanned" is included in this IC and EAL to preclude the declaration of an emergency as a result of planned maintenance activities.

If this loss results in the inability to maintain cold shutdown, the escalation to an Alert is via "Inability to Maintain Plant in Cold Shutdown."

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, SU7

LOSS OF POWER

ALERT

4.5.A.1 Loss of All Offsite Power and Loss of All Onsite AC Power to Essential Busses During Cold Shutdown Or Refueling Mode.

OPERATING MODE APPLICABILITY: **Mode 5 (Cold Shutdown)**
Mode 6 (Refueling)
No Mode (Defueled)

EMERGENCY ACTION LEVEL:

4.5.A.1-1 Loss of all offsite and onsite AC power as indicated by:

a. Loss of power on essential buses ETA and ETB.

AND

b. Failure to restore power to at least one essential bus within 15 minutes.

BASIS:

Loss of all AC power compromises all plant safety systems requiring electric power including Residual Heat Removal (RHR), Emergency Core Cooling Systems (ECCS), Containment Heat Removal, Spent Fuel Heat Removal and the Ultimate Heat Sink. When in cold shutdown, refueling, or defueled mode the event can be classified as an Alert, because of the significantly reduced decay heat, lower temperature and pressure, increasing the time to restore one of the essential busses, relative to that specified for the Site Area Emergency EAL. Escalating to Site Area Emergency, if appropriate, is by Abnormal Rad Levels/Radiological Effluent, or Emergency Coordinator/EOF Director Judgment ICs. Fifteen minutes was selected as a threshold to exclude transient or momentary power losses.

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, SA1

LOSS OF POWER

ALERT

4.5.A.2 **AC power to essential busses reduced to a single power source for greater than 15 minutes such that an additional single failure could result in station blackout.**

OPERATING MODE APPLICABILITY: **Mode 1 (Power Operation)**
Mode 2 (Startup)
Mode 3 (Hot Standby)
Mode 4 (Hot Shutdown)

EMERGENCY ACTION LEVEL:

4.5.A.2-1 The following condition exists:

AC power capability has been degraded to one essential bus powered from a single power source for > 15 min. due to the loss of all but one of:

SATA
SATB
ATC
ATD
D/G A
D/G B

BASIS:

This IC and the associated EAL is intended to provide an escalation from IC, "Loss of All Offsite Power To Essential Busses for Greater Than 15 Minutes." The condition indicated by this IC is the degradation of the offsite and onsite power systems such that an additional single failure could result in a station blackout. This condition could occur due to a loss of offsite power with a concurrent failure of one emergency generator to supply power to its essential busses. Another related condition could be the loss of all offsite power and loss of onsite emergency diesels with only one train of essential busses being back fed from the unit main generator, or the loss of onsite emergency diesels with only one train of essential busses being back fed from offsite power. The subsequent loss of this single power source would escalate the event to a Site Area Emergency in accordance with IC, "Loss of All Offsite and Loss of All Onsite AC Power to Essential Busses."

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, SA5

LOSS OF POWER

SITE AREA EMERGENCY

4.5.S.1 Loss of All Offsite Power and Loss of All Onsite AC Power to Essential Busses.

OPERATING MODE APPLICABILITY: **Mode 1 (Power Operation)**
Mode 2 (Startup)
Mode 3 (Hot Standby)
Mode 4 (Hot Shutdown)

EMERGENCY ACTION LEVEL:

4.5.S.1-1 Loss of all offsite and onsite AC power as indicated by:

a. Loss of power on essential buses ETA and ETB.

AND

b. Failure to restore power to at least one essential bus within 15 minutes.

BASIS:

Loss of all AC power compromises all plant safety systems requiring electric power including RHR, ECCS, Containment Heat Removal and the Ultimate Heat Sink. Prolonged loss of all AC power will cause core uncovering and loss of containment integrity; thus, this event can escalate to a General Emergency.

Escalation to General Emergency is via Fission Product Barrier Degradation or IC, "Prolonged Loss of All Offsite Power and Prolonged Loss of All Onsite AC Power."

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, SS1

LOSS OF POWER

SITE AREA EMERGENCY

4.5.S.2 Loss of All Vital DC Power.

OPERATING MODE APPLICABILITY: **Mode 1 (Power Operation)**
Mode 2 (Startup)
Mode 3 (Hot Standby)
Mode 4 (Hot Shutdown)

EMERGENCY ACTION LEVEL:

4.5.S.2-1 The following conditions exist:

a. Loss of both unit related busses: EBA and EBD both < 112 VDC, and EBB and EBC both <109 VDC.

AND

b. Failure to restore power to at least one required DC bus within 15 minutes from the time of loss.

BASIS:

Loss of all DC power compromises ability to monitor and control plant safety functions. Prolonged loss of all DC power will cause core uncovering and loss of containment integrity when there is significant decay heat and sensible heat in the reactor system. Escalation to a General Emergency would occur by Abnormal Rad Levels/Radiological Effluent, Fission Product Barrier Degradation, or Emergency Coordinator/EOF Director Judgment ICs. Fifteen minutes was selected as a threshold to exclude transient or momentary power losses.

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, SS3

LOSS OF POWER

GENERAL EMERGENCY

4.5.G.1 Prolonged Loss of All (Offsite and Onsite) AC Power.

OPERATING MODE APPLICABILITY: **Mode 1 (Power Operation)**
Mode 2 (Startup)
Mode 3 (Hot Standby)
Mode 4 (Hot Shutdown)

EMERGENCY ACTION LEVEL:

4.5.G.1-1 Prolonged loss of all offsite and onsite AC power as indicated by:

a. Loss of power on essential buses ETA and ETB for greater than 15 minutes.

AND

b. Standby Shutdown Facility (SSF) fails to supply NC pump seal injection **OR** CA supply to steam generators.

AND

c. At least one of the following conditions exist:

- Restoration of at least one essential bus within 4 hours is *NOT* likely.
- Indication of continuing degradation of core cooling based on Fission Product Barrier monitoring.

BASIS:

Loss of all AC power compromises all plant safety systems requiring electric power including RHR, ECCS, Containment Heat Removal and the Ultimate Heat Sink. Prolonged loss of all those functions necessary to maintain hot shutdown will lead to loss of fuel clad, NCS, and containment.

The SSF is capable of providing the necessary functions (reactor coolant pump seal injection and auxiliary feedwater supply to the steam generators) to maintain a hot shutdown condition for up to 72 hours. No fission product barrier degradation would be expected if the SSF is functioning as intended.

Analysis in support of the station blackout coping study indicates that the plant can cope with a station blackout for 4 hours without core damage.

The likelihood of restoring at least one essential bus should be based on a realistic appraisal of the situation since a delay in an upgrade decision based on only a chance of mitigating the event could result in a loss of valuable time in preparing and implementing public protective actions.

In addition, under these conditions, fission product barrier monitoring capability may be degraded. Although it may be difficult to predict when power can be restored, it is necessary to give the Emergency Coordinator/EOF Director a reasonable idea of how quickly (s)he may need to declare a General Emergency based on two major considerations:

1. Are there any present indications that core cooling is already degraded to the point that Loss or Potential Loss of Fission Product Barriers is IMMINENT?

2. If there are no present indications of such core cooling degradation, how likely is it that power can be restored in time to assure that a loss of two barriers with a potential loss of the third barrier can be prevented?

Thus, indication of continuing core cooling degradation must be based on Fission Product Barrier monitoring with particular emphasis on Emergency Coordinator/EOF Director judgment as it relates to IMMINENT Loss or Potential Loss of fission product barriers and degraded ability to monitor fission product barriers.

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, SG1

ENCLOSURE 4.6
FIRE/EXPLOSION AND SECURITY EVENTS

UNUSUAL EVENT

4.6.U.1 Fire Within Protected Area Boundary Not Extinguished Within 15 Minutes of Detection or Explosion Within the Protected Area Boundary.

OPERATING MODE APPLICABILITY: All

EMERGENCY ACTION LEVEL:

4.6.U.1-1 Fire in any of the following areas not extinguished within 15 minutes of control room notification or verification of a control room fire alarm.

- Reactor Building
- Auxiliary Building
- Diesel Generator Rooms
- Control Room
- RN Pumphouse
- Standby Shutdown Facility (SSF)
- Central Alarm Station (CAS)
- Secondary Alarm Station (SAS)
- Doghouses
- Refueling Water Storage Tank (FWST)
- Turbine Building
- Service Building
- Monitor Tank Building

4.6.U.1-2 Report by plant personnel of an unanticipated explosion within protected area boundary resulting in visible damage to permanent structure or equipment.

BASIS:

EAL 1: The purpose of this EAL is to address the magnitude and extent of fires that may be potentially significant precursors to damage to safety systems. Fire is combustion characterized by heat and light. Sources of smoke such as slipping drive belts or overheated electrical equipment do not constitute fires. Observation of flames is preferred but is NOT required if large quantities of smoke and heat are observed. This excludes such items as fires within administration buildings outside the protected area. Waste-basket fires, and other small fires of no safety consequence should easily be extinguished within 15 minutes of detection. This IC applies to buildings and areas contiguous to plant vital areas or other significant buildings or areas. Verification of the alarm in this context means those actions taken in the control room to determine that the control room alarm is not spurious.

EAL 2: Only those explosions of sufficient force to damage permanent structures or equipment within the protected area should be considered. As used here, an explosion is a rapid, violent, unconfined combustion, or a catastrophic failure of pressurized equipment, that potentially imparts significant energy to near-by structures and materials. No attempt is made in this EAL to assess the actual magnitude of the damage. The occurrence of the explosion with reports of evidence of damage (e.g., deformation, scorching) is sufficient for declaration. The Emergency Coordinator/EOF Director also needs to consider any security aspects of the explosion, if applicable.

Escalation to a higher emergency class is by, "Fire or Explosion Affecting the Operability of Plant Safety Systems Required to Establish or Maintain Safe Shutdown".

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, HU1 & HU2

FIRE/EXPLOSION AND SECURITY EVENTS

UNUSUAL EVENT

4.6.U.2 Confirmed Security Event Which Indicates a Potential Degradation in the Level of Safety of the Plant.

OPERATING MODE APPLICABILITY: All

EMERGENCY ACTION LEVELS:

4.6.U.2-1 Security confirmed bomb device discovered within plant Protected Area and outside Vital Areas.

4.6.U.2-2 Hostage situation/extortion

4.6.U.2-3 A violent civil disturbance within the owner controlled area.

BASIS:

The above situations represent a potential degradation in the level of safety of the plant.

A civil disturbance is to be considered violent when force has been used in an attempt to injure site personnel or damage plant property.

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, HU4

FIRE/EXPLOSION AND SECURITY EVENTS

ALERT

4.6.A.1 Fire or Explosion Affecting the Operability of Plant Safety Systems Required to Establish or Maintain Safe Shutdown.

OPERATING MODE APPLICABILITY: **Mode 1 (Power Operation)**
Mode 2 (Startup)
Mode 3 (Hot Standby)
Mode 4 (Hot Shutdown)
Mode 5 (Cold Shutdown)
Mode 6 (Refueling)

EMERGENCY ACTION LEVEL:

4.6.A.1-1 The following conditions exist:

a. Fire or explosion in any of the following areas:
- Reactor Building
- Auxiliary Building
- Diesel Generator Rooms
- Control Room
- RN Pumphouse
- SSF
- CAS
- SAS
- FWST
- Doghouses (Applies In Mode 1, 2, 3, 4 only)

AND

b. One of the following:

- Affected safety system parameter indications show degraded performance

- Plant personnel report visible damage to permanent structures or equipment within the specified area.

Note: Only one train of a system needs to be affected or damaged in order to satisfy this condition.

BASIS:

With regard to explosions, only those explosions of sufficient force to damage permanent structures or equipment required for safe operation within the identified plant area should be considered. As used here, an explosion is a rapid, violent, unconfined combustion, or a catastrophic failure of pressurized equipment, that potentially imparts significant energy to near-by structures and materials. Fire is combustion characterized by heat and light. Sources of smoke such as slipping drive belts or overheated electrical equipment do not constitute fires. Observation of flames is preferred but is NOT required if large quantities of smoke and heat are observed. The inclusion of a "report of visible damage" should not be interpreted as mandating a lengthy damage assessment prior to classification.

The key to classifying fires/explosions as an Alert is the damage as a result of the incident. The fact that safety-related equipment required for safe shutdown of the unit has been affected or damaged as a result of the fire/explosion is the driving force for declaring the Alert. **It is important to note that this EAL addresses a fire/explosion and not just the degradation of a safety system. The reference to damage of the systems is used to identify the magnitude of the fire/explosion and to discriminate against minor fires/explosions.**

Escalation to a higher emergency class, if appropriate, will be based on System Malfunction, Fission Product Barrier Degradation, Abnormal Rad Levels/Radiological Effluent, or Emergency Coordinator/EOF Director Judgment ICs.

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, HA2

FIRE/EXPLOSION AND SECURITY EVENTS

ALERT

4.6.A.2 Fire or Explosion Affecting the Operability of Plant Safety Systems Required to Establish or Maintain Safe Shutdown.

OPERATING MODE APPLICABILITY: No Mode (Defueled)

EMERGENCY ACTION LEVEL:

4.6.A.2-1 The following conditions exist:

a. Fire or explosion in any of the following areas:
- Spent Fuel Pool
- Auxiliary Building
- RN Pumphouse

AND

b. One of the following:

- Spent Fuel Pool level and/or temperature show degraded performance.
- Plant personnel report visible damage to permanent structures or equipment supporting Spent Fuel Pool cooling.

Note: Only one train of a system needs to be affected or damaged in order to satisfy this condition.

BASIS:

In a Defueled condition, the plant safety systems of interest are those that support Spent Fuel Pool inventory and cooling.

With regard to explosions, only those explosions of sufficient force to damage permanent structures or equipment required for safe operation within the identified plant area should be considered. As used here, an explosion is a rapid, violent, unconfined combustion, or a catastrophic failure of pressurized equipment, that potentially imparts significant energy to nearby structures and materials. Fire is combustion characterized by heat and light. Sources of smoke such as slipping drive belts or overheated electrical equipment do not constitute fires. Observation of flames is preferred but is NOT required if large quantities of smoke and heat are observed. The inclusion of a "report of visible damage" should not be interpreted as mandating a lengthy damage assessment prior to classification.

The key to classifying fires/explosions as an Alert is the damage as a result of the incident. The fact that safety-related equipment required for safe shutdown of the unit has been affected or damaged as a result of the fire/explosion is the driving force for declaring the Alert. **It is important to note that this EAL addresses a fire/explosion and not just the degradation of a safety system. The reference to damage of the systems is used to identify the magnitude of the fire/explosion and to discriminate against minor fires/explosions.**

Escalation to a higher emergency class, if appropriate, will be based on System Malfunction, Fission Product Barrier Degradation, Abnormal Rad Levels/Radiological Effluent or Emergency Coordinator/EOF Director Judgment ICs.

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, HA2

FIRE/EXPLOSION AND SECURITY EVENTS

ALERT

4.6.A.3 Security Event in a Plant Protected Area.

OPERATING MODE APPLICABILITY: All

EMERGENCY ACTION LEVEL:

4.6.A.3-1 Intrusion into plant protected area by a hostile force.

BASIS:

This class of security events represents an escalated threat to plant safety above that contained in the Unusual Event. A civil disturbance which penetrates the protected area boundary can be considered a hostile force. Intrusion into a vital area by a hostile force will escalate this event to a Site Area Emergency.

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, HA4

FIRE/EXPLOSION AND SECURITY EVENTS

SITE AREA EMERGENCY

4.6.S.1 Security Event in a Plant Vital Area.

OPERATING MODE APPLICABILITY: All

EMERGENCY ACTION LEVELS:

4.6.S.1-1 Intrusion into any of the following plant areas by a hostile force:

- Reactor Building
- Auxiliary Building
- Diesel Generator Rooms
- Control Room
- RN Pumphouse
- SSF
- Doghouses
- CAS
- SAS

4.6.S.1-2 Security confirmed bomb discovered/exploded in a vital area.

4.6.S.1-3 Security confirmed sabotage in a plant vital area.

BASIS:

This class of security events represents an escalated threat to plant safety above that contained in the Alert IC in that a hostile force has progressed from the Protected Area to the Vital Area.

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, HS1

FIRE/EXPLOSION AND SECURITY EVENTS

GENERAL EMERGENCY

4.6.G.1 Security Event Resulting in Loss Of Ability to Reach and Maintain Cold Shutdown.

OPERATING MODE APPLICABILITY: All

EMERGENCY ACTION LEVELS:

4.6.G.1-1 Loss of physical control of the control room due to security event.

4.6.G.1-2 Loss of physical control of the SSF and Auxiliary Shutdown Panel (ASP) due to security event.

BASIS:

This IC encompasses conditions under which a hostile force has taken physical control of vital area required to reach and maintain safe shutdown.

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, HG1

ENCLOSURE 4.7
NATURAL DISASTERS, HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

UNUSUAL EVENT

4.7.U.1 Natural and Destructive Phenomena Affecting the Protected Area.

OPERATING MODE APPLICABILITY: All

EMERGENCY ACTION LEVELS:

4.7.U.1-1 Tremor felt and valid alarm on the "strong motion accelerograph".

4.7.U.1-2 Tremor felt and valid alarm on the "Peak shock annunciator".

4.7.U.1-3 Report by plant personnel of tornado striking within protected area boundary.

4.7.U 1-4 Vehicle crash into plant structures or systems within protected area boundary.

4.7.U.1-5 Report of turbine failure resulting in casing penetration or damage to turbine or generator seals.

BASIS:

The protected area boundary is typically that part within the security isolation zone and is defined in the site security plan.

EALs 1&2: Damage may be caused to some portions of the site, but should not affect ability of safety functions to operate. Method of detection can be based on instrumentation, validated by a reliable source, or operator assessment. As defined in the EPRI-sponsored "Guidelines for Nuclear Plant Response to an Earthquake", dated October 1989, a "felt earthquake" is:

> An earthquake of sufficient intensity such that: (a) the vibratory ground motion is felt at the nuclear plant site and recognized as an earthquake based on a consensus of control room operators, and (b) valid alarm on seismic instrumentation occurs.

EAL 3: A tornado striking (touching down) within the protected boundary may have potentially damaged plant structures containing functions or systems required for safe shutdown of the plant. If such damage is confirmed visually or by other in-plant indications, the event may be escalated to Alert.

EAL 4: Addresses such items as a car, truck, plane, helicopter, or train crash that may potentially damage plant structures containing functions and systems required for safe shutdown of the plant. If the crash is confirmed to affect a plant vital area, the event may be escalated to Alert.

EAL 5: Addresses main turbine rotating component failures of sufficient magnitude to cause observable damage to the turbine casing or to the seals of the turbine generator. Of major concern is the potential for leakage of combustible fluids (lubricating oils) and gases (hydrogen cooling) to the plant environs. Actual fires and flammable gas build up are appropriately classified via other EALs. This EAL is consistent with the definition of an Unusual Event while maintaining the anticipatory nature desired and recognizing the risk to non-safety related equipment. Escalation of the emergency classification is based on potential damage done by the missiles generated by the failure or by the radiological releases in conjunction with a steam generator tube rupture. These latter events would be classified by the Radiological ICs or Fission Product Barrier ICs.

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, HU1
NOTE: NUMARC EAL #5 moved to Fire/Security Recognition Category

NATURAL DISASTERS, HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

ALERT

4.7.A.1 Natural and Destructive Phenomena Affecting the Plant Vital Area.

OPERATING MODE APPLICABILITY: All

EMERGENCY ACTION LEVELS:

4.7.A.1-1 Valid "OBE Exceeded" Alarm on 1AD-4,B/8

4.7.A.1-2 Tornado or high winds:

Tornado striking plant structures within the vital area:

- Reactor Building
- Auxiliary Building
- Refueling Water Storage Tank (FWST)
- Diesel Generator Rooms
- Control Room
- RN Pumphouse
- Standby Shutdown Facility (SSF)
- Doghouses
- Central Alarm Station (CAS)
- Secondary Alarm Station (SAS)

OR

sustained winds $\geq$ 74 mph for > 15 minutes.

4.7.A.1-3 Turbine failure generated missiles, vehicle crashes or other catastrophic events causing visible structural damage on any of the following plant structures:

- Reactor Building
- Auxiliary Building
- Refueling Water Storage Tank (FWST)
- Diesel Generator Rooms
- Control Room
- RN Pumphouse
- Standby Shutdown Facility (SSF)
- Doghouses
- Central Alarm Station (CAS)
- Secondary Alarm Station (SAS)

BASIS:

EAL 1: Based on the FSAR design basis. Seismic events of this magnitude (> OBE) can cause damage to safety functions.

EAL 2: Based on the available instrumentation (90 mph maximum range) and the FSAR design basis. which is 95 mph Wind loads of this magnitude (74 mph hurricane force winds) are approaching speeds that could cause damage to safety functions.

EAL 3: This EAL is intended to address the threat to safety related structures or equipment from uncontrollable and possibly catastrophic events. This list of areas includes areas containing safety-related equipment, their controls, and their power supplies. This EAL is, therefore, consistent with the definition of an ALERT in that if events have damaged areas containing safety-related equipment the potential exists for substantial degradation of the level of safety of the plant.

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, HA1

NATURAL DISASTERS, HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

UNUSUAL EVENT

4.7.U.2 Release of Toxic or Flammable Gases Deemed Detrimental to Safe Operation of the Plant.

OPERATING MODE APPLICABILITY: All

EMERGENCY ACTION LEVELS:

4.7.U.2-1 Report or detection of toxic or flammable gases that could enter within the site area boundary in amounts that can affect safe operation of the plant.

4.7.U.2-2 Report by Local, County or State Officials for potential evacuation of site personnel based on offsite event.

BASIS:

This IC is based on releases in concentrations within the site boundary that will affect the health of plant personnel or the safe operation of the plant with the plant being within the evacuation area of an offsite event (i.e., tanker truck accident releasing toxic gases, etc.).

Gases within the owner controlled area that are below life threatening or flammable concentrations do not meet this EAL.

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, HU3

NATURAL DISASTERS, HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

UNUSUAL EVENT

4.7.U.3 Other Conditions Existing Which in the Judgment of the Emergency Coordinator/EOF Director Warrant Declaration of an Unusual Event.

OPERATING MODE APPLICABILITY: All

EMERGENCY ACTION LEVEL:

4.7.U.3-1 Other conditions exist which in the judgment of the Emergency Coordinator/EOF Director indicate a potential degradation of the level of safety of the plant.

BASIS:

This EAL is intended to address unanticipated conditions not addressed explicitly elsewhere but that warrant declaration of an emergency because conditions exist which are believed by the Emergency Coordinator/EOF Director to fall under the Unusual Event emergency class.

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, HU5

NATURAL DISASTERS, HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

ALERT

4.7.A.2 Release of Toxic or Flammable Gases Within a Facility Structure Which Jeopardizes Operation of Systems Required to Maintain Safe Operations or to Establish or Maintain Cold Shutdown.

OPERATING MODE APPLICABILITY: All

EMERGENCY ACTION LEVELS:

4.7.A.2-1 Report or detection of toxic gases within a Facility Structure in concentrations that will be life threatening to plant personnel.

4.7.A.2-2 Report or detection of flammable gases within a Facility Structure in concentrations that will affect the safe operation of the plant.

Structures for above EALs:

- Reactor Building
- Auxiliary Building
- Diesel Generator Rooms
- RN Pumphouse
- Control Room
- SSF
- CAS
- SAS

BASIS:

This IC is based on gases that have entered a plant structure affecting the safe operation of the plant. Safe operations are affected when the area can not be accessed by plant personnel to ensure continued operability or availability of safety systems/components. This IC applies to buildings and areas contiguous to plant Vital Areas or other significant buildings or areas. The intent of this IC is not to include buildings (i.e., warehouses) or other areas that are not contiguous or immediately adjacent to plant Vital Areas. It is appropriate that increased monitoring be done to ascertain whether consequential damage has occurred. Escalation to a higher emergency class, if appropriate, will be based on System Malfunction, Fission Product Barrier Degradation, Abnormal Rad Levels/Radioactive Effluent, or Emergency Coordinator/EOF Director Judgment ICs.

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, HA3

NATURAL DISASTERS, HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

ALERT

4.7.A.3 Control Room Evacuation Has Been Initiated.

OPERATING MODE APPLICABILITY: All

EMERGENCY ACTION LEVEL:

4.7.A.3-1 Control Room evacuation has been initiated per AP/1(2)/A/5500/17.

BASIS:

With the control room evacuated, additional support, monitoring and direction through the Technical Support Center and/or Emergency Operations Facility is necessary. Inability to establish plant control from outside the control room, as evidenced by the inability to maintain NCS or SG inventories, will escalate this event to a Site Area Emergency.

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, HA5

NATURAL DISASTERS, HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

ALERT

4.7.A.4 Other Conditions Existing Which in the Judgment of the Emergency Coordinator/EOF Director Warrant Declaration of an Alert.

OPERATING MODE APPLICABILITY: All

EMERGENCY ACTION LEVEL:

4.7.A.4-1 Other conditions exist which in the Judgment of the Emergency Coordinator/EOF Director indicate that plant safety systems may be degraded and that increased monitoring of plant functions is warranted.

BASIS:

This EAL is intended to address unanticipated conditions not addressed explicitly elsewhere but that warrant declaration of an emergency because conditions exist which are believed by the Emergency Coordinator/EOF Director to fall under the Alert emergency class.

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, HA6

NATURAL DISASTERS, HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

SITE AREA EMERGENCY

4.7.S.1 Control Room Evacuation Has Been Initiated and Plant Control Cannot Be Established.

OPERATING MODE APPLICABILITY: All

EMERGENCY ACTION LEVEL:

4.7.S.1-1 The following conditions exist:

a. Control room evacuation has been initiated per AP/1(2)/A/5500/17.

AND

b. Control of the plant cannot be established from the ASP or the SSF within 15 minutes.

BASIS:

The timely transfer of control to alternate control areas has not been accomplished. This failure to transfer control would be evidenced by deteriorating reactor coolant system or steam generator parameters. For purposes of classification, the 15 minutes begins at the time that the determination to staff the alternate location is made. For most conditions, Reactor Coolant Pump seal LOCAs or steam generator dryout would be indications of failure to accomplish the transfer in the necessary time.

Escalation of this event, if appropriate, would be by Fission Product Barrier Degradation, Abnormal Rad Levels/Radiological Effluent, or Emergency Coordinator/EOF Director Judgment ICs.

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, HS2

NATURAL DISASTERS, HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

SITE AREA EMERGENCY

4.7.S.2 Other Conditions Existing Which in the Judgment of the Emergency Coordinator/EOF Director Warrant Declaration of Site Area Emergency.

OPERATING MODE APPLICABILITY: All

EMERGENCY ACTION LEVEL:

4.7.S.2-1 Other conditions exist which in the Judgment of the Emergency Coordinator/EOF Director indicate actual or likely major failures of plant functions needed for protection of the public.

BASIS:

This EAL is intended to address unanticipated conditions not addressed explicitly elsewhere but that warrant declaration of an emergency because conditions exist which are believed by the Emergency Coordinator/EOF Director to fall under the emergency class description for Site Area Emergency.

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, HS3

NATURAL DISASTERS, HAZARDS AND OTHER CONDITIONS AFFECTING PLANT SAFETY

GENERAL EMERGENCY

4.7.G.1 Other Conditions Existing Which in the Judgment of the Emergency Coordinator/EOF Director Warrant Declaration of General Emergency.

OPERATING MODE APPLICABILITY: All

EMERGENCY ACTION LEVEL:

4.7.G.1-1 Other conditions exist which in the Judgment of the Emergency Coordinator/EOF Director indicate:

- Actual or imminent substantial core degradation with potential for loss of containment

OR

- Potential for uncontrolled radionuclide releases. These releases can reasonably be expected to exceed Environmental Protection Agency Protective Action Guideline levels outside the site boundary.

BASIS:

This EAL is intended to address unanticipated conditions not addressed explicitly elsewhere but that warrant declaration of an emergency because conditions exist which are believed by the Emergency Coordinator/EOF Director to fall under the General Emergency class.

REFERENCE: NUMARC/NESP-007, REV. 2, 01/92, HG2