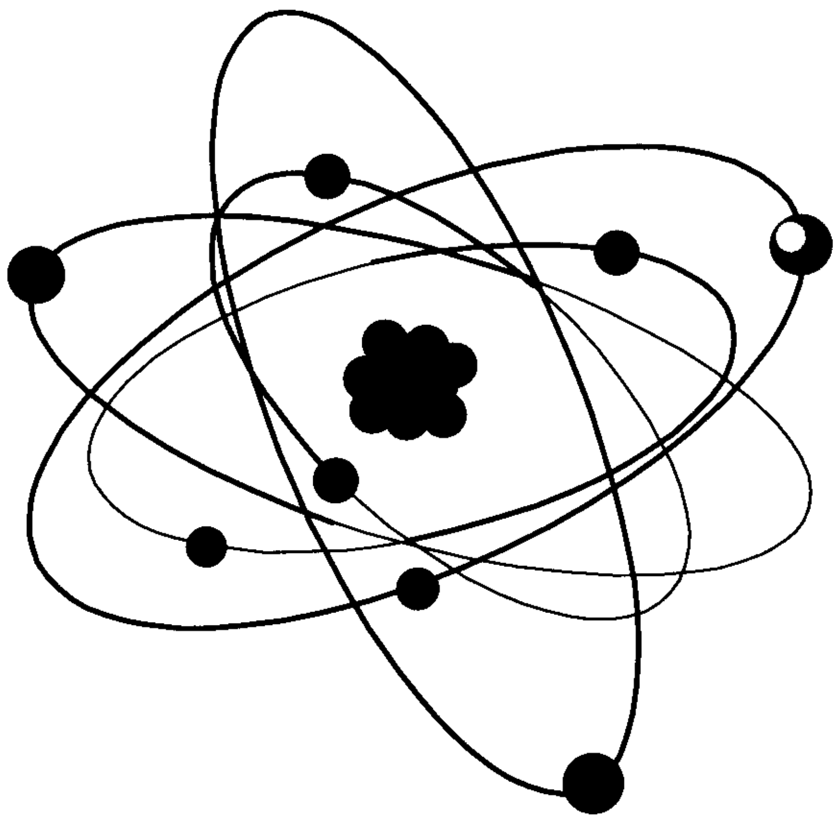
FINAL SUBMITTAL

MCGUIRE EXAM 2000-301
50-369, 370/2000-301

MAY 8 - 12, MAY 19,
MAY 22 - 25, 2000

FINAL RO/SRO JPMs

FINAL
NRC COPY



2000
RO JPMs

Facility: McGuire Date of Examination: ______
Exam Level (circle one): RO / SRO(I) / SRO(U) Operating Test No.: ______

B.1 Control Room Systems

System / JPM Title	Type Codes*	Safety Function
a. 026/ Align Containment Spray to Cold Leg Recirc **(NS-182A)**{026-A2.07-3.6/3.9}	N,A,S,**(P)**	SF-5
b. 005/ Respond to ND System Malf. At Mid Loop **(ND-183A)** {005-A4.01-3.6/3.4}	N,A,S,L	SF-4P
c. E09/ Depressurize NCS During Natural Circ **(NC-26)** {E09-EA1.1-3.5/3.5}	M,S	SF-3
d. 015/ Respond to Failure of SR NI's **(ENB-187A)** {015-A2.01-3.5/3.9}	N,A,S	SF-7
e. 062/ Resync. Gen. to Grid After Full Load Rejection **(MG-177)** {062-A4.07-3.1/3.1}	D,S,L	SF-6
f. 004/ Calculate Pot Setting and M/U to NCS (Unit 2) **(NV-186)** {004-A4.07-3.9/3.7}	M,C	SF-1
g. 013/ Terminate SI (Unit 2) **(NI-180A)** {EPE-E02-EA1.1-4.0/3.9}	N,C,A,**(P)**	SF-2

B.2 Facility Walk-Through

System / JPM Title	Type Codes*	Safety Function
a. 065/ Ensure Proper Response of Diesel VI Compressors During Loss of Inst. Air **(VI-164A)** {065-AA1.04-3.5/3.4}	D,A	SF-8
b. 064/ Transfer ETA to Normal Power Supply and S/D D/G **(DG-175)** {064-A4.06-3.9/3.9}	D	SF-6
c. 004/ Emergency Borate NCS Locally (Unit 2) **(NV-184T)** {004/A2.14-3.8/3.9}	R,M	SF-1

* Type Codes: (D)irect from bank, (M)odified from bank, (N)ew, (A)lternate path, (C)ontrol room, (S)imulator, (L)ow-Power, (R)CA, (P)SA

(P) - Indicates this JPM is associated with a Risk Significant System or Period as reflected in the MNS Probabilistic Safety Assessment.

Prepared By: Rob Billings

Reviewed By: Charles Sawyer

Approved By: Thomas Cuthbert

TASK: **Align the Containment Spray System to Cold Leg Recirculation**

POSITION: **RO**

Operator's Name________________________________

Location: **Simulator** Method: **Perform**

Estimated JPM Completion Time: 20 Minutes

Actual JPM Completion Time: _____ Minutes

The JPM Operator's performance was evaluated against the standards of this JPM and is determined to be:

SATISFACTORY/UNSATISFACTORY (circle one)

Evaluator's Signature________________________________ Date ___/___/___

References: EP/1/A/5000/ES-1.3 (Rev. 13) Transfer to Cold Leg Recirc

JPM verified current with references by ________________________________

Date ___/___/___

Rev. 00/03-13-00

FOR TRAINING PURPOSES ONLY

INITIAL CONDITIONS

You are the Unit 1 Balance of Plant (BOP) Operator. One hour ago, the Unit 1 reactor tripped due to a LOCA inside of containment.

EP/1/A/5000/ES-1.3 (Transfer To Cold Leg Recirc) has been implemented and completed through step # 7. Containment pressure is approximately 5 psig. The "FWST Level Lo-Lo" Alarm has just been received.

The SRO instructs you to perform Steps 8 and 9 of EP/1/A/5000/ES-1.3 (Transfer To Cold Leg Recirc).

JPM OVERALL STANDARD: 1A NS Pump is in operation with suction aligned to the Containment Sump and RN flow established to the 1A NS Hx. One train of ND is aligned to the Containment Aux Spray Header.

NOTES: This JPM is designed to be performed as a **SIMULATION** or as a **WALKTHROUGH.** Cues found in shaded boxes should be given to the trainee for either setting.

KA 026 A2.07 3.6/3.9

START TIME__________

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
1	**Check if NS should be aligned for recirc as follows:** Check "FWST LEVEL LO-LO" alarm – LIT.	Operator determines from JPM initial conditions or annunciator panel that the alarm is LIT.		
*2	Reset Containment Spray	Operator resets both trains of Containment Spray **Cue:** **Pushbuttons depressed and lights are illuminated**		
3 * *	Stop both NS Pumps: • A Train • B Train	Same **Cue:** **Pushbuttons depressed and lights are illuminated**		
4	Check 1A NS Pump – AVAILABLE TO RUN.	Operator determines that the pump is available to run.		

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
5	Align A Train NS to containment sump as follows:			
	• Check 1NI-185A (RB Sump To Train A ND & NS) - OPEN	Same **Cue:** **Red light is illuminated**		
	• Close 1NS-20A (A NS Pump Suct From FWST)	Same **Cue:** **Pushbutton depressed**		
	• Wait for 1NS-20A to close.	**Cue:** **Green light is illuminated**		
	• Open 1NS-18A (A NS Pump Suct From Cont Sump)	Operator attempts to open valve, realizes it will not open, and then proceeds to RNO. **Cue:** **Pushbutton depressed, <u>green</u> light is illuminated**		
	<u>GO TO</u> Step 8.f	Same		

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
6	Align B Train NS to containment sump as follows:			
	• Check 1NI-184B (RB Sump To Train B ND & NS) - OPEN	Same **Cue:** **Red light is illuminated**		
*	• Close 1NS-3B (B NS Pump Suct From FWST)	Same **Cue:** **Pushbutton depressed**		
	• Wait for 1NS-3B to close.	**Cue:** **Green light is illuminated**		
*	• Open 1NS-1B (B NS Pump Suct From Cont Sump)	Same **Cue:** **Pushbutton depressed, Red light is illuminated**		
	• Check "NS SYS CPCS TRAIN B INHIBIT" status light (1SI-12) - DARK	Same **Cue:** **Light is dark**		
*	• Start 1B NS Pump	Same **Cue:** **Pushbutton depressed Red light is illuminated**		

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
6	**CONTINUED**			
*	• Open 1RN-235B (B NS Hx Inlet Isol)	Same **Cue:** **Pushbutton depressed, Red light is illuminated**		
*	• Throttle open 1RN-238B (B NS Hx Outlet Isol) to establish 3200 GPM to 1B NS Hx.	Operator throttles open valve to get 3200 GPM (+/- 400 GPM) RN flow to 1B NS Hx. **Cue:** **Pushbutton depressed, red and green lights are illuminated, indicated flow increases to 3200 GPM**		
7	Check both NS pumps – ON.	Operator determines that 1A NS pump is <u>not ON</u> and proceeds to RNO. **Cue:** **Green light lit for 1A NS pump. Red light lit for 1B NS pump.**		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
8	Perform the following: • <u>IF</u> any NS pump is isolated from containment sump, <u>**THEN**</u> dispatch operator to pull control power fuses on affected NS pump to prevent it from starting with inadequate suction. • <u>**IF AT ANY TIME**</u> the idle NS pump(s) can be started, <u>**THEN**</u> ensure proper alignment <u>**PER**</u> Step 8.e or 8.f as required.	Same **Cue:** **An operator has been dispatched to pull control power fuses on 1A NS pump.** Operator reads step and continues to procedure step 9.		
9	**Check if ND aux spray is required:** • Containment pressure – GREATER THAN 3 PSIG.	Operator checks Post Accident Containment pressure gages on Main control board and verifies Containment pressure is GREATER THAN 3 PSIG. **Cue:** **Containment pressure gages indicate 4.5 PSIG.**		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
9	**Continued** Check the following: • Time after reactor trip – GREATER THAN 50 MINUTES	Operator determines from initial conditions that the Reactor tripped 60 minutes ago. **Cue:** **The Reactor tripped 60 minutes ago.**		
	• At least one of the following – ENERGIZED:	Operator checks main control board indicating lights to see if at least one valve is energized.		
	1NI-173A (Train A ND To A & B CL) **<u>OR</u>**	**Cue:** **Red light illuminated.**		
	1NI-178B (Train B ND To C & D CL)	**Cue:** **Red light illuminated.**		
	• Check if core cooling can be maintained with minimum S/I flow:	Same		
	At least one NV pump – ON	**Cue:** **Red lights illuminated.**		
	At least one NI pump – ON	**Cue:** **Red lights illuminated.**		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
9	**Continued**			
	At least one of the following valves – OPEN	Operator checks at least one valve open.		
	1NI-9A (NC Cold Leg Inj From NV)	**Cue:** **Red light illuminated.**		
	<u>OR</u>			
	1NI-10B (NC Cold Leg Inj From NV)	**Cue:** **Red light illuminated.**		
	• Establish ND aux spray from one train that is in Cold Leg Recirc mode:	**<u>Note to evaluator</u>:** It is Critical that <u>only one</u> train is aligned per the following steps. Either train can be used. N/A the steps for the unused train.		
	For A train:			
*	Close 1NI-173A (Train A ND To A & B CL)	Same **Cue:** **Pushbutton depressed, green light illuminated.**		
*	Open 1NS-43A (A Train ND To NS Cont Outside Isol)	Same **Cue:** **Pushbutton depressed, red light illuminated.**		
	<u>OR</u>			

* DENOTES CRITICAL

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
9	**Continued** For B train:	Same		
*	Close 1NI-178B (Train B ND To C & D CL)	**Cue:** **Pushbutton depressed, green light illuminated.**		
*	Open 1NS-38B (B Train ND To NS Cont Outside Isol)	Same **Cue:** **Pushbutton depressed, red light illuminated.**		
10	<u>**WHEN**</u> time allows, <u>**THEN**</u> place INFO tag on ND Pump control switch <u>**PER**</u> Enclosure 3 (ND Pump Restart Requirement If Aux Spray Is Open).	**Cue:** **Another operator has been directed to place the info tag per Enclosure 3.**		
11	<u>**WHEN**</u> containment pressure less than 1 PSIG, <u>**THEN**</u> stop ND aux spray <u>**PER**</u> Enclosure 4 (Securing ND Aux Containment Spray).	**Cue:** **Another operator has been directed to monitor containment pressure and complete this procedure.**		

STOP TIME___________

*** DENOTES CRITICAL**

INITIAL CONDITIONS

You are the Unit 1 Balance of Plant (BOP) Operator. One hour ago, the Unit 1 reactor tripped due to a LOCA inside of containment.

EP/1/A/5000/ES-1.3 (Transfer To Cold Leg Recirc) has been implemented and completed through step # 7. Containment pressure is approximately 5 psig. The "FWST Level Lo-Lo" Alarm has just been received.

The SRO instructs you to perform Steps 8 and 9 of EP/1/A/5000/ES-1.3 (Transfer To Cold Leg Recirc).

SIMULATOR OPERATOR GUIDELINES (NS-182A)

1. Reset to IC-39. **(*See note below)**

2. Insert Malfunction NC008A (Cold Leg LOCA) select loop = 1 (loop A).

3. Manually trip the Reactor, and stop all NCP's.

4. Close NV150 & 151.

5. Energize H2 Ignitors.

Note: To lower FWST to LO alarm level perform: (After Containment Sump level >4 ft.) Ramp ASISRWST=500000,30,0 (This will lower FWST level to approximately 80 inches.)

6. When Lo Level in FWST Alarms, align for C/L Recirc by performing EP/ES-1.3 steps 1-7.

7. Establish power to 1NI-173 and 1NI-178 by inserting the following LOA's:

   LOA NI24 SET = RACKED IN
   LOA NI25 SET = RACKED IN

8. After alignment to C/L Recirc complete allow FWST level to reach 33" (Lo-Lo Alarm)

9. Freeze simulator.

10. Insert OVR-NS014C (1A NS Pump Suction From CS Open PB) to "OFF".

11. Place the BOP panel switch to "SILENCE"

12. Set FWST levels so all channels indicate approximately 30 inches as follows:
    - XMT-FW004 LFW_5000 FWST LVL CH4 (set=30/30)
    - XMT-FW005 LFW_5010 FWST LVL CH1 (set=32/32)
    - XMT-FW006 LFW_5020 FWST LVL CH2 (set=38/38)

<u>Note:</u> <u>Leave simulator frozen until actually ready to perform JPM.</u>

13. If NS Pump trips due to cavitation on low suction, reset EP153 Pump Motor overcurrent/cavitation 2 times.

***NOTE: This JPM is snapped on Temporary IC ____# 149____.**

(R06-97)

Duke Power Company
PROCEDURE PROCESS RECORD

(1) ID No. EP/1/A/5000/ES-1.3
Revision No. 13

INFORMATION ONLY

PREPARATION
(2) Station McGuire Nuclear Station

(3) Procedure Title Transfer To Cold Leg Recirc

(4) Prepared By S. Hackney S. Hackney Date February 10, 2000

(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 [signature] (QR) Date 2/10/00
Cross-Disciplinary Review By ________ (QR) NA [initials] Date 2/10/00
Reactivity Mgmt. Review By ________ (QR) NA [initials] Date 2/10/00

(7) Additional Reviews
Reviewed By ________ Date ________
Reviewed By ________ Date ________

(8) Temporary Approval (*if necessary*)
By ________ (SRO/QR) Date ________
By ________ (QR) Date ________

(9) Approved By [signature] Date 2-11-00

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 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, 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.*)

A. Purpose

This procedure provides the necessary instructions for transferring the Safety Injection System and Containment Spray System to the recirculation mode.

B. Symptoms or Entry Conditions

This procedure is entered from:

- EP/1/A/5000/E-1 (Loss Of Reactor Or Secondary Coolant), Step 14, on low FWST level.
- EP/1/A/5000/ECA-2.1 (Uncontrolled Depressurization Of All Steam Generators), Step 10, on low FWST level.
- Other procedures whenever FWST level reaches the switchover setpoint.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
C. Operator Actions	
__ 1. **Have STA monitor foldout page.**	
__ 2. **Perform this EP without delay. CSF procedures should not be implemented until directed by this procedure.**	
__ 3. **Check containment sump level - GREATER THAN 3 FT.**	**Perform the following:** __ a. **IF** NS has actuated during this event, **THEN GO TO** Step 4. __ b. **IF** a tornado **OR** LOCA outside containment is known to have occurred, **THEN GO TO** Enclosure 2 (Loss of NC or FWST Inventory Outside Containment).
__ 4. **Check KC flow to each ND heat exchanger - GREATER THAN 5000 GPM.**	**Perform the following:** a. Close: __ • 1KC-50A (Trn A Aux Bldg Non Ess Sup Isol) __ • 1KC-53B (Trn B Aux Bldg Non Ess Sup Isol). b. Open: __ • 1KC-56A (KC To A ND Hx) __ • 1KC-81B (KC To B ND Hx).

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
5. **Reset the following:**	
__ a. S/I.	a. Perform the following: __ 1) Dispatch operator to open reactor trip breakers. __ 2) Reset S/I.
__ b. Sequencers.	b. Dispatch operator to open breaker for affected sequencer DC control power: __ • A Train - 1EVDA Breaker 6 __ • B Train - 1EVDD Breaker 8.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
6. **Align ND System for recirc:**	
__ a. Check 1NI-185A (RB Sump To Train A ND & NS) - OPEN.	a. Perform the following: __ 1) Place control permissive in "Bypass" and open 1NI-185A. __ 2) <u>**IF**</u> 1NI-185A is opening, <u>**THEN**</u> <u>**GO TO**</u> Step 6.b. 3) <u>**IF**</u> 1NI-185A is closed, <u>**THEN**</u>: __ a) Stop 1A ND Pump. __ b) <u>**GO TO**</u> Step 6.c.
__ b. Check 1A ND Pump - ON.	__ b. Start 1A ND Pump.
__ c. Check 1NI-184B (RB Sump To Train B ND & NS) - OPEN.	c. Perform the following: __ 1) Place control permissive in "Bypass" and open 1NI-184B. __ 2) <u>**IF**</u> 1NI-184B is opening, <u>**THEN**</u> <u>**GO TO**</u> Step 6.d. 3) <u>**IF**</u> 1NI-184B is closed, <u>**THEN**</u>: __ a) Stop 1B ND Pump. __ b) <u>**GO TO**</u> Step 6.e.
__ d. Check 1B ND Pump - ON.	__ d. Start 1B ND Pump.
__ e. Enable power disconnect and close 1FW-27A (FWST Supply To ND).	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
6. (Continued)	
__ f. Check any ND pump - ON.	f. **IF** both ND pumps are off, **THEN** perform the following: 1) **IF** both NS pumps are on, **AND** containment pressure is less than 15 PSIG, **THEN** stop one NS pump as follows: __ a) On train to be stopped, reset Containment Spray. __ b) Stop one NS pump. **NOTE** If EP/1/A/5000/FR-Z.1 (Response To High Containment Pressure) is in effect, it may be completed as time allows. __ 2) **IF** any red **OR** orange path procedure in effect, **THEN RETURN TO** that procedure. __ 3) **GO TO** EP/1/A/5000/ECA-1.1 (Loss Of Emergency Coolant Recirc).
7. **Align NV and NI Systems for recirc:**	
__ a. Check NC pressure - LESS THAN 1600 PSIG.	__ a. Stop NI pumps.
b. Close the following: __ • 1NI-115B (A NI Pump Miniflow) __ • 1NI-144B (B NI Pump Miniflow).	
__ c. Enable power disconnect and close 1NI-147A (NI Pumps Miniflow Hdr Isol).	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
7. (Continued)	
d. Close the following valves:	
__ • 1ND-30A (Train A ND To Hot Leg Isol)	
__ • 1ND-15B (Train B ND To Hot Leg Isol).	
e. Align ND train discharges to NI and NV pump suctions:	
__ 1) Check 1NI-334B (NV & NI Pumps Suct X-Over Blk) - OPEN.	__ 1) Open valve.
2) Open the following:	
__ • 1NI-332A (NV & NI Pumps Suction X-Over)	
__ • 1NI-333B (NV & NI Pumps Suction X-over).	
3) Open the following:	
__ • 1ND-58A (Train A ND To NV & NI Pumps)	
__ • 1NI-136B (B NI Pump Suction From ND).	
f. Isolate FWST from NV and NI pumps:	
__ 1) Enable power disconnect and close 1NI-100B (FWST To NI Pumps).	
2) Close the following:	
__ • 1NV-221A (NV Pumps Suct From FWST)	
__ • 1NV-222B (NV Pumps Suct From FWST).	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
8. Check if NS should be aligned for recirc as follows:	
__ a. Check "FWST LEVEL LO-LO" alarm - LIT.	a. Perform the following: **CAUTION** • **Steps 8.b and 8.c to reset Containment Spray and stop NS pumps must be completed within 45 seconds of receiving "FWST Level LO-LO" alarm.** • **This step applies even after leaving this EP.** __ 1) **WHEN** "FWST LEVEL LO-LO" alarm setpoint (33 inches) is reached, **THEN** suspend any steps being performed and complete Steps 8.b through 8.g. __ 2) Ensure this step is flagged and crew prepared to perform it immediately upon receiving alarm. __ 3) **GO TO** Step 9.
__ b. Reset Containment Spray.	
c. Stop both NS pumps: __ • A Train __ • B Train.	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
8. (Continued)	
__ d. Check 1A NS Pump - AVAILABLE TO RUN.	__ d. **GO TO** Step 8.f.
e. Align A Train NS to containment sump as follows:	
__ 1) Check 1NI-185A (RB Sump To Train A ND & NS) - OPEN.	__ 1) **GO TO** Step 8.f.
__ 2) Close 1NS-20A (A NS Pump Suct From FWST).	__ 2) **GO TO** Step 8.f.
__ 3) Wait for 1NS-20A to close.	__ 3) **IF** 1NS-20A remains open or intermediate for over 30 seconds, **THEN GO TO** Step 8.f.
__ 4) Open 1NS-18A (A NS Pump Suct From Cont Sump).	__ 4) **GO TO** Step 8.f.
__ 5) Check "NS SYS CPCS TRAIN A INHIBIT" status light (1SI-12) - DARK.	__ 5) **GO TO** Step 8.f.
__ 6) Start 1A NS Pump.	__ 6) **GO TO** Step 8.f.
__ 7) Open 1RN-134A (A NS Hx Inlet Isol).	__ 7) **GO TO** Step 8.f.
__ 8) Throttle open 1RN-137A (A NS Hx Outlet Isol) to establish 4000 GPM to 1A NS Hx.	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
8. (Continued)	
f. Align B Train NS to containment sump as follows:	
__ 1) Check 1NI-184B (RB Sump To Train B ND & NS) - OPEN.	__ 1) **GO TO** Step 8.g.
__ 2) Close 1NS-3B (B NS Pump Suct From FWST).	__ 2) **GO TO** Step 8.g.
__ 3) Wait for 1NS-3B to close.	__ 3) **IF** 1NS-3B remains open or intermediate for over 30 seconds, **THEN GO TO** Step 8.g.
__ 4) Open 1NS-1B (B NS Pump Suct From Cont Sump).	__ 4) **GO TO** Step 8.g.
__ 5) Check "NS SYS CPCS TRAIN B INHIBIT" status light (1SI-12) - DARK.	__ 5) **GO TO** Step 8.g
__ 6) Start 1B NS Pump.	__ 6) **GO TO** Step 8.g.
__ 7) Open 1RN-235B (B NS HX Inlet Isol).	__ 7) **GO TO** Step 8.g.
__ 8) Throttle open 1RN-238B (B NS Hx Outlet Isol) to establish 3200 GPM to 1B NS Hx.	
__ g. Check both NS pumps - ON.	g. Perform the following:
	__ 1) **IF** any NS pump is isolated from containment sump, **THEN** dispatch operator to pull control power fuses on affected NS pump to prevent it from starting with inadequate suction.
	__ 2) **IF AT ANY TIME** the idle NS pump(s) can be started, **THEN** ensure proper alignment **PER** Step 8.e or 8.f as required.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
9. **Check if ND aux spray is required:**	
__ a. Containment pressure - GREATER THAN 3 PSIG.	__ a. **GO TO** Step 10.
b. Check the following: __ • Time after reactor trip - GREATER THAN 50 MINUTES • At least one of the following - ENERGIZED: __ • 1NI-173A (Train A ND To A & B CL) OR __ • 1NI-178B (Train B ND To C & D CL).	b. Perform the following: 1) Ensure operator has been dispatched to remove tags and close breakers for the following valves: __ • 1EMXA, R2A (1NI-173A (Train A ND To A & B CL)) (aux bldg, 750, FF-54, FF-55) __ • 1EMXB-1, 6B (1NI-178B (Train B ND To C & D CL)) (aux bldg, 733, GG-55, GG-56). __ 2) Designate someone to notify crew when 50 minutes from reactor trip have elapsed. **CAUTION** **This step applies even after leaving this EP.** __ 3) **WHEN** at least one valve energized, **AND** time after reactor trip is greater than 50 minutes, **THEN** perform Step 9. __ 4) **GO TO** Step 10.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
9. (Continued)	
c. Check if core cooling can be maintained with minimum S/I flow: __ • At least one NV pump - ON __ • At least one NI pump - ON • At least one of the following valves - OPEN: __ • 1NI-9A (NC Cold Leg Inj From NV) OR __ • 1NI-10B (NC Cold Leg Inj From NV).	c. Check ND train status: __ 1) **IF** both ND trains are aligned **AND** operating in Cold Leg Recirc, **THEN GO TO** Step 9.d. __ 2) **GO TO** Step 10.
d. Establish ND aux spray from one train that is in Cold Leg Recirc mode: • For A train: __ 1) Close 1NI-173A (Train A ND To A & B CL). __ 2) Open 1NS-43A (A ND To NS Cont Outside Isol). OR • For B train: __ 1) Close 1NI-178B (Train B ND To C & D CL). __ 2) Open 1NS-38B (B ND To NS Cont Outside Isol).	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

9. (Continued)

CAUTION **If an ND pump aligned to aux spray ever stops with its spray valve open, the associated spray line will void. If this were to occur, Enclosure 3 (ND Pump Restart Requirement If Aux Spray Is Open) will prevent a water hammer and potential pipe failure in the Annulus.**

__ e. **WHEN** time allows, **THEN** place INFO tag on ND pump control switch **PER** Enclosure 3 (ND Pump Restart Requirement If Aux Spray Is Open).

CAUTION **Failure to stop ND aux spray when required may result in a negative containment pressure.**

__ f. **WHEN** containment pressure less than 1 PSIG, **THEN** stop ND aux spray **PER** Enclosure 4 (Securing ND Aux Containment Spray).

__ 10. **IF AT ANY TIME a B/O signal occurs, THEN restart S/I equipment previously on.**

Prepared By: Rob Billy

Reviewed By: Charles Sawyer

Approved By: T Conlon

TASK: **Respond to ND System Malfunction While at Mid Loop**

POSITION: **RO**

Operator's Name ____________________

Location: **Simulator** Method: **Perform**

Estimated JPM Completion Time: 15 Minutes

Actual JPM Completion Time: _____ Minutes

The JPM Operator's performance was evaluated against the standards of this JPM and is determined to be:

SATISFACTORY/UNSATISFACTORY (circle one)

Evaluator's Signature ____________________ Date __/__/__

References: AP/1/A/5500/19 (Rev. 11) Loss of ND or ND System Leakage

JPM verified current with references by ____________________

Date __/__/__

Rev. 00/03-10-00

FOR TRAINING PURPOSES ONLY

INITIAL CONDITIONS

Unit 1 is in mode 5 with the NC System drained to approximately 10 inches. 1A ND Pump is in service to all four Cold Legs. ND flow has suddenly increased due to the rupture of an Instrument air line feeding 1ND-29 and 1ND-34. IAE has been dispatched to initiate repairs.

The SRO directs you to perform steps 1 through 8 of AP/1/A/5500/19 (Loss of ND or ND System Leakage).

JPM OVERALL STANDARD: "A" ND Train flow is throttled to less than 3000 gpm using 1NI-173, 1NI-178 and 1ND-33.

NOTES: This JPM is designed to be performed as a **SIMULATION** or as a **WALKTHROUGH.** Cues found in shaded boxes should be given to the trainee for either setting.

KA 005 A4.01 3.6/3.4

INITIAL CONDITIONS

Unit 1 is in mode 5 with the NC System drained to approximately 10 inches. 1A ND Pump is in service to all four Cold Legs. ND flow has suddenly increased due to the rupture of an Instrument air line feeding 1ND-29 and 1ND-34. IAE has been dispatched to initiate repairs.

The SRO directs you to perform steps 1 through 8 of AP/1/A/5500/19 (Loss of ND or ND System Leakage).

SIMULATOR OPERATORS GUIDELINES (ND:183A)

1. Reset to IC-01

2. Insert OVERRIDE/TRANSMITTERS:

   A. XMT-NC008 (LNC_5991 NC SYS N/R LVL) = 10

   B. XMT-NC009 (LNC_8470 NC LOOP A ULTRASONIC LEVEL) = 10

   C. XMT-NC010 (LNC_8460 NC LOOP C ULTRASONIC LEVEL) = 10

   D. XMT-NC007 (LNC_5990 NC SYS W/R LVL) = 10

3. Insert MAL ND005B (ND Heat Exchanger Outlet Or Bypass Valve 1ND29) = 100
   Insert MAL ND005C (ND Heat Exchanger Outlet Or Bypass Valve 1ND34) = 100

4. Freeze Simulator

5. Remove Red Tag stickers from the following:

   1NI-173A
   1NI-183B

temp snap 147

START TIME__________

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
1	**Check if ND pumps should be stopped:**			
	ND pumps – ANY RUNNING.	**Cue:** **Red light lit, meters indicate flow.**		
	NC level -GREATER THAN 4 INCHES	**Cue:** **Meter indicates NCS level at 10 inches.**		
	Check NC subcooling based on core exit T/C's – GREATER THAN 0^0F	**Cue:** **Subcooling indicates 97 degrees F.**		
	Check the following valves – OPEN	Operator checks OAC to verify valve positions. (valves are de-energized in this mode)		
	1ND-1B (C NC Loop To ND Pumps)	**Cue:** **OAC indication is red.**		
	1ND-2AC (C NC Loop to ND pumps)	**Cue:** **OAC indication is red.**		
	IF AT ANY TIME NC level goes below 4 inches **OR** NC subcooling goes below 0^0F, **THEN** stop ND pump(s).			

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
2	**Check ND Flow control:** Check total ND system flow – GREATER THAN 3000 GPM.	**Cue:** **Total flow indicates 4,600 gpm ND flow.**		
	Throttle as necessary to reduce ND System to less than 3000 GPM:	Operator determines from initial conditions of JPM that these valves have failed open <u>OR</u> attempts to use 1ND-29 and 1ND-34 to reduce flow and recognizes they will not respond. Operator proceeds to <u>RNO</u>.		
	1ND-14 (B ND Hx Outlet)	N/A		
	1ND-29 (A ND Hx Outlet)	**Cue:** **Controller adjusted, flow still reads 4,600 GPM.**		
	1ND-34 (A & B ND Hx Bypass)	**Cue:** **Controller adjusted, flow still reads 4,600 GPM.**		

* **DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
3	Perform the following:			
	Throttle as necessary to reduce ND System to less than 3000 GPM:	NOTE: The critical task is to reduce total flow to less than 3000 GPM. Operator may throttle one or both of the valves.		
*	1NI-173A (Train A ND To A & B CL)	**Cue:** **Pushbutton depressed until flow begins to decrease to less than 3000 GPM, pushbutton released.**		
*	1NI-178B (Train B ND To C & D CL)	**Cue:** **Pushbutton depressed until flow begins to decrease to less than 3000 GPM, pushbutton released.**		
	IF ND Pump(s) cavitating, **THEN**:	Operator checks for an oscillation in flow, motor amps and pressure, then determines ND pump is not cavitating. Proceeds to RNO step 2.b.3.		
	• Stop ND pump(s)			
	• GO TO Step 3.			

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
3	**Continued**			
	Place the following manual loaders in the full open position:	Same		
*	1ND-29 (A ND Hx Outlet) 1ND-14 (B ND Hx Outlet)	**Cue:** **Both loaders rotated fully counter clockwise, needles are at 100%.**		
	<u>GO TO</u> Step 2.f	Same		
	Throttle 1ND-34 (A & B ND Hx Bypass) as necessary to control ND Hx bypass flow.	Operator attempts to use 1ND-34 to reduce flow and recognizes it will not respond. Operator proceeds to <u>RNO</u>.		
4	Perform the following: Throttle the following as necessary to control ND Hx bypass flow:	Operator completely closes 1ND-33, then bumps it open to adjust ND Hx Bypass flow, after receiving the following cue:		
	1ND-33 (A ND Hx Bypass)	**Cue:** **The SRO desires you to cooldown the NC system to 105^0 F.**		
		Cue: **Close pushbutton depressed, green light lit, flow is dropping. Open pushbutton depressed, red/green lights lit, flow going up**		

* **DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
4	**Continued** 1ND-18 (B ND Hx Bypass) IF necessary to isolate ND Hx bypass flow **AND** valve(s) above will not close, **THEN** close the following: 1ND-30A (Train A ND To Hot Leg Isol) 1ND-15B (Train B ND To Hot Leg Isol)	N/A N/A		
*	Place the manual loader for 1ND-34 (A & B ND Hx Bypass) in the full open position.	**Cue:** **Loader rotated fully counter clockwise, needle is at 100%.**		
5	**Check if makeup should be initiated as follows:** Check NC temperature – GREATER THAN 200 degrees F.	Operator determines NC temperature is not greater than 200 degs F and proceeds to RNO **Cue:** **NC temperature indicates 115 degs F.**		

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
6	Perform the following: __IF__ NC level going down, __THEN__ initiate makeup as required __PER__ Enclosure 3 (NC System Makeup During Loss of ND). __GO TO__ Step 4.	Same **Cue:** **NC System level is stable at 10 inches.** Same		
7	**__REFER TO__ RP/0/A/5700/000 (Classification of Emergency).**	**Cue:** **The SRO is referring to RP/000.**		
8	**Check NC pressure – LESS THAN 450 PSIG.**	**Cue:** **NC pressure indicates 2 PSIG**		
9	**Check Pzr level – LESS THAN 76%.**	Operator determines Pzr level is below 76% since unit is in midloop operation. **Cue:** **NC System Narrow Range level gage reads 10 inches.**		

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
10	**Isolate letdown and known drain paths as follows:**			
	Stop any NC System draining in progress.	**Cue:** **No draining is in progress.**		
	Close the following NV letdown isolation valves:			
	• 1NV-458A	**Cue:** **Green light illuminated.**		
	• 1NV-457A	**Cue:** **Green light illuminated.**		
	• 1NV-35A	**Cue:** **Green light illuminated.**		
	• 1NV-1A	**Cue:** **Green light illuminated.**		
	• 1NV-2A	**Cue:** **Green light illuminated.**		
	• 1NV-7B	**Cue:** **Red light illuminated, Pushbutton depressed, green light illuminated.**		

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
10	**Continued** Close the following ND letdown valves: • 1NV-121 • 1ND-32 (A ND Hx To Letdown Hx) • 1ND-17 (B ND Hx To Letdown Hx)	Same **Cue:** **Loader indicates 0% open.** **NOTE:** 1ND-32 will take approximately 60 seconds to close. **Cue:** **Red light illuminated, Pushbutton depressed, green light illuminated.** **Cue:** **Green light illuminated.**		
11	Suspend all operations that will: • Raise decay heat load • Reduce NC boron concentration	Give the following cue if necessary. **Cue:** **There are no operations in progress involving increases in decay heat load or reductions in Boron Concentration**		

STOP TIME___________

* DENOTES CRITICAL

(R06-97)

Duke Power Company
PROCEDURE PROCESS RECORD

(1) ID No. AP/1/A/5500/19
Revision No: 11

INFORMATION ONLY

REPARATION

(2) Station McGuire Nuclear Station

(3) Procedure Title Loss Of ND Or ND System Leakage

(4) Prepared By S. Hackney S. Hackney Date September 22, 1999

(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 9-27-99
Cross-Disciplinary Review By ______ (QR) NA ______ Date 9-27-99
Reactivity Mgmt. Review By ______ (QR) NA ______ Date 9-27-99

(7) Additional Reviews
Reviewed By ______ Date ______
Reviewed By ______ Date ______

(8) Temporary Approval (*if necessary*)
By ______ (SRO/QR) Date ______
By ______ (QR) Date ______

(9) Approved By Peter J. Schuerger Date 10.11.99

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 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, 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.*)

A. Purpose

To identify the appropriate actions in the event of a loss of the ND System or a leak on the ND System.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

B <u>Symptoms</u>

"A (B) ND PUMP LO FLOW TO COLD LEGS" Alarm

"A (B) ND PUMP DISCHARGE HI PRESS" Alarm

ND pump tripped

ND pump low discharge pressure OAC alarm

Core exit T/Cs high temperature OAC alarm

"NC SYSTEM LO LEVEL" OAC alarm

ND flow low OAC alarm.

Containment Sump level going up

Refueling Cavity level going down

ND Pump flow going up

NC System level going down

NC System pressure going down.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
C. <u>Operator Actions</u>	
<u>CAUTION</u> **Changes in NC pressure could result in inaccuracies in NC Level indications.**	
1. **Check if ND pumps should be stopped:**	
__ a. ND pumps - ANY RUNNING.	__ a. **<u>GO TO</u>** Step 3.
__ b. NC Level - GREATER THAN 4 INCHES.	b. Perform the following: __ 1) Stop ND pumps. __ 2) **<u>GO TO</u>** Step 3.
__ c. Check NC subcooling based on core exit T/Cs - GREATER THAN 0° F.	c. Perform the following: __ 1) Stop ND pump(s). __ 2) **<u>GO TO</u>** Step 3.
d. Check the following valves - OPEN: __ • 1ND-1B (C NC Loop to ND Pumps) __ • 1ND-2AC (C NC Loop To ND Pumps).	d. Perform the following: __ 1) Stop ND pump(s). __ 2) **<u>GO TO</u>** Step 3.
__ e. **<u>IF AT ANY TIME</u>** NC level goes below 4 inches **<u>OR</u>** NC subcooling based on core exit T/Cs goes below 0° F, **<u>THEN</u>** stop ND pump(s).	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
NOTE ND flow control valves fail open on a loss of air.	
2. **Check ND flow control:**	
__ a. Check total ND System flow - GREATER THAN 3000 GPM.	__ a. **GO TO** Step 2.c.
b. Throttle as necessary to reduce ND System to less than 3000 GPM: __ • 1ND-14 (B ND Hx Outlet) __ • 1ND-29 (A ND Hx Outlet) __ • 1ND-34 (A & B ND Hx Bypass).	b. Perform the following: 1) Throttle as necessary to reduce ND System to less than 3000 GPM: __ • 1NI-173A (Train A ND To A & B CL) __ • 1NI-178B (Train B ND To C & D CL). 2) **IF** ND pump(s) cavitating, **THEN**: __ a) Stop ND pump(s) __ b) **GO TO** Step 3. 3) Place the following manual loaders in the full open position: __ • 1ND-29 (A ND Hx Outlet) __ • 1ND-14 (B ND Hx Outlet). __ 4) **GO TO** Step 2.f.
__ c. Check ND pump(s) - CAVITATING.	__ c. **GO TO** Step 3.
__ d. Stop ND pump(s).	
__ e. **GO TO** Step 3.	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
2. (Continued)	
__ f. Throttle 1ND-34 (A & B ND Hx Bypass) as necessary to control ND Hx bypass flow.	f. Perform the following: **NOTE** 1ND-33 (A ND Hx Bypass) and 1ND-18 (B ND Hx Bypass) can be throttled in open direction only (seals in on closed direction). 1) Throttle the following as necessary to control ND Hx bypass flow: __ • 1ND-33 (A ND Hx Bypass) __ • 1ND-18 (B ND Hx Bypass). 2) <u>IF</u> necessary to isolate ND Hx bypass flow **<u>AND</u>** valve(s) above will not close, **<u>THEN</u>** close the following: __ • 1ND-30A (Train A ND To Hot Leg Isol) __ • 1ND-15B (Train B ND To Hot Leg Isol). __ 3) Place the manual loader for 1ND-34 (A & B ND Hx Bypass) in the full open position.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
3. **Check if makeup should be initiated as follows:**	
__ a. Check NC temperature - GREATER THAN 200° F.	a. Perform the following: __ 1) <u>IF</u> NC level going down, <u>THEN</u> initiate makup as required <u>PER</u> Enclosure 3 (NC System Makeup During Loss of ND). __ 2) <u>GO TO</u> Step 4.
__ b. Maintain charging flow less than 175 GPM at all times in subsequent steps.	
__ c. Increase charging flow as necessary to stabilize Pzr level.	
d. Check Pzr level as follows: __ • Pzr level - GREATER THAN 11% (29% ACC). __ • Pzr level - STABLE OR GOING UP.	__ d. <u>GO TO</u> Step 3.g.
__ e. Check NC subcooling based on core exit T/Cs - GREATER THAN 0° F.	__ e. <u>GO TO</u> Step 3.g.
__ f. <u>GO TO</u> Step 4.	
g. Initiate makeup as follows: __ 1) Initiate makeup through 1NI-9A or 1NI-10B <u>PER</u> Enclosure 5 (Makeup Via NV Pumps Through S/I Flow Path). __ 2) <u>IF</u> subcooling or Pzr level cannot be restored, <u>THEN</u> start one NI pump aligned to cold legs <u>PER</u> Enclosure 6 (Makeup Via NI Pumps).	
__ 4. **<u>REFER TO</u> RP/0/A/5700/000 (Classification of Emergency).**	
__ 5. **Check NC pressure - LESS THAN 450 PSIG.**	__ **Reduce NC pressure to less than 385 PSIG.**

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ 6. **Check Pzr level - LESS THAN 76%.**	**Perform the following:** __ a. <u>**IF**</u> level has gone down in an uncontrolled manner, <u>**OR**</u> NC subcooling based on core exit T/Cs less than 0° F, <u>**THEN**</u> <u>**GO**</u> <u>**TO**</u> Step 7. __ b. <u>**IF**</u> level stable or going up, <u>**THEN**</u> <u>**GO**</u> <u>**TO**</u> Step 8.

7. **Isolate letdown and known drain paths as follows:**

__ a. Stop any NC System draining in progress.

b. Close the following NV letdown isolation valves:

__ 1) 1NV-458A (75 GPM L/D Orifice Outlet Cont Isol).

__ 2) 1NV-457A (45 GPM L/D Orifice Outlet Cont Isol).

__ 3) 1NV-35A (Variable L/D Orifice Outlet Cont Isol).

__ 4) 1NV-1A (NC L/D Isol To Regen Hx).

__ 5) 1NV-2A (NC L/D Isol To Regen Hx).

__ 6) 1NV-7B (Letdown Cont Outside Isol).

c. Close the following ND letdown valves:

__ 1) 1NV-121 (ND Letdown Control).

__ 2) 1ND-32 (A ND Hx To Letdown Hx).

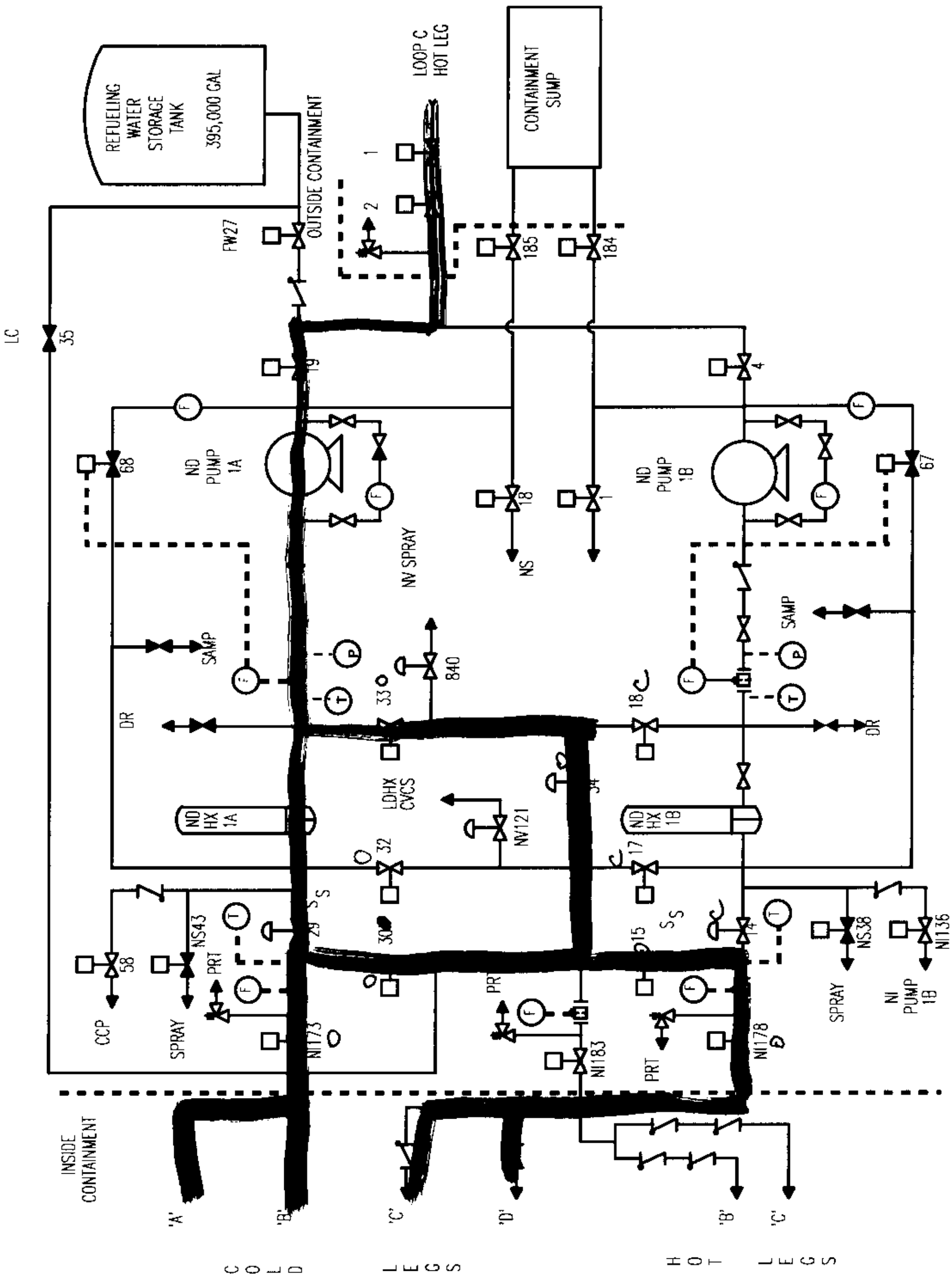
__ 3) 1ND-17 (B ND Hx To Letdown Hx).

8. **Suspend all operations that will:**

__ • Raise decay heat load

__ • Reduce NC boron concentration.

7.1, ND System Composite (09/21/98)



Prepared By: Rob Billings

Reviewed By: Charles Sawyer

Approved By: Thomas C. Cole

TASK: **Depressurize the Reactor Coolant System during Natural Circulation**

POSITION: **RO**

Operator's Name______________________________

Location: **Simulator** Method: **Perform**

Estimated JPM Completion Time: 25 Minutes

Actual JPM Completion Time: ____ Minutes

The JPM Operator's performance was evaluated against the standards of this JPM and is determined to be:

SATISFACTORY/UNSATISFACTORY (circle one)

Evaluator's Signature__________________________ Date __/__/__

References: EP/1/A/5000/ES-0.2 (Rev.05) Natural Circulation Cooldown
EP/1/A/5000/G-1 (Rev.11) Establishing NV Aux Spray

JPM verified current with references by ______________________________

Date __/__/__

Rev. 15/03-13-00

INITIAL CONDITIONS

Plant cooldown is in progress per EP/1/A/5000/ES-0.2 (Natural Circulation Cooldown). NC Pressure is 2100 psig, NC Hotleg Temp is 545^0 F. The NC Pumps are NOT available to start.

The SRO instructs you to depressurize the NC System to 1905 psig per Steps 13, 14, and 15 of EP/1/A/5000/ES-0.2.

JPM OVERALL STANDARD:	NC System is depressurized to approximately 1905 psig using NV Spray. A self induced Safety Injection does not occur while depressurizing. Heaters and sprays are adjusted to maintain pressure at approximately 1905 psig. Regenerative Hx temperature is maintained less than 380^0 F. Pzr spray water delta T maintained less than 320^{0}F. Low Pressure Steamline Isolation and Pzr Low Pressure S/I signals are blocked.
Notes:	This JPM is designed to be performed as a **SIMULATION** or as a **WALKTHROUGH.** Cues found in shaded boxes should be given to the trainee for either setting. The Simulator runner will need to control NC system cooldown while examinee performs this JPM.

KA E09 EA1.1 3.5/3.5

START TIME__________

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
1	**Depressurize NC System to 1905 PSIG as follows:** Check letdown - IN SERVICE Depressurize to 1905 PSIG using NV Aux spray <u>PER</u> EP/1/A5000/G-1 (Generic Enclosures), Enclosure 3 (Establishing NV Aux. Spray).	Operator verifies that there is a letdown flowpath and there is letdown flow via the letdown flowmeter. **Cue:** **Gage indication reads 75 gpm** Operator transitions to EP/1/A5000/G-1 (Generic Enclosures), Enclosure 3 (Establishing NV Aux. Spray).		
2	From EP/1/A5000/G-1 (Generic Enclosures), Enclosure 3 (Establishing NV Aux. Spray). **<u>IF</u> SI has occurred, <u>THEN</u> observe Caution and Note prior to Step and <u>GO TO</u> Step 3.**	Operator determines no SI has occurred by checking status lights then proceeds to step 2.		
3	**<u>REFER TO</u> OP/1/A/6200/001A (Chemical and Volume Control System Letdown), Enclosure 4.7 (Operator Actions With NV Aux Spray or Excess Letdown in Service)**	**Cue:** **Another operator will refer to the NV enclosure.**		

* DENOTES CRITICAL

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
4	**Control charging and letdown flow in subsequent steps as required to:**	Operator compares Pzr Gas space temp with charging line temp and ensures their Delta-T is less than 320⁰F. Operator also monitors/adjusts charging flow as needed to ensure Regenerative Hx temperature stays less than 380⁰F.		
*	Maintain Pzr spray water delta T - less than 320⁰F	**Cue:** **Pzr Gas/Liquid space temp is 652⁰F and charging line temp is 470⁰F**		
*	Maintain Regenerative HX letdown temperature less than 380⁰F	**Cue:** **Regenerative Hx letdown temperature gage indicates 280⁰F.**		
5	**<u>IF AT ANY TIME</u> normal letdown is lost, <u>THEN</u> immediately isolate NV Aux spray.**	Operator acknowledges step, then continues. Operator may also flag it as a continuous action (this is usually done by the SRO reading the procedure). **Cue:** **Letdown flow indicates 75 gpm.**		

* DENOTES CRITICAL

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
6	**Close normal Pzr spray valves and leave closed while NV aux spray is used:**	Operator places both controllers to manual and closes the valves. Either valve can be closed first.		
*	1NC-27 (A Loop PZR Spray Control)	**Cue:** **"MAN" Pushbutton depressed, "CLOSE" pushbutton depressed, output signal reads zero, green light – LIT**		
*	1NC-29 (B Loop PZR Spray Control)	**Cue:** **"MAN" Pushbutton depressed, "CLOSE" pushbutton depressed, output signal reads zero, green light – LIT**		
7	**<u>IF AT ANY TIME</u> NV aux spray must be stopped <u>OR</u> reduced, <u>THEN</u> perform the following:**	Operator acknowledges step, then continues. Operator may also flag it as a continuous action (this is usually done by the SRO reading the procedure). No cue is required at this time.		
	<u>IF</u> 1NV-13B (NV Supply to A NC Loop Isol) **<u>AND</u>** 1NV-16A (NV Supply to B NC Loop Isol) are closed, **<u>THEN</u>** open 1NV-13B (NV Supply to A NC Loop Isol)	N/A		

* **DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
7	**Continued** <u>IF</u> completely stopping NV aux spray is desired, <u>**THEN**</u> close 1NV-21A (NV Spray To PZR)	N/A		
*8	**Open 1NV-21A (NV Spray to Pzr Isol)**	Same **Cue:** **Pushbutton depressed red light illuminated**		
9	**<u>IF</u> required to raise NV aux spray flow, <u>THEN</u> close the following:**	Operator may ask for the SRO's guidance on this step. Give the following cue if needed: **Cue:** **The SRO desires increased Aux spray flow.**		
*	1NV-13B (NV Supply to A NC Loop Isol)	**Cue:** **Pushbutton depressed, green light illuminated**		
	1NV-16A (NV Supply to D NC Loop Isol)	**Cue:** **Green light illuminated**		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
10	**IF procedure in effect has restored PZR heaters, THEN manually operate Pzr heaters as desired to adjust rate of NC System depressurization**	Operator determines Pzr heaters are in their normal configuration. Operator secures some or all heaters. **Cue:** **Switches rotated clockwise to "MAN", Pushbuttons depressed, green lights illuminated.**		
11	**IF maximum depressurization rate is desired, THEN perform the following…..**	Operator receives the following cue, then proceeds to step # 11. The operator will basically maintain the current configuration until NC system pressure is 1900 PSIG. At that time, they will perform step # 6 of Enclosure 3 and then return to ES-0.2, step #14.		
		Cue: **Maximum depressurization rate is not desired. The SRO wants you to depressurize as quickly as possible without going to "maximum rate".**		
		Note to evaluator: If a self-induced S/I occurs here due to Low Pzr Pressure, the JPM is failed.		

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
12	**<u>RETURN</u> <u>TO</u> STEP 1.**	Same		
13	**<u>IF</u> SI has occurred, <u>THEN</u> observe Caution and Note prior to Step and <u>GO TO</u> Step 3.**	Operator determines no SI has occurred by checking status lights then proceeds to step 2.		
14	**<u>REFER TO</u> OP/1/A/6200/001A (Chemical and Volume Control System Letdown), Enclosure 4.7 (Operator Actions With NV Aux Spray or Excess Letdown in Service)**	**Cue:** **Another operator will refer to the NV enclosure.**		
15	**Control charging and letdown flow in subsequent steps as required to:**	Operator compares Pzr Gas space temp with charging line temp and ensures their Delta-T is less than 320^{0}F. Operator also monitors/adjusts charging flow as needed to ensure Regenerative Hx temperature stays less than 380^{0}F.		
*	Maintain Pzr spray water delta T - less than 320^{0}F	**Cue:** **Pzr Gas/Liquid space temp is 652^{0}F and charging line temp is 470^{0}F**		
*	Maintain Regenerative HX letdown temperature less than 380^{0}F	**Cue:** **Regenerative Hx letdown temperature gage indicates 280^{0}F.**		

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
16	**<u>IF AT ANY TIME</u> normal letdown is lost, <u>THEN</u> immediately isolate NV Aux spray.**	Operator acknowledges step, then continues. Operator may also flag it as a continuous action (this is usually done by the SRO reading the procedure). **Cue:** **Letdown flow indicates 75 gpm.**		
17	**Close normal Pzr spray valves and leave closed while NV aux spray is used:** 1NC-27 (A Loop PZR Spray Control) 1NC-29 (B Loop PZR Spray Control)	Operator determines this step has already been completed. **Cue:** **Output signal reads zero, green light – LIT** **Cue:** **Output signal reads zero, green light – LIT**		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
18	**<u>IF AT ANY TIME</u> NV aux spray must be stopped <u>OR</u> reduced, <u>THEN</u> perform the following:**	Operator determines NV aux spray needs to be reduced or stopped, makes appropriate alignments, and returns to ES-0.2 step 14. **<u>Note to evaluator:</u>** It is acceptable for the operator to perform step # 14 of ES-0.2 concurrently with this procedure.		
*	<u>IF</u> 1NV-13B (NV Supply to A NC Loop Isol) **<u>AND</u>** 1NV-16A (NV Supply to B NC Loop Isol) are closed, **<u>THEN</u>** open 1NV-13B (NV Supply to A NC Loop Isol)	**Cue:** **Green lights are illuminated on both valves,** **Pushbutton depressed, red light illuminated on NV-13B.** **<u>Note to evaluator:</u>** It is acceptable to leave 1NV-21A open or to close it per this step. Cue accordingly:		
	<u>IF</u> completely stopping NV aux spray is desired, **<u>THEN</u>** close 1NV-21A (NV Spray To PZR)	**Cue:** **Pushbutton depressed, green light illuminated.** **<u>OR</u>** **Red light illuminated.**		

* DENOTES CRITICAL

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
19	EP/1/A/5000/ES-0.2, returning to step 14: **Block S/I actuation circuits as follows:**			
	Check "P-11 PRESSURIZER S/I BLOCK PERMISSIVE" (1SI-18) status light – LIT.	Same **Cue:** **Light is illuminated**		
*	Depress "BLOCK" on Pzr S/I block switches.	Same **Cue:** **Both pushbuttons depressed and lights are illuminated**		
*	Depress "BLOCK" on Low Pressure Steamline Isolation block switches.	Same **Cue:** **Both pushbuttons depressed and lights are illuminated**		

* **DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
20	**Maintain following plant conditions:** • NC pressure - AT 1905 PSIG • Pzr level - AT 25% • Cooldown rate based on NC T-Colds - LESS THAN 50^0 F IN AN HOUR • NC temperature and pressure - WITHIN LIMITS OF DATA BOOK CURVE 1.6	**Cue:** **Another operator will complete step 15 and continue in this procedure.**		

STOP TIME__________

* **DENOTES CRITICAL**

INITIAL CONDITIONS

Plant cooldown is in progress per EP/1/A/5000/ES-0.2 (Natural Circulation Cooldown). NC Pressure is 2100 psig, NC Hotleg Temp is 545^0 F. The NC Pumps are NOT available to start.

The SRO instructs you to depressurize the NC System to 1905 psig per Steps 13, 14, and 15 of EP/1/A/5000/ES-0.2.

SIMULATOR OPERATIONAL GUIDELINES (NC-26)

1. Reset the Simulator to IC-49, 100% Power EOL
2. Trip open all four NC Pump Safety and 6900 Volt Breakers

NOTE: Place the Steam Dumps into Pressure Mode quickly after trip or the dumps will remain open causing a Steamline depressurization and subsequent MSI.

3. Implement EP/1/A/5000/ES-0.1 (Reactor Trip) through step 39.
4. Implement EP/1/A/5000/ES-0.2 (Natural Circulation Cooldown) and complete steps 1 through 12.
5. Cooldown NC Tavg to approximately 545^0 F and depressurize NCS to 2100 PSIG.
6. Get pressurizer level as close to 25% as possible.
7. Ensure spray valves are in auto, NV-21 closed and NV-13 opened.
8. Open 1CF-126, 1CF-127, 1CF-128 and 1CF-129.
9. If MSI occurs, have the simulator runner reestablish the flowpath to condenser by performing ES-0.2, step 11.C RNO while the examinee performs the depressurization.
10. Fully Open 1HM-95.
11. Allow plant to stabilize.
12. Freeze Simulator
13. Insert ANN-AD11-B05 XFMR 1A Trouble - ON
    Insert ANN-AD11-E05 XFMR 1B Trouble - ON

TEMP SNAP # 125

(R06-97)

Duke Power Company
PROCEDURE PROCESS RECORD

(1) ID No. EP/1/A/5000/ES-0.2
Revision No. 5

INFORMATION ONLY

PREPARATION

(2) Station McGuire Nuclear Station

(3) Procedure Title Natural Circulation Cooldown

(4) Prepared By Mike Weiner Mike Weiner Date November 22, 1999

(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 S. Hackney (QR) Date 2/1/00

Cross-Disciplinary Review By (QR) NA JSH Date 2/1/00

Reactivity Mgmt. Review By (QR) NA JSH Date 2/1/00

(7) Additional Reviews

Reviewed By ______ Date ______

Reviewed By ______ Date ______

(8) Temporary Approval (*if necessary*)

By ______ (SRO/QR) Date ______

By ______ (QR) Date ______

(9) Approved By Peter J Schuerger Date 2-9-00

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 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, 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.*)

A. Purpose

This procedure provides actions to perform a Natural Circulation NC System cooldown and depressurization to Cold Shutdown, with no accident in progress, under requirements that will preclude any upper head void formation.

B. Symptoms or Entry Conditions

This procedure is entered from:

- EP/1/A/5000/ES-0.1 (Reactor Trip Response), Step 39, when it has been determined that a Natural Circulation cooldown is required.
- EP/1/A/5000/ES-1.1 (Safety Injection Termination), Step 33, after the plant conditions have been stabilized and no NC pumps can be started.
- EP/1/A/5000/ECA-0.1 (Loss Of All AC Power Recovery Without S/I Required), Step 28, after the plant conditions have been stabilized following the restoration of AC emergency power.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
C. Operator Actions	
__ 1. **Monitor foldout page.**	
NOTE . Preference should be given to running 1B NC Pump first, then 1A NC Pump to provide Pzr spray capability.	
2. **Try to restart an NC pump:**	
a. Check if NC pump seal cooling has been maintained: __ • 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 **PER** OP/1/A/6150/002A (Reactor Coolant Pump Operation), Enclosure 4.1 (Startup and Operation).	__ b. **GO TO** Step 3.
__ c. Start one NC pump **PER** OP/1/A/6150/002A (Reactor Coolant Pump Operation), Enclosure 4.1 (Startup and Operation).	__ c. **GO TO** Step 3.
__ d. Ensure applicable steps of OP/1/A/6100/003 (Controlling Procedure For Unit Operation), Enclosure 4.2 (Power Reduction) have been completed.	
__ e. **GO TO** OP/1/A/6100/002 (Controlling Procedure for Unit Shutdown).	
3. **Check reactor vessel head cooling:**	
__ a. Cooling water to VL AHUs - AVAILABLE.	__ a. Establish cooling flow to containment.
__ b. VL AHUs - ON.	__ b. Start fans.
__ c. All CRDM fans - ON.	__ c. Start all fans.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

__ 4. **Ensure applicable steps of OP/1/A/6100/003 (Controlling Procedure For Unit Operation), Enclosure 4.2 (Power Reduction) have been completed.**

__ 5. **Notify IAE to perform PT/1/A/4150/014 (Pzr PORV LTOP Protection Analog Channel Operational Test (1NC34A, 1NC32B)).**

6. **<u>WHEN</u> access to containment is possible, <u>THEN</u> dispatch operator to:**

   __ • Close 1NC-24 (Reactor Vessel Head Gasket Leakoff Drain Manual Block) (Unit 1 reactor bldg, 725+13, 194 degrees, C hot leg at primary shield wall).

   __ • Perform inspection of piping between 1ND-1B (C NC Loop to ND Pumps) and 1ND-2AC (C NC Loop To ND Pumps) <u>PER</u> OP/1/A/6100/SD-1 (Prepare for Cooldown).

7. **Borate NC System to cold shutdown boron concentration:**

   __ a. Perform shutdown margin calculation for Cold Shutdown <u>PER</u> OP/0/A/6100/006 (Reactivity Balance Calculation),Enclosure 4.5 (Shutdown Margin - Unit Shutdown Modes 5, 4, or 3 Without Xenon Credit).

   __ b. Borate NC System to required value plus an additional 150 PPM <u>PER</u> AP/1/A/5500/38 (Emergency Boration).

   __ c. Set VCT controls to makeup at required cold shutdown boron concentration plus 150 PPM.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
8. **Check NC cold shutdown boron concentration by sampling:**	
a. Obtain current boron concentration from Primary Chemistry at the following locations:	
__ • NC loops	
__ • IF normal letdown in service, THEN sample letdown.	
__ b. Do not continue until sample(s) obtained.	
__ c. Check NC boron concentration (from sample(s) in Step 8.a.) - GREATER THAN OR EQUAL TO THE REQUIRED COLD SHUTDOWN BORON CONCENTRATION PLUS 150 PPM.	__ c. **RETURN TO** Step 7.
d. Notify Primary Chemistry to periodically (approximately every 1-2 hours) sample all available sample points for boron, and notify station management of results:	
__ • NC loops	
__ • IF normal letdown in service, THEN sample letdown.	
__ • Pzr liquid	
__ • WHEN ND is in service, THEN sample ND train in service.	
9. **Check VCT makeup control system:**	
__ a. Ensure VCT controls are set to makeup at required cold shutdown boron concentration plus 150 PPM.	
__ b. Ensure makeup controller in "AUTO".	
__ c. Place makeup switch to "START".	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
10. **Block Feedwater Isolation as follows:**	
__ a. Check all CA pumps - OFF.	a. Perform the following: __ 1) <u>IF</u> CM or CF system is being used to feed S/Gs, <u>**THEN**</u> <u>**GO**</u> <u>**TO**</u> Step 10.b. __ 2) Ensure Feedwater Isolation <u>**PER**</u> Enclosure 2 (Feedwater Isolation Valves). __ 3) Observe Caution prior to Step 11 and <u>**GO**</u> <u>**TO**</u> Step 11.
__ b. Depress Feedwater Isolation resets to block Feedwater Isolation.	

CAUTION **Main Steam Isolation will occur if S/G pressure goes below 775 PSIG before Low Pressure Steamline Isolation signal is blocked.**

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
11. **Initiate NC System cooldown to Cold Shutdown as follows:**	
__ a. Record NC System cooldown parameters every 15 minutes <u>**PER**</u> Enclosure 3 (NC System Cooldown Monitoring).	
__ b. Check "C-9 COND AVAILABLE FOR STEAM DUMP" status light (1SI-18) - LIT.	b. Perform the following: __ 1) Dump steam using S/G PORVs while maintaining cooldown rate in NC T-Colds less than 50° F in an hour. __ 2) <u>**GO**</u> <u>**TO**</u> Step 11.g.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

11. (Continued)

__ c. Check MSIVs - OPEN.

c. Perform the following:

1) Reset the following Main Steam Isolation signals:

__ a) Main Steam Isolation.

__ b) S/G PORVs.

__ c) MSIV Bypass Valves.

__ 2) **IF** intact S/G MSIVs required closed to isolate leak, **THEN GO TO** RNO for Step 11.f.

__ 3) Place "STEAM DUMP SELECT" in steam pressure mode.

__ 4) Place "STM PRESS CONTROLLER" in manual and close.

__ 5) Open MSIV bypass valves to equalize pressure across MSIVs.

6) **WHEN** pressure equalized, **THEN**:

__ a) Open all MSIVs.

__ b) Close all MSIV bypass valves.

__ c) Perform Steps 11.e and 11.f.

__ 7) **GO TO** Step 11.g.

__ d. Check "STEAM DUMP SELECT" - IN STEAM PRESSURE MODE.

d. Perform the following to place steam dumps in steam pressure mode:

__ 1) Place "STM PRESS CONTROLLER" in manual.

__ 2) Adjust "STM PRESS CONTROLLER" output to equal "STEAM DUMP DEMAND" signal.

__ 3) Place "STEAM DUMP SELECT" in steam pressure mode.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
11. (Continued)	
__ e. **WHEN** "P-12 LO-LO TAVG" status light (1SI-18) lit, **THEN** place steam dumps in bypass interlock.	
__ f. Dump steam to condenser while maintaining cooldown rate in NC T-Colds less than 50° F in an hour.	__ f. Dump steam using S/G PORVs while maintaining cooldown rate in NC T-Colds less than 50° F in an hour.
__ g. Maintain all S/G N/R levels - AT 39%.	
__ h. Monitor CA suction sources on Foldout page.	
__ i. Maintain NC temperature and pressure within limits of Data Book curve 1.6.	
__ 12. **Check NC T-Hots - LESS THAN 550° F.**	**Perform the following:** **NOTE** Maintaining S/G pressures greater than 800 PSIG will prevent inadvertent Main Steam Isolation. __ a. Monitor S/G pressures. __ b. **IF** any S/G pressure goes below 850 PSIG, **THEN** control pressure between 800 PSIG and 850 PSIG as NC T-Hots go below 550° F. __ c. Observe Caution prior to Step 11 and **RETURN TO** Step 11.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
13. **Depressurize NC System to 1905 PSIG as follows:**	
__ a. Check letdown - IN SERVICE.	a. Perform the following: __ 1) Establish letdown **PER** EP/1/A/5000/G-1 (Generic Enclosures), Enclosure 1 (Establishing Normal Letdown). 2) **IF** normal letdown can not be established, **THEN**: __ a) Depressurize to 1905 PSIG with one Pzr PORV. __ b) Observe Caution and Note prior to Step 14 and **GO TO** Step 14.
__ b. Depressurize to 1905 PSIG using NV aux spray **PER** EP/1/A/5000/G-1 (Generic Enclosures), Enclosure 3 (Establishing NV Aux Spray).	

CAUTION **If Pzr pressure goes above 1955 PSIG, then Pzr S/I actuation circuit and Low Pressure Steamline Isolation circuit will automatically unblock.**

NOTE After the Low Pressure Steamline Isolation signal is blocked, maintaining steam pressure negative rate less than 2 PSIG per second will prevent a Main Steam Isolation.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
14. **Block S/I actuation circuits as follows:**	
__ a. Check "P-11 PRESSURIZER S/I BLOCK PERMISSIVE" (1SI-18) status light - LIT.	__ a. **RETURN TO** Step 13.
__ b. Depress "BLOCK" on Pzr S/I block switches.	
__ c. Depress "BLOCK" on Low Pressure Steamline Isolation block switches.	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

15. **Maintain following plant conditions:**

   __ • NC pressure - AT 1905 PSIG

   __ • Pzr level - AT 25%

   __ • Cooldown rate based on NC T-Colds - LESS THAN 50 °F IN AN HOUR

   __ • NC temperature and pressure - WITHIN LIMITS OF DATA BOOK CURVE 1.6.

16. **Monitor NC cooldown:**

   __ • Core exit T/Cs - GOING DOWN

   __ • NC T-Hots - GOING DOWN

   __ • NC subcooling based on core exit T/Cs - GOING UP.

__ 17. **IF AT ANY TIME cooldown rate must be raised to greater than 50° F in an hour, THEN GO TO EP/1/A/5000/ES-0.3 (Natural Circulation Cooldown With Steam Void In Vessel).**

__ 1. **IF S/I has occured, THEN observe Caution and Note prior to Step 3 and GO TO Step 3.**

__ 2. **REFER TO OP/1/A/6200/001A (Chemical and Volume Control System Letdown), Enclosure 4.7 (Operator Actions with NV Aux Spray or Excess Letdown in Service).**

CAUTION **Raising charging flow will raise NV aux spray water delta T and raise spray flowrate.**

NOTE Pzr spray water delta T can be determined by subtracting "REGEN HX CHARGING TEMP" from "PZR VAPOR SPACE TEMP".

3. **Control charging and letdown flow in subsequent steps as required to:**

   __ • Maintain Pzr spray water delta T less than 320° F.

   __ • Maintain Regenerative HX letdown temperature less than 380° F.

__ 4. **IF AT ANY TIME normal letdown is lost, THEN immediately isolate NV aux spray.**

5. **Close normal Pzr spray valves and leave closed while NV aux spray is used:**

   __ • 1NC-27 (A Loop PZR Spray Control)

   __ • 1NC-29 (B Loop PZR Spray Control).

CAUTION **If excessive depressurization occurs, the following step may need to be performed immediately.**

6. **IF AT ANY TIME NV aux spray must be stopped OR reduced, THEN perform the following:**

   __ a. IF 1NV-13B (NV Supply To A NC Loop Isol) AND 1NV-16A (NV Supply To D NC Loop Isol) are closed, THEN open 1NV-13B (NV Supply To A NC Loop Isol).

   __ b. IF completely stopping NV aux spray is desired, THEN close 1NV-21A (NV Spray To PZR Isol).

__ 7. **Open 1NV-21A (NV Spray To PZR Isol).**

CAUTION **The number of times the following valves are cycled should be kept to minimum, to limit the number of thermal transients on charging nozzle.**

8. **IF required to raise NV aux spray flow, THEN close the following:**

__ • 1NV-13B (NV Supply To A NC Loop Isol)

__ • 1NV-16A (NV Supply To D NC Loop Isol).

__ 9. **IF procedure in effect has restored Pzr heaters, THEN manually operate Pzr heaters as desired to adjust rate of NC System depressurization.**

10. **IF maximum depressurization rate is desired, THEN perform the following:**

__ • Ensure Step 8 has been completed.

__ • Turn off Pzr heaters as required.

__ • Raise charging flow up to 175 GPM while maintaining Pzr spray water delta T less than 320° F.

• WHEN maximum depressurization is no longer required, THEN:

  __ • IF procedure in effect has restored Pzr heaters THEN manually operate Pzr heaters as desired to control NC pressure.

  __ • Reduce charging flow to normal while maintaining Regenative HX letdown temperature less than 380° F.

  __ • IF NV aux spray is no longer required, THEN observe Caution prior to Step 6 and RETURN TO Step 6.

__ 11. **RETURN TO Step 1.**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
10	**IF procedure in effect has restored PZR heaters, THEN manually operate Pzr heaters as desired to adjust rate of NC System depressurization**	Operator determines Pzr heaters are in their normal configuration. Operator secures some or all heaters. **Cue:** **Switches rotated clockwise to "MAN", Pushbuttons depressed, green lights illuminated.**		
11	**IF maximum depressurization rate is desired, THEN perform the following…..** Revised per NRC 4/27/00 comments of 5/2/00 RAB Cue: Maximum depressurization rate is not desired. The SRO wants you to depressurize as quickly as possible without going to "maximum rate".	Operator receives the following cue, then proceeds to step # 11. The operator will basically maintain the current configuration until NC system pressure is 1900 PSIG. At that time, they will perform step # 6 of Enclosure 3 and then return to ES-0.2, step #14. ~~**Cue:**~~ ~~**The SRO does NOT desire for you to depressurize at "maximum rate".**~~ **Note to evaluator:** If a self-induced S/I occurs here due to Low Pzr Pressure, the JPM is failed.		

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
10	**<u>IF</u> procedure in effect has restored PZR heaters, <u>THEN</u> manually operate Pzr heaters as desired to adjust rate of NC System depressurization**	Operator determines Pzr heaters are in their normal configuration. Operator secures some or all heaters. **Cue:** **Switches rotated clockwise to "MAN", Pushbuttons depressed, green lights illuminated.**		
11	**<u>IF</u> maximum depressurization rate is desired, <u>THEN</u> perform the following.....**	Operator receives the following cue, then proceeds to step # 11. The operator will basically maintain the current configuration until NC system pressure is 1900 PSIG. At that time, they will perform step # 6 of Enclosure 3 and then return to ES-0.2, step #14. **Cue:** **Maximum depressurization rate is <u>not desired</u>. The SRO wants you to depressurize as quickly as possible <u>without</u> going to "maximum rate".** <u>**Note to evaluator:**</u> If a self-induced S/I occurs here due to Low Pzr Pressure, the JPM is failed.		

* DENOTES CRITICAL

Prepared By: Rob Billings

Reviewed By: Tom Arlow

Approved By: Charles Sawyer

TASK: **Respond to a Source Range Nuclear Instrumentation Failure**

POSITION: **RO**

Operator's Name ______________________

Location: **Simulator** Method: **Perform**

Estimated JPM Completion Time: 10 Minutes

Actual JPM Completion Time: ____ Minutes

The JPM Operator's performance was evaluated against the standards of this JPM and is determined to be:

SATISFACTORY/UNSATISFACTORY (circle one)

Evaluator's Signature______________________ Date __/__/__

References: AP/1/A/5500/16 (Rev. 07) Malfunction of Nuclear Instrumentation

JPM verified current with references by ______________________

Date __/__/__

Rev. 00/01-28-00

INITIAL CONDITIONS

Unit 1 is in the process of performing a Unit Start-Up. Control Bank "A" has been pulled to 50 steps withdrawn. Mode 2 has just been declared. Source Range count rate is approximately 150 CPS. The RO observes that SR channel N-31 has failed low. AP/1/A/5500/16 Case I (Source Range Malfunctions) is implemented.

The SRO directs you to remove the failed SR channel (N-31) from service by performing AP/1/A/5500/16 (Malfunction of Nuclear Instrumentation), Case I (Source Range Malfunctions).

JPM OVERALL STANDARD: All Source Range Selector switches are placed to channel 32 and the SR trip and High Flux at Shutdown signals from channel 31 are blocked. When the only other channel of SR Nuclear Instrumentation fails, the Operator recognizes all indications of Reactor power are gone and then manually trips the Reactor.

NOTES: This JPM is designed to be performed as a **SIMULATION** or as a **WALKTHROUGH.** Cues found in shaded boxes should be given to the trainee for either setting.

KA 015 A2.01 3.5/3.9

START TIME__________

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
1	**Check at least one of the following S/R Channels - OPERABLE** **N-31** **<u>OR</u>** **N-32**	Operator determines that SR Channel N32 is OPERABLE **Cue:** **Channel N-32 is OPERABLE**		
2	**Announce occurrence on paging system.**	Same		
3	**Check unit status - IN MODE 6.**	Operator determines from initial conditions that the plant is in Mode 2 and proceeds to the RNO		
4	**<u>GO</u> <u>TO</u> Step 6.**	Same		
5	**Check S/R detector(s) - HIGH VOLTAGE INADVERTANTLY APPLIED AT POWER (ABOVE P-10).**	Operator determines from initial conditions that the plant is in Mode 2 and proceeds to the RNO		
6	**<u>GO</u> <u>TO</u> Step 7**	Same		
7	**Check "S/R HI FLUX AT SHUTDOWN" alarm (1AD2-D3) - DARK**	Same **Cue:** **Window is dark**		

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
8	**Monitor available I/R Channels and W/R Neutron Flux Monitors**	Same **Cue:** **Neutron Flux is below the I/R Channels scale. W/R Monitor indications are stable.**		
9	**Check if failure has occurred on any of the following S/R Channels:** **N-31** **OR** **N-32**	Operator determines from initial conditions that N-31 has failed. **Cue:** **N-31 has failed low** **N/A**		
10	**Check at least one of the following S/R channels – OPERABLE** **N-31** **OR** **N-32**	Operator determines that SR Channel N32 is OPERABLE **Cue:** **Channel 32 is OPERABLE, meter indicates 150 CPS.**		

* DENOTES CRITICAL

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
11	**Check plant status - IN MODE 3 OR BELOW**	Operator determines from initial conditions that the plant is in Mode 2 and proceeds to the RNO.		
12	**IF in Mode 2 below P-6, THEN suspend operations involving positive reactivity additions.**	Operator determines unit is in Mode 2 and below P-6 (10^{-10} IR amps).		
13	**Perform the following actions on the failed S/R drawer:**			
*	Place the "LEVEL TRIP" switch to "BYPASS"	Same **Cue:** **Switch rotated clockwise**		
	Check "LEVEL TRIP BYPASS" light - LIT	**Light is illuminated**		
	Place the "HIGH FLUX AT SHUTDOWN" switch to "BLOCK".	Same **Cue:** **Switch is in the "BLOCK" position.**		

* DENOTES CRITICAL

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
14	**Check the following - LIT:**			
	"S/R OR I/R TRIP BYPASS" alarm (1AD-2, E-2).	Same **Cue:** **Light is illuminated**		
	The failed channel's status light on 1SI-19:	Same		
	• "1/N-31B S/R CHANNEL I TRIP BYPASS"	**Cue:** **Light is illuminated for channel N-31**		
	OR			
	• "1/N-32B S/R CHANNEL II TRIP BYPASS".	**N/A**		
	"S/R HI FLUX ALM BLOCKED" alarm (1AD-2, D-2).	Same **Cue:** **Light is illuminated**		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
15	**“S/R HI VOLTAGE FAILURE” alarm actuates.**	<u>**Note to evaluator:**</u> The Simulator runner will actuate the failure of SR N-32 while the operator is checking "S/R HI FLUX ALM BLOCKED" alarm. Another annunciator (S/R HI VOLTAGE FAILURE) will alarm when the failure occurs. The operator should recognize that no Source Range or Intermediate Range Nuclear Instrumentation is operable and re-enter AP/16 (Case 1) at step #1. Immediately tripping the Reactor based on previous guidance in RNO for Step #1 would also be acceptable. **Cue:** **“S/R HI VOLTAGE FAILURE” alarm, (1AD-2, D-1) is flashing.** **S/R N-32 meter indicates “0” CPS.**		ONLY 1 CORRECT ACTION STEP 1 REQUIRES TRIPPING REACTOR WHEN NO SOURCE RANGE INSTRUMENTATION IS AVAILABLE.

* DENOTES CRITICAL

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
16	**Check at least one of the following S/R Channels - OPERABLE** **N-31** **<u>OR</u>** **N-32**	The operator recognizes that no Source Range Nuclear Instrumentation channels are operable and proceeds to RNO. **Cue:** **N-31 and N-32 meters indicate "0" CPS.**		
17	**<u>IF</u> in Mode 2 below P-6 or Mode 3, 4, or 5, <u>THEN</u>:**	Operator determines that the plant is in Mode 2 below P-6, manually trips the Reactor and begins performing the Immediate Actions of E-0. When the Reactor is tripped, terminate the JPM with the following cue:		
*	• **Immediately open Reactor Trip Breakers**	**Cue:** **Trip switches rotated counter clockwise, Green lights illuminated**		
	• **<u>IF</u> the step above results in rods dropping <u>AND</u> Pzr pressure is above P-11, <u>THEN GO TO</u> EP/1/A/5000/E-0 (Reactor Trip or Safety Injection).**	**Cue:** **The CR SRO has directed another operator to continue in E-0.**		

STOP TIME__________

* DENOTES CRITICAL

SIMULATOR OPERATIONAL GUIDELINES (ENB-187A)

1. Reset Simulator to IC-26 (Mode 2 , Normal operating temp/press, CBA at 50 steps withdrawn.)

2. Insert Mal ENB-2A (SR Channel 31 Failure)
Select = 0, Activate

3. Insert Mal ENB-012B (SR Channel 32 High Voltage Loss)
Select = 0, Set to Trigger 1.

4. Freeze Simulator

NOTES: Place "Audio Count Rate" and "Startup Rate" selectors to SR N-32 prior to implementing this JPM.

5. Go to RUN

6. **When** examinee checks the "S/R HI FLUX ALM BLOCKED" annunciator in step 14 of this JPM, **Then** activate Trigger 1.

TEMP SNAP # 131

INITIAL CONDITIONS

Unit 1 is in the process of performing a Unit Start-Up. Control Bank "A" has been pulled to 50 steps withdrawn. Mode 2 has just been declared. Source Range count rate is approximately 150 CPS. The RO observes that SR channel N-31 has failed low. AP/1/A/5500/16 Case I (Source Range Malfunctions) is implemented.

The SRO directs you to remove the failed SR channel (N-31) from service by performing AP/1/A/5500/16 (Malfunction of Nuclear Instrumentation), Case I (Source Range Malfunctions).

(R06-97)

Duke Power Company
PROCEDURE PROCESS RECORD

(1) ID No. AP/1/A/5500/16
Revision No. 7

INFORMATION ONLY

PREPARATION

(2) Station **McGuire Nuclear Station**

(3) Procedure Title **Malfunction Of Nuclear Instrumentation**

(4) Prepared By S. Hackney Date **July 15, 1999**

(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 [signature] (QR) Date 8/11/99

Cross-Disciplinary Review By ____ (QR) NA MW Date 8/18/99

Reactivity Mgmt. Review By ____ (QR) NA MW Date 8/11/99

(7) Additional Reviews

Reviewed By Phillip A Kelly Date 8/15/99

Reviewed By ____ Date ____

(8) Temporary Approval (*if necessary*)

By ____ (SRO/QR) Date ____

By ____ (QR) Date ____

(9) Approved By Peter L Schuerger Date 8.18.99

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 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, 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.*)

A. <u>Purpose</u>

To ensure proper response in the event of a malfunction of nuclear instrumentation and identify the appropriate actions for the following cases:

Case I Source Range Malfunctions

Case II Intermediate Range Malfunction

Case III Power Range Malfunction.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

B. Symptoms

- **Erratic or loss of indication**
- **Audio count rate signal stops**
- **"S/R HI FLUX RX TRIP" alarm**
- **"S/R HI VOLTAGE FAILURE" alarm**
- **"S/R HI FLUX AT SHUTDOWN" alarm**
- **Loss of "INSTR POWER ON" or "CONTROL POWER ON " lights at Nuclear Instrumentation drawer.**

C. Operator Actions

CAUTION
- **Pulling S/R control power fuses anytime the S/R is energized will result in a reactor trip.**
- **Pulling S/R instrument power fuses with the S/R energized will result in a reactor trip unless the channel "LEVEL TRIP" switch is in "BYPASS".**

NOTE
- Audio count rate is only supplied from S/R channels N-31 or N-32.
- In mode 6, the W/R Neutron Flux Monitors can be used as S/R neutron flux indication.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
1. **Check at least one of the following S/R Channels - OPERABLE.** __ • N-31 OR __ • N-32.	**IF in Mode 2 below P-6 or Mode 3, 4, or 5, THEN:** __ a. Immediately open Reactor Trip Breakers. __ b. IF the step above results in rods dropping AND Pzr pressure is above P-11, **THEN GO TO** EP/1/A/5000/E-0 (Reactor Trip or Safety Injection).
__ 2. **Announce occurrence on paging system.**	
__ 3. **Check unit status - IN MODE 6.**	__ **GO TO Step 6.**

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ 4. **Check Audio Count Rate - OPERABLE.**	**Perform the following:** __ a. Place Audio Count Rate "CHANNEL SELECTOR" switch to operable channel. __ b. <u>IF</u> Audio Count Rate operable, <u>**THEN**</u> <u>**GO**</u> <u>**TO**</u> Step 5. __ c. Suspend Core Alterations. __ d. Stop positive reactivity changes.
5. **Check at least two of the following S/R channels - OPERABLE:** __ • N-31 OR __ • N-32 OR __ • W/R A OR __ • W/R B.	**Perform the following:** __ a. Suspend Core Alterations. __ b. Stop positive reactivity changes. __ c. <u>IF</u> no S/R channel operable, <u>**THEN**</u> immediately initiate action to restore one of the four monitors to operable.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
6. **Check S/R detector(s) - HIGH VOLTAGE INADVERTENTLY APPLIED AT POWER (ABOVE P-10).**	__ **<u>GO TO</u> Step 7.**

__ a. Immediately remove S/R instrument power fuses to prevent detector degradation.

__ b. A work request should be written for IAE to test S/R channel for operability.

<u>CAUTION</u> **Failure to complete Step 6.c prior to lowering power to P-6 may result in a reactor trip.**

__ c. **<u>WHEN</u>** high voltage problem resolved, **<u>THEN</u>** replace S/R instrument power fuses.

d. Notify station management that the following should be performed immediately the next time S/R is unblocked (procedure changes will be required):

__ • Trend on recorder the signals from both S/R detectors

__ • Have IAE compare S/R trends to ensure proper operation of S/R detector (reference Westinghouse Tech Bulletin 80-8).

__ e. **<u>RETURN</u> <u>TO</u>** procedure and step in effect.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ 7. **Check "S/R HI FLUX AT SHUTDOWN" alarm (1AD-2, D-3) - DARK.**	**Perform the following:** __ a. IF "S/R HI FLUX AT SHUTDOWN" alarm is caused by malfunction of N-31 OR N-32, THEN announce over plant page to disregard containment evacuation alarm. b. IF "S/R HI FLUX AT SHUTDOWN" alarm is caused by malfunction of W/R Neutron Flux Monitor, THEN perform the following: __ 1) Notify IAE of failure. __ 2) Reset W/R Neutron Flux Monitor. __ 3) RETURN TO procedure in effect. __ c. IF "S/R HI FLUX AT SHUTDOWN" alarm is caused by a valid alarm on th. W/R Neutron Flux Monitors, THEN actuate the containment evacuation alarm. __ d. IF containment evacuation is required, THEN REFER TO RP/0/A/5700/011 (Conducting a Site Assembly, Site Evacuation, or Containment Evacuation).
__ 8. **Monitor available I/R Channels and W/R Neutron Flux Monitors.**	
9. **Check if failure has occured on any of the following S/R Channels:** __ • N-31 OR __ • N-32.	__ **RETURN TO procedure in effect.**

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
10. **Check at least one of the following S/R Channels - OPERABLE:** __ • N-31 OR __ • N-32.	**Perform the following:** __ a. **IF** in Mode 1 or 6, **THEN GO TO** Step 12. __ b. **IF** in Mode 2 above P-6, **THEN GO TO** Step 12. __ c. **IF** a loss of SG feedwater occurs, **THEN REFER TO** AP/1/A/5500/06 (Loss Of S/G Feedwater) as required. __ d. Suspend operations involving positive reactivity additions. **NOTE** The following step will cause a loss of normal "blended" VCT M/U. __ e. Dispatch an operator to close and lock 1NV-250 (Reactor M/U Water to NV System) (aux bldg, 733, JJ-54, 25 ft north of KC pumps) within one hour. __ f. **IF AT ANY TIME** 1NV-250 is required to be open for make-up to FWST, **THEN REFER TO** Tech Spec Bases 3.9.2 for list of unborated water source isolation valves required to be locked closed. __ g. Monitor available I/R channels and W/R Neutron Flux Monitors. __ h. Ensure adequate shutdown margin **PER** OP/0/A/6100/006 (Reactivity Balance Calculation) within one hour. __ i. **GO TO** Step 12.
__ 11. **Check plant status - IN MODE 3 OR BELOW.**	__ **IF in Mode 2 below P-6, THEN suspend operations involving positive reactivity additions.**

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
12. **Perform the following actions on the failed S/R drawer:**	__ **Notify IAE.**
__ a. Place the "LEVEL TRIP" switch to "BYPASS".	
__ b. Check "LEVEL TRIP BYPASS" light - LIT.	
__ c. Place the "HIGH FLUX AT SHUTDOWN" switch to "BLOCK".	
13. **Check the following - LIT:**	__ **Notify IAE.**
__ a. "S/R OR I/R TRIP BYPASS" alarm (1AD-2, E-2).	
b. The failed channel's status light on 1SI-19:	
__ • "1/N-31B S/R CHANNEL I TRIP BYPASS"	
OR	
__ • "1/N-32B S/R CHANNEL II TRIP BYPASS".	
__ c. "S/R HI FLUX ALM BLOCKED" alarm (1AD-2, D-2).	
__ 14. **Place operable S/R channel to record on NIS Recorder.**	
__ 15. **<u>IF</u> <u>AT</u> <u>ANY</u> <u>TIME</u> S/R fuses are pulled above P-6, <u>THEN</u> they should be inserted prior to energizing S/R (to prevent a reactor trip).**	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
16. **<u>WHEN</u> malfunctioning S/R channel repaired, <u>THEN</u> perform the following:**	__ **Notify IAE.**

__ a. Place "HIGH FLUX AT SHUTDOWN" switch to "NORMAL".

__ b. Ensure "S/R HI FLUX ALM BLOCKED" alarm (1AD-2, D-2) - DARK.

__ c. Place "LEVEL TRIP" switch on S/R Drawer to "NORMAL".

d. Ensure the following - DARK:

__ 1) "LEVEL TRIP BYPASS" indicating light on S/R Drawer.

__ 2) "S/R OR I/R TRIP BYPASS" alarm (1AD-2, E-2).

3) The failed channel's status light on 1SI-19:

__ • "1/N-31B S/R CHANNEL I TRIP BYPASS"

OR

__ • "1/N-32B S/R CHANNEL II TRIP BYPASS".

__ e. **<u>IF</u>** 1NV-250 (Reactor M/U Water to NV System) (aux bldg, 733, JJ-54, 25 ft north of KC pumps) was closed per Step 10, **<u>AND</u>** allowed open per Tech Specs, **<u>THEN</u>** evaluate dispatching operator to open 1NV-250.

<u>END</u>

Prepared By: Rob Billings

Reviewed By: Tom Cadman

Approved By: Charles Sawyer

TASK: **Resynchronize Unit 1 to the Grid Following a Full Load Rejection**

POSITION: **RO**

Operator's Name______________________________

Location: **Simulator** Method: **Perform**

Estimated JPM Completion Time: 20 Minutes

Actual JPM Completion Time: ____ Minutes

The JPM Operator's performance was evaluated against the standards of this JPM and is determined to be:

SATISFACTORY/UNSATISFACTORY (circle one)

Evaluator's Signature______________________________ Date __/__/__

References:	AP/1/A/5500/03 (Rev.09)	Load Rejection
	OP/1/A/6350/005 (Rev.27)	AC Electrical Operation Other Than Normal Lineup

JPM verified current with references by ______________________________

Date __/__/__

Rev. 01/02-12-00

FOR TRAINING PURPOSES ONLY

INITIAL CONDITIONS

You are the Unit 1 Balance of Plant Operator (BOP).

Approximately one hour ago, with Unit 1 at 20% power, PCB's 8, 9, 11, and 12 were opened due to frequency problems on the power system grid. The generator is still in service, supplying in-house loads. AP/1/A/5500/03 (Load Rejection) was entered and has been completed up to step # 36. The TCC (Transmission Control Center) reports the cause for the frequency problem has been corrected and requests McGuire Unit 1 to tie back into the grid.

The CR SRO directs you to tie Unit 1 to the grid by performing step # 36 of AP/1/A/5500/03 (Load Rejection). You may assume that another operator will control Reactor power and S/G levels while you are performing this task.

JPM OVERALL STANDARD: PCB's 8, 9, 11, 12 and both Generator breakers are closed. No Turbine or Reactor trip occurs during this evolution.

NOTES: A copy of OP/1/A/6350/005 (AC Electrical Operation Other Than Normal Lineup), enclosure 4.1 shall be provided to examinee upon request.

This JPM is designed to be performed as a **SIMULATION** or as a **WALKTHROUGH.** Cues found in shaded boxes should be given to the trainee for either setting.

KA 062-A4.07 3.1/3.1

START TIME__________

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
1	**AP/1/A/5500/03 (Load Rejection) step # 36:** **WHEN** TCC (Transmission Control Center) advises, **THEN** tie unit to grid as follows:	Operator determines from initial conditions of JPM that TCC desires the unit to be tied to the grid.		
	Check A Aux Electric Boiler – SHUTDOWN.	**Cue:** **"A" Aux Electric Boiler is shutdown.**		
	Transfer all 6.9 KV swgr to 1ATA or 1ATB, **PER** OP/1/A/6350/005 (AC Electrical Operation Other Than Normal Lineup), enclosure 4.1 (Shifting Power Supplies on 6.9 KV Bus (1TA, 1TB, 1TC, 1TD)	Operator uses enclosure 4.1 to transfer all 6.9 KV loads to 1ATA after receiving the following cue: **Cue:** **The SRO directs you to transfer all 6.9 KV loads to 1ATA per the enclosure.**		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
2	**OP/1/A/6350/005 (AC Electrical Operation Other Than Normal Lineup), enclosure 4.1**	Operator uses OAC or main control board indications to verify both transformers are energized and supplying its respective 6.9KV bus.		
	Initial Conditions			
	Aux Transformer 1ATA is energized and supplying its respective 6.9KV bus.	Same **Cue:** **Transformer voltage indicates 7KV, supply breakers to 1TA and 1TC are closed.**		
	Aux Transformer 1ATB is energized and supplying its respective 6.9KV bus.	Same **Cue:** **Transformer voltage indicates 7KV, supply breakers to 1TB and 1TD are closed.**		
3	Evaluate all outstanding R&R's that may impact performance of this procedure.	Same **Cue:** **R&R's have been evaluated. There are no outstanding R&R's.**		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
4	Evaluate shifting power to be safe for current plant conditions.	Operator requests the SRO to evaluate this step (SRO signoff). **Cue:** **The CR SRO has evaluated shifting power and has signed off this step.**		
5	Ensure lockout relays are reset before shifting power supplies to 6.9KV and 4.16KV Switchgear.	Operator checks Annunciator panel to ensure it is clear of any lockout alarms and discusses checking the relay panels just inside the C/R door (although an annunciator should be lit if any lockouts are present on this panel). Operator may dispatch NLO to check local 6.9KV Swgr lockout relays reset. Cue accordingly. **Cue:** **All annunciator lockout alarms are dark.** **Cue:** **All lockout relays have been verified reset (locally at the 6.9KV Switchgear room and in the C/R).**		

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
6	Perform the following sections as applicable: Section 3.5, Shifting Bus 1TA from 1ATA to 1ATB power supply. Section 3.6, Shifting Bus 1TB from 1ATB to 1ATA power supply. Section 3.7, Shifting Bus 1TC from 1ATA to 1ATB power supply. Section 3.8, Shifting Bus 1TD from 1ATB to 1ATA power supply.	Operator determines to use sections 3.6 and 3.8 to transfer 1TB and 1TD loads to 1ATA **Note to evaluator:** Repeat the following cue from Step #1, if re-verification of instructions is requested. **Cue:** **The SRO directs you to transfer all 6.9 KV loads to 1ATA per the enclosure.**		
7	Section 3.6 (Shifting Bus 1TB from 1ATB to 1ATA power supply) Notify CR SRO that power supply for Bus 1TB is being shifted from 1ATB to 1ATA.	Same **Cue:** **CR SRO understands.**		
*	Place "1TB Mode Select" switch in "MAN"	Same **Cue:** **Switch rotated clockwise to "MAN"**		
*	Close "1TB Stdby Breaker"	Same **Cue:** **Pushbutton depressed, red light illuminated**		

* DENOTES CRITICAL

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
7	**Continued**			
	Check "1TB Normal Breaker" open	Same **Cue:** **Green light illuminated**		
	Place "1TB Mode Select" switch in "AUTO"	Same **Cue:** **Switch rotated Counter-clockwise to "AUTO"**		
8	Section 3.8 (Shifting Bus 1TD from 1ATB to 1ATA power supply)			
	Notify CR SRO that power supply for Bus 1TD is being shifted from 1ATB to 1ATA.	Same **Cue:** **CR SRO understands.**		
*	Place "1TD Mode Select" switch in "MAN"	Same **Cue:** **Switch rotated clockwise to "MAN"**		
*	Close "1TD Stdby Breaker"	Same **Cue:** **Pushbutton depressed, red light illuminated**		
	Check "1TD Normal Breaker" open	Same **Cue:** **Green light illuminated**		

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
8	**Continued** Place "1TD Mode Select" switch in "AUTO"	Same **Cue:** **Switch rotated Counter-clockwise to "AUTO"**		
9	**Returning to AP/03, step #36. b:** Do not continue until this step is complete.	Operator determines this step is complete.		
10	Perform the following to align offsite power:	Operator determines 1ATB is unloaded and completes the applicable steps.		
	<u>IF</u> 1ATB transformer is unloaded, **<u>THEN:</u>**	Same		
*	Open 1B Generator Breaker	**Cue:** **Pushbutton depressed, green light illuminated**		
*	Close PCB's 11 and 12.	**Cue:** **Pushbutton depressed, red lights illuminated**		
	<u>OR</u>			
	<u>IF</u> 1ATA transformer is unloaded, **<u>THEN:</u>**	N/A		
	Open 1A Generator Breaker	N/A		
	Close PCB's 8 and 9.	N/A		

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*11	Depress the "SYNC" pushbutton on Generator Breaker to be closed while performing the next step.	Depresses "SYNC" P.B. for Generator Breaker 1B **Cue:** **Pushbutton depressed and held**		
12	Ensure "STATION RUN VOLTS" is slightly higher than "GEN INCOMING VOLTS" by adjusting "VOLTAGE ADJUST" pushbutton.	Same **Cue:** **Pushbutton depressed, Run volts are higher than incoming volts**		
13	Close generator breaker MODs for generator breaker to be closed.	Operator closes 1B Generator breaker MODs **Cue:** **Pushbutton depressed, red lights illuminated**		
14	Dispatch operator to check Generator MODs closed for Generator Breaker to be closed.	Operator dispatches NLO to check 1B MOD locally. **Cue:** **NLO reports that the 1B MOD's are closed.**		

* **DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
15	Notify SOC (System Operation Center) unit is ready to be paralleled to grid.	Operator uses red phone to call SOC. **Cue:** **SOC understands unit is ready to parallel to grid.**		
*16	Place the "GEN AUTO/MAN SYNC SELECT" switch to the Generator Breaker to be closed.	Operator moves switch into the 1B Generator Breaker position. **Cue:** **Switch rotated clock-wise to 1B Generator Breaker position.**		
17	Check selected Generator Breaker – CLOSED.	Same **Cue:** **Red light illuminated.**		
18	<u>GO TO</u> Step 36.n	Same		
19	Return the "GEN AUTO/MAN SYNC SELECT" switch to "MAN".	Same **Cue:** **Switch rotated counter-clockwise to "MAN".**		

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
20	Check generator power factor – 0.9 TO 1.0 LAGGING.	**Note to evaluator:** Power Factor is uncontrollable at this load. Operator checks control board PF meter, which will be pegged HI, then adjusts voltage per the RNO. If voltage can not be adjusted, give the following cue:		
	RNO – Adjust Power Factor using the "VOLTAGE ADJUST" pushbutton.	**Cue:** **The C/R SRO directs you to continue with the procedure and complete this step as load is increased.**		
*21	Close PCB's on other bus line to restore both sources of offsite power.	Operator closes PCB's 8 and 9. **Cue:** **Pushbuttons depressed, red lights illuminated.**		
22	Transfer 6.9 KV swgr to normal lineup **PER** OP/1/A/6350/005 (AC Electrical Operation Other Than Normal Lineup), enclosure 4.1 (Shifting Power Supplies on 6.9 KV Bus (1TA, 1TB, 1TC, 1TD)	**Cue:** **Another operator will transfer 6.9 KV swgr power supplies back to normal and complete this AP.**		

STOP TIME___________

*** DENOTES CRITICAL**

INITIAL CONDITIONS

You are the Unit 1 Balance of Plant Operator (BOP).

Approximately one hour ago, with Unit 1 at 20% power, PCB's 8, 9, 11, and 12 were opened due to frequency problems on the power system grid. The generator is still in service, supplying in-house loads. AP/1/A/5500/03 (Load Rejection) was entered and has been completed up to step # 36. The TCC (Transmission Control Center) reports the cause for the frequency problem has been corrected and requests McGuire Unit 1 to tie back into the grid.

The CR SRO directs you to tie Unit 1 to the grid by performing step # 36 of AP/1/A/5500/03 (Load Rejection). You may assume that another operator will control Reactor power and S/G levels while you are performing this task.

SIMULATOR OPERATOR GUIDELINES (MG-177)

1. Reset to I/C 12.

2. Go to RUN.

3. Open PCB's 8, 9, 11 and 12.

4. Place rods in MANUAL when they drive in to 88 steps.

5. Place NV-238 in manual. Adjust NV-238 and NV-241 to attain approximately 90 gpm charging and 8-9 gpm seal injection flow.

6. Clear annunciators. Allow unit to stabilize for 1-2 minutes.

7. Leave main feed reg. valves in service. If bypasses are placed in service, additional operator actions will be required to maintain S/G levels.

8. Go to FREEZE

9. Go to RUN when examinee is ready to begin.

(R06-97)

Duke Power Company
PROCEDURE PROCESS RECORD

(1) ID No. AP/1/A/5500/03
Revision No. 9

INFORMATION ONLY

PREPARATION
(2) Station **McGuire Nuclear Station**

(3) Procedure Title **Load Rejection**

(4) Prepared By **S. Hackney** S. Hackney Date **January 5, 2000**

(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 1-10-00

Cross-Disciplinary Review By ____ (QR) NA ____ Date 1-10-00

Reactivity Mgmt. Review By ____ (QR) NA ____ Date 1-10-00

(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 1-13-00

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 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, 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.*)

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
36. **<u>WHEN</u> TCC (Transmission Control Center) advises, <u>THEN</u> tie unit to grid as follows:**	
__ a. Check A Aux Electric Boiler - SHUTDOWN.	a. <u>IF</u> A Aux Electric Boiler in service, <u>THEN</u> perform one of the following: __ • <u>WHEN</u> performing Step 36.b, <u>THEN</u> place all 6.9 KV swgr on 1ATA. OR • Perform the following: __ 1) Start up B Aux Electric Boiler <u>PER</u> OP/1/B/6250/007B (Auxiliary Electric Boilers), Enclosure 4.2 (Auxiliary Electric Boiler B Startup/Shutdown). __ 2) Shut down A Aux Electric Boiler <u>PER</u> OP/1/B/6250/007B (Auxiliary Electric Boilers), Enclosure 4.1 (Auxiliary Electric Boiler A Startup/Shutdown).
b. Transfer all 6.9 KV swgr to 1ATA or 1ATB, <u>PER</u> OP/1/A/6350/005 (AC Electrical Other Than Normal Lineup), Enclosure 4.1 (Shifting Power Supplies on 6.9KV Bus (1TA, 1TB, 1TC, 1TD)). __ • Do not continue until this step is complete.	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
36. (Continued)	
c. Perform the following to align offsite power :	
• **IF** 1ATB transformer is unloaded, **THEN**:	
__ 1) Open 1B Generator Breaker.	
__ 2) Close PCBs 11 and 12.	
OR	
• **IF** 1ATA transformer is unloaded, **THEN**:	
__ 1) Open 1A Generator Breaker.	
__ 2) Close PCBs 8 and 9.	
__ d. Depress the "SYNC" pushbutton on Generator Breaker to be closed while performing the next step.	
__ e. Ensure "STATION RUN VOLTS" is slightly higher than "GEN INCOMING VOLTS" by adjusting "VOLTAGE ADJUST" pushbutton.	
__ f. Close Generator Breaker MODs for Generator Breaker to be closed.	
__ g. Dispatch operator to check Generator MODs closed for Generator Breaker to be closed.	
__ h. Notify SOC (System Operation Center) unit is ready to be paralleled to grid.	

NOTE If the generator is in sync with the system, the selected Generator Breaker will close while performing the next step.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ i. Place the "GEN AUTO/MAN SYNC SELECT" switch to the Generator Breaker to be closed.	
__ j. Check selected Generator Breaker - CLOSED.	__ j. **GO TO** Step 36.l.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
36. (Continued)	
__ k. **GO TO** Step 36.n.	
__ l. Depress the "AUTO SYNC" pushbutton on the DEH panel.	
__ m. Check selected Generator Breaker- CLOSED.	m. Perform the following: __ 1) Place the "GEN AUTO/MAN SYNC SELECT" switch in "MAN". __ 2) Depress and hold "SYNC" pushbutton for the Generator Breaker to be closed. __ 3) Adjust the T/G speed as necessary until the hand on the synscope moves slowly in the "FAST" direction. __ 4) Ensure "STATION RUN VOLTS" is slightly higher than "GEN INCOMING VOLTS" by adjusting "VOLTAGE ADJUST" pushbutton. __ 5) **WHEN** the hand of the synchroscope is in the "Five Minutes until Twelve O'Clock" position **THEN** depress the "CLOSE" pushbutton for that breaker until the "CLSD" light illuminates. __ 6) **GO TO** Step 36.o.
__ n. Return the "GEN AUTO/MAN SYNC SELECT" switch to "MAN".	
__ o. Check generator power factor - 0.9 TO 1.0 LAGGING.	__ o. Adjust power factor using the "VOLTAGE ADJUST" pushbutton.
__ p. Close PCBs on other bus line to restore both sources of offsite power.	
__ q. Transfer 6.9 KV swgr to normal lineup **PER** OP/1/A/6350/005 (AC Electrical Other Than Normal Lineup), Enclosure 4.1 (Shifting Power Supplies on 6.9KV Bus (1TA, 1TB, 1TC, 1TD)).	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

36. (Continued)

__ r. Raise turbine load as desired **PER** OP/1/A/6100/003 (Controlling Procedure For Unit Operation), Enclosure 4.1 (Power Increase).

__ 37. **WHEN reason for runback has been determined, THEN unit may be loaded or shutdown PER OP/1/A/6100/003 (Controlling Procedure For Unit Operation).**

END

(R06-97)

Duke Power Company
PROCEDURE PROCESS RECORD

(1) ID No. OP/1/A/6350/005
Revision No. 27

INFORMATION ONLY

REPARATION

(2) Station McGuire Nuclear Station

(3) Procedure Title AC Electrical Operation Other Than Normal Lineup

(4) Prepared By D.E. Moore DE Moore Date November 5, 1999

(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 [signature] (QR) Date 11/9/99

Cross-Disciplinary Review By ____ (QR) NA RLB Date 11/9/99

Reactivity Mgmt. Review By ____ (QR) NA RLB Date 11/9/99

(7) Additional Reviews

Reviewed By ____ Date ____

Reviewed By ____ Date ____

(8) Temporary Approval (*if necessary*)

By ____ (SRO/QR) Date ____

By ____ (QR) Date ____

(9) Approved By Peter F Schuerger Date 11.10.99

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 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, 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.*)

AC Electrical Operation Other Than Normal Lineup

1. Purpose

To describe the steps necessary to properly shift the in plant AC Electrical Systems to power supplies other than normal and to shift back to normal supplies.

2. Limits and Precautions

2.1 **ALL** unnecessary personnel shall remain clear of the area during breaker racking operations.

2.2 All electrical equipment access doors and covers should be secured with all closures and fasteners provided.

2.3 **WHEN** transporting breakers from cubicles, care must be taken to prevent damage of electrical contacts.

2.4 Except while racking the breaker in 1TC(B) Cubicle 4, control power fuses shall be installed in 1TC(B) Cubicle 4 regardless of whether SATA(B) is supplied from 1TC(B) or 2TC(B). These fuses provide power to differential relaying.

2.5 **WHEN** swapping power supplies on SMXA, NCDT pressure and flow indication could fail low causing NCDT pumps on both units to trip.

2.6 **WHEN** swapping /de energizing 1EMXH, "A" Train RN on both units should be declared inoperable. This action may be preferable versus compensatory actions required to maintain "A" Train RN operable due to RN valves powered from 1EMXH losing power. (Reference 1EMXH one line MCCD-1703-06.02 and associated DBD/TAC sheets for all affected valves. {PIP M94-1369}

3. Procedure

See Section 4.

4. Enclosures

4.1 Shifting Power Supplies on 6.9KV Bus (1TA, 1TB, 1TC, 1TD)

4.2 Shifting Power Supplies on 4.16KV Essential Bus 1ETA

4.3 Shifting Power Supplies on 4.16KV Essential Bus 1ETB

4.4 Shifting Power Supplies on Essential 600V Load Centers (1ELXA, 1ELXB, 1ELXC, 1ELXD)

4.5 Shifting Power Supplies on Essential 600V Motor Control Centers and Kirk-Keyed Shared Motor Control Centers (1EMXG, 1EMXH, SMXG-1)

4.6 Shifting Power Supplies on Non-Essential 600V Motor Control Centers

4.7 Shifting Power Supplies on Pzr Heater Group 1C

4.8 Shifting Power Supplies of Shared Motor Control Centers

4.9 Removing/Returning 4160 Bus 1ETA From/To Service

4.10 Removing/Returning 4160 Bus 1ETB From/To Service

4.11 Shifting Power Supplies for SATA

4.12 Removing/Returning 6900 Volt Buses From/To Service (1TA, 1TB, 1TC, 1TD)

4.13 Isolation/Restoring Unit 1 Main Generator Electrically

4.14 Removing/Returning 600 VAC MCCs From/To Service

4.15 Manual Operation Of Auxiliary Transformer Cooling Equipment

4.16 Troubleshooting 600 VAC Electrical Grounds

End Of Body

Unit 1

1. Limits and Precautions

None

2. Initial Conditions

_____ 2.1 Aux transformer 1ATA is energized and supplying its respective 6.9KV buses.

_____ 2.2 Aux transformer 1ATB is energized and supplying its respective 6.9KV buses.

3. Procedure

❑ 3.1 Evaluate all outstanding R&Rs that may impact performance of this procedure.

_____ 3.2 Evaluate shifting power to be safe for current plant conditions.
SRO

NOTE:	Transfer of the 6.9KV Switchgear is live bus and sync-check relays prevent breaker closing until the sources are in synchronism.

❑ 3.3 Ensure lockout relays are reset before shifting power supplies to 6.9KV and 4.16KV Switchgear.

3.4 Perform the following Sections as applicable:

- ❑ Section 3.5, Shifting Bus 1TA from 1ATA to 1ATB power supply.
- ❑ Section 3.6, Shifting Bus 1TB from 1ATB to 1ATA power supply.
- ❑ Section 3.7, Shifting Bus 1TC from 1ATA to 1ATB power supply.
- ❑ Section 3.8, Shifting Bus 1TD from 1ATB to 1ATA power supply.
- ❑ Section 3.9, Shifting Bus 1TA from 1ATB to 1ATA power supply.
- ❑ Section 3.10, Shifting Bus 1TB from 1ATA to 1ATB power supply.
- ❑ Section 3.11, Shifting Bus 1TC from 1ATB to 1ATA power supply.
- ❑ Section 3.12, Shifting Bus 1TD from 1ATA to 1ATB power supply.

3.5 Shifting Bus 1TA from 1ATA to 1ATB power supply:

_____ 3.5.1 Notify CR SRO that power supply for Bus 1TA is being shifted from 1ATA to 1ATB.

_____ 3.5.2 Place "1TA Mode Select" switch in "MAN".

_____ 3.5.3 Close "1TA Stdby Breaker".

☐ 3.5.4 Check "1TA Normal Breaker" open.

_____ 3.5.5 Place "1TA Mode Select" switch in "AUTO".

3.6 Shifting Bus 1TB from 1ATB to 1ATA power supply:

_____ 3.6.1 Notify CR SRO that power supply for Bus 1TB is being shifted from 1ATB to 1ATA.

_____ 3.6.2 Place "1TB Mode Select" switch in "MAN".

_____ 3.6.3 Close "1TB Stdby Breaker".

☐ 3.6.4 Check "1TB Normal Breaker" open.

_____ 3.6.5 Place "1TB Mode Select" switch in "AUTO".

3.7 Shifting Bus 1TC from 1ATA to 1ATB power supply:

_____ 3.7.1 Notify CR SRO that power supply for Bus 1TC is being shifted from 1ATA to 1ATB.

_____ 3.7.2 Place "1TC Mode Select" switch in "MAN".

_____ 3.7.3 Close "1TC Stdby Breaker".

☐ 3.7.4 Check "1TC Normal Breaker" open.

_____ 3.7.5 Place "1TC Mode Select" switch in "AUTO".

3.8 Shifting Bus 1TD from 1ATB to 1ATA power supply:

_____ 3.8.1 Notify CR SRO that power supply for Bus 1TD is being shifted from 1ATB to 1ATA.

_____ 3.8.2 Place "1TD Mode Select" switch in "MAN".

_____ 3.8.3 Close "1TD Stdby Breaker".

☐ 3.8.4 Check "1TD Normal Breaker" open.

_____ 3.8.5 Place "1TD Mode Select" switch in "AUTO".

3.9 Shifting Bus 1TA from 1ATB to 1ATA power supply:

_____ 3.9.1 Notify CR SRO that power supply for Bus 1TA is being shifted from 1ATB to 1ATA.

_____ 3.9.2 Place "1TA Mode Select" switch in "MAN".

_____ 3.9.3 Close "1TA Normal Breaker".

☐ 3.9.4 Check "1TA Stdby Breaker" open.

_____ 3.9.5 Place "1TA Mode Select" switch in "AUTO".

3.10 Shifting Bus 1TB from 1ATA to 1ATB power supply:

_____ 3.10.1 Notify CR SRO that power supply for Bus 1TB is being shifted from 1ATA to 1ATB.

_____ 3.10.2 Place "1TB Mode Select" switch in "MAN".

_____ 3.10.3 Close "1TB Normal Breaker".

☐ 3.10.4 Check "1TB Stdby Breaker" open.

_____ 3.10.5 Place "1TB Mode Select" switch in "AUTO".

3.11 Shifting Bus 1TC from 1ATB to 1ATA power supply:

_____ 3.11.1 Notify CR SRO that power supply for Bus 1TC is being shifted from 1ATB to 1ATA.

_____ 3.11.2 Place "1TC Mode Select" switch in "MAN".

_____ 3.11.3 Close "1TC Normal Breaker".

☐ 3.11.4 Check "1TC Stdby Breaker" open.

_____ 3.11.5 Place "1TC Mode Select" switch in "AUTO".

3.12 Shifting Bus 1TD from 1ATA to 1ATB power supply:

_____ 3.12.1 Notify CR SRO that power supply for Bus 1TD is being shifted from 1ATA to 1ATB.

_____ 3.12.2 Place "1TD Mode Select" switch in "MAN".

_____ 3.12.3 Close "1TD Normal Breaker".

☐ 3.12.4 Check "1TD Stdby Breaker" open.

_____ 3.12.5 Place "1TD Mode Select" switch in "AUTO".

End Of Enclosure

Prepared By: Rob Billings

Reviewed By: Charles Dawson

Approved By: Thomas C. Cutler

TASK: **Calculate Boric Acid Potentiometer Setting and begin Manual Makeup to Unit 2 VCT**

POSITION: **RO**

Operator's Name______________________________

Location: **Plant C/R** Method: **Walkthrough**

Estimated JPM Completion Time: 15 Minutes

Actual JPM Completion Time: ____ Minutes

The JPM Operator's performance was evaluated against the standards of this JPM and is determined to be:

SATISFACTORY/UNSATISFACTORY (circle one)

Evaluator's Signature__________________________ Date __/__/__

References: OP/2/A/6150/009 (Rev. 35) Boron Concentration Control
OP/2/A/6100/22 (Rev. 431) Unit 2 Data Book

JPM verified current with references by ______________________________

Date __/__/__

Rev. 00/05-02-00

INITIAL CONDITIONS

IAE testing has the automatic portion of the Unit 2 NC SYS M/U Controller out of service. The controller is positioned to the **OFF** position at the present time. The level in the VCT is dropping and the RO wishes to makeup at the VCT Concentration. The following conditions exist:

BAT Boron Concentration - 7530 PPM

VCT Boron Concentration - 1320 PPM

Blender Flow Rate - 90 GPM

The NV system is in its normal alignment, all valves are aligned per the valve checklist and all R&R's have been evaluated.

The Control Room SRO directs you to Calculate the Boric Acid Potentiometer Setting and begin Manual Makeup to the VCT per OP/2/A/6150/009 Encl. 4.5 (Manual Makeup).

JPM OVERALL STANDARD: Boric Acid Potentiometer set for 3.92 - 3.96 (exact setting = 3.94) and VCT makeup started in manual.

NOTES: The evaluator will provide a calculator and a copy of the applicable procedures [OP/2/A/6150/009 (Rev. 35) Boron Concentration Control, Enc. 4.5 and OP/2/A/6100/22 (Rev. 431) Unit 2 Data Book] upon request.

KA 004 A4.07 3.9/3.7

TASK: M0-8310

START TIME__________

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
1	Evaluate all outstanding R&Rs that may impact the performance of this procedure	Operator determines from initial conditions that R&Rs have already been evaluated		
2	To makeup to the following tank(s), ensure it is in operation with its associated system. VCT - NV System is in normal operation per OP/2/A/6200/001A (Chemical and Volume Control System Letdown) RHT - NB System in operation per OP/0/A/6200/003 (Boron Recycle System)	Operator determines from initial conditions that NV system is aligned normally. **Cue:** **NV system is aligned for normal operation.** N/A		

* DENOTES CRITICAL

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
3	Ensure total makeup and boric acid integrator thumbwheels set at high enough value to prevent stopping inadvertently.	Operator checks thumbwheel settings to ensure they are set high enough to prevent premature makeup termination. **Cue:** **Counters indicate "999999" on both integrator thumbwheels, both flow integrators indicate ""000000".**		
4	IF makeup to the RHT is desired, notify Radwaste Chemistry	Operator determines from initial conditions that makeup to the VCT is desired and N/A's this step.		

* DENOTES CRITICAL

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
5	Align flow path to the selected tank as follows:	Operator aligns valves associated with VCT Makeup. Opening <u>either</u> **or** <u>both</u> valve(s) is acceptable.		
	For RHT open: 2NV-172 (Boric Acid Blender Disch to Systems NB and FW) 1NB-4 (NB System Supply from NV System Unit 2 Isol)	N/A		
	For VCT, open:	Same		
*	2NV-175A (BA Blender to VCT Outlet) **<u>AND/OR</u>**	**Cue:** **Switch rotated clockwise, red light is illuminated** <u>AND/OR</u>		
*	2NV-171 (BA Blender to VCT Inlet)	**Cue:** **Switch rotated clockwise red light is illuminated**		

* DENOTES CRITICAL

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*6	Refer to the McGuire Data Book or OAC and determine the flow rates required to produce desired blended flow boron concentration	<u>**Note**</u>: Give operator the exam copy of Data book table 5.2 once the C/R copy has been located. **Cue:** **The SRO directs you to use the McGuire Data Book** Operator determines Boric Acid Pot setting to be 3.92 - 3.96 by using the formula from Data Book Table 5.2 as follows: $\frac{1320 \text{ PPM} \times 90 \text{ GPM}}{7530 \text{ PPM}} =$ $\frac{15.77 \text{ GPM Acid}}{4} =$ Potentiometer Setting of 3.94 turns		
*7	Place "NC SYS M/U Controller" switch to "MANUAL".	Same **Cue:** **Switch is rotated clockwise two positions and is in the "MANUAL" position.**		

* DENOTES CRITICAL

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
8	IF makeup requires high Boron concentration, perform the following: {PIP-0-M-97-2543}.....	Operator determines these steps are not required to attain the desired Boron concentration and proceeds to step 3.9. Give the following cue if necessary: **Cue:** **The SRO indicates that High Boron concentration makeup is not required.**		
*9	Position "BA Flow Control" potentiometer to the value determined in Step 3.6:	Operator sets "BA Flow Control" potentiometer (2NVSS5450) to setting calculated in step 3.6 (should be 3.92-3.96 turns). **Cue:** **Potentiometer rotated in clockwise (counterclockwise) direction to _______ turns.** (value as described by Operator)		

* DENOTES CRITICAL

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
10	Place the following in "AUTO":			
	"BA Blend Disch CNTRL"	**Cue:** **"Auto" white light lit**		
	"BA Flow Control"	**Cue:** **"Auto" white light lit**		
*	One Boric Acid Transfer Pump	Operator receives following cue, then places one BAT pump to "AUTO".		
		Cue: **2A and 2B Boric Acid Transfer pump control switches are in "STOP", green lights are lit.**		
		(pause) **Switch placed to "Auto", green light lit**		
	One Reactor Makeup Water Pump	**Cue:** **Switch in "Auto", green light lit.**		
*11	Place "NC System Makeup" switch to "START".	Same **Cue:** **Switch rotated clockwise, red light is lit, Red lights are lit on BAT and Reactor M/U pumps in "AUTO".**		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
12	Ensure Reactor Makeup Water and Boric Acid flow is acceptable.	Operator checks chart recorder (2MNVCR5450) to verify adequate flow. (Boric acid flow should be approx. 15.8 GPM, Total blend flow = 90 GPM.) **Cue:** **Reactor Makeup Water flow is ______ GPM and Boric Acid flow is ______GPM.** (give values as indicated by operator) **Cue:** **The SRO has directed another operator to complete this procedure.**		

STOP TIME___________

* DENOTES CRITICAL

INITIAL CONDITIONS

IAE testing has the automatic portion of the Unit 2 NC SYS M/U Controller out of service. The controller is positioned to the **OFF** position at the present time. The level in the VCT is dropping and the RO wishes to makeup at the VCT Concentration. The following conditions exist:

BAT Boron Concentration	-	7530 PPM
VCT Boron Concentration	-	1320 PPM
Blender Flow Rate	-	90 GPM

The NV system is in its normal alignment, all valves are aligned per the valve checklist and all R&R's have been evaluated.

The Control Room SRO directs you to Calculate the Boric Acid Potentiometer Setting and begin Manual Makeup to the VCT per OP/2/A/6150/009 Encl. 4.5 (Manual Makeup).

(R06-97)

Duke Power Company
PROCEDURE PROCESS RECORD

(1) ID No. OP/2/A/6150/009
Revision No. 35

INFORMATION ONLY

REPARATION
(2) Station McGuire Nuclear Station

(3) Procedure Title Boron Concentration Control

(4) Prepared By D.E. Moore *D E Moore* Date September 23, 1999

(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 9/23/99
Cross-Disciplinary Review By ______ (QR) NA *NLB* Date 9/23/99
Reactivity Mgmt. Review By ______ (QR) NA ______ Date 9/25/99

(7) Additional Reviews
Reviewed By ______ Date ______
Reviewed By ______ Date ______

(8) Temporary Approval (*if necessary*)
By ______ (SRO/QR) Date ______
By ______ (QR) Date ______

(9) Approved By *Peter J Schuerger* Date 9.28.99

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 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, 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.*)

1. Limits and Precautions

1.1 WHEN changing NC System boron concentration, a minimum of one NC Pump shall be in operation to ensure adequate mixing of NC loops to prevent pockets of diluted water. {SOER 94-2} {PIP-M99-2915}

The following exceptions apply:

- Boration per Abnormal or Emergency Procedures.
- Both the NC System and makeup source greater than required boron concentration. (Shutdown Margin, refueling concentration)

1.2 WHEN reactor is subcritical and count rate on either Source Range Channel increases by a factor of two or more during a recent boron concentration change, the operation must be immediately stopped until a satisfactory evaluation of the situation has been made.

1.3 WHEN changing boron concentration closely monitor rod motion, Tave, and nuclear instrumentation for expected indication.

1.4 Ensure sufficient capacity is available in the RHT for any dilution / boration operation.

1.5 To prevent dead heading the weaker group, minimize running both Boric Acid tank Pumps simultaneously, unless under high flow demands.

2. Initial Conditions

None

3. Procedure

☐ 3.1 Evaluate all outstanding R&Rs that may impact the performance of this procedure.

3.2 To makeup to the following tank(s), ensure it is in operation with its associated system.

- ☐ VCT - NV System is in normal operation per OP/2/A/6200/001A (Chemical and Volume Control System Letdown).
- ☐ RHT - NB System in operation per OP/0/A/6200/003 (Boron Recycle System).

☐ 3.3 Ensure total makeup and boric acid integrator thumbwheels set at high enough value to prevent stopping inadvertently.

☐ 3.4 <u>IF</u> makeup to the RHT is desired, notify Radwaste Chemistry.

______________ ______/______
Person Contacted Date Time

3.5 Align flow path to selected tank as follows:

3.5.1 For RHT, open:

_____ • 2NV-172 (Boric Acid Blender Disch to Systems NB and FW)
_____ • 1NB-4 (NB System Supply from NV System Unit 2 Isol).

3.5.2 For VCT, open:

_____ • 2NV-175A (BA Blender To VCT Outlet)
<u>AND/ OR</u>
_____ • 2NV-171A (BA Blender to VCT Inlet)

☐ 3.6 Refer to McGuire Data Book or OAC and determine flow rates required to produce desired blended flow boron concentration.

_____ 3.7 Place "NC SYS M/U Controller" switch to "MANUAL".

_____ 3.8 <u>IF</u> makeup requires high Boron concentration, perform the following: {PIP 0-M-97-2543}

3.8.1 Place the following in "MAN":

_____ • "BA Blend Disch CNTRL"
_____ • "BA Flow Control"

3.8.2 Place the following in "AUTO":

_____ • One Boric Acid Transfer Pump
_____ • One Reactor Makeup Water Pump

/OTE: Place "NC Makeup Control" switch to "STOP" to terminate makeup at anytime.

_____ 3.8.3 Place "NC System Makeup" switch to "START".

3.8.4 Adjust the following as necessary to obtain flow rates as determined in Step 3.6:

- ❑ "BA Blend Disch CNTRL"
- ❑ "BA Flow Control"

❑ 3.8.5 GO TO Step 3.12.

❑ 3.9 Position "BA Flow Control" potentiometer to the value determined in Step 3.6.

3.10 Place the following in "AUTO":

- _____ • "BA Blend Disch CNTRL"
- _____ • "BA Flow Control"
- _____ • One Boric Acid Transfer Pump
- _____ • One Reactor Makeup Water Pump

OTE: Place "NC Makeup Control" switch to "STOP" to terminate makeup at anytime.

_____ 3.11 Place "NC System Makeup" switch to "START".

❑ 3.12 Ensure Reactor Makeup Water and Boric Acid flow is acceptable.

_____ 3.13 <u>IF</u> VCT level is higher than desired, place 2NV-137A (NC Filters Otlt 3-Way Control) to "HUT".

_____ 3.14 <u>WHEN</u> VCT level is at desired level, place 2NV-137A (NC Filters Otlt 3-Way Control) in "AUTO".

3.15 <u>WHEN</u> desired amount of makeup has been transferred, align system for normal operation as follows:

_____ 3.15.1 Place "NC System Makeup" switch to "STOP".

3.15.2 IF desired, flush Blender for 1 (one) minute by performing the following:

_____ • Open 2NV-252A (RX M/U Water To Blender Control).
_____ • Start either 2A or 2B Rx M/U Water Pump.

3.15.2.1 **WHEN** 1 (one) minute flush is completed, perform the following:

_____ • Stop either 2A or 2B Rx M/U Water Pump.
_____ • 2NV-252A (RX M/U Water To Blender Control) to "AUTO".

_____ 3.15.3 IF makeup was to the RHT, close the following valves:

_____ • 2NV-172 (Boric Acid Blender #1 Disch to Systems NB and FW).
_____ • 1NB-4 (NB System Supply from NV System Unit #2 Isol).

3.15.4 IF makeup was to VCT, place the following control switches to "AUTO":

_____ • 2NV-175 (BA Blender To VCT Outlet).
_____ • 2NV-171 (BA Blender to VCT Inlet).

3.15.5 Ensure the following controls are positioned to "AUTO":

- ☐ 2NV-171A (BA Blender To VCT Inlet).
- ☐ 2NV-175A (BA Blender To VCT Outlet)
- ☐ 2NV-252A (RX M/U Water To Blender Control)
- ☐ 2NV-267A (BA To BA Blender Control)
- ☐ Either 2A or 2B Rx M/U Water Pump
- ☐ Either 2A or 2B BA Trans Pump
- ☐ BA BLEND DISCH CNTRL
- ☐ BA Flow Control

3.15.6 Ensure the following are set to proper NC System concentration: {PIP M97-2543}

- ☐ "BA Blend Disch CNTRL"
- ☐ "BA Flow Control"

_____ 3.15.7 Place "NC System M/U controller" switch to "AUTO".

_____ 3.15.8 Place "NC System Makeup" switch to "START".

End Of Enclosure

Unit 2

CHG V
TMJS
07/13/99

Table 5.2
Makeup Concentration Equations

To determine the boric acid flow rate:

To determine the boric acid flow rate for a desired VCT makeup boron concentration, use the following equation:

$$\frac{\text{Desired VCT boron concentration (ppmB) x Total blender flow rate (gpm)}}{\text{Boric acid tank boron concentration (ppmB)}}$$

To set the potentiometer on NVSS5450, use the following equation:

$$\text{Potentiometer setting} = \frac{\text{Boric acid flow rate (gpm)}}{4}$$

Current total blender flow rate in automatic is 90 gpm.

NOTE: If the unit has operated continuously for several months, significant Boron 10 depletion may have occurred. The effective boron concentration of the NC system may be lower than indicated by Chemistry samples. NC temperature should be carefully monitored following VCT makeups.

For diluting or borating while in Modes 3, 4 or 5:

Use the correction factor, K, for a dilution/boration performed in Modes 3, 4 or 5. Obtain the volume of water/boric acid for the desired dilution/boration from Table 5.1. Then apply the appropriate K listed below to the volume from Table 5.1.

Plant Conditions			Correction
Pressure (psig)	Tavg (°F)	Pressurizer Level	Factor (K)
2235	557 - 588	Normal Operating	1.00
1600	500	No-Load	1.05
1200	450	No-Load	1.10
800	400	No-Load	1.16
400	350	No-Load	1.18
400	300	No-Load	1.20
400	300	Solid Water	1.35
400	200	No-Load	1.28
400	200	Solid Water	1.40
400	100	Solid Water	1.47

Prepared By: ______

Reviewed By: ______

Approved By: ______

TASK: **Terminate SI Flow After a LOCA in Unit 2 Containment**

POSITION: **RO**

Operator's Name______________________

Location: **Unit 2 Control Room** Method: **Walkthrough**

Estimated JPM Completion Time: __20__ Minutes

Actual JPM Completion Time: ______ Minutes

The JPM Operator's performance was evaluated against the standards of this JPM and is determined to be:

SATISFACTORY/UNSATISFACTORY (circle one)

Evaluator's Signature______________________ Date __/__/__

References: EP/2/A/5000/ES-1.1 (Rev.12) Safety Injection Termination
EP/2/A/5000/G-1 (Rev.14) Enc. 18 (Aligning Normal Charging With NV Recirc Path Isolated)

JPM verified current with references by ______________________

Date __/__/__

Rev. 00/03-14-00

INITIAL CONDITIONS

LOCA inside containment is in progress on Unit 2. EP/2/A/5000/E-1 (Loss of Reactor or Secondary Coolant) has been implemented. SI termination criteria has been met per step 6.

The SRO instructs you to perform EP/2/A/5000/ES-1.1 (Safety Injection Termination) to secure SI flow.

JPM OVERALL STANDARD: One NV Pump is in operation and aligned to normal charging. All NI Pumps are off.

NOTES: The evaluator shall provide copies of EP/2/A/5000/ES-1.1 (Safety Injection Termination) and EP/2/A/5000/G-1 (Enc.18 - Aligning Normal Charging With NV Recirc Path Isolated) upon request.

KA 013 A4.02 4.3/4.4

START TIME__________

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
1	**Monitor Foldout page.**	Same **Cue:** **The SRO has directed another operator to monitor the foldout page and inform you of any actions that may be required per the foldout page.**		
2	**Reset the following:**			
*	S/I	Same **Cue:** **Pushbuttons depressed and lights are illuminated**		
*	Sequencers	Same **Cue:** **Pushbuttons depressed and lights are illuminated**		

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
3	**<u>IF</u> <u>AT</u> <u>ANY</u> <u>TIME</u> a B/O signal occurs, <u>THEN</u> restart S/I equipment previously on**	Same **Cue:** **There is no Blackout in progress**		
*4	**Stop all but one NV Pump**	Operator secures either NV pump <u>after receiving the following cue:</u> **Cue:** **Red lights are illuminated on both NV Pumps.** **Cue:** **Pushbutton depressed, green light is illuminated**		
5	**Check NC pressure - STABLE OR GOING UP**	Operator checks OAC or one of several NC System pressure indications. **Cue:** **NC System Pressure is 1800 PSIG and is going up slowly.**		

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
6	**Isolate NV S/I flowpath:**			
	Check NV pump - SUCTION ALIGNED TO FWST	Operator checks the position of 2NV-221 and 2NV-222. After receiving the following cue, the Operator proceeds to the RNO. **Cue:** **Green lamps are illuminated** (on 2NV-221 and 2NV-222).		
	IF suction aligned to discharge of ND pumps in S/I Recirc mode, **THEN**:	**Cue:** **2ND-58 red light lit, 2NI-136 red light lit, 2NI-332 red light lit, 2NI-333 red light lit, 2NI-334 red light lit**		
	Realign charging **PER** EP/2/A/5000/G-1 (Generic Enclosures), Enclosure 18 (Aligning Normal Charging With NV Recirc Path Isolated).	Operator transitions to Generic Enclosure 18.		

* DENOTES CRITICAL

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
7	From Generic Enclosure 18, (Aligning Normal Charging With NV Recirc Path Isolated) Check VI header pressure - GREATER THAN 60 PSIG	Operator checks gage on Unit 1 main control board. **Note to evaluator:** The common VI header pressure gage is located on the **UNIT 1** condensate board. **Cue:** **Gage indicates 105 PSIG.**		
8	**Close 2NV-241 (Seal Inj Flow Control).**	Operator rotates loader counter clockwise till needle is at bottom of loader. **Cue:** **Knob rotated counter clockwise, needle indicates "0"**		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
9	**Open the following:**	Same		
*	• 2NV-244A (Charging Line Cont Isol Otsd)	**Cue:** **Green light lit.**		
*	• 2NV-245B (Charging Line Cont Isol Otsd)	**Cue:** **Green light lit.** **Cue:** **Pushbuttons depressed, red lights illuminated.**		
10	**Check NC Pressure - GREATER THAN 1950 PSIG**	<u>After receiving the following cue</u>, the operator proceeds to the RNO: **Cue:** **NC System pressure is 1800 PSIG**		
	<u>GO</u> <u>TO</u> Step 6.	Same		

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
11	**For 2NV-238 (Charging Line Flow Control) perform the following:**	Same		
*	• Place manual loader in "MAN".	**Cue:** **Pushbutton depressed, Amber light illuminated**		
*	• Fully open manual loader.	**Cue:** **"Output" pushbutton depressed, output reads 100%, red light illuminated.**		
12	**Close the following:**	Same		
*	• 2NI-9A (NC Cold Leg Inj From NV)	**Cue:** **Red light lit. Pushbutton depressed, green light illuminated.**		
*	• 2NI-10B (NC Cold Leg Inj From NV)	**Cue:** **Red light lit. Pushbutton depressed, green light illuminated.**		

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
13	**Throttle 2NV-238 (Charging Line Flow Control) and 2NV-241 (Seal Inj Flow Control) to:** • Establish 60 GPM charging flow. • Maintain seal injection flow.	Operator decreases output from 2NV-238 and opens 2NV-241 until charging flow is 60 GPM and seal injection flow to each NC pump is 6-10 GPM. **Cue:** **Controllers for 2NV-238 and 2NV-241 adjusted. Charging flow meter indicates 60 GPM. Seal injection flow to each NC pump is 8 GPM.**		
14	**Maintain charging flow between 60 GPM and 175 GPM in subsequent steps.**	Operator reads step and continues.		
15	**RETURN TO procedure and step in effect.**	Operator returns to EP/2/A/5000/ES-1.1, step 6, RNO a.2.		
16	Back in EP/2/A/5000/ES-1.1, step 6, RNO a.2. GO TO Step 8.	Same		

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
17	**Control Pzr level as follows:** • Control charging flow as required to maintain Pzr level – STABLE • Check Pzr level – STABLE OR GOING UP.	RO monitors pressurizer level using meters, OAC or chart recorder to verify level trend, and adjusts charging flow to maintain level stable **Cue:** **Pzr level indication is stable**		
18 * *	**Check if NI pumps should be stopped:** Check NC Pressure • STABLE OR GOING UP • GREATER THAN 1600 PSIG Stop NI Pumps	Same **Cue:** **Meter indication is going up** **Meter indication is 1850 psig** **Cue:** **Pushbutton depressed, green light illuminated.** **Cue:** **Pushbutton depressed, green light illuminated.**		

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
19	**Check if ND pumps should be stopped:**			
*	Check ND pumps suction - ALIGNED TO FWST	Operator checks the position of 2FW-27, 2NI-184 and 2NI-185. After receiving the following cue, the operator proceeds to the RNO: **Cue:** **Green lamp is illuminated on 2FW-27, Red lights illuminated on 2NI-184 and 2NI-185.**		
	<u>GO TO</u> Step 11.	Same		
20	**Check S/I flow not required:**			
	• NC Subcooling based on core exit T/C's - GREATER THAN 0^0F	Same **Cue:** **Subcooling is 80^0F**		
	• Pzr level - GREATER THAN 11% (29% ACC)	Same **Cue:** **Gages indicate Pzr level is at 60%.**		

* DENOTES CRITICAL

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
21	**Reset the following:**	Operator resets both Trains of Phase A and Phase B Isolation.		
*	• Phase A Isolation.	**Cue:** **Pushbuttons depressed for both trains, "RESET" lights illuminated.**		
*	• Phase B Isolation.	**Cue:** **Pushbuttons depressed for both trains, "RESET" lights illuminated.**		
22	**Establish VI to Containment** Open the following…	**Cue:** **The SRO has directed another operator to continue in this procedure.**		

STOP TIME___________

*** DENOTES CRITICAL**

INITIAL CONDITIONS

LOCA inside containment is in progress on Unit 2. EP/2/A/5000/E-1 (Loss of Reactor or Secondary Coolant) has been implemented. SI termination criteria has been met per step 6.

The SRO instructs you to perform EP/2/A/5000/ES-1.1 (Safety Injection Termination) to secure SI flow.

(R06-97)

Duke Power Company
PROCEDURE PROCESS RECORD

(1) ID No. EP/2/A/5000/ES-1.1
Revision No. 12

WORKING COPY

EPARATION

(2) Station McGuire Nuclear Station

(3) Procedure Title Safety Injection Termination

(4) Prepared By Mike Weiner Mike Weiner Date January 20, 2000

(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 S. Hackney (QR) Date 1/25/00

Cross-Disciplinary Review By ______ (QR) NA SH Date 1/25/00

Reactivity Mgmt. Review By ______ (QR) NA SH Date 1/25/00

INFORMATION ONLY

(7) Additional Reviews

Reviewed By ______ Date ______

Reviewed By ______ Date ______

(8) Temporary Approval (*if necessary*)

By ______ (SRO/QR) Date ______

By ______ (QR) Date ______

(9) Approved By Peter T Schwinger Date 2-9-00

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 ______

INFORMATION ONLY

(11) Date(s) Performed ______

Work Order Number (WO#) ______

COMPLETION

(12) Procedure Completion Verification

- ☐ Yes ☐ N/A Check lists and/or blanks 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, 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.*)

A. Purpose

This procedure provides the necessary instructions to terminate safety injection and stabilize plant conditions.

B. Symptoms or Entry Conditions

This procedure is entered from:

- EP/2/A/5000/E-0 (Reactor Trip Or Safety Injection), Step 33, and EP/2/A/5000/E-1 (Loss Of Reactor Or Secondary Coolant), Step 6, when specified termination criteria are satisfied.
- EP/2/A/5000/FR-H.1 (Response To Loss Of Secondary Heat Sink), Step 50, after secondary heat sink has been reestablished and S/I has been terminated.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
C. Operator Actions	
__ 1. **Monitor foldout page.**	
2. **Reset the following:**	
__ a. S/I.	a. Perform the following: __ 1) Dispatch operator to open reactor trip breakers. __ 2) Reset S/I.
__ b. Sequencers.	b. Dispatch operator to open breaker for affected sequencer DC control power: __ • A Train - 2EVDA Breaker 6 __ • B Train - 2EVDD Breaker 8.
__ 3. **IF AT ANY TIME a B/O signal occurs, THEN restart S/I equipment previously on.**	
__ 4. **Stop all but one NV pump.**	
__ 5. **Check NC pressure - STABLE OR GOING UP.**	__ **GO TO EP/2/A/5000/ES-1.2 (Post LOCA Cooldown And Depressurization).**
6. **Isolate NV S/I flowpath:**	
__ a. Check NV pump - SUCTION ALIGNED TO FWST.	a. IF suction aligned to discharge of ND pumps in S/I Recirc mode, THEN: __ 1) Realign charging PER EP/2/A/5000/G-1 (Generic Enclosures), Enclosure 18 (Aligning Normal Charging With NV Recirc Path Isolated). __ 2) GO TO Step 8.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

6. (Continued)

b. Check NV pumps miniflow valves - OPEN:

__ • 2NV-150B (NV Pumps Recirculation)

__ • 2NV-151A (NV Pumps Recirculation).

RESPONSE NOT OBTAINED

b. Perform the following:

__ 1) Open valves.

__ 2) <u>**IF**</u> both valves open, <u>**THEN**</u> <u>**GO**</u> <u>**TO**</u> Step 6.c.

3) <u>**IF**</u> either valve closed, <u>**THEN**</u>:

a) Dispatch operator to open valve(s):

__ • 2NV-150B (aux bldg, 716+8, HH-57, room 634, NV pump room 2A)

__ • 2NV-151A (aux bldg, 716+7, HH-57, room 634, NV pump room 2A).

__ b) Realign charging <u>**PER**</u> EP/2/A/5000/G-1 (Generic Enclosures), Enclosure 18 (Aligning Normal Charging With NV Recirc Path Isolated).

__ c) <u>**WHEN**</u> both 2NV-150B and 2NV-151A open, <u>**THEN**</u> charging flow may be throttled to less than 60 GPM.

__ d) <u>**GO**</u> <u>**TO**</u> Step 8.

ACTION/EXPECTED RESPONSE

c. Close the following valves:

__ • 2NI-9A (NC Cold Leg Inj From NV)

__ • 2NI-10B (NC Cold Leg Inj From NV).

RESPONSE NOT OBTAINED

c. Dispatch operator to close valve(s):

__ • 2NI-9A (aux bldg, 733+15, JJ-61, VCT hallway, 2 ft from reactor bldg at ceiling)

__ • 2NI-10B (aux bldg, 733+4, JJ-61, VCT hallway, 2 ft from reactor bldg wall).

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
7. **Establish charging:**	
__ a. Check VI header pressure - GREATER THAN 60 PSIG.	a. Perform the following: 1) Dispatch operators to perform the following and standby: __ • Throttle 2NV-237 (NV Pump Disch Control Isol) (aux bldg, 716+8, JJ-58, room 636, north of PD pump) to maintain 6-10 GPM seal injection flow to each NC pump. __ • Loosen lock nut and close 2NV-241 (Seal Inj Flow Control) (aux bldg, 716+8, HH-60, room 646, 3 ft north of BW pumps). 2) **WHEN** 2NV-241 is locally closed, **AND** 2NV-237 is locally throttled, **THEN**: a) Open the following: __ • 2NV-244A (Charging Line Cont Outside Isol) __ • 2NV-245B (Charging Line Cont Outside Isol). b) **IF** 2NV-244A or 2NV-245B closed, **THEN** dispatch operator to open valve(s): __ • 2NV-244A (aux bldg, 716+7, HH-60, room 646, front of BW pumps, 4 ft from reactor bldg) __ • 2NV-245B (aux bldg, 716+7, HH-60, room 646, front of BW pumps, 3 ft from reactor bldg). __ c) Place 2NV-238 (Charging Line Flow Control) controller in manual and fully open. __ d) Place 2NV-241 (Seal Inj Flow Control) manual loader fully open.

(RNO continued on next page)

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

7. (Continued)

3) **IF AT ANY TIME** charging flow is required to be controlled in subsequent steps, **THEN** have dispatched operators locally adjust flow rate as follows:

__ • Slowly throttle 2NV-241.

__ • Throttle 2NV-237 while maintaining NC pump seal injection flow.

__ • Maintain charging flow less than 175 GPM.

__ 4) **GO TO** Step 8.

__ b. Throttle 2NV-238 (Charging Line Flow Control) to maintain 6-10 GPM seal injection flow to each NC pump.

__ c. Close 2NV-241 (Seal Inj Flow Control).

d. Open the following valves:

__ • 2NV-244A (Charging Line Cont Outside Isol)

__ • 2NV-245B (Charging Line Cont Outside Isol).

RNO d. Dispatch operator to open valve(s):

__ • 2NV-244A (aux bldg, 716+7, HH-60, room 646, front of BW pumps, 4 ft from reactor bldg)

__ • 2NV-245B (aux bldg, 716+7, HH-60, room 646, front of BW pumps, 3 ft from reactor bldg).

e. **IF AT ANY TIME** charging flow is required to be controlled in subsequent steps, **THEN**:

__ • Slowly throttle 2NV-241.

__ • Throttle 2NV-238 while maintaining NC pump seal injection flow.

__ • Maintain charging flow less than 175 GPM.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
8. **Control Pzr level as follows:**	
__ a. Control charging flow as required to maintain Pzr level - STABLE.	
__ b. Check Pzr level - STABLE OR GOING UP.	b. Perform the following: __ 1) Attempt to stabilize Pzr level by raising charging flow (maximum 175 GPM). __ 2) **IF** Pzr level stabilizes or is going up, **THEN GO TO** Step 9. 3) **IF** Pzr level continues to go down, **THEN**: a) Open the following: __ • 2NI-9A (NC Cold Leg Inj From NV) __ • 2NI-10B (NC Cold Leg Inj From NV). b) Close the following: __ • 2NV-244A (Charging Line Cont Outside Isol) __ • 2NV-245B (Charging Line Cont Outside Isol). __ c) **GO TO** EP/2/A/5000/ES-1.2 (Post LOCA Cooldown And Depressurization).

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
9. **Check if NI pumps should be stopped:**	
a. Check NC pressure - __ • STABLE OR GOING UP __ • GREATER THAN 1600 PSIG.	a. Perform the following: __ 1) **IF** T-Ave less than 350° F prior to event, **AND** NC pressure stable or going up, **THEN GO TO** Step 9.b. __ 2) **IF** all S/Gs intact, **THEN GO TO** EP/2/A/5000/ES-1.2 (Post LOCA Cooldown And Depressurization). 3) **IF** any S/G is faulted, **THEN**: __ a) Do not continue until faulted S/G depressurization stops. __ b) **IF** criteria for stopping NI pumps (Step 9.a) can not be satisfied after faulted S/G depressurization stops, **THEN GO TO** EP/2/A/5000/ES-1.2 (Post LOCA Cooldown And Depressurization).
__ b. Stop NI pumps.	
10. **Check if ND pumps should be stopped:**	
__ a. Check ND pumps suction - ALIGNED TO FWST.	__ a. **GO TO** Step 11.
__ b. Stop ND pumps.	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
11. **Check S/I flow not required:**	
__ a. NC subcooling based on core exit T/Cs - GREATER THAN 0° F.	a. Perform the following: 1) Raise S/I flow to restore subcooling as follows: __ • Start one or more S/I pumps. • **IF** necessary, **THEN** realign NV S/I flow path: __ a) **IF** suction aligned to VCT, **THEN** realign to FWST or to discharge of ND pumps in S/I Recirc mode. b) Realign discharge as follows: (1) Open the following: __ • 2NI-9A (NC Cold Leg Inj From NV) __ • 2NI-10B (NC Cold Leg Inj From NV). (2) Close the following: __ • 2NV-244A (Charging Line Cont Outside Isol) __ • 2NV-245B (Charging Line Cont Outside Isol). __ 2) **GO TO** EP/2/A/5000/E-1 (Loss Of Reactor Or Secondary Coolant).

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
11. (Continued)	
__ b. Pzr level - GREATER THAN 11% (29% ACC).	b. Perform the following: __ 1) Control charging flow to maintain Pzr level. __ 2) <u>**IF**</u> Pzr level can be maintained with normal charging, <u>**THEN**</u> <u>**GO TO**</u> Step 12. 3) Raise S/I flow to restore level as follows: __ • Start one or more S/I pumps. • <u>**IF**</u> necessary, <u>**THEN**</u> realign NV S/I flow path: __ a) <u>**IF**</u> suction aligned to VCT, <u>**THEN**</u> realign to FWST or to discharge of ND pumps in S/I Recirc mode. b) Realign discharge as follows: (1) Open the following: __ • 2NI-9A (NC Cold Leg Inj From NV) __ • 2NI-10B (NC Cold Leg Inj From NV). (2) Close the following: __ • 2NV-244A (Charging Line Cont Outside Isol) __ • 2NV-245B (Charging Line Cont Outside Isol). __ 4) <u>**GO TO**</u> EP/2/A/5000/E-1 (Loss Of Reactor Or Secondary Coolant).

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
12. **Reset the following:**	
__ • Phase A Isolation	
__ • Phase B Isolation.	
13. **Establish VI to containment:**	
a. Open the following:	
__ • 2VI-129B (A Ess Hdr Cont Outside Isol)	
__ • 2VI-160B (B Ess Hdr Cont Outside Isol)	
__ • 2VI-150B (Lwr Cont Non Ess Cont Outside Isol).	
__ b. Check VI header pressure - GREATER THAN 85 PSIG.	b. Perform the following:
	1) Align N_2 to all PORVs by opening:
	__ • 2NI-430A (Emerg N2 From CLA To 2NC-34A)
	__ • 2NI-431B (Emerg N2 From CLA To 2NC-32B & 36B).
	__ 2) **IF** VI not available for CA flow control in subsequent steps, **THEN** control flow **PER** EP/2/A/5000/G-1 (Generic Enclosures), Enclosure 16 (CA Flow Control With Loss of VI).
	__ 3) Restore VI **PER** AP/2/A/5500/22 (Loss Of VI).

(R06-97)

Duke Power Company
PROCEDURE PROCESS RECORD

WORKING COPY

(1) ID No. **EP/2/A/5000/G-1**
Revision No. **14**

PARATION
Station **McGuire Nuclear Station**

(3) Procedure Title **Generic Enclosures**

(4) Prepared By **Mike Weiner** Date **March 4, 1999**

(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 S. Hackney (QR) Date 3/26/99
Cross-Disciplinary Review By ______ (QR) NA JSH Date 3/26/99
Reactivity Mgmt. Review By ______ (QR) NA JSH Date 3/26/99

(7) Additional Reviews

INFORMATION ONLY

Reviewed By ______ Date ______
Reviewed By ______ Date ______

(8) Temporary Approval (*if necessary*)
By ______ (SRO/QR) Date ______
By ______ (QR) Date ______

(9) Approved By [signature] Date 3/31/99

.RFORMANCE (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#) ______

INFORMATION ONLY

COMPLETION
(12) Procedure Completion Verification

☐ Yes ☐ N/A Check lists and/or blanks 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, 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.*)

Aligning Normal Charging With NV Recirc Path Isolated

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ 1. **Check VI header pressure - GREATER THAN 60 PSIG.**	__ **GO TO Step 11.**
__ 2. **Close 2NV-241 (Seal Inj Flow Control).**	
3. **Open the following:** __ • 2NV-244A (Charging Line Cont Outside Isol) __ • 2NV-245B (Charging Line Cont Outside Isol).	**Perform the following:** a. Dispatch operator to open valve(s): __ • 2NV-244A (aux bldg, 716+7, HH-60, room 646, front of BW pumps, 4 ft from reactor bldg) __ • 2NV-245B (aux bldg, 716+7, HH-60, room 646, front of BW pumps, 3 ft from reactor bldg). __ b. Do not continue until 2NV-244A and 2NV-245B are open.
__ 4. **Check NC pressure - GREATER THAN 1950 PSIG.**	__ **GO TO Step 6.**
__ 5. **Throttle open 2NV-241 (Seal Inj Flow Control) to 50%.**	
6. **For 2NV-238 (Charging Line Flow Control) perform the following:** __ a. Place manual loader in "MAN". __ b. Fully open manual loader.	
7. **Close the following:** __ • 2NI-9A (NC Cold Leg Inj From NV) __ • 2NI-10B (NC Cold Leg Inj From NV).	**Dispatch operator to close valve(s):** __ • 2NI-9A (aux bldg, 733+15, JJ-61, VCT hallway, 2 ft from reactor bldg at ceiling) __ • 2NI-10B (aux bldg, 733+4, JJ-61, VCT hallway, 2 ft from reactor bldg wall).

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
8. **Throttle 2NV-238 (Charging Line Flow Control) and 2NV-241 (Seal Inj Flow Control) to:** __ • Establish 60 GPM charging flow. __ • Maintain seal injection flow.	
__ 9. **Maintain charging flow between 60 GPM and 175 GPM in subsequent steps.**	
__ 10. **<u>RETURN</u> <u>TO</u> procedure and step in effect.**	
__ 11. **Dispatch operator to loosen lock nut and close 2NV-241 (Seal Inj Flow Control) (aux bldg, 716+8, HH-60, room 646, 3 ft north of BW pumps).**	
__ 12. **Do not continue until 2NV-241 (Seal Inj Flow Control) is locally closed.**	
13. **Open the following:** __ • 2NV-244A (Charging Line Cont Outside Isol) __ • 2NV-245B (Charging Line Cont Outside Isol).	**Perform the following:** a. Dispatch operator to open valve(s): __ • 2NV-244A (aux bldg, 716+7, HH-60, room 646, front of BW pumps, 4 ft from reactor bldg) __ • 2NV-245B (aux bldg, 716+7, HH-60, room 646, front of BW pumps, 3 ft from reactor bldg). __ b. Do not continue until 2NV-244A and 2NV-245B are open.
__ 14. **Check NC pressure - GREATER THAN 1950 PSIG.**	__ **<u>GO</u> <u>TO</u> Step 17.**

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ 15. **Notify dispatched operator to throttle 2NV-241 (Seal Inj Flow Control) 6 turns open.**	
__ 16. **Do not continue until Step 15 is completed.**	
__ 17. **Fully open the manual loader for 2NV-241 (Seal Inj Flow Control).**	
18. **For 2NV-238 (Charging Line Flow Control) perform the following:** __ a. Place manual loader in "MAN". __ b. Fully open manual loader.	
19. **Close the following:** __ • 2NI-9A (NC Cold Leg Inj From NV) __ • 2NI-10B (NC Cold Leg Inj From NV).	**Dispatch operator to close valve(s):** __ • 2NI-9A (aux bldg, 733+15, JJ-61, VCT hallway, 2 ft from reactor bldg at ceiling) __ • 2NI-10B (aux bldg, 733+4, JJ-61, VCT hallway, 2 ft from reactor bldg wall).
20. **Establish 60 GPM charging flow while maintaining seal injection flow as follows:** __ • Notify dispatched operator to throttle 2NV-241 (Seal Inj Flow Control). __ • Dispatch operator to throttle 2NV-237 (NV Pump Disch Control Isol) (aux bldg, 716+8, JJ-58, room 636, north of PD pump).	
__ 21. **Maintain charging flow between 60 GPM and 175 GPM in subsequent steps.**	
__ 22. **<u>RETURN TO</u> procedure and step in effect.**	

Prepared By: Rob Billy

Reviewed By: Charles Sawyer

Approved By: Thomas C. Cole

TASK: **Ensure Proper Response of Diesel VI Compressors on Loss of VI**

POSITION: **NLO**

Operator's Name________________________________

Location: **Plant** Method: **Walkthrough**

Estimated JPM Completion Time: 10 Minutes

Actual JPM Completion Time: ______ Minutes

The JPM Operator's performance was evaluated against the standards of this JPM and is determined to be:

SATISFACTORY/UNSATISFACTORY (circle one)

Evaluator's Signature______________________________ Date __/__/__

References: AP/1/A/5500/22 (Rev. 15) LOSS OF VI

JPM verified current with references by ______________________________

Date __/__/__

Rev. 01/11-29-99

INITIAL CONDITIONS

You are the Service Building Rounds person.

Units 1 and 2 are at 100% power when a leak develops in the VI system. AP/1/A/5500/22 (Loss of VI) has been implemented up to step 4.c. VI header pressure is 75 PSIG and going down.

The Control Room SRO dispatches you to ensure Diesel VI compressors are running per Enclosure 4 (Diesel VI Compressor Operation) of AP/1/A/5500/22 (Loss of VI). Upon arriving at the scene, the following conditions exist:

"H" VI Compressor is running

"G" VI Compressor is NOT running

JPM OVERALL STANDARD: "G" VI compressor is started per Enclosure 4 (Diesel VI Compressor Operation) of AP/1/A/5500/22.

NOTES: Evaluator will provide a copy of AP/22, Enclosure 4 upon request.

KA-APE-065-AA1.04 3.5/3.4

TASK: MO-5012

START TIME__________

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
1	**On running compressors, ensure associated compressor switches are in the following positions:**	Operator determines from JPM initial conditions that "H" VI Compressor is running and proceeds to check the switches for "H" VI Compressor.		
	"Auto/Off-Reset" toggle switch in "AUTO".	**Cue:** **"Auto/Off-Reset" toggle switch is in "AUTO"**		
	"HIGH/LOW SELECTOR" switch, in "HIGH".	**Cue:** **"HIGH/LOW Selector" switch is in "HIGH".**		
	"START/WARM-UP/RUN" selector switch in "RUN".	**Cue:** **"START/WARM-UP/RUN" switch is in "RUN".**		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
2	**IF G VI Compressor is off, THEN perform the following:**	Operator determines from JPM initial conditions that "G" VI Compressor is NOT running and proceeds to step 2.a.		
*	Place the "Auto/Off-Reset" toggle switch in "OFF-RESET".	**Cue:** **"Auto/Off-Reset" toggle switch moved one position to the right**		
	Ensure the "HIGH/LOW Selector" switch, is in "HIGH".	**Cue:** **"HIGH/LOW Selector" switch is in "HIGH".**		
	Ensure the "START/WARM-UP/RUN" selector switch is in "RUN".	**Cue:** **"START/WARM-UP/RUN" switch is in "RUN".**		
*	Place "ENGINE SWITCH" in "START".	**Cue:** **"ENGINE SWITCH" rotated clockwise to "START"**		
	IF Diesel compressor fails to start within approximately 15 seconds, **THEN** perform the following:	**Cue:** **15 seconds have elapsed and the engine is NOT running**		

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
2	**CONTINUED**			
*	Place "Engine" switch in "OFF".	**Cue:** **"Engine" switch rotated counterclockwise to "OFF"**		
	Do not attempt to start G VI compressor until 2 minutes have elapsed.	<u>**Note**</u>: Allow the next two steps to be read before giving the "2 minutes have elapsed" cue.		
	<u>**IF**</u> H VI compressor is off, <u>**THEN**</u> start H VI compressor <u>**PER**</u> step 3 while waiting to start G VI compressor.	Operator determines from JPM initial conditions that "H" VI Compressor is running and proceeds to step 2.e.4.		
	<u>**WHEN**</u> 2 minutes have elapsed, <u>**THEN**</u> observe note prior to Step 2.d and <u>**RETURN TO**</u> Step 2.d.	**Cue:** **Two minutes have elapsed.**		
*	Place "ENGINE SWITCH" in "START".	**Cue:** **"ENGINE SWITCH" rotated clockwise to "START" and the engine is running**		

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
3	IF H VI compressor is off, THEN perform the following…	Operator determines from JPM initial conditions that "H" VI Compressor is running and proceeds to step 4.		
4	**WHEN time allows, THEN check running parameters PER OP/0/A/6450/005 (Instrument Air system), Enclosure 4.12 (Response to Auto/Emergency Start of G and/or H VI Compressor).**	Same **Cue:** **Another operator will check the running parameters when time allows.**		

STOP TIME__________

*** DENOTES CRITICAL**

INITIAL CONDITIONS

You are the Service Building Rounds person.

Units 1 and 2 are at 100% power when a leak develops in the VI system. AP/1/A/5500/22 (Loss of VI) has been implemented up to step 4.c. VI header pressure is 75 PSIG and going down.

The Control Room SRO dispatches you to ensure Diesel VI compressors are running per Enclosure 4 (Diesel VI Compressor Operation) of AP/1/A/5500/22 (Loss of VI). Upon arriving at the scene, the following conditions exist:

"H" VI Compressor is running

"G" VI Compressor is <u>NOT</u> running

(R06-97)

Duke Power Company
PROCEDURE PROCESS RECORD

(1) ID No. AP/1/A/5500/22
Revision No. 15

INFORMATION ONLY

PREPARATION

(2) Station McGuire Nuclear Station

(3) Procedure Title Loss Of VI

(4) Prepared By S. Hackney *S. Hackney* Date September 27, 1999

(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 10-18-99
Cross-Disciplinary Review By ______ (QR) NA ______ Date 10-18-99
Reactivity Mgmt. Review By ______ (QR) NA ______ Date 10-18-99

(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 10.20.99

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 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, 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.*)

1. **On running compressors, ensure associated compressor switches are in the following positions:**

__ • "AUTO/OFF-RESET" toggle switch in "AUTO"

__ • "HIGH/LOW" selector switch in "HIGH"

__ • "START/WARM-UP/RUN" selector switch in "RUN".

NOTE Several G and H VI compressor gauges will not function until the associated "ENGINE SWITCH" is placed in the "START" position in the following steps.

2. **IF G VI compressor is off, THEN perform the following:**

__ a. Place the "AUTO/OFF-RESET" toggle switch in "OFF-RESET".

__ b. Ensure the "HIGH/LOW" selector switch is in "HIGH".

__ c. Ensure the "START/WARM-UP/RUN" selector switch is in "RUN".

NOTE Engine will start after a 5 to 10 second time delay in next step.

__ d. Place "ENGINE SWITCH" in "START".

e. IF diesel compressor fails to start within approximately 15 seconds, **THEN** perform the following:

__ 1) Place "ENGINE SWITCH" in "OFF".

__ 2) Do not attempt to start G VI compressor until 2 minutes have elapsed.

__ 3) IF H VI compressor is off, **THEN** start H VI compressor **PER** Step 3 while waiting to start G VI compressor.

__ 4) **WHEN** 2 minutes have elapsed, **THEN** observe Note prior to Step 2.d and **RETURN TO** Step 2.d.

3. **IF H VI compressor is off, THEN perform the following:**

__ a. Place the "AUTO/OFF-RESET" toggle switch in "OFF-RESET".

__ b. Ensure the "HIGH/LOW" selector switch is in "HIGH".

__ c. Ensure the "START/WARM-UP/RUN" selector switch is in "RUN".

NOTE Engine will start after a 5 to 10 second time delay in next step.

__ d. Place "ENGINE SWITCH" in "START".

e. IF diesel compressor fails to start within approximately 15 seconds, THEN perform the following:

__ 1) Place "ENGINE SWITCH" in "OFF".

__ 2) Do not attempt to start H VI compressor until 2 minutes have elapsed.

__ 3) WHEN 2 minutes have elapsed, THEN observe Note prior to Step 3.d and RETURN TO Step 3.d.

__ 4. **WHEN time allows, THEN check running parameters PER OP/0/A/6450/005 (Instrument Air System), Enclosure 4.12 (Response to Auto/Emergency Start of G And/Or H VI Compressor).**

Prepared By: Rob Billy

Reviewed By: Charles Sawyer

Approved By: Thomas C. Cu

TASK: **Restore Normal Power to 1ETA and Shutdown D/G 1A**

POSITION: **NLO**

Operator's Name________________________________

Location: **D/G Simulator**

Method: **Perform/Walkthrough**

Estimated JPM Completion Time: ___15___ Minutes

Actual JPM Completion Time: _______ Minutes

The JPM Operator's performance was evaluated against the standards of this JPM and is determined to be:

SATISFACTORY/UNSATISFACTORY (circle one)

Evaluator's Signature______________________________ Date __/__/__

References: OP/1/A/6350/002 (Rev.85) Diesel Generator

JPM verified current with references by ______________________________

Date __/__/__

Rev. 00/11-16-99

INITIAL CONDITIONS

Unit 1 is recovering from a loss of power to 1ETA due to an inadvertent Normal breaker trip. Power has been restored to 1ETA from 1A D/G per AP/1/A/5500/07, Case II (Loss of Normal Power to Either 1ETA or 1ETB). All steps have been completed up to step 68. 1A D/G output is approximately 2200 KW.

The RO directs you to return the 4160V Bus (1ETA) to normal power supply (Normal Breaker Closed) and shutdown the D/G locally <u>PER</u> OP/1/A/6350/002, DIESEL GENERATOR, Enclosure 4.3 (D/G 1A Shutdown). All initial conditions of the Operating Procedure have been satisfied. The D/G Mode Select Switch has been placed to Local. All R&R's have been evaluated.

JPM OVERALL STANDARD: Power to 4160V Bus 1ETA is being supplied from 1ATC and D/G 1A is shutdown.

NOTES: This JPM is designed to be performed as a **SIMULATION** or as a **WALKTHROUGH.** <u>Cues found in shaded boxes should be given to the trainee for either setting</u>.

KA 064000 A4.06 3.9/3.9

TASK: MO-3328

START TIME__________

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
1	Another power source is available to the 4160V Bus	Operator determines from JPM initial conditions that the procedure initial conditions have been satisfied		
2	Evaluate all outstanding R&R's that may impact the performance of this procedure	Operator determines from initial conditions that R&R's have been evaluated		
3	<u>IF</u> Maintenance must enter the crankcase rapidly for Hot Bearing Deflection Measurements, verify appropriate tags have been prepared.	Same **Cue:** **Maintenance Hot Bearing Deflection Measurements are not required.**		
4	Ensure the Control Room "1A D/G Mode Select" switch is selected to the location at which the D/G is to be controlled.	Operator determines from the initial conditions that the Mode Select Switch is in the Local position		

✓ **DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
5	Perform the following as applicable : IF the 4160V bus is separated from the Duke grid, then proceed with step 3.5 IF the 4160V bus is parallel to the Duke grid, proceed to Step 3.6 IF the D/G is not loaded, proceed to step 3.11	Same **Cue:** **The red light is illuminated for the D/G Emerg Breaker and the green light is illuminated for the Normal Breaker.** Operator determines that the D/G is separated from the Duke grid and proceeds to step 3.5		
6	IF the 4160V bus is separated from the Duke grid, then perform the following:	Operator determines that the 4160V bus is separated from the grid.		
	Verify indication on "Line Volts" meter 3960 to 4360 volts.	Same **Cue:** **"Line Volts" Meter indicates 4000V**		
*	Using the "1A D/G Volt Adjust" handle, match D/G and line voltage.	Same **Cue:** **"D/G Volts" Meter indicates 4160V,** (pause) **Switch rotated counterclockwise and meters indicate the same** (4000V)		

* DENOTES CRITICAL

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
6	**Continued**			
*	Place the "1A D/G Sync" switch to "ON".	Same **Cue:** **Switch rotated clockwise to the "ON" position and meter dial is moving slowly in the slow direction**		
*	Using the "1A D/G Gov Cntrl" pushbutton, adjust Diesel speed to allow synchroscope to move slowly in the "FAST" direction.	Operator depresses the RAISE pushbutton causing the synchroscope to move slowly in the "FAST" direction **Cue:** **Meter dial is moving slowly in the clockwise direction**		
*	<u>**WHEN**</u> synchroscope pointer is within 3 minutes before the 12 o'clock position, firmly press and promptly release the "CLOSE" pushbutton for "1ETA Normal Breaker or "1ETA Stdby Breaker".	Operator determines from initial conditions that it is desired to close the normal breaker **Cue:** **Pointer is 3 minutes before vertical, Pushbutton is depressed, "Normal Breaker" red lamp is lit, KW meter reads 200.**		

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
6	**Continued**			
*	Quickly raise D/G output to 1000KW using the "1A D/G Gov Cntrl".	Load is raised to approximately 1000 KW within 60 seconds of closing the Normal breaker. **Cue:** **Raise pushbutton has been depressed and meter indicates 1000KW**		
	Adjust power factor to 0.9 lagging using the "1A D/G Volt Adjust".	Same **Cue:** **Meter reads 0.6 LAG,** (pause) **Voltage Adjust handle rotated counter clockwise, meter indication reads 0.9 Lagging**		
	Place the "1A D/G Sync switch to "OFF".	Same **Cue:** **Switch rotated counterclockwise and is in the "OFF" position**		
	Go to step 3.8.	Same		

* **DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
7	Allow D/G to run at 1000 KW for 10 minutes unless otherwise directed by Maintenance or Engineering. {NRC-1 Commitment per LER 370/98-02}	Same **Cue:** **10 minutes have elapsed**		
8	Perform the following two steps in rapid succession:			
	Lower D/G output below 200 KW. using the "1A D/G Gov Cntrl".	Same **Cue:** **Lower pushbutton depressed,** **Meter indicates less than 200 KW.**		
*	Open "1ETA Emergency Breaker".	Same **Cue:** **Pushbutton depressed and green lamp is illuminated.**		

* DENOTES CRITICAL

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
9	<u>IF</u> the engine is being run for maintenance checkout **and** quick entry into the crankcase is desired after shutdown, wait for any one cylinder temperature to drop below 450^0 F, then go to step 3.12. (Turn On Code: DGATMPA)	Operator determines that the D/G is not being run for maintenance and N/A's this step.		
10	Allow D/G to run unloaded for 15 minutes. {NRC-1 Commitment per LER 370/98-02}	Same **Cue:** **15 minutes have elapsed**		
11 *	Depress the "STOP" pushbutton on the switch labeled "1A Diesel Generator' on the Local Control Panel or in Control Room, depending on alignment. (PIP M98-3039)	Same **Cue:** **Pushbutton depressed, and green lamp is illuminated**		

DENOTES CRITICAL

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
12	Notify the Control Room to perform the following:	The operator directs the Control Room to perform the following steps:		
	Depress the "1A D/G Load Seq" "RESET" pushbutton in the Control Room.	Operator calls C/R to have them depress the 1A Sequencer Reset PB		
		Cue: **Reset PB has been depressed**		
	<u>IF</u> either of the following conditions exist, go to step 3.13.4:	Same		
	RN is aligned to CA pump suction	**Cue:** **RN is <u>NOT</u> aligned to the CA pump suction**		
	<u>OR</u>			
	"A" Train RN is aligned to SNSWP	**Cue:** **"A" Train RN is <u>NOT</u> <u>aligned</u> to SNSWP**		
		Operator receives cues, then proceeds to step 3.13.3.		

* DENOTES CRITICAL

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
12	**Continued** Close 1RN-70A (A KD Hx Supply Isol)	Operator calls C/R to have them Close 1RN-70A (A KD Hx Supply Isol).		
		Cue: **1RN-70A is CLOSED**		
	Ensure 1RN-73A (A KD Hx Outlet Isol), is in the full open position.	Operator directs Control Room to ensure 1RN-73A (A KD Hx Outlet Isol) is fully open		
		Cue: **1RN-73A is fully OPEN**		
	Place the "1A D/G Mode Select" switch to "AUTO".	Operator calls C/R to have them place 1A D/G Mode Select Switch to "AUTO".		
		Cue: **The 1A D/G Mode Select Switch is in "auto "**		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
13	Unless quick entry into the crankcase is desired after shutdown, verify the following heat removing auxiliaries are running:	Operator determines that the D/G is not being run for maintenance and verifies the Jacket/Intercooler Water Pumps, Before and After Lube Oil pump and the Crankcase Vacuum Blower are running.		
	Jacket and Intercooler Water Pumps	**Cue:** **Red light illuminated.**		
	Before and After Lube Oil Pump	**Cue:** **Red light illuminated.**		
	Crankcase Vacuum Blower	**Cue:** **Red light illuminated.**		
14	Verify the following: Check governor oil level between 3/4 full and top of the sightglass. etc...	**Cue:** **Another NLO will perform step 3.15 and complete this procedure.**		

STOP TIME___________

* DENOTES CRITICAL

(R06-97)

Duke Power Company
PROCEDURE PROCESS RECORD

(1) ID No. OP/1/A/6350/002
Revision No. 85

INFORMATION ONLY

PREPARATION

(2) Station **McGuire Nuclear Station**

(3) Procedure Title **Diesel Generator**

(4) Prepared By **W. R. Hatley** W.R. Hatley Date **June 2, 1999**

(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 MdC [signature] (QR) Date 6-23-99

Cross-Disciplinary Review By ________ (QR) NA MHC Date ________

Reactivity Mgmt. Review By ________ (QR) NA MHC Date ________

(7) Additional Reviews

Reviewed By W. D. White Date 7-14-99

Reviewed By ________ Date ________

(8) Temporary Approval (*if necessary*)

By ________ (SRO/QR) Date ________

By ________ (QR) Date ________

(9) Approved By Peter L. Schuerger Date 7-27-99

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 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, 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.*)

1. Limits and Precautions

1.1 Operation of the D/G at a reduced speed should be minimized. Due to possible damage to the Exciter-Regulator and the Generator Field, operation at speeds lower than normal must be assessed by System Engineering or IAE personnel and covered by applicable procedures.

1.2 Maximum differential temperature between cylinders is 200°F with the D/G loaded greater than 1000KW.

1.3 **IF** a sudden loss of crankcase vacuum is indicated, together with an unusual knock or sudden decrease in speed, stop the engine with the normal stop switch to ensure circulation of LD and KD for at least 20 minutes. Engine covers must remain in place during this cooling period, since crankcase vapors may ignite.

1.4 Allow the D/G to come to a complete stop before restarting.

1.5 Any fuel oil spilled in the diesel room will be cleaned up per RP/0/A/5700/022 (Spill/Incident Response Procedure).

2. Initial Conditions

_____ 2.1 Another power source is available to the 4160V Bus.

3. Procedure

❑ 3.1 Evaluate all outstanding R&Rs that may impact the performance of this procedure.

_____ 3.2 **IF** Maintenance must enter the crankcase rapidly for Hot Bearing Deflection Measurements, verify appropriate tags have been prepared.

❑ 3.3 Ensure the Control Room "1A D/G Mode Select" switch is selected to the location at which the D/G is to be controlled.

3.4 Perform the following as applicable:

- ❑ **IF** the 4160V bus is separated from the Duke grid, then proceed with step 3.5.
- ❑ **IF** the 4160V bus is parallel to the Duke grid, proceed to Step 3.6.
- ❑ **IF** the D/G is **NOT** loaded, proceed to step 3.11.

3.5 **IF** the 4160V bus is separated from the Duke grid, perform the following:

☐ 3.5.1 Verify indication on "Line Volts" meter 3960-4360 volts.

_____ 3.5.2 Using the "1A D/G Volt Adjust" handle, match D/G and line voltage.

_____ 3.5.3 Place the "1A D/G Sync" switch to "ON".

NOTE:	As a guide, have the synchroscope traveling no faster than one revolution in ten seconds.

_____ 3.5.4 Using the "1A D/G Gov Cntrl" pushbutton, adjust Diesel speed to allow synchroscope to move slowly in the "FAST" direction.

NOTE:
- D/G load will drop to 0 Amps when bus is paralleled to Duke grid.
- Increase D/G load quickly after closing the breaker to prevent reverse power condition.

☐ 3.5.5 **WHEN** synchroscope pointer is within 3 minutes before the 12 o'clock position, firmly press and promptly release the "CLOSE" pushbutton for "1ETA Normal Breaker" or "1ETA Stdby Breaker".

☐ 3.5.6 Quickly raise D/G output to 1000KW using the "1A D/G Gov Cntrl".

☐ 3.5.7 Adjust power factor to 0.9 lagging using the "1A D/G Volt Adjust".

_____ 3.5.8 Place the "1A D/G Sync" switch to "OFF".

☐ 3.5.9 Go to step 3.8.

NOTE:	D/G load changes different from procedure may be performed as directed by System Engineer.

3.6 **IF** necessary, lower the D/G output by performing the following:

_____ 3.6.1 Slowly lower D/G output to 2800-3000KW using the "1A D/G Gov Cntrl".

_____ 3.6.2 Adjust power factor to 0.9 lagging using the "1A D/G Volt Adjust".

☐ 3.6.3 Maintain 2800-3000KW a minimum of 5 minutes.

_____ 3.6.4 Slowly lower D/G output to 1800-2000KW using the "1A D/G Gov Cntrl".

_____ 3.6.5 Adjust power factor to 0.9 lagging using the "1A D/G Volt Adjust".

❑ 3.6.6 Maintain 1800-2000KW for a minimum of 10 minutes. {NRC-1 Commitment per LER 370/98-02}

_____ 3.6.7 Slowly lower D/G output to 1000KW using the "1A D/G Gov Cntrl".

_____ 3.6.8 Adjust power factor to 0.9 lagging using the "1A D/G Volt Adjust".

_____ 3.7 IF the engine is being run for maintenance checkout and quick entry into the crankcase is desired after shutdown, go to step 3.9.

_____ 3.8 Allow D/G to run at 1000KW for 10 minutes unless otherwise directed by Maintenance or Engineering. {NRC-1 Commitment per LER 370/98-02}

3.9 Perform the following two steps in rapid succession:

❑ 3.9.1 Lower D/G output below 200KW using the "1A D/G Gov Cntrl".

_____ 3.9.2 Open "1ETA Emerg Breaker".

_____ 3.10 IF the engine is being run for maintenance checkout and quick entry into the crankcase is desired after shutdown, wait for any one cylinder temperature to drop below 450°F, then go to step 3.12. (Turn On Code: DGATMPA)

_____ 3.11 Allow D/G to run unloaded for 15 minutes. {NRC-1 Commitment per LER 370/98-02}

_____ 3.12 Depress the "STOP" pushbutton on the switch labeled "1A Diesel Generator" on the Local Control Panel or in Control Room, depending on alignment. {PIP M98-3039}

3.13 Notify the Control Room to perform the following:

_____ 3.13.1 Depress the "1A D/G Load Seq" "RESET" pushbutton in the Control Room.

_____ 3.13.2 IF either of the following conditions exist, go to step 3.13.4:

❑ RN is aligned to CA pump suction

OR

❑ "A" Train RN is aligned to SNSWP

_____ 3.13.3 Close 1RN-70A (A KD Hx Supply Isol).

_____ _____ 3.13.4 Ensure 1RN-73A (A KD Hx Outlet Isol), is in the full open position.
DV

_____ 3.13.5 Place the "1A D/G Mode Select" switch to "AUTO".

3.14 Unless quick entry into the crankcase is desired after shutdown, verify the following heat removing auxiliaries are running:

- ❑ Jacket and Intercooler Water Pumps
- ❑ Before & After Lube Oil Pump
- ❑ Crankcase Vacuum Blower

3.15 Verify the following:

- ❑ Governor oil level between 3/4 full and top of sightglass.
- ❑ Generator pedestal bearing oil level sightglass greater than or equal to 1/2 full.
- ❑ Turbocharger oil level (turbine and compressor sides) within bullseye in lower sightglass.
- ❑ "1A D/G Cooling Water Surge Tk Level" greater than 3.3 feet (1KDPG5120).
- ❑ Diesel lube oil sump level visible in sightglass.
- ❑ "1A D/G Fuel Oil Day Tank Level" greater than 27.5 inches (1FDPG5040)
- ❑ "Starting Air Press A1 and A2" indicates 210-240 psig (1MVGPG5040).
- ❑ "Control Air Pressure" indicates 105-140 psig (1MVGPG5080).
- ❑ D/G 1A room "Ventilation Control" switch in "AUTO" and D/G Blower "ON".
- ❑ All "AUTO/RUN" switches on Local Control Panel in "AUTO".
- ❑ 1LD-108A (1A D/G Lube Oil Filter Bypass) is closed.
- ❑ "1A" Diesel Fuel Oil Tank Level greater than 39,500 gallons (1FDMT5140 - 1A & 1B D/G Fuel Oil Storage Tank Level).

3.15.1 IF any discrepancies noted, contact SWM for correction.

________________________ _____/_____
Person Contacted Date Time

_____ 3.16 IF the Diesel was operated for at least 1 hour, verify no water in the 1A D/G Fuel Oil Day Tank by performing the following (SLC 16.15-4.8.1.1.2.b.1):

_____ 3.16.1 **WHEN** pipe cap is removed, slowly throttle open 1FD-91 (1A D/G Fuel Oil Test Conn Isol) to drain any accumulated water into a container.

_____ 3.16.2 **WHEN** all water drained, close 1FD-91 (1A D/G Fuel Oil Test Conn Isol)

❑ 3.16.3 Ensure pipe cap installed at 1FD-91 (1A D/G Fuel Oil Test Conn Isol).

_____ 3.16.4 **IF** water was present, notify D/G System Engineer.

______________________ _____/_____
Person Contacted Date Time

_____ 3.17 Ensure CR SRO signs the appropriate D/G logbook.

End of Enclosure

Prepared By: Rob Billings

Reviewed By: Tom Cullen

Approved By: Charles Sawyer

TASK: **Emergency Borate the Reactor Coolant System Locally Using 2NV-269**

POSITION: **NLO**

Operator's Name______________________________

Location: **Plant** Method: **Walkthrough**

Estimated JPM Completion Time: 6 Minutes

Actual JPM Completion Time: _____ Minutes

Required Time Critical Completion Time 10 Minutes

Actual Time Critical Completion Time _____ Minutes

The JPM Operator's performance was evaluated against the standards of this JPM and is determined to be:

SATISFACTORY/UNSATISFACTORY (circle one)

Evaluator's Signature______________________________ Date __/__/__

References: AP/2/A/5500/38 (Rev.04) Emergency Boration

JPM verified current with references by ______________________________

Date __/__/__

INITIAL CONDITIONS

Unit 2 was at 100% power when a Boron dilution event occurred. AP/2/A/5500/38 (Emergency Boration) was entered. While performing step 10.c, the RO discovered that 2NV-265B (Boric Acid To NV Pumps) was de-energized.

The Control Room SRO instructs YOU to emergency borate the NC System by locally opening 2NV-265B (Boric Acid To NV Pumps). Notify the control room when the valve is opened.

THIS IS A TIME CRITICAL JPM.

JPM OVERALL STANDARD: 2NV-269 is located and manually opened (simulated) within ten (10) minutes.

NOTE: Start this JPM from the hallway outside of the Operations kitchen.

KA 004 A2.14 3.8/3.9

START TIME__________

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
1	Locate and attempt to open 2NV-265B (Boric Acid To NV Pumps)	Operator locates 2NV-265B and attempts to open it (simulated). After receiving the cue below, the operator calls the C/R to report that the valve will not open. Note: Give the following cue as soon as the operator begins to describe opening the valve: **Cue:** **Handwheel clutch engaged,** **Force applied in the counter clockwise direction,** **Handwheel is not moving** Note: Give the following cue if the Operator simulates calling the C/R and requests valve location. **Cue:** **2NV-265 is located in the Aux. Building, Elevation 733 + 3', Column JJ-57, near the chemical addition tank.**		

DENOTES CRITICAL

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
2	Notify the Control Room that 2NV-265B will not open.	Operator notifies the C/R that 2NV-265B will not open. **Cue:** **The Control room operator directs you to unlock and open 2NV-269 (Boric Acid Supply to NV Pumps Block). <u>Notify the C/R when the valve is open.</u>** <u>Note:</u> Give the following cue if the Operator simulates calling the C/R and requests valve location. **Cue:** **2NV-269 is located in the Aux. Building, Elevation 733 + 4', Column JJ-58, near the chemical addition tank.**		
*3	Unlock and open 2NV-269 (Boric Acid Supply to NV Pumps Block)	Operator locates 2NV-269, then unlocks and opens it (simulated) within ten minutes of dispatch. **Cue:** **Lock removed, Handwheel rotated fully counter clockwise.** Stop Time for Time Critical Task ___________		

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
4	Notify Control Room that 2NV-269 is open.	The operator calls the C/R to report that the valve is open. **Cue:** **The Control Room operator understands that 2NV-269 is open. Another operator is being dispatched to relieve you and to stand by the valve until further notice.**		

STOP TIME__________

DENOTES CRITICAL

INITIAL CONDITIONS

Unit 2 was at 100% power when a Boron dilution event occurred. AP/2/A/5500/38 (Emergency Boration) was entered. While performing step 10.c, the RO discovered that 2NV-265B (Boric Acid To NV Pumps) was de-energized.

The Control Room SRO instructs YOU to emergency borate the NC System by locally opening 2NV-265B (Boric Acid To NV Pumps). Notify the control room when the valve is opened.

THIS IS A TIME CRITICAL JPM.

(R06-97)

Duke Power Company
PROCEDURE PROCESS RECORD

(1) ID No. AP/2/A/5500/38
Revision No. 4

INFORMATION ONLY

IEPARATION
2) Station McGuire Nuclear Station

(3) Procedure Title Emergency Boration

(4) Prepared By S. Hackney Date May 10, 1999

(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 Mike [signature] (QR) Date 5/12/99
Cross-Disciplinary Review By [signature] (QR) NA____ Date 6-2-99
Reactivity Mgmt. Review By SC Ballard (QR) NA____ Date 5-26-99

(7) Additional Reviews
Reviewed By ____ Date ____
Reviewed By ____ Date ____

(8) Temporary Approval (*if necessary*)
By ____ (SRO/QR) Date ____
By ____ (QR) Date ____

(9) Approved By Peter J Schuerger Date 6.7.99

ERFORMANCE (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 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, 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.*)

A. Purpose

To provide guidance on methods of rapidly injecting boric acid into the NC System and to provide appropriate actions to stop an uncontrolled NC System boron dilution.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

B. Symptoms

- **Excessive control rod insertion**
- **Failure of two or more control rods to drop following a reactor trip**
- **NC T-Ave going up in an uncontrolled manner**
- **Steam pressure going up in an uncontrolled manner**
- **Reactor power going up in an uncontrolled manner**
- **Inadequate shutdown margin**
- **"CONTROL ROD BANK LO LIMIT" alarm**
- **"CONTROL ROD BANK LO-LO LIMIT" alarm**
- **Less than the minimum Mode 6 boron concentration**
- **"S/R HI FLUX AT SHUTDOWN" alarm**
- **Neutron count rate going up**
- **Emergency boration per this AP has been specified by another procedure.**

C. Operator Actions

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ 1. **Check if boron dilution - SUSPECTED.**	__ **GO TO Step 8.**
2. **Isolate reactor makeup water to VCT as follows:**	
__ a. Ensure both reactor makeup water pumps are off.	
b. Select "CLOSE" on the following valve switches:	
__ • 2NV-171A (BA Blender To VCT Inlet)	
__ • 2NV-175A (BA Blender to VCT Outlet)	
__ • 2NV-252A (Rx M/U Water To Blender Control).	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ 3. **Check reactor status at time of dilution - CRITICAL.**	**IF any control rod withdrawn, THEN perform the following:** __ a. Trip reactor. b. IF above P-11, THEN: __ 1) Have another operator continue with this procedure. __ 2) GO TO EP/2/A/5000/E-0 (Reactor Trip or Safety Injection).
__ 4. **Check cation or mixed bed dimineralizer - PLACED IN SERVICE WITHIN THE LAST HOUR.**	__ **GO TO Step 6.**
__ 5. **Place 2NV-127A (L/D Hx Outlet 3-Way Temp Cntrl) in the "VCT" position.**	
6. **Notify the OSM or another SRO to perform the following while continuing with this procedure:** __ • Evaluate ongoing or recent plant evolutions for potential dilution sources. • IF source of dilution cannot readily be determined or isolated, THEN perform the following: __ a. Evalutate dispatching an operator to close 2NB-256 (RMWST #2 Outlet) (West Side of RMWST,760+2). __ b. IF 2NB-256 is closed, THEN notify Radwaste Chemistry the Reactor Makeup Water flush header is isolated.	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ 7. **Check unit status - IN MODE 1 OR 2.**	**Perform the following:** __ a. **IF** in Mode 6, **THEN** dispatch operator to ensure 2NV-250 (Reactor M/U Water to NV System) (aux bldg, 733+7, JJ-58, at emergency boration station) is closed. __ b. Evaluate need to evacuate Containment **PER** RP/0/A/5700/011 (Conducting a Site Assembly, Site Evacuation, or Containment Evacuation). __ c. **GO TO** Step 10.
__ 8. **Check if Load Rejection - HAS OCCURRED.**	__ **GO TO Step 10.**
9. **Do not continue unless one of the following is met:** __ • Emergency boration is specified by AP/2/A/5500/03 (Load Rejection) or another AP. OR __ • Boron dilution is known to have occurred.	
10. **Initiate emergency boration:**	
__ a. Ensure a charging pump - ON.	a. Perform the following: __ 1) Ensure suction flow path aligned. 2) Ensure the following valves are open: __ • 2NV-150B (NV Pumps Recirculation) __ • 2NV-151A (NV Pumps Recirculation). __ 3) Close 2NV-238 (Charging Line Flow Control). __ 4) Start an NV pump.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
10. (Continued)	
b. Check the following boric acid system components - AVAILABLE. __ • Boric Acid Storage Tank __ • Boric Acid Transfer Pump.	b. Align NV pump suction to the FWST: 1) Open the following: __ • 2NV-221A (NV Pumps Suct From FWST) __ • 2NV-222B (NV Pumps Suct From FWST). 2) Close the following: __ • 2NV-141A (VCT Outlet Isol) __ • 2NV-142B (VCT Outlet Isol). __ 3) **<u>GO</u> <u>TO</u>** Step 13.
__ c. Open 2NV-265B (Boric Acid To NV Pumps).	c. Perform the following: __ 1) Dispatch operator to open 2NV-265B (aux bldg, 733+3, JJ-57, near chemical addition tank). 2) **<u>IF</u>** 2NV-265B can not be opened, **<u>THEN</u>**: __ a) Dispatch operator to unlock and open 2NV-269 (BA Supply to NV Pumps Block) (aux bldg, 733+4, JJ-58, near chemical addition tank). __ b) Open 2NV-267A (Boric Acid To Blender Control). __ 3) Do not continue until 2NV-265B or 2NV-269 flowpath above is aligned.
__ d. Ensure a boric acid transfer pump is running.	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
10. (Continued)	
e. Check boration flow using one of the following methods: __ • **IF** 2NV-265B is open, **THEN** check "EMERGENCY BORATION FLOW" - ESTABLISHED. OR __ • **IF** 2NV-269 is open, **THEN** check "BORIC ACID FLOW" on chart recorder 2MNVCR5450 - ESTABLISHED.	e. Perform the following: __ 1) Start second boric acid transfer pump. 2) **IF** boration flow cannot be established, **THEN** align NV pump suction to FWST: a) Open the following: __ • 2NV-221A (NV Pumps Suct From FWST) __ • 2NV-222B (NV Pumps Suct From FWST). b) Close the following: __ • 2NV-141A (VCT Outlet Isol) __ • 2NV-142B (VCT Outlet Isol). __ c) **GO TO** Step 13.
__ 11. **IT AT ANY TIME boration no longer required, THEN GO TO Step 18.**	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

12. **IF AT ANY TIME a higher boration flowrate is desired, THEN evaluate performing the following as required:**

__ • Start second boric acid transfer pump.

• Align NV pump suction to FWST as follows:

a. Open the following:

__ • 2NV-221A (NV Pumps Suct From FWST)

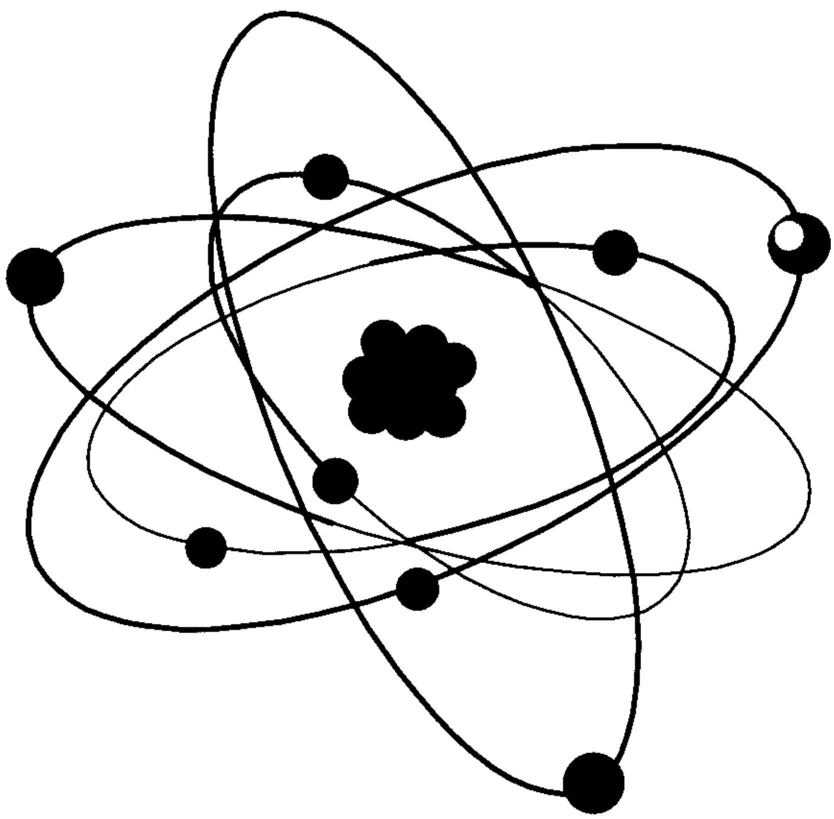
__ • 2NV-222B (NV Pumps Suct From FWST).

b. Close the following:

__ • 2NV-141A (VCT Outlet Isol)

__ • 2NV-142B (VCT Outlet Isol).

FINAL
NRC COPY



2000
SRO JPMs

Facility: McGuire   Date of Examination: ____________
Exam Level (circle one): RO / SRO(I) / SRO(U) Operating Test No.: ____________

B.1 Control Room Systems

System / JPM Title	Type Codes*	Safety Function
a. 015/ Return PR NI To Service, Respond To Continuos Rod Movement **(ENB-181A)** {015-A2.01-3.5/3.9}	N,S,A	SF-7
b. 005/ Respond to a Loss of ETA at Mid Loop **(EP-188A)** {005-A4.01-3.6/3.4}	N,S,A,L,**(P)**	SF-4P
c. 008/ RN Emergency Alignment After a Loss of All AC (Unit 2) **(RN-185)** {008-A4.01-3.3/3.1}	M,C,**(P)**	SF-8
d.		
e.		
f.		
g.		

B.2 Facility Walk-Through

a. 068/ Transfer of Control to SSF-SSF Building Actions **(AD-127T)** {068-AA1.21-3.9/4.1}	D,P,Repeat	SF-2
b. 004/ Emergency Borate From Aux. Shutdown Panel (Unit 2) **(ASP-138)** {004-A2.14-3.8/3.9}	R,M	SF-1
c.		

* Type Codes: (D)irect from bank, (M)odified from bank, (N)ew, (A)lternate path, (C)ontrol room, (S)imulator, (L)ow-Power, (R)CA

(P) - Indicates this JPM is associated with a Risk Significant System or Period as reflected in the MNS Probabilistic Safety Assessment.

Prepared By: Rob Billings

Reviewed By: Charles Sawyer

Approved By: Thomas C. Cole

TASK: **Respond to a Failure of Power Range Channel N-42**

POSITION: **RO**

Operator's Name____________________

Location: **Simulator** Method: **Perform**

Estimated JPM Completion Time: 15 Minutes

Actual JPM Completion Time: ____ Minutes

The JPM Operator's performance was evaluated against the standards of this JPM and is determined to be:

SATISFACTORY/UNSATISFACTORY (circle one)

Evaluator's Signature____________________ Date __/__/__

References: AP/1/A/5500/16 (Rev. 07) Malfunction of Nuclear Instrumentation
AP/1/A/5500/14 (Rev. 05) Rod Control Malfunction

JPM verified current with references by ____________________

Date __/__/__

INITIAL CONDITIONS

You are the Unit 1 Balance of Plant Operator (BOP).

Unit 1 was operating at 55% power with control rods at 120 steps Bank "D", when PR N42 failed high causing rods to step in approximately 6 steps. AP/1/A/5500/16 (Malfunction of Nuclear Instrumentation) Case III (Power Range Malfunction), has been entered and completed through step 5.

The SRO directs you to perform steps 6 through 18 of AP/1/A/5500/16 (Malfunction of Nuclear Instrumentation, Case III (Power Range Malfunction).

JPM OVERALL STANDARD:	Power Range Channel NI-42 is removed from service with control power fuses removed. Tavg is restored to within 1 degree of Tref by adjusting control rods. Continuous rod motion is recognized and the Immediate Actions of AP-14 (Rod Control Malfunctions) are properly performed from memory. The Reactor is manually tripped before receiving annunciator 1AD6, B-10 (Tref-Tauct Abnormal).
NOTES:	This JPM is designed to be performed as a **SIMULATION** or as a **WALKTHROUGH.** Cues found in shaded boxes should be given to the trainee for either setting.

KA 015 A2.01 3.5/3.9

START TIME__________

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
1	Secure any power increase in progress	Same **Cue:** **No power increase is in progress**		
2	Perform the following actions at the "MISCELLANEOUS CONTROL AND INDICATION PANEL" drawer: Place the appropriate "ROD STOP BYPASS" switch to the failed channel position Place the "POWER MISMATCH BYPASS" switch to the failed channel position	Same **Cue:** **Switch is rotated counterclockwise one position** **Cue:** **Switch is rotated counterclockwise one position**		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
3	Perform the following actions at the "DETECTOR CURRENT COMPARATOR" drawer:	Same		
	Place "UPPER SECTION" defeat switch to the failed channel position.	**Cue:** **Switch is rotated counterclockwise one position**		
	Check the "CHANNEL DEFEAT" light for the upper section - LIT.	**Cue:** **Light is lit.**		
	Place the "LOWER SECTION" defeat switch to the failed channel position.	**Cue:** **Switch is rotated counterclockwise one position**		
	Check the "CHANNEL DEFEAT" light for the lower section - LIT.	**Cue:** **Light is lit.**		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
4	Perform the following actions at the "COMPARATOR AND RATE" drawer:	Same		
	Place the "COMPARATOR CHANNEL DEFEAT" switch to the failed channel position.	**Cue:** **Switch is rotated counterclockwise one position**		
	Check the "COMPARATOR DEFEAT" light - LIT.	**Cue:** **Light is lit.**		
5	**NOTE:** Removing fuses from power range drawers may cause associated NIS annunciators to alarm.	Operator removes the Control Power fuses for N42, but does not remove the Instrument Power fuses for N-42.		
	Trip Bistables of failed channel as follows:	Same		
*	Remove Control power fuses from "POWER RANGE A" drawer	**Cue:** **Fuses are rotated 1/8 turn counterclockwise and removed**		
	IF Power Range Cabinet shows evidence of damage (i.e. visual smoke or abnormal smell), **THEN** remove Instrument power fuses from "POWER RANGE B" drawer	**Cue:** **No smoke or abnormal smell is apparent at the Power Range Cabinet.**		

* DENOTES CRITICAL

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
6	Check the following status lights for the failed channel - LIT "NUC OVERPOWER ROD STOP CH I(II,III,IV) BYP" (1SI-19) "P/R HI FLUX LO STPT" (1SI-2) "P/R HI FLUX HI STPT" (1SI-2) "P/R HI FLUX RATE" (1SI-3)	Same **Cue:** **Light is illuminated** **Cue:** **Light is illuminated** **Cue:** **Light is illuminated** **Cue:** **Light is illuminated**		
7	Check the following annunciator lights - LIT: "P/R HI VOLTAGE FAILURE" (1AD-2, F-3) "P/R HI FLUX HI STPT ALERT" (1AD-2, A-3) "P/R HI FLUX RATE ALERT" (1AD-2, A-1).	**Cue:** **Light is illuminated** **Cue:** **Light is illuminated** **Cue:** **Light is illuminated**		

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
8	Check the following status lights on 1SI-18 - LIT P/R LO SETPOINT TRAIN A TRIP BLOCKED P/R LO SETPOINT TRAIN B TRIP BLOCKED	Same **Cue:** **Light is illuminated** **Cue:** **Light is illuminated**		
9	<u>IF</u> desired to control S/G levels in auto, **<u>THEN</u>** return affected S/G CF control valves to auto.	Same **Cue:** **S/G CF control valves are in "AUTO"**		
10	Ensure operable P/R channel selected to record on Nuclear Power recorder	Same **Cue:** **Switch positioned to P-1(3,4)**		
*11	Adjust control rods to maintain T-Ave at T-Ref .	**<u>Note to evaluator</u>**: Respond as C/R SRO if permission to move rods is requested. This step is critical only if >1 degree deviation between Tavg and Tref. **Cue:** **Rods are being moved in "MANUAL" and T-Ave is approaching T-Ref.**		

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*12	**WHEN** T-Avg within 1°F of T-Ref **AND** auto rod control is desired, **THEN** return rods to auto	The Operator positions rods until T-Avg is within 1°F of T-Ref, then returns rods to "AUTO" **after the first cue is given.** **Cue:** **Automatic rod control is desired.** When rod control switch is placed in AUTO, the rods will begin stepping out at 72 steps/minute. The Operator should recognize this as an entry condition of AP/14 (Rod Control Malfunction) and perform the Immediate Actions from memory. **Cue:** **Rods placed to AUTO, rods are stepping out at 72 steps per minute,** **Turbine/generator output is stable** **Turbine impulse pressure, Tref, Power Range NI's, T-hot and T-cold indications are stable.**		

* DENOTES CRITICAL

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
13	**AP/1/A/5500/14 Rod Control Malfunction (Immediate Actions)**	Operator determines no rods are dropped and proceeds to Step 2. Operator places rods to MANUAL. Rods continue to step out. The Reactor should be manually tripped <u>before</u> annunciator 1AD6, B-10 (Tref-Tauct Abnormal) actuates (approximately 40 seconds after the rods begin stepping out).		
	<u>IF</u> more than one rod dropped, <u>THEN</u>: • Trip reactor • <u>GO TO</u> EP/1/A/5000/E-0 (Reactor Trip or Safety Injection)	**Cue:** **No indications of a dropped rod are present on DRPI screen**		
	Place control rods in manual.	**Cue:** **Switch rotated clockwise one position.**		
	Check rod movement – STOPPED	Operator recognizes rods are not stopped and proceeds to RNO. **Cue:** **Rods are stepping out.**		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
13	**Continued**	Operator manually trips Reactor and begins to perform Immediate Actions of E-0.		
*	**<u>IF</u> rod movement continues, <u>THEN</u> perform the following:** • Trip reactor • <u>GO TO</u> EP/1/A/5000/E-0 (Reactor Trip or Safety Injection)	**Cue:** **Reactor trip switches rotated counter clockwise. All rod bottom lights are lit. Green lights lit on both Reactor trip breakers. I/R amps going down.** Terminate JPM with the following cue:		
		Cue: **The CR SRO has directed another operator to continue in E-0.**		

STOP TIME___________

* DENOTES CRITICAL

INITIAL CONDITIONS

You are the Unit 1 Balance of Plant Operator (BOP).

Unit 1 was operating at 55% power with control rods at 120 steps Bank "D", when PR N42 failed high causing rods to step in approximately 6 steps. AP/1/A/5500/16 (Malfunction of Nuclear Instrumentation) Case III (Power Range Malfunction), has been entered and completed through step 5.

The SRO directs you to perform steps 6 through 18 of AP/1/A/5500/16 (Malfunction of Nuclear Instrumentation, Case III (Power Range Malfunction).

SIMULATOR OPERATOR GUIDELINES (ENB-181A)

1 Reset to IC-34, place Simulator to RUN and allow the plant to stabilize.

2 Insert Malfunction ENB013C set = 200%.

3 Allow rods to step in approximately ten steps, then place Rods in MANUAL

4 Place "PR To S/G Program Level Channel Defeat" switch to "Defeat PR 42 & 44"

5 Acknowledge alarms, then FREEZE simulator

6 Insert Override OVR-IRE002A (CRD Bank Sel Sw Auto Pos) = OFF, set to trigger 1.

7 Insert Override OVR-IRE002B (CRD Bank Sel Sw Man Pos) = ON, set to trigger 1.

8 Insert Override OVR-IRE003B (Full Length Rod Motion Sw Out Pos) = ON, set to trigger 1.

9 Insert Malfunction MAL-IRE016A (Control Rod Speed Selection) = 72 Severity Value and set to trigger 1.

TEMP SNAP RESET TO IC-142

10 Place simulator in RUN when examinee is ready to begin JPM.

11 * **When examinee places Rod Control back to AUTO per step 17 of the procedure, Activate trigger 1.**

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

B. Symptoms

- Erratic or loss of P/R indication
- "P/R HI VOLTAGE FAILURE" alarm
- "P/R HI FLUX RATE ALERT" alarm
- "P/R HI FLUX LO STPT ALERT" alarm
- "P/R HI FLUX HI STPT ALERT" alarm
- "P/R CHANNEL DEVIATION" alarm
- "P/R UPPER DET HI FLUX DEV OR AUTO DEFEAT" alarm
- "P/R OVER POWER ROD STOP" alarm
- "P/R LOWER DET HI FLUX DEV OR AUTO DEFEAT" alarm
- Loss of "INSTRUMENT POWER ON" or "CONTROL POWER ON" lights.

C. Operator Actions

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ 1. Place rods in manual.	
__ 2. Check S/G levels - AT PROGRAMMED LEVEL.	__ Place affected S/G CF control valves in manual and return level to programmed level.
__ 3. Announce occurrence on paging system.	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ 4. **Check P/R channels - ONLY ONE CHANNEL FAILED.**	**Perform the following:** __ a. Initiate unit shutdown to Mode 3 within one hour, as required by Tech Spec 3.0.3. __ b. **<u>REFER TO</u>** RP/0/A/5700/010 (NRC Immediate Notification Requirements). c. Ensure the following interlocks in proper condition for existing plant conditions: __ • P-10 Nuclear at Power __ • P-7 Lo Power Rx Trips Blocked __ • P-8 Hi Pwr Lo Flo Rx Trip Blocked. __ d. **<u>RETURN TO</u>** procedure in effect.
__ 5. **Position "PR TO S/G PROGRAM LEVEL CHANNEL DEFEAT" switch to defeat inoperable channel.**	
__ 6. **Secure any power increase in progress.**	
7. **Perform the following actions at the "MISCELLANEOUS CONTROL AND INDICATION PANEL" drawer:** __ a. Place the appropriate "ROD STOP BYPASS" switch to the failed channel position. __ b. Place the "POWER MISMATCH BYPASS" switch to the failed channel position.	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
8. **Perform the following actions at the "DETECTOR CURRENT COMPARATOR" drawer:**	__ **Notify IAE.**
__ a. Place "UPPER SECTION" defeat switch to the failed channel position.	
__ b. Check the "CHANNEL DEFEAT" light for the upper section - LIT.	
__ c. Place the "LOWER SECTION" defeat switch to the failed channel position.	
__ d. Check the "CHANNEL DEFEAT" light for the lower section - LIT.	
9. **Perform the following actions at the "COMPARATOR AND RATE" drawer:**	__ **Notify IAE.**
__ a. Place the "COMPARATOR CHANNEL DEFEAT" switch to the failed channel position.	
__ b. Check the "COMPARATOR DEFEAT" light - LIT.	

NOTE Removing fuses from power range drawers may cause associated NIS annunciators to alarm.

10. **Trip bistables of failed channel as follows:**

__ a. Remove Control Power fuses from "POWER RANGE A" drawer.

__ b. **IF** Power Range Cabinet shows evidence of damage (i.e. visual smoke or abnormal smell), **THEN** remove Instrument Power fuses from "POWER RANGE B" drawer.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
11. **Check the following status lights for the failed channel - LIT:** __ • "NUC OVERPOWER ROD STOP CH I(II,III,IV) BYP" (1SI-19) __ • "P/R HI FLUX LO STPT" (1SI-2) __ • "P/R HI FLUX HI STPT" (1SI-2) __ • "P/R HI FLUX RATE" (1SI-3).	__ **Notify IAE.**
12. **Check the following annunciator lights - LIT:** __ • "P/R HI VOLTAGE FAILURE" (1AD-2, F-3) __ • "P/R HI FLUX HI STPT ALERT" (1AD-2, A-3) __ • "P/R HI FLUX RATE ALERT" (1AD-2, A-1).	__ **Notify IAE.**
13. **Check the following status lights on 1SI-18 - LIT:** __ • "P/R LO SETPOINT TRAIN A TRIP BLOCKED" __ • "P/R LO SETPOINT TRAIN B TRIP BLOCKED".	**Perform the following:** __ a. Check "P/R HI FLUX LO STPT ALERT" alarm (1AD-2, A-2) - LIT. __ b. IF alarm is dark, THEN notify IAE to investigate.
__ 14. **IF desired to control S/G levels in auto, THEN return affected S/G CF control valves to auto.**	
__ 15. **Ensure operable P/R channel selected to record on NIS Recorder.**	
__ 16. **Adjust control rods to maintain T-Ave at T-Ref.**	__ **IF rods will not move in manual, THEN adjust turbine load to maintain T-Ave at T-Ref.**

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ 17. **WHEN T-ave within 1° F of T-Ref, AND auto rod control desired, THEN return rods to auto.**	
18. **Instruct IAE to trip bistables associated with failed P/R channel within 6 hours of failure PER IP/0/A/3090/014 (Tripping Inoperable Protection Channels):** __ • OPDT __ • OTDT.	
19. **IF AT ANY TIME failed P/R channel is repaired prior to IAE tripping bistables, THEN:** __ a. Inform IAE that bistables are no longer required to be tripped. __ b. GO TO Step 21.	
20. **WHEN IAE completes Step 18, THEN check status lights for affected P/R - LIT:** • For P/R N-41: __ • "NC LOOP A OPDT RX TRIP" (1SI-7) __ • "NC LOOP A OTDT RX TRIP" (1SI-7). • For P/R N-42: __ • "NC LOOP B OPDT RX TRIP" (1SI-7) __ • "NC LOOP B OTDT RX TRIP" (1SI-7). • For P/R N-43: __ • "NC LOOP C OPDT RX TRIP" (1SI-7) __ • "NC LOOP C OTDT RX TRIP" (1SI-7). • For P/R N-44: __ • "NC LOOP D OPDT RX TRIP" (1SI-7) __ • "NC LOOP D OTDT RX TRIP" (1SI-7).	__ **Notify IAE.**

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
21. **<u>WHEN</u> malfunctioning P/R channel repaired, <u>THEN</u> perform the following:**	
__ a. Ensure instrument power fuses in "POWER RANGE B" drawer installed.	
__ b. Install control power fuses in "POWER RANGE A" drawer.	
__ c. Select "RESET" on the "RATE MODE SWITCH".	
__ d. Check reactor power - GREATER THAN 25%.	d. Perform the following: 1) Check the following bistable - DARK: __ • "P/R HI FLUX LO STPT" (1SI-2). __ 2) <u>IF</u> bistable lit, <u>THEN</u> notify IAE. __ 3) <u>GO TO</u> Step 21.f.
e. Check the following bistable - LIT: __ • "P/R HI FLUX LO STPT" (1SI-2).	__ e. Notify IAE.
f. Check the following bistables - DARK: __ • "P/R HI FLUX HI STPT" (1SI-2) __ • "P/R HI FLUX RATE" (1SI-3).	__ f. Notify IAE.
__ g. Place "COMPARATOR CHANNEL DEFEAT" switch to "NORMAL".	
__ h. Place "POWER MISMATCH BYPASS" switch to "OPERATE".	
__ i. Place "UPPER SECTION" switch to "NORMAL".	
__ j. Place "LOWER SECTION" switch to "NORMAL".	
__ k. Place "ROD STOP BYPASS" switch to "OPERATE".	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
21. (Continued)	
__ l. Place "P/R TO S/G PROGRAM LEVEL CHANNEL DEFEAT" switch to "NORM".	
m. **IF** IAE tripped bistables **PER** Step 18, **THEN** perform the following:	
1) Instruct IAE to place the following bistables for failed channel back in service: __ • OPDT __ • OTDT.	
2) **WHEN** IAE has placed bistables back in service, **THEN** check status lights for failed P/R - DARK: • For P/R N-41: __ • "NC LOOP A OPDT RX TRIP" (1SI-7) __ • "NC LOOP A OTDT RX TRIP" (1SI-7). • For P/R N-42: __ • "NC LOOP B OPDT RX TRIP" (1SI-7) __ • "NC LOOP B OTDT RX TRIP" (1SI-7). • For P/R N-43: __ • "NC LOOP C OPDT RX TRIP" (1SI-7) __ • "NC LOOP C OTDT RX TRIP" (1SI-7). • For P/R N-44: __ • "NC LOOP D OPDT RX TRIP" (1SI-7) __ • "NC LOOP D OTDT RX TRIP" (1SI-7).	__ 2) Notify IAE.

END

(R06-97)

Duke Power Company
PROCEDURE PROCESS RECORD

(1) ID No. AP/1/A/5500/14
Revision No. 5

INFORMATION ONLY

PREPARATION

(2) Station McGuire Nuclear Station

(3) Procedure Title Rod Control Malfunction

(4) Prepared By S. Hackney Date July 15, 1999

(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 Miles [signature] (QR) Date 8/11/99

Cross-Disciplinary Review By ____ (QR) NA MW Date 8/18/99

Reactivity Mgmt. Review By ____ (QR) NA MW Date 8/11/99

(7) Additional Reviews

Reviewed By Jeffrey L. Frye Date 8-18-99

Reviewed By ____ Date ____

(8) Temporary Approval (*if necessary*)

By ____ (SRO/QR) Date ____

By ____ (QR) Date ____

(9) Approved By Peter J Schuerger Date 8-18-99

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 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, 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.*)

A. Purpose

The purpose of this procedure is to ensure proper response in the event of a rod control malfunction and to assess plant conditions and identify appropriate steps for the following conditions:

- Dropped Control Rod
- Control Rod Misalignment
- Failure of Control Rods to Move on Demand
- Continuous Control Rod Movement

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

B. Symptoms

1. **Dropped Control Rod**
   - "RPI AT BOTTOM ROD DROP" alarm (1AD-2, D-9)
   - "RPI AT BOTTOM > 1 ROD DROPPED" alarm (1AD-2, E-9)
   - Individual rod "RB" indication on DRPI monitor (yellow or green rod with orange background)
   - "P/R CHANNEL DEVIATION" alarm (1AD-2, B-3)
   - Unanticipated rod withdrawal
   - Sudden drop in T-Ave
   - "T-REF/T-AUCT ABNORMAL" alarm (1AD-6, B-10)
   - Turbine load deceasing
   - "PZR LO PRESS CONTROL" alarm (1AD-6, C-6)
   - Nuclear Instrument indication of flux tilt

2. **Control Rod Misalignment**
   - "P/R LOWER DET HI FLUX DEV OR AUTO DEFEAT" alarm (1AD-2, B-1)
   - "P/R UPPER DET HI FLUX DEV OR AUTO DEFEAT" alarm (1AD-2, B-2)
   - "DEVIATION > 12 STEPS" DRPI monitor alarm
   - Nuclear Instrument indication of flux tilt

3. **Failure of Control Rods to Move on Demand**
   - No automatic rod motion occurring when expected
   - No manual rod motion occurring when expected
   - "ROD CONTROL URGENT FAILURE" alarm (1AD-2, A-10)
   - "T-REF/T-AUCT ABNORMAL" alarm (1AD-6, B-10)

4. **Continuous Control Rod Movement**
   - Unwarranted rod insertion or withdrawal
   - "T-REF/T-AUCT ABNORMAL" alarm (1AD-6, B-10)

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
C. Operator Actions	
1. IF more than one rod dropped, THEN:	
__ a. Trip reactor.	
__ b. **GO TO** EP/1/A/5000/E-0 (Reactor Trip or Safety Injection).	
__ **2. Place control rods in manual.**	
__ **3. Check rod movement - STOPPED.**	**IF rod movement continues, THEN perform the following:** __ a. Trip reactor. __ b. **GO TO** EP/1/A/5000/E-0 (Reactor Trip or Safety Injection).
4. Perform the following as necessary to maintain T-Ave within 1° F of programmed T-Ref: __ • Lower Turbine load to raise T-Ave. OR __ • Borate the NC System to lower T-Ave.	
__ 5. **Announce occurrence on paging system.**	

Prepared By: Rob Billings

Reviewed By: Charles Sawyer

Approved By: Thomas C. Geer

TASK: **Respond To A Loss Of Normal Power To ETA While In Midloop**

POSITION: **RO**

Operator's Name ______________________________

Location: **Simulator** Method: **Perform**

Estimated JPM Completion Time: 30 Minutes

Actual JPM Completion Time: ____ Minutes

The JPM Operator's performance was evaluated against the standards of this JPM and is determined to be:

SATISFACTORY/UNSATISFACTORY (circle one)

Evaluator's Signature ______________________________ Date __/__/__

References: AP/1/A/5500/07 (Rev. 18) Loss of Electrical Power

JPM verified current with references by ______________________________

Date __/__/__

Rev. 00/05-01-00

INITIAL CONDITIONS

Unit One has been shutdown for 15 days and drained to 10" to allow work on 1A NCP Seals. NC System temperature is approximately 120^0 F. The "A" Train of Essential Components was in service. Normal and Emergency Power Sources are available to 1ETA and 1ETB. A fault occurs on 1ATC, causing the Normal Feeder to 1ETA to open. The 1A Diesel Generator has started and tripped off.

The SRO directs you to respond to the Blackout on 1ETA and restore ND flow by performing AP/1/A/5500/07 (Loss of Electrical Power) case II (Loss of Normal Power to <u>Either</u> 1ETA OR 1ETB) steps 1 - 21.

JPM OVERALL STANDARD: "B" Train of RN, KC, and ND are placed in service.

NOTES: The Simulator should be operated per the Simulator Operator Guidelines.

This JPM is designed to be performed as a **SIMULATION** or as a **WALKTHROUGH.** <u>Cues found in shaded boxes should be given to the trainee for either setting</u>.

KA 005 A4.01 3.6/3.4

START TIME__________

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
1	Check bus energized and sequencer applying loads	RO verifies no voltage on 4160V bus, and verifies sequencer not applying loads, then proceeds to RNO. **Cue:** **Meter indicates "0" volts on 1ETA bus,** **1ETA UV stat lights are illuminated**		
	Perform the following:			
	IF SI has occurred, **THEN GO TO** Step 37.	Operator checks SI stat light dark and determines SI has not occurred, then proceeds to RNO 1.b		
	IF operating train is lost, **THEN GO TO** Step 3.	Operator determines operating train was lost and proceeds to Step 3.		

* **DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
2	Isolate all letdown: • Normal letdown • Excess letdown • ND letdown	Operator determines all letdown is already isolated by ensuring the following valves closed: • Normal letdown (1NV-1, 2, 458, 457, 35) **Cue:** **Green lights lit.** • Excess letdown (1NV-24 and 1NV-25) **Cue:** **Green lights lit.** • ND letdown (1NV-121 manual loader) **Cue:** **Manual loader output needle indicates 0%.** **<u>OR</u>** **Cue:** **Valve indicates green on OAC.**		

* DENOTES CRITICAL

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
3	**Start the opposite train of RN as follows:**	Operator starts 1B RN Pump.		
	To start 1A RN Pump…	N/A		
	To start 1B RN Pump:	Same		
	• Ensure flowpath for 1B RN Pump is available.	Operator checks control board and/or OAC to ensure suction and discharge flowpaths for 1B RN pump are open.		
	• Place manual loader for 1RN-190B (RN TO B KC Hx Control) to 10% open.	**Cue:** **Loader rotated counter clockwise, needle indicates 10% open**		
*	• Start 1B RN Pump	**Cue:** **Pushbutton depressed, red light illuminated, Meter indicates increasing flow**		

* DENOTES CRITICAL

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
4	**Start opposite train KC pumps as follows:**			
	Place control switch for valve on train to be started in "AUTO":	Same		
	• 1KC-51A (Train A Recirc Isol)	N/A		
	OR			
	• 1KC-54B (Train B Recirc Isol)	**Cue:** **Switch rotated clockwise to AUTO**		
*	Start KC Pumps one at a time.	**Cue:** **Pushbutton depressed, red light illuminated, amps have stabilized on first pump,** **Pushbutton depressed, red light illuminated, amps have stabilized on second pump**		
	Ensure the following valves on the energized train are open :	Operator aligns B Train KC valves.		
	• A Train	N/A		
	OR			

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
4	**Continued**			
	B Train:	Same		
	• 1KC-18B (Trn B Rx Bldg Non Ess Ret Isol)	**Cue:** **Pushbutton depressed, red light illuminated**		
	• 1KC-228B (Trn B Rx Bldg Non Ess Sup Isol)	**Cue:** **Pushbutton depressed, red light illuminated**		
	• 1KC-364B (B NC Pump Therm Bar Otlt)	**Cue:** **Red light illuminated**		
	• 1KC-413B (D NC Pump Therm Bar Otlt)	**Cue:** **Red light illuminated**		
	<u>IF</u> required to maintain thermal barrier valves open, <u>**THEN**</u> raise KC flow to KF Hx by throttling open the following valves:	Step not required, valves are staying open.		
	• 1KC-149 (A KF Hx Outlet Flow)	N/A		
	<u>**OR**</u>			
	• 1KC-156 (B KF Hx Outlet Flow)	N/A		
	Ensure KC flow is less than 4000 GPM per operating KC pump	**Cue:** **KC flow gage indicates 7000 GPM** (gage 1KCP 5540, 1B1/1B2 KC Pumps flow)		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
5	<u>IF</u> ND pump on prior to event, **<u>THEN</u>** ensure 1NV-121 (ND Letdown Control) is closed.	Operator checks manual loader or OAC to verify 1NV-121 is closed. **Cue:** **Loader output needle indicates 0% open, OAC indication is green**		
6	<u>IF</u> 1A RN Pump started, **<u>THEN</u>** perform the following....	N/A		
7 *	<u>IF</u> 1B RN Pump started, **<u>THEN</u>** perform the following: Throttle 1RN-190B (RN TO B KC Hx Control) to establish 1B KC Train cooling, while ensuring 1B RN Pump flow remains less than the following: • <u>IF</u> 1B RN Pump suction is aligned to Low Level Intake, **<u>THEN</u>** limit flow to 16,000 GPM.	Operator determines 1B RN is aligned to Low Level Intake and establishes 2000-4000 GPM RN flow through the B KC Hx. (This is a typical value for these conditions.) The Operator may adjust 1RN-190B to get more or less flow, which is acceptable, as long as max. flow of 16,000 GPM is not exceeded. **Cue:** **Knob rotated clockwise, meter output for RN To KC Hx flow** (1RNP 5370) **increasing to 4,000 GPM.** **Cue:** **Total RN flow** (1RNP 5050) **indicates 14,000 GPM.**		

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
7	**Continued** **<u>OR</u>** • <u>IF</u> 1B RN Pump suction is aligned to SNSWP, <u>**THEN**</u> limit flow to 13,000 GPM.	N/A		
8	**<u>IF</u> desired, <u>THEN</u> restore charging flow as follows…**	Operator determines that charging is not required with the NC system at mid-loop. Cue if needed. **Cue:** **It is not desired to restore charging flow at this time.**		
9	**Notify Unit 2 RO to start 2A RN Pump**	Same **Cue:** **Unit 2 A RN Pump is running.**		
10	**Check - B/O ON 1ETA**	Operator determines B/O was on 1ETA. **Cue**: **1ETA UV stat lights are illuminated**		

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
11	**Check 1RN-187B (B KC Hx Inlet Isol) – OPEN**	Same **Cue:** **Red light illuminated.**		
12	Perform one of the following to isolate RN train crosstie: • Dispatch operator to close 1RN-40A (Train A To Non Ess Hdr Isol) (aux bldg, 716+7, GG-55) **OR** • Evaluate closing 1RN-41B (Train B To Non Ess Hdr Isol)	Operator determines that closing 1RN-41B from the C/R would be the best choice, since RN flow to the NC pumps is not a concern in this mode. If asked to locally close 1RN-40A, give the following cue: **Cue:** **No operators are available for dispatch at this time.** **Note to Evaluator:** If SRO guidance is sought, direct Operator to close 1RN-41B. **Cue:** **Red light illuminated,** **Pushbutton depressed, green light illuminated.**		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
13	**<u>WHEN</u> RN train crosstie is isolated, <u>THEN</u> 1RN-190B (RN TO B KC Hx Control) may be throttled further open, while maintaining 1B RN Pump flow less than the following:** • <u>IF</u> 1B RN Pump suction is aligned to Low Level Intake, **<u>THEN</u>** limit flow to 16,000 GPM. **<u>OR</u>** • <u>IF</u> 1B RN Pump suction is aligned to SNSWP, **<u>THEN</u>** limit flow to 13,000 GPM.	Operator checks total RN flow (which will be decreasing as 1RN-41B closes) and RN to B KC Hx flow. Operator adjusts 1RN-190B, if necessary, while maintaining 1B RN Pump flow less than 16,000 GPM. Cue accordingly. **Cue:** **Total RN flow indicates 5,000 GPM.** **Cue:** **Knob rotated clockwise, meter output for RN To KC Hx flow is increasing.** N/A		
14	**Dispatch operator to close the following:** • 1KC-230A (Trn A Rx Bldg Non Ess Sup Isol) • 1KC-3A (Trn A Rx Bldg Non Ess Ret Isol)	Same **Cue:** **An operator has been dispatched to close the valves.**		

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
15	**Check 1A ND Train – WAS IN RHR MODE.**	Operator determines from initial conditions that 1A ND was in RHR mode.		
16	**Check NC System makeup as follows:**	Operator receives the following cue, then proceeds to the RNO:		
	Check if additional makeup flowpath to the NC system **PER** AP/1/A/5500/19 (Loss of ND or ND System Leakage) – HAS BEEN INITIATED	**Cue:** **Additional makeup per AP/19 has NOT been initiated**		
	(RNO 17.a) – **GO TO** Step 18.	Same		
17	**Check VI pressure – GREATER THAN 60 PSIG.**	Same **Cue:** **Meter indicates 105 PSIG.**		

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
18	**Check NC System Level – GREATER THAN OR EQUAL TO PRE B/O LEVEL**	Operator checks one or more of the following NC System level indications to determine level is greater than or equal to 10 inches: Ultrasonic A-1NCP-8470 Ultrasonic C-1NCP-8460 N/R - 1NCP-5991 OAC **Cue:** **NC System level indicates approximately 12 inches**		
19	**Check NC System Subcooling – GREATER THAN 0^0 F**	Operator checks ICCM or OAC to verify subcooling > 0^0 F. **Cue:** **Instrument indicates NC system subcooling is 60 degrees**		

* DENOTES CRITICAL

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
20	**Place 1B Train ND in service as follows:** Close the following valves:	Same		
*	• Close 1ND-34 (A&B NDHX Bypass)	**Cue:** **Knob rotated counter clockwise, needle at bottom**		
*	• Close 1ND-33 (A NDHX Bypass)	**Cue:** **Red light lit, Pushbutton depressed, green light illuminated.**		
	• Close 1ND-32 (A NDHX to L/D HX)	**Cue:** **Green light illuminated.**		
	• Close 1ND-18 (B NDHX Bypass)	**Cue:** **Green light illuminated.**		
	• Close 1ND-17 (B NDHX to L/D HX)	**Cue:** **Green light illuminated.**		
	• Close 1ND-14 (B NDHX Outlet)	**Cue:** **Loader needle at bottom**		
	<u>IF</u> adequate KC flow cannot be established in Step 21.d due to excessive KC flow to 1A ND Hx, <u>**THEN**</u> dispatch operator to close 1KC-56A (KC To A ND Hx).	Operator reads step, then proceeds to step 21.c.		

* **DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
20	**Continued** **<u>IF AT ANY TIME</u>** adequate KC flow to the 1B ND Hx cannot be established, **<u>THEN</u>** throttle closed the following valves as required: • 1KC-149 (A KF Hx Outlet Flow) **<u>OR</u>** • 1KC-156 (B KF Hx Outlet Flow)	Operator reads step, then proceeds to step 21.d.		
*	Throttle open 1KC-81B (KC To B ND Hx) to establish 2000 GPM to 5000 GPM flow to 1B ND Hx, while limiting each KC Pump flow to 4000 GPM.	Operator throttles open on 1KC-81B to establish 2000 GPM to 5000 GPM flow to 1B ND Hx while monitoring total KC flow. As total KC flow approaches 8000 GPM, operator throttles 1KC-149 to limit total KC flow to less than 8000 GPM. **<u>Note:</u>** Momentarily exceeding the limit would not constitute failure of this step, however, a sustained flow rate of greater than 4000 GPM per pump could cause pump damage. If the flow limit is exceeded here and not reduced before completing this JPM, performance of this step would be UNSAT.		

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
20	**Continued**	**Cue:** **Pushbutton depressed, KC to 1B ND Hx flow meter increasing, total KC flow indicates 8200 GPM, 1KC-149 loader output reduced, total KC flow reads 7800 gpm, KC flow to 1B ND Hx reads 2200 GPM.**		
*	Start 1B ND Pump	Same **Cue:** **Pushbutton depressed, red light illuminated.**		
	Ensure 1ND-67B (B ND Pump & B Hx Miniflow) opens.	**Cue:** **Red light illuminated.**		
	Open the following valves:	Same		
*	• 1ND-18 (B NDHX Bypass)	**Cue:** **Green light lit, Pushbutton depressed, red light illuminated.**		
	• 1NI-178B (Train B ND to C & D CL)	**Cue:** **Red light illuminated.**		
	• 1ND-15B (Train B ND to Hot Leg Isol)	**Cue:** **Red light illuminated.**		

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
20	**Continued**			
	CAUTION: Minimum ND System flow of 2000 GPM must be maintained anytime ND flow is discharging to all 4 cold legs.	Operator recognizes ND is discharging to all 4 cold legs and maintains minimum flow in subsequent steps. (Checks flow gages 1NDP-5191 [C&D Loops] and 1NDP-5181 [A&B Loops])		
*	Slowly throttle open 1ND-34 (A&B NDHX Bypass) to obtain ND flow of at least 2000 GPM.	**Cue:** **Knob rotated clockwise, needle going up, total ND flow increasing to 2500 GPM.**		

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
20	**Continued** Throttle the following valves as necessary to stabilize NC System temperature:	**<u>Note to Evaluator:</u>** By this time, NC System temperature will be approximately 140-160 degrees F. Direct the Operator to commence a cooldown to bring NC System temperature back to 120 degrees F. by giving the following cue: **Cue:** **Commence cooldown to return NC System to 120 degrees F.**		
	• 1ND-34 (A&B ND HX Bypass) • 1ND-14 (B ND HX Outlet) • <u>IF</u> NC System temperature is greater than 200 degrees F, **<u>THEN</u>** maintain KC flow greater than 2000 GPM. • 1KC-81B (KC To B ND Hx)	Operator adjusts 1ND-34 and/or 1ND-14 and/or 1KC-81B to begin cooldown. Once the cooldown has been started and the Operator has demonstrated desired proficiency, give the following terminating cue: **Cue:** **Another operator will continue in this procedure.**		

STOP TIME__________

*** DENOTES CRITICAL**

INITIAL CONDITIONS

Unit One has been shutdown for 15 days and drained to 10" to allow work on 1A NCP Seals. NC System temperature is approximately 120^0 F. The "A" Train of Essential Components was in service. Normal and Emergency Power Sources are available to 1ETA and 1ETB. A fault occurs on 1ATC, causing the Normal Feeder to 1ETA to open. The 1A Diesel Generator has started and tripped off.

The SRO directs you to respond to the Blackout on 1ETA and restore ND flow by performing AP/1/A/5500/07 (Loss of Electrical Power) case II (Loss of Normal Power to <u>Either</u> 1ETA OR 1ETB) steps 1 - 21.

SIMULATOR OPERATOR GUIDELINES (EP-188A)

1. Reset to IC-21, MOL, NCS at 9.5", NC System temperature 120^0 F. Place Simulator in RUN.

2. Swap to "A" train only for RN, KC, ND, KF, VC-YC.

3. Adjust KC flow to the 1A NDHX to 3000 GPM using 1KC-56A.

4. Tag out both MD CA pumps via:
   - LOA-CA009 CA Pump 1A Rackout (Racked Out)
   - LOA-CA010 CA Pump 1B Rackout (Racked Out)

5. Ensure 1NV-121 is fully closed.

6. Insert MALF - EP008A (Loss of 4160 V Bus ETA Due to Ground Fault).

7. Open 1ATC Incoming Breaker.

8. Acknowledge all Annunciator and OAC alarms. Go to **FREEZE** until ready to begin JPM.

TEMP SNAP #143

(R06-97)

Duke Power Company
PROCEDURE PROCESS RECORD

(1) ID No. **AP/1/A/5500/07**
Revision No. **18**

INFORMATION ONLY

PREPARATION

(2) Station **McGuire Nuclear Station**

(3) Procedure Title **Loss Of Electrical Power**

(4) Prepared By **S. Hackney** S. Hackney Date **November 22, 1999**

(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 [signature] (QR) Date 12/1/99

Cross-Disciplinary Review By [signature] (CEN POWER) (QR) NA____ Date 12-6-99

Reactivity Mgmt. Review By ____ (QR) NA [initials] Date 12/1/99

(7) Additional Reviews

Reviewed By ____ Date ____

Reviewed By ____ Date ____

(8) Temporary Approval (*if necessary*)

By ____ (SRO/QR) Date ____

By ____ (QR) Date ____

(9) Approved By [signature] Date 12.15.99

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 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, 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.*)

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
B. Symptoms	
• **Loss of normal power power to 1ETA or 1ETB**	
• **Loss of normal operating components supplied from affected bus**	
• **"Blackout Seq Actuated Train A" status light**	
• **"Blackout Seq Actuated Train B" status light.**	
C. Operator Actions	
__ 1. **Check bus energized and sequencer applying loads.**	**Perform the following:** __ a. IF S/I has occurred, **THEN GO TO** Step 37. __ b. IF operating train is lost, **THEN GO TO** Step 3. __ c. IF operating train is still energized by offsite power, **THEN GO TO** Step 37.
__ 2. **GO TO Step 34.**	
3. **Isolate all letdown:** __ • Normal letdown __ • Excess letdown __ • ND letdown.	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

4. **Start the opposite train of RN as follows:**

   • To start 1A RN Pump:

   __ a. Ensure flowpath for 1A RN Pump is available.

   __ b. Place manual loader for 1RN-89A (RN to A KC Hx Control) to 10% open.

   __ c. Start 1A RN Pump.

   OR

   • To start 1B RN Pump:

   __ a. Ensure flowpath for 1B RN Pump is available.

   __ b. Place manual loader for 1RN-190B (RN To B KC Hx Control) to 10% open.

   __ c. Start 1B RN Pump.

5. **Start opposite train KC pumps as follows:**

   a. Place control switch for valve on train to be started in "AUTO":

   __ • 1KC-51A (Train A Recirc Isol)

   OR

   __ • 1KC-54B (Train B Recirc Isol).

   __ b. Start KC pumps one at a time.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

5. (Continued)

c. Ensure the following valves on the energized train are open:

- A Train:

__ 1) 1KC-3A (Trn A Rx Bldg Non Ess Ret Isol).

__ 2) 1KC-230A (Trn A Rx Bldg Non Ess Sup Isol).

__ 3) 1KC-394A (A NC Pump Therm Bar Otlt).

__ 4) 1KC-345A (C NC Pump Therm Bar Otlt).

OR

- B Train:

__ 1) 1KC-18B (Trn B Rx Bldg Non Ess Ret Isol).

__ 2) 1KC-228B (Trn B Rx Bldg Non Ess Sup Isol).

__ 3) 1KC-364B (B NC Pump Therm Bar Otlt).

__ 4) 1KC-413B (D NC Pump Therm Bar Otlt).

d. IF required to maintain thermal barrier valves open, THEN raise KC flow to KF Hx by throttling open the following valves:

__ • 1KC-149 (A KF Hx Outlet Flow)

OR

__ • 1KC-156 (B KF Hx Outlet Flow).

__ e. Ensure KC flow is less than 4000 GPM per operating KC pump:

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

__ 6. **IF ND pump on prior to event, THEN ensure 1NV-121 (ND Letdown Control) is closed.**

7. **IF 1A RN Pump started, THEN perform the following:**

__ a. Close 1RN-43A (Train B To Non Ess Hdr Isol).

__ b. Throttle open 1RN-89A (RN to A KC Hx Control) to establish desired 1A KC Train cooling.

8. **IF 1B RN Pump started, THEN perform the following:**

- Throttle 1RN-190B (RN To B KC Hx Control) to establish 1B KC Train cooling, while ensuring 1B RN Pump flow remains less than the following:

__ • IF 1B RN Pump suction is aligned to Low Level Intake, THEN limit flow to 16,000 GPM.

OR

__ • IF 1B RN Pump suction is aligned to SNSWP, THEN limit flow to 13,000 GPM.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
9. **<u>IF</u> desired, <u>THEN</u> restore charging flow as follows:**	
__ a. Fully open 1NV-241 (Seal Inj Flow Control).	
__ b. Place 1NV-238 (Charging Line Flow Control) in manual and close.	
__ c. Start available NV Pump.	
d. Slowly restore seal injection flow to limit cooldown of NC pump bearings to 1° F per minute as follows:	
__ • Throttle open 1NV-238.	
__ • Throttle close 1NV-241.	
__ 10. **Notify Unit 2 RO to start 2A RN Pump.**	
__ 11. **Check - B/O ON 1ETA.**	__ **Observe Note prior to Step 23 and <u>GO TO</u> Step 23.**

<u>NOTE</u> The following steps start 1B Train equipment.

__ 12. **Check 1RN-187B (B KC Hx Inlet Isol) - OPEN.**	__ **Open valve.**
13. **Perform one of the following to isolate RN train crosstie:**	
__ • Dispatch operator to close 1RN-40A (Train A To Non Ess Hdr Isol) (aux bldg, 716+7, GG-55).	
OR	

<u>CAUTION</u> **Closing 1RN-41B (Train B To Non Ess Hdr Isol) will isolate 1B Train RN flow to NC pumps and other non essential loads.**

__ • Evaluate closing 1RN-41B (Train B To Non Ess Hdr Isol).

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
14. **<u>WHEN</u> RN train crosstie is isolated, <u>THEN</u> 1RN-190B (RN To B KC Hx Control) may be throttled further open, while maintaining 1B RN Pump flow less than the following:**	
__ • <u>IF</u> 1B RN Pump suction is aligned to Low Level Intake, <u>THEN</u> limit flow to 16,000 GPM.	
OR	
__ • <u>IF</u> 1B RN Pump suction is aligned to SNSWP, <u>THEN</u> limit flow to 13,000 GPM.	
15. **Dispatch operator to close the following:**	
__ a. 1KC-230A (Trn A Rx Bldg Non Ess Sup Isol) (aux bldg, 750+12, JJ-55, above north end of KC Heat Exchanger 1A).	
__ b. 1KC-3A (Trn A Rx Bldg Non Ess Ret Isol) (aux bldg, 733+8, HH-55, north of column HH-55).	
__ 16. **Check 1A ND Train - WAS IN RHR MODE.**	__ **<u>GO</u> <u>TO</u> Step 31.**
17. **Check NC System makeup as follows:**	
__ a. Check if additional makeup flowpath to the NC System <u>PER</u> AP/1/A/5500/19 (Loss Of ND Or ND System Leakage) - HAS BEEN INITIATED.	__ a. <u>GO</u> <u>TO</u> Step 18.
__ b. <u>REFER</u> <u>TO</u> AP/1/A/5500/19 (Loss Of ND Or ND System Leakage).	
__ c. <u>GO</u> <u>TO</u> Step 31.	
__ 18. **Check VI pressure - GREATER THAN 60 PSIG.**	**Perform the following:** __ a. <u>REFER</u> <u>TO</u> AP/1/A/5500/19 (Loss Of ND Or ND System Leakage) __ b. <u>GO</u> <u>TO</u> Step 31.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ 19. **Check NC System level - GREATER THAN OR EQUAL TO PRE B/O LEVEL.**	**Perform the following:** __ a. <u>REFER</u> <u>TO</u> AP/1/A/5500/19 (Loss Of ND Or ND System Leakage). __ b. <u>GO</u> <u>TO</u> Step 31.
__ 20. **Check NC System subcooling - GREATER THAN 0° F.**	**Perform the following:** __ a. <u>REFER</u> <u>TO</u> AP/1/A/5500/19 (Loss Of ND Or ND System Leakage). __ b. <u>GO</u> <u>TO</u> Step 31.
21. **Place 1B Train ND in service as follows:** a. Close the following valves: __ • Close 1ND-34 (A & B ND Hx Bypass) __ • Close 1ND-33 (A ND Hx Bypass) __ • Close 1ND-32 (A ND Hx To Letdown Hx) __ • Close 1ND-18 (B ND Hx Bypass) __ • Close 1ND-17 (B ND Hx To Letdown Hx) __ • Close 1ND-14 (B ND Hx Outlet). __ b. <u>IF</u> adequate KC flow cannot be established in Step 21.d due to excessive KC flow to 1A ND Hx, <u>**THEN**</u> dispatch operator to close 1KC-56A (KC To A ND Hx) (aux bldg, 750+9, MM-54, room 811, above cation demineralizer hatch).	__ **<u>IF</u> ND pump cannot be started, <u>THEN</u> <u>REFER</u> <u>TO</u> AP/1/A/5500/19 (Loss Of ND Or ND System Leakage).**

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

21. (Continued)

c. **__IF AT ANY TIME__** adequate KC flow to 1B ND Hx cannot be established, **__THEN__** throttle closed the following valves as required:

__ • 1KC-149 (A KF Hx Outlet Flow)

OR

__ • 1KC-156 (B KF Hx Outlet Flow).

__ d. Throttle open 1KC-81B (KC To B ND Hx) to establish 2000 GPM to 5000 GPM KC flow to 1B ND Hx, while limiting each KC pump flow to 4000 GPM.

__ e. Start 1B ND Pump.

__ f. Ensure 1ND-67B (B ND Pump & B Hx Miniflow) opens.

g. Open the following valves:

__ • 1ND-18 (B ND Hx Bypass)

__ • 1NI-178B (Train B ND To C & D CL)

__ • 1ND-15B (Train B ND To Hot Leg Isol).

__CAUTION__ **Minimum ND System flow of 2000 GPM must be maintained anytime ND flow is discharging to all 4 cold legs.**

__ h. Slowly throttle open 1ND-34 (A & B ND Hx Bypass) to obtain ND flow of at least 2000 GPM.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

21. (Continued)

i. Throttle the following valves as necessary to stabilize NC System temperature:

__ • 1ND-34 (A & B ND Hx Bypass)

__ • 1ND-14 (B ND Hx Outlet)

__ • **IF** NC System temperature is greater than 200° F, **THEN** maintain KC flow greater than 2000 GPM.

__ • 1KC-81B (KC To B ND Hx).

__ j. **IF** desired, **THEN** establish letdown from ND **PER** OP/1/A/6200/001A (Chemical and Volume Control System Letdown), Enclosure 4.1 (Establishing Letdown Flow from the ND System, Charging Flow, and Seal Injection Flow).

__ 22. **GO TO Step 31.**

NOTE The following steps start 1A Train equipment.

__ 23. **Check 1RN-86A (A KC Hx Inlet Isol) - OPEN.** — RNO: __ **Open valve.**

24. **Dispatch operator to close the following:**

__ a. 1KC-228B (Trn B Rx Bldg Non Ess Sup Isol) (aux bldg, 750+18, JJ-55, above middle of KC Heat Exchanger 1B)

__ b. 1KC-18B (Trn B Rx Bldg Non Ess Ret Isol) (aux bldg, 739+9, HH-56, north of KC Pump 1B1).

__ 25. **Check 1B ND Train - WAS IN RHR MODE.** — RNO: __ **GO TO Step 31.**

Prepared By: Rob Billings

Reviewed By: Charles Sawyer

Approved By: Thomas C. Cole

TASK: **RN Emergency Alignment After A Loss Of All AC On Unit 2**

POSITION: **RO**

Operator's Name______________________________

Location: **Unit 2 Control Room** Method: **Walkthrough**

Estimated JPM Completion Time: 30 Minutes

Actual JPM Completion Time: ______ Minutes

The JPM Operator's performance was evaluated against the standards of this JPM and is determined to be:

SATISFACTORY/UNSATISFACTORY (circle one)

Evaluator's Signature______________________________ Date __/__/__

References: EP/2/A/5000/ECA-0.0 (Rev. 14) Loss Of All AC Power

JPM verified current with references by ______________________________

Date __/__/__

INITIAL CONDITIONS

You are the Unit 2 Balance of Plant Operator (BOP).

Unit 2 is operating at 100% power with 'A' train in service, when a loss of all AC power occurs. The Control Room SRO has implemented EP/2/A/5000/ECA-0.0 (Loss Of All AC Power). Unit 2 ETA is de-energized. The "2B" D/G has just been started and the essential bus (2ETB) energized and loaded per EP/2/A/5000/ECA-0.0, Enclosure 7 (Energizing 4160 V Bus With D/G). Unit 1 is at 100% power with 1ETA and 1ETB energized from their normal power source. EP/2/A/5000/ECA-0.0 Enclosure 19 (RN Emergency Alignment) has been implemented.

The Control Room SRO directs you to perform EP/2/A/5000/ECA-0.0 Enclosure 19 (RN Emergency Alignment).

JPM OVERALL STANDARD: B Train RN is aligned to the SNSWP per Enclosure 19.

NOTES: The evaluator shall provide a copy of EP/2/A/5000/ECA-0.0, Enclosure 19 (RN Emergency Alignment) upon request.

KA 008 A4.01 3.3/3.1

START TIME__________

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
1	**Check the following Train A valves aligned as follows:**	Operator begins to check Train A valve positions via control board or OAC indications. The Train A, "Unit 0" valves will still have power (from Unit 1). Some Train A valves will have neither control power nor motive power. The operator may dispatch someone to locally position these valves, but will probably just continue to the next valve and address them later. Other Train A valves are pneumatic and may be repositioned per the RNO. Cue as follows: **NOTE:** It is not critical to reposition any of the valves listed in JPM steps # 1 and 2, due to current system configuration.		
	2RN-126A (A NS Pump ESS AHU Sup Isol) – OPEN	**Cue:** **Green light is lit** **Pushbutton depressed, red light lit**		
	2RN-130A (A ND Pump ESS AHU Sup Isol) – OPEN	**Cue:** **Green light is lit** **Pushbutton depressed, red light lit**		

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
1	**CONTINUED**			
	2RN-114A (A NI Pump Cooler Sup Isol) - OPEN	**Cue:** **Green light is lit Pushbutton depressed, red light lit**		
	2RN-103A (A NV Pump Cooler Sup Isol) - OPEN	**Cue:** **Red light lit**		
	0RN-148AC (Train 1A & 2A Disch to RC) - OPEN	**Cue:** **Red light lit**		
	2RN-89A (RN to A KC Hx Control) - OPEN	**Cue:** **Needle indicates 30%,** (pause) **Control Knob rotated clockwise, needle indicates 100%**		
	2RN-140A (A KF Pump ESS AHU Sup Isol) - OPEN	**Cue:** **Red light lit**		
	2RN-296A (Train A ESS Hdr Ret Isol) - OPEN	**Cue:** **Both control board lights are dark.** **NOTE**: if OAC is used, cue the valve is **OPEN**.		

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
1	**CONTINUED**			
	0RN-147AC (Train 1A & 2A Disch to RC) – OPEN	**Cue:** **Red light lit**		
	2RN-86A (A KC Hx Inlet Isol) – OPEN	**Cue:** **Both control board lights are dark.** **<u>NOTE</u>:** if OAC is used, cue the valve is **<u>OPEN</u>**.		
	0RN-13A (Train 1A & 2A LLI Supply) – OPEN	**Cue:** **Red light lit**		
	2RN-16A (A RN Pump Suction Isol)	**Cue:** **Both control board lights are dark.** **<u>NOTE</u>:** if OAC is used, cue the valve is **<u>OPEN</u>**.		
	2RN-70A (A D/G Hx Inlet Isol) – OPEN	**Cue:** **Both control board lights are dark.** **<u>NOTE</u>:** if OAC is used, cue the valve is **<u>CLOSED</u>**.		
	0RN-12AC (Train 1A & 2A LLI Supply) – OPEN	**Cue:** **Red light lit**		

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
2	**Check the following Train A valves – CLOSED:**	Operator begins to check Train A valve positions via control board or OAC indications. The Train A, "Unit 0" valves will still have power (from Unit 1). Some Train A valves will have neither control power nor motive power. The operator may dispatch someone to locally position these valves, but will probably just continue to the next valve and address them later. Cue as follows:		
	0RN-3A (Train 1A & 2A RC Supply) – CLOSED	**Cue:** **Green light is lit**		
	0RN-7A (Train 1A & 2A SNSWP Supply) - CLOSED	**Cue:** **Green light is lit**		
	0RN-149A (Train 1A & 2A Disch to SNSWP) - CLOSED	**Cue:** **Green light is lit**		
	0RN-150A (Train 1A & 2A Disch X-Connect) – CLOSED	**Cue:** **Green light is lit**		
	0RN-14A (Train 1A & 2A Supply X-Connect) – CLOSED	**Cue:** **Green light is lit**		

* **DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
2	**CONTINUED**			
	2RN-42A (AB Non Ess Supply) – CLOSED	**Cue:** **Both control board lights are dark.** **NOTE**: if OAC is used, cue the valve is **OPEN**.		
	2RN-64A (AB Non Ess Return Isol) – CLOSED	**Cue:** **Both control board lights are dark.** **NOTE**: if OAC is used, cue the valve is **CLOSED**.		
	2RN-43A (Traion B To Non Ess Hdr Isol) – CLOSED	**Cue:** **Both control board lights are dark.** **NOTE**: if OAC is used, cue the valve is **OPEN**.		
	2RN-299A (AB Vent Sys Return Isol) – CLOSED	**Cue:** **Both control board lights are dark.** **NOTE**: if OAC is used, cue the valve is **OPEN**.		
	0RN-4AC (Train 1B & 2B RC Supply) - CLOSED	**Cue:** **Green light lit.**		

* **DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
3	**Check the following Train B valves aligned as follows:**	Operator checks valve position and positions valves as required per the RNO		
*	2RN-227B (B NS Pump ESS AHU Sup Isol) - OPEN	**Cue:** **Green light is lit Pushbutton depressed, red light lit**		
*	2RN-231B (B ND Pump ESS AHU Sup Isol) - OPEN	**Cue:** **Green light is lit Pushbutton depressed, red light lit**		
*	2RN-215B (B NI Pump Cooler Sup Isol) - OPEN	**Cue:** **Green light is lit Pushbutton depressed, red light lit**		
*	2RN-204B (B NV Pump Cooler Sup Isol) - OPEN	**Cue:** **Green light is lit Pushbutton depressed, red light lit**		
*	0RN-9B (Train 1B & 2B SNSWP Supply) - OPEN	**Cue:** **Green light is lit Pushbutton depressed, red light is lit**		

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
3	**CONTINUED**			
	2RN-18B (B RN Pump Suction Isol) - OPEN	**Cue:** **Red light is lit**		
	2RN-190B (RN To B KC Hx Control) - OPEN	**Cue:** **Needle indicates 30%, Control Knob rotated clockwise, needle indicates 100%**		
*	2RN-240B (B KF Pump ESS AHU Sup Isol) - OPEN	**Cue:** **Green light is lit Pushbutton depressed, red light is lit**		
	2RN-297B (Train B Ess Hdr Ret Isol) - OPEN	**Cue:** **Red light is lit**		
*	0RN-152B (Train 1B & 2B Disch to SNSWP) - OPEN	**Cue:** **Green light is lit Pushbutton depressed, red light is lit**		
	2RN-187B (B KC Hx Inlet Isol) Mode Select - IN AUTO	**Cue:** **Switch is in "Auto" position**		
	2RN-171B (B D/G Hx Inlet Isol) – OPEN	**Cue:** **Red light is lit**		

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
4	**Check the following Train B valves - CLOSED:**	Operator checks valve position and positions valves as required per the RNO		
	0RN-2B (Train 1A & 2A RC Supply) - CLOSED	**Cue:** **Green light is lit**		
	2RN-63B (AB Non Ess Return Isol) - CLOSED	**Cue:** **Red light is lit** **Pushbutton depressed, green light is lit**		
	2RN-41B (Train B To Non Ess Hdr Isol) - CLOSED	**Cue:** **Green light is lit**		
*	2RN-279B (AB Vent Sys Return Isol) - CLOSED	**Cue:** **Red light is lit** **Pushbutton depressed, green light is lit**		
*	0RN-11B (Train 1B & 2B LLI Supply) - CLOSED	**Cue:** **Red light is lit** **Pushbutton depressed, green light is lit**		
	0RN-15B (Train 1B & 2B Supply X-Connect) - CLOSED	**Cue:** **Green light is lit**		

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
4	**CONTINUED**			
	0RN-151B (Train 1B & 2B Disch X-Connect) - CLOSED	**Cue:** **Green light is lit**		
	0RN-5B (Train 1B & 2B RC Supply) - CLOSED	**Cue:** **Green light is lit**		
*	0RN-284B (Train 1B & 2B Disch To RC) - CLOSED	**Cue:** **Red light is lit Pushbutton depressed, green light is lit**		
5	**Check either of the following - ENERGIZED:** 2ETB <u>**OR**</u> 1ETB	Operator determines from initial conditions that 2ETB and 1ETB are energized. Cue as appropriate. **Cue:** **Volt meter indicates 4160 volts, Undervoltage Status lights are dark**		

* DENOTES CRITICAL

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
6	**Check B train RN - ALIGNED TO SNSWP**	Operator utilizes control board indication or OAC indication to determine B Train RN is aligned to the SNSWP. Valves should be aligned as follows, cue as appropriate: 0RN-9B Open 2RN-18B Open 2RN-297B Open 0RN-152B Open **Cue:** **Red light is lit** **OR** **Valve indicates open**		
7	**Check 2ETA - ENERGIZED**	Operator determines that 2ETA is not energized and goes to the RNO **Cue:** **Undervoltage Status lights are illuminated,** **2ETA bus Volt meter indicates "0" volts**		
8	<u>GO</u> <u>TO</u> Step 9	Same		

* DENOTES CRITICAL

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
9	**Check containment pressure has remained less than 3 PSIG**	Operator determines that containment pressure has remained less than 3 PSIG (checks W/R Containment Pressure gages on main control board and checks "Cont Isol Phase B" annunciator [AD9-E8] is dark). **Cue:** **W/R containment pressure gages indicate 0.4 PSIG, "Cont Isol Phase B" annunciator [AD9-E8] is dark).**		
10	**<u>RETURN</u> <u>TO</u>** step in effect in body of procedure	Operator terminates JPM.		

STOP TIME___________

* DENOTES CRITICAL

INITIAL CONDITIONS

You are the Unit 2 Balance of Plant Operator (BOP).

Unit 2 is operating at 100% power with 'A' train in service, when a loss of all AC power occurs. The Control Room SRO has implemented EP/2/A/5000/ECA-0.0 (Loss Of All AC Power). Unit 2 ETA is de-energized. The "2B" D/G has just been started and the essential bus (2ETB) energized and loaded per EP/2/A/5000/ECA-0.0, Enclosure 7 (Energizing 4160 V Bus With D/G). Unit 1 is at 100% power with 1ETA and 1ETB energized from their normal power source. EP/2/A/5000/ECA-0.0 Enclosure 19 (RN Emergency Alignment) has been implemented.

The Control Room SRO directs you to perform EP/2/A/5000/ECA-0.0 Enclosure 19 (RN Emergency Alignment).

(R06-97)

Duke Power Company
PROCEDURE PROCESS RECORD

(1) ID No. EP/2/A/5000/ECA-0.0
Revision No. 14

INFORMATION ONLY

PREPARATION

(2) Station McGuire Nuclear Station

(3) Procedure Title Loss Of All AC Power

(4) Prepared By S. Hackney S. Hackney Date November 29, 1999

(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 [signature] (QR) Date 12/15/99

Cross-Disciplinary Review By [signature] H. P[illegible] (QR) NA ______ Date 12/14/99

Reactivity Mgmt. Review By ______ (QR) NA MW Date 12/15/99

(7) Additional Reviews

Reviewed By ______ Date ______

Reviewed By ______ Date ______

(8) Temporary Approval (*if necessary*)

By ______ (SRO/QR) Date ______

By ______ (QR) Date ______

(9) Approved By Peter J Schuerger Date 12-15-99

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 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, 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.*)

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
1. **Check the following Train A valves aligned as follows:**	__ **Align valve(s).**

__ • 2RN-126A (A NS Pump ESS AHU Sup Isol) - OPEN

__ • 2RN-130A (A ND Pump ESS AHU Sup Isol) - OPEN

__ • 2RN-114A (A NI Pump Cooler Sup Isol) - OPEN

__ • 2RN-103A (A NV Pump Cooler Sup Isol) - OPEN

__ • 0RN-148AC (Train 1A & 2A Disch To RC) - OPEN

__ • 2RN-89A (RN to A KC Hx Control) - OPEN

__ • 2RN-140A (A KF Pump ESS AHU Sup Isol) - OPEN

__ • 2RN-296A (Train A ESS Hdr Ret Isol) - OPEN

__ • 0RN-147AC (Train 1A & 2A Disch To RC) - OPEN

__ • 2RN-86A (A KC Hx Inlet Isol) Mode Select - IN AUTO

__ • 0RN-13A (Train 1A & 2A LLI Supply) - OPEN

__ • 2RN-16A (A RN Pump Suction Isol) - OPEN

__ • 2RN-70A (A D/G Hx Inlet Isol) - OPEN

__ • 0RN-12AC (Train 1A & 2A LLI Supply) - OPEN.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
2. **Check the following Train A valves - CLOSED:**	__ **Close valve(s).**
__ • 0RN-3A (Train 1A & 2A RC Supply) - CLOSED	
__ • 0RN-7A (Train 1A & 2A SNSWP Supply) - CLOSED	
__ • 0RN-149A (Train 1A & 2A Disch to SNSWP) - CLOSED	
__ • 0RN-150A (Train 1A & 2A Disch X-Connect) - CLOSED	
__ • 0RN-14A (Train 1A & 2A Supply X-Connect) - CLOSED	
__ • 2RN-42A (AB Non Ess Supply Isol) - CLOSED	
__ • 2RN-64A (AB Non Ess Return Isol) - CLOSED	
__ • 2RN-43A (Train B To Non Ess Hdr Isol) - CLOSED	
__ • 2RN-299A (AB Vent Sys Return Isol) - CLOSED	
__ • 0RN-4AC (Train 1B & 2B RC Supply) - CLOSED.	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
3. **Check the following Train B valves aligned as follows:**	__ **Align valve(s).**

- __ • 2RN-227B (B NS Pump ESS AHU Sup Isol) - OPEN
- __ • 2RN-231B (B ND Pump ESS AHU Sup Isol) - OPEN
- __ • 2RN-215B (B NI Pump Cooler Sup Isol) - OPEN
- __ • 2RN-204B (B NV Pump Cooler Sup Isol) - OPEN
- __ • 0RN-9B (Train 1B & 2B SNSWP Supply) - OPEN
- __ • 2RN-18B (B RN Pump Suction Isol) - OPEN
- __ • 2RN-190B (RN To B KC Hx Control) - OPEN
- __ • 2RN-240B (B KF Pump ESS AHU Sup Isol) - OPEN
- __ • 2RN-297B (Train B Ess Hdr Ret Isol) - OPEN
- __ • 0RN-152B (Train 1B & 2B Disch to SNSWP) - OPEN
- __ • 2RN-187B (B KC Hx Inlet Isol) Mode Select - IN AUTO
- __ • 2RN-171B (B D/G Hx Inlet Isol) - OPEN.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
4. **Check the following Train B valves - CLOSED:**	__ **Close valve(s).**
__ • 0RN-2B (Train 1A & 2A RC Supply) - CLOSED	
__ • 2RN-63B (AB Non Ess Return Isol) - CLOSED	
__ • 2RN-41B (Train B To Non Ess Hdr Isol) - CLOSED	
__ • 2RN-279B (AB Vent Sys Return Isol) - CLOSED	
__ • 0RN-11B (Train 1B & 2B LLI Supply) - CLOSED	
__ • 0RN-15B (Train 1B & 2B Supply X-Connect) - CLOSED	
__ • 0RN-151B (Train 1B & 2B Disch X-Connect) - CLOSED	
__ • 0RN-5B (Train 1B & 2B RC Supply) - CLOSED	
__ • 0RN-284B (Train 1B & 2B Disch To RC) - CLOSED.	
5. **Check either of the following - ENERGIZED:**	**Perform the following:**
__ • 2ETB	a. Close the following:
OR	__ • 0RN-10AC (Train 1B & 2B LLI Supply)
__ • 1ETB.	__ • 0RN-283AC (Train 1B & 2B Disch To RC).
	__ b. **GO TO** Step 9.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ 6. **Check B train RN -ALIGNED TO SNSWP.**	**Perform the following:** a. **WHEN** B train aligned to SNSWP, **THEN** close the following: __ • 0RN-10AC (Train 1B & 2B LLI Supply) __ • 0RN-283AC (Train 1B & 2B Disch To RC). __ b. **GO TO** Step 9.
__ 7. **Check 2ETA - ENERGIZED.**	__ **GO TO Step 9.**
8. **Close the following:** __ • 0RN-10AC (Train 1B & 2B LLI Supply) __ • 0RN-283AC (Train 1B & 2B Disch To RC).	
__ 9. **Check containment pressure has remained less than 3 PSIG.**	**Perform the following:** __ a. Stop all RV pumps. b. Close the following valves: __ • 2RN-40A (Train A To Non Ess Hdr Isol) __ • 2RN-253A (RB Non Ess Sup Cont Inside Isol) __ • 2RN-276A (RB Non Ess Ret Cont Inside Isol) __ • 2RN-252B (RB Non Ess Sup Cont Outside Isol) __ • 2RN-277B (RB Non Ess Ret Cont Outside Isol) __ • 0RN-301AC (RV Supply From LLI) __ • 0RN-302B (RV Supply From LLI).

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ 10. **RETURN TO step in effect in body of procedure.**	

Prepared By: Rob Billing

Reviewed By: Charles Sawyer

Approved By: [signature]

TASK: **Transfer of Control to SSF - SSF Building Actions**

POSITION: **NLO**

Operator's Name________________________________

Location: **Plant** Method: **Walkthrough**

Estimated JPM Completion Time: 15 Minutes

Actual JPM Completion Time: _____ Minutes

Required Time Critical Completion Time 8 Minutes

Actual Time Critical Completion Time _____ Minutes

The JPM Operator's performance was evaluated against the standards of this JPM and is determined to be:

SATISFACTORY/UNSATISFACTORY (circle one)

Evaluator's Signature________________________________ Date __/__/__

References: AP/1/A/5500/24 (Rev.16) LOSS OF PLANT CONTROL DUE TO FIRE

JPM verified current with references by ________________________________

Date __/__/__

Rev. 09/03-14-00

INITIAL CONDITIONS

Unit 1 is operating at 100% power when a fire occurs that results in the loss of plant control from the control room and the Aux Shutdown Panel. AP/1/A/5500/24 (Loss Of Plant Control Due To Fire) has been implemented.

The SRO dispatches you to obtain the Blue Folder at the SSF AND to complete Enclosure 1 (Unit 1 SSF-AP-24 Actions) of AP/1/A/5500/24 (Loss Of Plant Control Due To Fire).

This is a TIME CRITICAL JPM.

JPM OVERALL STANDARD: SSF Diesel is in operation and supplying power to 1SLXG. 1SLXG is supplying power to SMXG and SMXG-1. Battery Chargers SDSP-1 and SDSP-2 supply breakers are closed. Standby makeup pump is supplying NCP seal injection and CA valves aligned open with switches disabled within 8 minutes. 1EMXH-1 Alternate Feeder Breaker is closed. 1NV-94AC is closed. The incore thermocouples are indicating at the SSF and the Pzr heaters are in the Local position.

NOTES: This JPM should be timed starting from the OPS Kitchen area. **Once 1CA161C and 1CA162C are aligned with power disabled the "critical time" stops**. Timing of the JPM begins after the examinee has read and acknowledged understanding of the initial conditions.

As soon as the copy of the enclosure is located at the SSF, the evaluator shall provide a copy of AP/1/A/5500/24 (Loss of Plant Control Due to Fire), Enclosure 1 (Unit 1 SSF-AP-24 Actions) to allow proper place keeping.

KA 000 068 AA1.21 3.9/4.1

START TIME__________

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
1	**At SSF D/G Control Panel:** Check "LINE VOLTS" - APPROXIMATELY 600V **GO TO** Step 1.c.	Operator determines line volts do not exist and proceeds to RNO **Cue:** **Meter indicates 0 volts** Same		
*2	Place the "SSF DIESEL TEST/EMERGENCY" switch to "EMER"	Same **Cue:** **Switch rotated clockwise**		
3	Check "SSF DIESEL START CONTROL" switch – "OFF"	Same **Cue:** **Switch is in the "OFF" position.**		
*4	Place "SSF DIESEL START CONTROL" switch to "ON"	Same **Cue:** **Switch rotated clockwise**		
5	Check D/G starts within 30 seconds	Same **Cue:** **Background noise level has increased, Various gauge indications are up**		

DENOTES CRITICAL

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*6	Depress "TRIP" for "NORMAL INCOMING BREAKER CONTROL"	Same **Cue:** **Pushbutton depressed, green lamp is illuminated**		
7	**At 1SLXG:**	Operator proceeds to Load Center 1SLXG and opens any breakers that are closed		
*	Open all 600V load center breakers.	**Cue:** **Switches rotated counterclockwise, green lamps are illuminated**		
8	**At SMXG-1:** Open the following breakers:			
*	SMXG-1, FAE (Battery Charger No. SDSP1)	Same **Cue:** **Breaker handle is moved down**		
*	SMXG-1, RAD (Battery Charger No. SDSP2)	Same **Cue:** **Breaker handle is moved down**		

DENOTES CRITICAL

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
9	**At 1SLXG:**			
*	Depress "CLOSE" on 600 V load center breaker 1SLXG-5B (Diesel Generator No. 5) (on breaker)	Same **Cue:** **Pushbutton depressed and breaker indicates closed**		
	Using pistol grip switches, close the following breakers			
*	Close "600V MCC SMXG-1"	Same **Cue:** **Pistol grip rotated clockwise, red light is illuminated**		
	Wait 10 Seconds	**Cue:** **10 seconds have elapsed**		
*	Close "600V MCC SMXG"	Same **Cue:** **Pistol grip rotated clockwise, red light is illuminated**		

* DENOTES CRITICAL

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
10	**At SSF Control Panel:** Open the following valves:			
*	1NV-842AC (Standby M/U Pump Suction Isol)	Same **Cue:** **Pushbutton depressed, red light is illuminated**		
*	1NV-849AC (Standby M/U Pump Cont Outside Isol)	Same **Cue:** **Pushbutton depressed, red light is illuminated**		
	Check the following valves – OPEN			
	1NV-1013C (Standby M/U Pump to NC Pump Seals Isol)	Same **Cue:** **Red light is illuminated**		
	1NV-842AC (Standby M/U Pump Suction Isol)	Same **Cue:** **Red light is illuminated**		
	1NV-849AC (Standby M/U Pump Cont Outside Isol)	Same **Cue:** **Red light is illuminated**		

DENOTES CRITICAL

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
10	**Continued**			
*	Start Unit 1 Standby Makeup Pump	Same **Cue:** **Pushbutton depressed, red light is illuminated**		
	Check Unit 1 Standby Makeup Pump flow - GREATER THAN OR EQUAL TO 26 GPM	Same **Cue:** **Meter indicates 28 GPM**		
	Ensure suction source for TD CA pump remains available as follows:	Same		
*	Open 1CA-161C (CA Suction Hdr RN Supply Isol)	**Cue:** **Pushbutton depressed, red light is illuminated**		
*	Open 1CA-162C (CA Suction Hdr RN Supply Isol)	**Cue:** **Pushbutton depressed, red light is illuminated**		
*	Select "DISABLE" on "RN TO CA CROSS CONNECT VLVS 1CA-161C & 1CA-162C" switch	**Cue:** **Switch rotated to the "disable" position**		
		Stop Time for Time Critical Task ____________		

* DENOTES CRITICAL

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*11	**Seal in TD CA Pump AUTO start signal by selecting "OPEN" on 1SA-48ABC (SM FROM S/G C TO TD CA PUMP) CONTROL SELECTOR"**	Same **Cue:** **Switch placed into the OPEN position**		
12	**Check 1NV-1012C (Standby M/U Pump Disch to Cont Sump) - CLOSED**	Same **Cue:** **Green light is illuminated**		
13	**Notify operator at 1ETA to open the following breakers:** 1EMXA-5, 2A (Aux FDWP #1 Disch. To SG1A Cntl. Outlet Isol. Vv. 1CA66A) 1EMXA-5, 3D (Aux FDWP #1 Disch. To SG1B Cntl. Outlet Isol. Vv. 1CA54A)	Operator simulates calling 1ETA via phone or radio to request breaker positioning. **Cue:** **Operator at 1ETA indicates both breakers have been opened.**		
14	**Check SSF D/G - RUNNING**	Same **Cue:** **The SSF D/G is running**		

DENOTES CRITICAL

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
15	**At SSF Control Panel:** Check SSF D/G "FREQUENCY" - AT 60 Hz Check SSF D/G "VOLTAGE" - AT 600 V	Same **Cue:** **Meter indicates 60 Hz** **Cue:** **Meter indicates 600 V**		
16	**At SMXG-1:**	Same		
*	Close SMXG-1, FAE (BATTERY CHARGER NO. SDSP1)	**Cue:** **Breaker handle is moved up**		
	Wait 10 Seconds	**Cue:** **10 seconds have elapsed**		
*	Close SMXG-1, RAD (BATTERY CHARGER NO. SDSP2)	**Cue:** **Breaker handle is moved up**		
	Wait 10 Seconds	**Cue:** **10 seconds have elapsed**		

DENOTES CRITICAL

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
16	**Continued**			
	At 1SLXG:	Same		
	Using pistol grip switch close "SSF STDBY BATTERY CHARGER NO. SDSS"	**Cue:** **Switch rotated clockwise, red light is illuminated**		
	Wait 10 seconds	**Cue:** **10 seconds have elapsed**		
*	Using pistol grip switch close "MOTOR CONTROL CENTER 1EMXH-1 ALTERNATE FEEDER"	**Cue:** **Switch rotated clockwise, red light is illuminated**		

DENOTES CRITICAL

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
17	**At SSF Control Panel:** Check SSF D/G "FREQUENCY" - AT 60 Hz Check SSF D/G "VOLTAGE" - AT 600 V Check SSF Generator load - LESS THAN OR EQUAL TO 700KW	Same Same **Cue:** **Meter indicates 60 Hz** Same **Cue:** **Meter indicates 600 V** Same **Cue:** **Meter indicates 500 KW**		
18	**Ensure SSF D/G room intake louvers are open (located above roll up door in D/G room)**	Same **Cue:** **Intake louvers indicate open**		

DENOTES CRITICAL

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
19	**IF AT ANY TIME SSF D/G trips without apparent cause, OR is unable to be started without apparent cause, THEN:**	**Cue:** **The SSF D/G is running**		
	Ensure "GENERATOR BREAKER CONTROL" indicates "OPEN"	N/A		
	Ensure the "SSF DIESEL START CONTROL" switch is in "OFF"	N/A		
	Turn manual knob on the "FUEL OIL SOLENOID BYPASS" (located on the SSF control room side of D/G, 3 ft from floor) fully clockwise	N/A		
	RETURN TO step 1.e.	N/A		
20	**At SMXG:** Ensure SMXG-F5A (Unit 1 Pressurizer Heater Group #28, #55, #56 Fdr) is closed.	Same **Cue:** **Breaker indicates closed.**		

DENOTES CRITICAL

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
*21	**Close 1NV-94AC (NC Pumps Seal Ret Cont Inside Isol) to ensure proper NC Pump seal back pressure**	Same **Cue:** **Pushbutton depressed, green lamp is illuminated**		
*22	**Transfer incore thermocouple indication to SSF by swapping connection on left side of SSF control panel**	Same **Cue:** **Cable unplugged** **Cable plugged into SSF receptacle**		
*23	**Transfer control of Pzr heaters by placing "PZR HTRS UNIT 1" to "LOCAL"**	Same **Cue:** **Switch rotated clockwise to Local position**		

STOP TIME___________

DENOTES CRITICAL

INITIAL CONDITIONS

Unit 1 is operating at 100% power when a fire occurs that results in the loss of plant control from the control room and the Aux Shutdown Panel. AP/1/A/5500/24 (Loss Of Plant Control Due To Fire) has been implemented.

The SRO dispatches you to obtain the Blue Folder at the SSF AND to complete Enclosure 1 (Unit 1 SSF-AP-24 Actions) of AP/1/A/5500/24 (Loss Of Plant Control Due To Fire).

This is a TIME CRITICAL JPM.

(R06-97)

Duke Power Company
PROCEDURE PROCESS RECORD

(1) ID No. AP/1/A/5500/24
Revision No. 16

INFORMATION ONLY

PREPARATION

(2) Station McGuire Nuclear Station

(3) Procedure Title Loss Of Plant Control Due To Fire

(4) Prepared By S. Hackney S. Hackney Date February 16, 2000

(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 Nikola Ami (QR) Date 2/18/00
Cross-Disciplinary Review By (QR) NA MW Date 2/18/00
Reactivity Mgmt. Review By (QR) NA MW Date 2/18/00

(7) Additional Reviews
Reviewed By Date
Reviewed By Date

(8) Temporary Approval (*if necessary*)
By (SRO/QR) Date
By (QR) Date

(9) Approved By Kelly F. Schwarz Date 2-23-00

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 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, 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.*)

A. Purpose

The purpose of this procedure is to describe steps to be taken to achieve and maintain Hot Standby following a fire event that results or could result in a loss of plant control from the control room and Aux Shutdown Panel.

This procedure will also be used when referenced by any procedure that requires plant shutdown using the SSF.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

B. Symptoms

- **Fire has caused loss of control of both trains of systems required to safely shutdown the plant.**
- **Fire makes control room and Aux Shutdown Panel unusable for plant shutdown.**
- **Other procedure requires plant shutdown using the SSF.**

C. Operator Actions

1. **Check if use of this AP is required:**

NOTE Control room system controls that are damaged should also be considered damaged at Aux Shutdown Panel in next step.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ a. Check if control of systems required to safely shutdown the plant is lost from control room and Aux Shutdown Panel.	a. Perform the following: __ 1) **IF** loss of plant control is due only to control room evacuation, **THEN GO TO** AP/1/A/5500/17 (Loss Of Control Room). __ 2) Exit this procedure.

NOTE Equipment in next step may be assumed available if operable at start of event.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
b. Check: __ • SSF - AVAILABLE __ • TD CA Pump and S/G(s) - AVAILABLE TO REMOVE DECAY HEAT.	__ b. Operator discretion may be required to complete this AP as applicable.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

NOTE
- Steps 2 through 12 should be initiated from the control room.
- A copy of this AP is located at the SSF.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
2. **Trip the reactor and ensure tripped:**	__ **Dispatch operator to trip reactor.**
__ • All rod bottom lights - LIT	
__ • Reactor trip and bypass breakers - OPEN	
__ • Neutron flux - GOING DOWN.	
__ 3. **Ensure turbine is tripped.**	__ **Dispatch operator to trip turbine.**
__ 4. **Announce occurrence on page.**	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
5. **Dispatch personnel as follows:**	
a. Dispatch operator to SSF to perform the following:	
__ • Obtain Blue Folder at SSF **AND** complete Enclosure 1 (Unit 1 SSF - AP-24 Actions).	
b. Dispatch operator to 1EMXA-4 (North wall of Unit 1 ETA room) to perform the following:	
__ 1) **IF** entering aux bldg from back of control room, **THEN** obtain self reading pocket dosimeter from U2 BOP desk.	
__ 2) Obtain Blue Folder at 1EMXA-4 **AND** complete Enclosure 2 (Unit 1 EMXA-4 - AP-24 Actions).	

NOTE
- Enclosure 3 (Automatic Actions that Occur When Swapping to SSF) lists Automatic actions that occur when power is swapped to SMXG.
- Security ringdown phone located on Unit 2 BOP desk may be used in next step (Security backup phone numbers 2688 or 4900).

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ c. Notify security to immediately dispatch officer with key to SSF to ensure operator can access SSF.	
6. **Initiate Main Steam Isolation and ensure the following valves - CLOSED:**	**Dispatch operator to close valves by opening the following breakers:**
__ • MSIVs	__ • 1EVDA Breaker 16
__ • MSIV bypass valves	__ • 1EVDA Breaker 18.
__ • SM PORVs.	
__ 7. **Start TD CA Pump.**	
__ 8. **Trip both CF pumps.**	__ **Dispatch operator to trip both CF pumps.**

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

NOTE

- Hand held battery lights are available (near Unit 1 Loose Parts Monitor) for use in going to SSF from control room.
- The following notes apply if both Units 1 and 2 are transferring control to the SSF:
  - Steps 1 through 4 operate shared equipment.
  - Steps 1 through 4 are identical to steps in AP/2/A/5500/24 (Loss Of Plant Control Do To Fire), and only need to be completed once.

1. **At SSF D/G Control Panel:**

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ a. Check "LINE VOLTS" - APPROXIMATELY 600 V.	__ a. **<u>GO</u> <u>TO</u>** Step 1.c.
__ b. **<u>GO</u> <u>TO</u>** Step 5.	
__ c. Place "SSF DIESEL TEST/EMERGENCY" switch to "EMER".	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
1. (Continued)	
__ d. Check "SSF DIESEL START CONTROL" switch - "OFF".	d. Perform the following at SSF D/G Control Panel: 1) **IF** "GENERATOR BREAKER CONTROL" switch indicates "CLSD", **THEN**: __ a) Ensure "1SLXG-6A FEEDER TO BMXA" (on control panel) is open. __ b) **GO TO** Step 5. __ 2) Depress "ALARM RELAY RESET" pushbutton (on control panel, upper right corner of relay board). 3) **IF** SSF D/G running, **THEN**: __ a) Adjust "SSF DIESEL GOVERNOR CONTROL" until frequency is 60 Hz. __ b) **GO TO** Step 1.g. __ 4) **IF** SSF D/G not running, **THEN GO TO** RNO for Step 1.f.
__ e. Place "SSF DIESEL START CONTROL" switch to "ON".	
__ f. Check D/G starts within 30 seconds.	f. Perform the following: __ 1) Place "SSF DIESEL START CONTROL" switch to "OFF". __ 2) **IF** 2 D/G start attempts have been performed, **THEN** read Notes prior to Step 15 and **GO TO** Step 15. __ 3) Wait 20 seconds and **RETURN TO** Step 1.e.
__ g. Depress "TRIP" for "NORMAL INCOMING BREAKER CONTROL".	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

2. **At 1SLXG:**

__ a. Open all 600 V load center breakers.

3. **At SMXG-1:**

a. Open the following breakers:

__ • SMXG-1, FAE (Battery Charger No. SDSP1)

__ • SMXG-1, RAD (Battery Charger No. SDSP2).

NOTE Yellow "TIME CRITICAL" tags are located next to switches used in Steps 4 through 5.c.

4. **At 1SLXG:**

__ a. Depress "CLOSE" on 600 V load center breaker 1SLXG-5B (Diesel Generator No. 5) (on breaker).

b. Using pistol grip switches,close the following breakers:

__ 1) Close "600V MCC SMXG-1".

__ 2) Wait 10 seconds.

__ 3) Close "600V MCC SMXG".

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
5. **At SSF Control Panel:**	
a. Open the following valves:	a. Perform the following:
__ 1) 1NV-842AC (Standby M/U Pump Suction Isol).	__ 1) Call control room or operator in 1ETA room to ensure 1EMXA-4 has been swapped to alternate power **PER** Enclosure 2 (Unit 1 EMXA-4 - AP-24 Actions).
__ 2) 1NV-849AC (Standby M/U Pump Cont Outside Isol).	
	NOTE Indicating lights on 1NV-842AC and 1NV-849AC switches will light when 1EMXA-4 is swapped.
	__ 2) **WHEN** 1EMXA-4 is swapped, **THEN** open valves in step5.a.
	__ 3) Do not continue until 1EMXA-4 is swapped to alternate power.
b. Check the following valves - OPEN:	__ b. Open valve(s).
__ 1) 1NV-1013C (Standby M/U Pump to NC Pmp Seals Isol).	
__ 2) 1NV-842AC (Standby M/U Pump Suction Isol).	
__ 3) 1NV-849AC (Standby M/U Pump Cont Outside Isol).	
__ c. Start Unit 1 Standby Makeup Pump.	
__ d. Check Unit 1 Standby Makeup Pump flow - GREATER THAN OR EQUAL TO 26 GPM.	__ d. Ensure valves in Step 5.b are properly aligned.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

5. (Continued)

   e. Ensure suction source for TD CA pump remains available as follows:

   __ 1) Open 1CA-161C (CA Suction Hdr RN Supply Isol).

   __ 2) Open 1CA-162C (CA Suction Hdr RN Supply Isol).

   __ 3) Select "DISABLE" on "RN TO CA CROSS CONNECT VLVS 1CA-161C & 1CA-162C" switch.

NOTE Remaining steps in this enclosure should not be time critical, but need to be completed in a timely manner.

__ 6. **Seal in TD CA Pump auto start signal by selecting "OPEN" on "1SA-48ABC (SM FROM S/G C TO TD CA PUMP) CONTROL SELECTOR".**

__ 7. **Check 1NV-1012C (Standby M/U Pump Disch to Cont Sump) - CLOSED.**

Perform the following:

__ a. Stop Unit 1 Standby Makeup Pump.

__ b. Close 1NV-1012C.

__ c. Do not re-start Unit 1 Standby Makeup Pump until 1NV-1012C is closed.

__ d. <u>**RETURN**</u> <u>**TO**</u> Step 5.c.

8. **Notify operator at 1ETA to open the following breakers:**

   __ • 1EMXA-5, 2A (Aux. FDWP#1 Disch To SG1A Cntl Outlet Isol. Vlv. 1CA 66A)

   __ • 1EMXA-5, 3D (Aux. FDWP#1 Disch To SG1B Control Isol Vlv 1CA54A).

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
__ 9. **Check SSF D/G - RUNNING.**	**Perform the following:** a. Notify OSM of the following: __ • **<u>IF</u> <u>AT</u> <u>ANY</u> <u>TIME</u>** Unit 1 offsite power is lost to 1SLXG (powered from 6900V switchgear 1TC), **<u>THEN</u>** Enclosure 1 (Unit 1 SSF - AP-24 Actions), Step 1 must be performed again. __ b. **<u>GO</u> <u>TO</u>** Step 16.

<u>NOTE</u> The following notes apply if both Units 1 and 2 are transferring control to the SSF:

- Steps 10 through 15 operate shared equipment
- Steps 10 through 15 are identical to steps in AP/2/A/5500/24 (Loss Of Plant Control Do To Fire), and only need to be completed once.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
10. **At SSF Control Panel:**	
__ a. Check SSF D/G "FREQUENCY" - AT 60 Hz.	__ a. Adjust the "SSF DIESEL GOVERNOR CONTROL" to obtain a frequency of 60 Hz.
__ b. Check SSF D/G "VOLTAGE" - AT 600 V.	__ b. Adjust "SSF DIESEL VOLTAGE CONTROL" to bring "GEN VOLTS" to 600 V.
11. **At SMXG-1:**	
__ a. Close SMXG-1, FAE (BATTERY CHARGER NO. SDSP1).	
__ b. Wait 10 seconds.	
__ c. Close SMXG-1, RAD (BATTERY CHARGER NO. SDSP2).	
__ d. Wait 10 seconds.	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
12. **At 1SLXG:**	
__ a. Using pistol grip switch close "SSF STDBY BATTERY CHARGER NO. SDSS".	
__ b. Wait 10 seconds.	
__ c. Using pistol grip switch close "MOTOR CONTROL CENTER 1EMXH-1 ALTERNATE FEEDER".	
13. **At SSF Control Panel:**	
__ a. Check SSF D/G "FREQUENCY" - AT 60 Hz.	__ a. Adjust the "SSF DIESEL GOVERNOR CONTROL" to obtain a frequency of 60 Hz.
__ b. Check SSF D/G "VOLTAGE" - AT 600 V.	__ b. Adjust "SSF DIESEL VOLTAGE CONTROL" to bring "GEN VOLTS" to 600 V.
__ c. Check SSF Generator load - LESS THAN **OR** EQUAL TO 700 KW.	__ c. Contact station management to evaluate reducing load.
__ 14. **Ensure SSF D/G room intake louvers are open (located above rollup door in D/G room).**	

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

NOTE
- Inability to start D/G or a D/G trip without apparent cause may indicate an electrical failure of the Fuel Oil Solenoid valve.
- Manually opening the "FUEL OIL SOLENOID BYPASS" valve bypasses all trips (including manual).

15. **IF AT ANY TIME SSF D/G trips without apparent cause, OR is unable to be started without apparent cause, THEN:**

__ a. Ensure "GENERATOR BREAKER CONTROL" indicates "OPEN".

__ b. Ensure the "SSF DIESEL START CONTROL" switch is in "OFF."

__ c. Turn the manual knob on the "FUEL OIL SOLENOID BYPASS" (located on the SSF control room side of D/G, 3 ft from floor) fully clockwise.

__ d. **RETURN TO** Step 1.e.

16. **At SMXG:**

__ a. Ensure SMXG-F5A (Unit 1 Pressurizer Heater Group #28, #55, #56 Fdr) is closed.

__ 17. **Close 1NV-94AC (NC Pumps Seal Ret Cont Inside Isol) to ensure proper NC pump seal back pressure.**

__ 18. **Transfer incore thermocouple indication to SSF by swapping connection on left side of SSF control panel.**

__ 19. **Transfer control of Pzr heaters by placing "PZR HTRS UNIT 1" to "LOCAL".**

Prepared By: Rob Billings

Reviewed By: Tom Cuben

Approved By: Charles Sawyer

TASK: **Borate Unit 2 Reactor Coolant System from the Auxiliary Shutdown Panel**

POSITION: **RO/SRO**

Operator's Name ______________________________

Location: **Plant** Method: **Walkthrough**

Estimated JPM Completion Time: 10 Minutes

Actual JPM Completion Time: ____ Minutes

The JPM Operator's performance was evaluated against the standards of this JPM and is determined to be:

SATISFACTORY/UNSATISFACTORY (circle one)

Evaluator's Signature ______________________________ Date __/__/__

References:	AP/2/A/5500/17 (Rev. 09)	Loss of Control Room
	OP/2/A/6100/22 (Rev. 431)	Unit 2 Data Book

JPM verified current with references by ______________________________

Date __/__/__

Rev. 02/02-14-00

INITIAL CONDITIONS

Toxic fumes have forced the evacuation of the Control Room. AP/2/A/5500/17 (Loss of Control Room) has been implemented and completed through Step 16b. Unit 2 is now in Mode 3 at full temperature and pressure. Plant control has been transferred to the Aux. Shutdown Panel. Control Rod positions cannot be determined in step 16c of the procedure. 2A NV Pump is in operation and current NCS boron concentration is 1430 ppm.

The SRO instructs you to emergency borate the NC System per AP/2/A/5500/17 (Loss of Control Room) step 16c RNO.

JPM OVERALL STANDARD: Required volume of boric acid to increase NC System concentration to 2000 ppm is determined from Data Book and boric acid flow is initiated from the Auxiliary Shutdown Panel.

NOTES: Evaluator shall provide a copy of applicable section of AP/17 upon request. Evaluator shall provide a copy of the applicable Data Book tables to the examinee once the remote Data Book (in the CA pump room) is located.
In this scenario, the ASP door would already be unlocked and open. However, in order to access the ASP controls for this JPM, key # 172 is needed. There is a key # 172 at the panel in a locked breakglass station. The keys an operator normally carries should unlock the breakglass station. If the operator does not have the proper key to unlock the breakglass station, they will have to return to the WCC and obtain one. The Evaluator may choose to have the examinee check out key # 172 from the WCC prior to JPM administration, in order to preclude delays.

Notify the Control Room at x4263 each time prior to opening and after reclosing the ASP door.

* Calculation to determine amount of Boric acid required to Borate to 2000 PPM from 1430 PPM is as follows:

1430 to 1700 = 3348 gal
1700 to 1900 = 2592 gal
1900 to 2000 = 1334 gal
Total = 7274 gallons

$$\frac{\text{7274 gals}}{\text{100 GPM}} = \text{approximately 73 minutes}$$

***Note:** Operator may refer to Data Book Table 5.2 to evaluate the Correction factor (K). Since the unit is at full temperature and pressure, the Correction factor (K) is 1.0 and will not impact the calculation. Reference to table 5.2 is therefore not critical to the successful completion of this JPM.

KA 004 A2.14 3.8/3.9

START TIME__________

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
1	Perform the following: Determine the amount NC System must be borated:	Operator determines from initial conditions that rod position cannot be determined		
	IF two or more rods not fully inserted, **THEN** emergency borate 2100 gallons for each rod not fully inserted	N/A		
	OR			
*	**IF** rod positions can not be determined, **THEN** emergency borate to 2000 PPM.	Operator prepares to borate the NC System based on not being able to determine rod position		

* **DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
1	**CONTINUED** Borate as follows:			
*	Determine amount of boric acid to add from Data Book	Operator uses Data Book pages provided to determine the amount of acid needed, based on initial conditions (1430 PPM), to be (7274 gal ± 10 gal) **Note:** One calculation flowpath is shown below. Operator could use a different flowpath resulting in a slightly different answer. Give credit for answer within +/- 10 gallons. **1430 to 1700 = 3348 gal** **1700 to 1900 = 2592 gal** **1900 to 2000 = 1334 gal** **Total = 7274 gallons**		

* DENOTES CRITICAL

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
1	**CONTINUED**	**Note to Examiner:** **Ensure CR is called at x4263 before ASP door is opened.** Operator will use key # 172 (per note on page 2 of this JPM) to open ASP door. All control switches have been placed in the local position as a result of previous procedure steps. The following components are aligned as indicated: 2NV-241 70% open 2NV-238 80% open 2NV-13 Open 2NV-16 Closed 2A BA Pump ON 2B BA Pump OFF 2A NV Pump ON 2B NV Pump OFF		
*	Open 2NV-265B (Boric Acid To NV Pumps)	Same **Cue:** **Pushbutton depressed, red light is lit**		

* **DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
1	**CONTINUED**			
	Start either BA Transfer pump	Operator starts a pump or verifies one pump is running **Cue:** **Pushbutton depressed, red light is lit** **<u>OR</u>** **Red light is lit.**		
	Determine emergency boration flow from local gauge or assume 30 GPM emergency boration	**Cue:** **An NLO reports Emergency Boration flow is 100 GPM** <u>**Note**</u>: The critical part of the following step is for the Operator to correctly determine the amount of time required to add boric acid. An answer of greater than 73 minutes is acceptable. Total = 7274 gallons = approximately 73 minutes at 100 GPM		
*	<u>**WHEN**</u> desired amount of boric acid is added, <u>**THEN**</u>:	**Cue:** ___________ **Minutes (calculated time) have elapsed.**		

*** DENOTES CRITICAL**

STEPS	ELEMENTS	STANDARD	S/U	COMMENTS REQUIRED FOR UNSAT
1	**CONTINUED**			
	Ensure only one BA transfer pump is running	Operator stops one BA Transfer pump if two are running. Cue as appropriate based on number of pumps running **Cue:** **2A BA pump red light is lit, 2B BA pump red light is lit** **Pushbutton depressed, green light is lit** **<u>OR</u>** **2A BA pump red light is lit, 2B BA pump green light is lit**		
*	Close 2NV-265B	Same **Cue:** **Pushbutton depressed, green light is lit**		

STOP TIME___________

*** DENOTES CRITICAL**

INITIAL CONDITIONS

Toxic fumes have forced the evacuation of the Control Room. AP/2/A/5500/17 (Loss of Control Room) has been implemented and completed through Step 16b. Unit 2 is now in Mode 3 at full temperature and pressure. Plant control has been transferred to the Aux. Shutdown Panel. Control Rod positions cannot be determined in step 16c of the procedure. 2A NV Pump is in operation and current NCS boron concentration is 1430 ppm.

The SRO instructs you to emergency borate the NC System per AP/2/A/5500/17 (Loss of Control Room) <u>step 16c RNO</u>.

(R06-97)

Duke Power Company
PROCEDURE PROCESS RECORD

(1) ID No. AP/2/A/5500/17
Revision No. 9

INFORMATION ONLY

PREPARATION

(2) Station McGuire Nuclear Station

(3) Procedure Title Loss of Control Room

(4) Prepared By Philip A. Thompson Date June 7, 1999

(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 S. Hackney (QR) Date 6/7/99

Cross-Disciplinary Review By (QR) NA___ Date 6-16-99

Reactivity Mgmt. Review By (QR) NA___ Date 6/15/1999

(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 6/16/99

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 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, 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.*)

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
16. (Continued)	
__ c. Have operator at OAC check all rods fully inserted using OAC (turn on code "RODS").	c. Perform the following: 1) Determine the amount NC System must be borated: __ • **IF** two or more rods not fully inserted, **THEN** emergency borate 2100 gallons for each rod not fully inserted. OR __ • **IF** rod positions can not be determined, **THEN** emergency borate to 2000 PPM. 2) Borate as follows: __ a) Determine amount of boric acid to add from Data Book. __ b) Open 2NV-265B (Boric Acid To NV Pumps). __ c) Start either BA Transfer pump. __ d) Determine emergency boration flow from local gauge or assume 30 GPM emergency boration. e) **WHEN** desired amount of boric acid is added, **THEN**: __ (1) Ensure only one BA transfer pump is running. __ (2) Close 2NV-265B.

ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
16. (Continued)	
__ d. Periodically check "NUCLEAR FLUX" - STABLE OR GOING DOWN.	d. Borate to 2000 PPM as follows: __ 1) Open 2NV-265B (Boric Acid To NV Pumps). __ 2) Start either BA Transfer pump. __ 3) Determine emergency boration flow from local gauge or assume 30 GPM emergency boration. __ 4) Determine amount of boric acid to add to reach 2000 PPM from Data Book. 5) **<u>WHEN</u>** desired amount of boric acid is added, **<u>THEN</u>**: __ a) Ensure only one BA transfer pump is running. __ b) Close 2NV-265B.
__ 17. **<u>WHEN</u> TSC is staffed, <u>THEN</u> request guidance on maintaining shutdown margin greater than 1.3% Delta k/k as xenon decays.**	
18. **Dispatch operator to ensure the following on main turbine:** __ a. Oil lift pump running. __ b. On turning gear.	
__ 19. **<u>REFER TO</u> RP/0/A/5700/000 (Classification of Emergency).**	
__ 20. **<u>IF</u> cooldown is desired, <u>THEN GO TO</u> OP/2/A/6100/004 (Shutdown Outside The Control Room From Hot Standby To Cold Shutdown).**	

<u>END</u>

DUKE POWER COMPANY
PROCEDURE MINOR CHANGE PROCESS RECORD

ID No. OP/2/A/6100/22
Revision No. 431 Change No. AV

Station McGuire Nuclear Station
Procedure Title Unit 2 Data Book

Section(s) of Procedure Affected: Enclosure 4.3, Graphs 1.1
Description of Change: *(Attach additional pages, if necessary)*
Remove existing Graphs 1.1 and replace with attached Graphs 1.1.

Reason for Change
To update AFD targets in accordance with PT/0/A/4150/008, Target Flux Difference Calculation.

Prepared By Sonya M. Hamilton Dealey Date 12/16/99
Reviewed By [signature] (QR) Date 12/16/99
Cross-Disciplinary Review by ____ (QR) NA [initials] Date ____
Additional Reviews
Reviewed By ____ Date ____
Reviewed By ____ Date ____
Temporary Approval *(if necessary)*
By ____ (SRO/QR) Date ____
By ____ (QR) Date ____

Approved By M C Efird Date 12/16/99

Boration and Dilution Tables

The attached tables provide the information to determine the number of gallons of boric acid or demineralized water to accomplish a boron change between 10 ppmB and 3000 ppmB.

In the compilation of these tables, it was assumed that makeup concentrations for dilution and boration were 0 ppmB and 7000 ppmB, respectively.

While all possible boron changes could not be listed in the tables, the volumes are additive and any maneuver between 10 ppmB and 3000 ppmB can be determined.

Instructions:

A. Note the present Reactor Coolant System (NCS) boron concentration and proceed to the table which includes this value.

B. In the left column, find the NCS boron concentration that is desired. (If the desired boron concentration is not on this table, an additive method must be utilized. See Example #2).

C. If the desired NCS boron concentration is less than the initial NCS boron concentration (i.e. dilution), a value above the zero line will be read. This value corresponds to the number of gallons of demineralized water which must be made up to the system.

D. If the desired NCS boron concentration is greater than the initial NCS boron concentration (i.e. boration), a value below the zero line will be read. This value corresponds to the number of gallons of boric acid which must be made up to the system.

E. When diluting or borating in Modes 3, 4 or 5, a correction factor, K, must be applied to the makeup amount obtained from the tables. The appropriate correction factor, K, is obtained from Table 5.2, Makeup Concentration Equations.

Example #1

Present NCS boron concentration = 960 ppmB
Desired NCS boron concentration = 790 ppmB

Turn to the proper page and locate 960 across the top. Locate 790 in the left column. Read 13134 gallons of demineralized water. (Above the zero line.)

Example #2

Present boron concentration = 250 ppmB
Desired boron concentration = 650 ppmB

Turn to the proper page and locate 250 across the top. The number 650 does not appear in the left hand column. However, the volume of boric acid to change boron from 250 ppmB to 650 ppmB is equal to the volume of boric acid to change boron from 250 ppmB to 500 ppmB plus the volume of boric acid to change from 500 ppmb to 650 ppmB.

Volume B.A. (250 to 650) = Volume B.A. (250 to 500) + Volume B.A. (500 to 650)

Locate 500 in the left column. Read 2543 gallons of boric acid. Turn two pages ahead and locate 500 across the top. Locate 650 in the left column. Read 1573 gallons of boric acid. Therefore, 2543 + 1573, or 4116 gallons of boric acid must be made up to the system.

CAUTION: *If in Modes 3, 4 or 5, a correction factor, K, from Table 5.2 must be applied.*

PRESENT BORON CONCENTRATION (ppmB)

DESIRED BORON CONCENTRATION (ppmB)	800	810	820	830	840	850	860	870	880	890	900
610	18272	19110	19936	20753	21560	22358	23146	23925	24695	25457	26210
620	17177	18014	18841	19657	20465	21262	22050	22829	23599	24361	25114
630	16098	16936	17762	18579	19386	20184	20972	21751	22521	23283	24036
640	15037	15874	16701	17518	18325	19123	19911	20690	21460	22221	22974
650	13992	14830	15656	16473	17280	18078	18866	19645	20415	21177	21930
660	12964	13801	14628	15444	16251	17049	17837	18616	19386	20148	20901
670	11950	12787	13614	14431	15238	16036	16824	17603	18373	19134	19887
680	10952	11789	12616	13433	14240	15037	15825	16604	17375	18136	18889
690	9968	10805	11632	12449	13256	14053	14842	15621	16391	17152	17905
700	8998	9836	10662	11479	12286	13084	13872	14651	15421	16183	16936
710	8043	8880	9707	10523	11330	12128	12916	13695	14465	15227	15980
720	7100	7937	8764	9581	10388	11185	11974	12753	13523	14284	15037
730	6171	7008	7835	8651	9458	10256	11044	11823	12593	13355	14108
740	5254	6091	6918	7734	8542	9339	10127	10906	11676	12438	13191
750	4349	5186	6013	6830	7637	8434	9223	10002	10772	11533	12286
760	3457	4294	5121	5937	6744	7542	8330	9109	9879	10641	11394
770	2576	3413	4240	5056	5864	6661	7449	8228	8998	9760	10513
780	1706	2543	3370	4187	4994	5791	6580	7359	8129	8890	9643
790	848	1685	2512	3328	4136	4933	5721	6500	7270	8032	8785
800	0	837	1664	2481	3288	4085	4874	5653	6423	7184	7937
810	109	0	827	1644	2451	3248	4036	4815	5586	6347	7100
820	218	109	0	817	1624	2421	3210	3989	4759	5520	6273
830	327	218	109	0	807	1605	2393	3172	3942	4703	5456
840	436	327	218	109	0	798	1586	2365	3135	3896	4649
850	546	437	328	219	109	0	788	1567	2337	3099	3852
860	655	547	438	328	219	110	0	779	1549	2311	3064
870	765	656	547	438	329	220	110	0	770	1532	2285
880	875	766	657	548	439	330	220	110	0	761	1514
890	985	877	768	659	549	440	330	220	110	0	753
900	1096	987	878	769	660	550	440	331	221	110	0
910	1206	1098	989	879	770	661	551	441	331	221	111
920	1317	1208	1099	990	881	771	662	552	442	332	221
930	1428	1319	1210	1101	992	882	773	663	553	443	332
940	1539	1430	1321	1212	1103	993	884	774	664	554	443
950	1650	1542	1433	1324	1214	1105	995	885	775	665	555
960	1762	1653	1544	1435	1326	1216	1107	997	887	776	666
970	1874	1765	1656	1547	1437	1328	1218	1108	998	888	778
980	1985	1877	1768	1659	1549	1440	1330	1220	1110	1000	890
990	2097	1989	1880	1771	1661	1552	1442	1332	1222	1112	1002
1000	2210	2101	1992	1883	1773	1664	1554	1444	1334	1224	1114
1010	2322	2213	2104	1995	1886	1776	1667	1557	1447	1337	1226
1020	2435	2326	2217	2108	1998	1889	1779	1669	1559	1449	1339
1030	2547	2439	2330	2221	2111	2002	1892	1782	1672	1562	1452
1040	2660	2552	2443	2334	2224	2115	2005	1895	1785	1675	1565
1050	2774	2665	2556	2447	2337	2228	2118	2008	1898	1788	1678
1060	2887	2778	2669	2560	2451	2341	2232	2122	2012	1902	1791
1070	3000	2892	2783	2674	2564	2455	2345	2235	2125	2015	1905
1080	3114	3005	2896	2787	2678	2569	2459	2349	2239	2129	2018
1090	3228	3119	3010	2901	2792	2682	2573	2463	2353	2243	2132
1100	3342	3233	3125	3015	2906	2797	2687	2577	2467	2357	2246

CAUTION: *If in Modes 3, 4 or 5, a correction factor, K, from Table 5.2 must be applied.*

PRESENT BORON CONCENTRATION (ppmB)

DESIRED BORON CONCENTRATION (ppmB)	900	910	920	930	940	950	960	970	980	990	1000
710	15980	16724	17461	18189	18910	19623	20329	21027	21718	22402	23080
720	15037	15782	16518	17247	17968	18681	19386	20085	20776	21460	22137
730	14108	14852	15589	16317	17038	17751	18457	19155	19846	20530	21208
740	13191	13935	14672	15400	16121	16834	17540	18238	18929	19614	20291
750	12286	13031	13767	14496	15217	15930	16635	17334	18025	18709	19386
760	11394	12138	12875	13603	14324	15037	15743	16441	17132	17816	18494
770	10513	11257	11994	12722	13443	14156	14862	15560	16251	16936	17613
780	9643	10388	11124	11853	12574	13287	13992	14691	15382	16066	16743
790	8785	9529	10266	10994	11715	12428	13134	13832	14523	15208	15885
800	7937	8682	9418	10147	10868	11581	12286	12985	13676	14360	15037
810	7100	7845	8581	9310	10030	10744	11449	12147	12839	13523	14200
820	6273	7018	7754	8483	9204	9917	10622	11321	12012	12696	13373
830	5456	6201	6937	7666	8387	9100	9805	10504	11195	11879	12556
840	4649	5394	6130	6859	7580	8293	8998	9697	10388	11072	11749
850	3852	4596	5333	6061	6782	7495	8201	8899	9590	10275	10952
860	3064	3808	4545	5273	5994	6707	7413	8111	8802	9486	10164
870	2285	3029	3766	4494	5215	5928	6634	7332	8023	8707	9385
880	1514	2259	2996	3724	4445	5158	5864	6562	7253	7937	8614
890	753	1498	2234	2963	3683	4396	5102	5800	6492	7176	7853
900	0	745	1481	2210	2930	3643	4349	5047	5739	6423	7100
910	111	0	736	1465	2186	2899	3604	4303	4994	5678	6355
920	221	111	0	729	1449	2162	2868	3566	4257	4942	5619
930	332	222	111	0	721	1434	2139	2838	3529	4213	4890
940	443	333	222	111	0	713	1419	2117	2808	3492	4170
950	555	444	333	222	111	0	706	1404	2095	2779	3457
960	666	556	445	334	223	111	0	698	1389	2074	2751
970	778	667	556	446	334	223	112	0	691	1375	2053
980	890	779	668	557	446	335	224	112	0	684	1361
990	1002	891	780	669	558	447	336	224	112	0	677
1000	1114	1003	893	782	671	559	448	336	224	112	0
1010	1226	1116	1005	894	783	672	560	449	337	225	112
1020	1339	1228	1118	1007	896	784	673	561	449	337	225
1030	1452	1341	1230	1119	1008	897	786	674	562	450	338
1040	1565	1454	1343	1232	1121	1010	899	787	675	563	451
1050	1678	1567	1456	1346	1234	1123	1012	900	788	676	564
1060	1791	1681	1570	1459	1348	1237	1125	1013	902	789	677
1070	1905	1794	1683	1572	1461	1350	1239	1127	1015	903	791
1080	2018	1908	1797	1686	1575	1464	1352	1241	1129	1017	905
1090	2132	2022	1911	1800	1689	1578	1466	1355	1243	1131	1018
1100	2246	2136	2025	1914	1803	1692	1580	1469	1357	1245	1133
1110	2361	2250	2139	2029	1917	1806	1695	1583	1471	1359	1247
1120	2475	2365	2254	2143	2032	1921	1809	1698	1586	1474	1361
1130	2590	2479	2369	2258	2147	2035	1924	1812	1700	1588	1476
1140	2705	2594	2484	2373	2262	2150	2039	1927	1815	1703	1591
1150	2820	2709	2599	2488	2377	2265	2154	2042	1930	1818	1706
1160	2935	2825	2714	2603	2492	2381	2269	2158	2046	1934	1821
1170	3051	2940	2829	2719	2607	2496	2385	2273	2161	2049	1937
1180	3166	3056	2945	2834	2723	2612	2500	2389	2277	2165	2053
1190	3282	3172	3061	2950	2839	2728	2616	2505	2393	2281	2168
1200	3398	3288	3177	3066	2955	2844	2732	2621	2509	2397	2285

CAUTION: *If in Modes 3, 4 or 5, a correction factor, K, from Table 5.2 must be applied.*

PRESENT BORON CONCENTRATION (ppmB)

DESIRED BORON CONCENTRATION (ppmB)	1000	1010	1020	1030	1040	1050	1060	1070	1080	1090	1100
810	14200	14871	15535	16192	16843	17488	18127	18759	19386	20007	20623
820	13373	14044	14708	15365	16016	16661	17300	17933	18559	19181	19796
830	12556	13227	13891	14548	15199	15844	16483	17116	17743	18364	18979
840	11749	12420	13084	13741	14392	15037	15676	16309	16936	17557	18172
850	10952	11622	12286	12944	13595	14240	14878	15511	16138	16759	17375
860	10164	10834	11498	12156	12807	13452	14090	14723	15350	15971	16586
870	9385	10055	10719	11377	12028	12672	13311	13944	14571	15192	15807
880	8614	9285	9949	10606	11257	11902	12541	13174	13801	14422	15037
890	7853	8524	9187	9845	10496	11141	11780	12412	13039	13660	14276
900	7100	7771	8434	9092	9743	10388	11027	11659	12286	12907	13523
910	6355	7026	7690	8347	8998	9643	10282	10915	11542	12163	12778
920	5619	6289	6953	7611	8262	8907	9546	10178	10805	11426	12042
930	4890	5561	6225	6882	7533	8178	8817	9450	10077	10698	11313
940	4170	4840	5504	6162	6813	7458	8096	8729	9356	9977	10592
950	3457	4127	4791	5448	6100	6744	7383	8016	8643	9264	9879
960	2751	3421	4085	4743	5394	6039	6678	7310	7937	8558	9174
970	2053	2723	3387	4044	4696	5340	5979	6612	7239	7860	8475
980	1361	2032	2696	3353	4004	4649	5288	5921	6548	7169	7784
990	677	1348	2012	2669	3320	3965	4604	5237	5864	6485	7100
1000	0	671	1334	1992	2643	3288	3927	4559	5186	5807	6423
1010	112	0	664	1321	1972	2617	3256	3889	4516	5137	5752
1020	225	113	0	657	1309	1953	2592	3225	3852	4473	5088
1030	338	225	113	0	651	1296	1935	2567	3194	3815	4431
1040	451	338	226	113	0	645	1284	1916	2543	3164	3780
1050	564	452	339	226	113	0	639	1272	1898	2519	3135
1060	677	565	452	339	227	113	0	633	1260	1881	2496
1070	791	678	566	453	340	227	114	0	627	1248	1863
1080	905	792	680	567	454	341	227	114	0	621	1237
1090	1018	906	793	681	568	455	341	228	114	0	615
1100	1133	1020	908	795	682	569	455	342	228	114	0
1110	1247	1135	1022	909	796	683	570	456	342	228	114
1120	1361	1249	1136	1024	911	798	684	571	457	343	229
1130	1476	1364	1251	1138	1025	912	799	685	572	458	344
1140	1591	1479	1366	1253	1140	1027	914	800	686	573	458
1150	1706	1594	1481	1368	1255	1142	1029	915	802	688	574
1160	1821	1709	1596	1484	1371	1257	1144	1031	917	803	689
1170	1937	1824	1712	1599	1486	1373	1260	1146	1032	918	804
1180	2053	1940	1828	1715	1602	1489	1375	1262	1148	1034	920
1190	2168	2056	1943	1831	1718	1605	1491	1378	1264	1150	1036
1200	2285	2172	2060	1947	1834	1721	1607	1494	1380	1266	1152
1210	2401	2288	2176	2063	1950	1837	1724	1610	1496	1382	1268
1220	2517	2405	2292	2180	2067	1953	1840	1727	1613	1499	1385
1230	2634	2522	2409	2296	2183	2070	1957	1843	1729	1616	1501
1240	2751	2639	2526	2413	2300	2187	2074	1960	1846	1732	1618
1250	2868	2756	2643	2530	2417	2304	2191	2077	1963	1850	1735
1260	2985	2873	2760	2648	2535	2421	2308	2194	2081	1967	1853
1270	3103	2990	2878	2765	2652	2539	2426	2312	2198	2084	1970
1280	3221	3108	2996	2883	2770	2657	2543	2430	2316	2202	2086
1290	3338	3226	3113	3001	2888	2775	2661	2548	2434	2320	2206
1300	3457	3344	3232	3119	3006	2893	2779	2666	2552	2438	2324

CAUTION: *If in Modes 3, 4 or 5, a correction factor, K, from Table 5.2 must be applied.*

PRESENT BORON CONCENTRATION (ppmB)

DESIRED BORON CONCENTRATION (ppmB)	1100	1110	1120	1130	1140	1150	1160	1170	1180	1190	1200
910	12778	13388	13992	14591	15185	15774	16357	16936	17509	18078	18642
920	12042	12652	13256	13855	14449	15037	15621	16199	16773	17341	17905
930	11313	11923	12527	13126	13720	14309	14892	15471	16044	16613	17177
940	10592	11202	11807	12406	12999	13588	14171	14750	15323	15892	16456
950	9879	10489	11094	11693	12286	12875	13458	14037	14610	15179	15743
960	9174	9784	10388	10987	11581	12169	12753	13331	13905	14473	15037
970	8475	9085	9690	10289	10882	11471	12054	12633	13206	13775	14339
980	7784	8394	8998	9597	10191	10780	11363	11942	12515	13084	13648
990	7100	7710	8314	8913	9507	10096	10679	11257	11831	12400	12964
1000	6423	7033	7637	8236	8830	9418	10002	10580	11154	11722	12286
1010	5752	6362	6966	7565	8159	8748	9331	9910	10483	11052	11616
1020	5088	5698	6303	6902	7495	8084	8667	9246	9819	10388	10952
1030	4431	5041	5645	6244	6838	7426	8010	8588	9162	9730	10294
1040	3780	4390	4994	5593	6187	6775	7359	7937	8511	9079	9643
1050	3135	3745	4349	4948	5542	6130	6714	7292	7866	8434	8998
1060	2496	3106	3710	4309	4903	5492	6075	6654	7227	7796	8360
1070	1863	2473	3078	3677	4270	4859	5442	6021	6594	7163	7727
1080	1237	1846	2451	3050	3643	4232	4815	5394	5967	6536	7100
1090	615	1225	1830	2429	3022	3611	4194	4773	5346	5915	6479
1100	0	610	1214	1813	2407	2996	3579	4157	4731	5300	5864
1110	114	0	604	1203	1797	2386	2969	3548	4121	4690	5254
1120	229	115	0	599	1193	1781	2365	2943	3517	4085	4649
1130	344	229	115	0	594	1182	1766	2344	2918	3486	4050
1140	458	344	230	115	0	589	1172	1750	2324	2893	3457
1150	574	459	345	230	115	0	583	1162	1735	2304	2868
1160	689	574	460	345	230	115	0	578	1152	1721	2285
1170	804	690	575	461	346	231	115	0	574	1142	1706
1180	920	806	691	576	462	346	231	116	0	569	1133
1190	1036	922	807	692	577	462	347	232	116	0	564
1200	1152	1038	923	808	694	578	463	348	232	116	0
1210	1268	1154	1039	925	810	695	579	464	348	232	116
1220	1385	1270	1156	1041	926	811	696	580	465	349	233
1230	1501	1387	1273	1158	1043	928	813	697	581	466	349
1240	1618	1504	1389	1275	1160	1045	930	814	698	582	466
1250	1735	1621	1507	1392	1277	1162	1047	931	815	700	583
1260	1853	1738	1624	1509	1394	1279	1164	1048	933	817	701
1270	1970	1856	1741	1627	1512	1397	1281	1166	1050	934	818
1280	2088	1974	1859	1744	1629	1514	1399	1284	1168	1052	936
1290	2206	2092	1977	1862	1747	1632	1517	1402	1286	1170	1054
1300	2324	2210	2095	1980	1866	1750	1635	1520	1404	1288	1172
1310	2442	2328	2213	2099	1984	1869	1753	1638	1522	1406	1290
1320	2561	2447	2332	2217	2102	1987	1872	1757	1641	1525	1409
1330	2680	2565	2451	2336	2221	2106	1991	1875	1760	1644	1528
1340	2799	2684	2570	2455	2340	2225	2110	1994	1879	1763	1647
1350	2918	2803	2689	2574	2459	2344	2229	2113	1998	1882	1766
1360	3037	2923	2808	2694	2579	2464	2348	2233	2117	2001	1885
1370	3157	3042	2928	2813	2698	2583	2468	2352	2237	2121	2005
1380	3276	3162	3048	2933	2818	2703	2588	2472	2356	2241	2124
1390	3396	3282	3168	3053	2938	2823	2708	2592	2476	2361	2245
1400	3517	3402	3288	3173	3058	2943	2828	2712	2597	2481	2365

CAUTION: *If in Modes 3, 4 or 5, a correction factor, K, from Table 5.2 must be applied.*

PRESENT BORON CONCENTRATION (ppmB)

DESIRED BORON CONCENTRATION (ppmB)	1200	1210	1220	1230	1240	1250	1260	1270	1280	1290	1300
1010	11616	12175	12730	13280	13825	14367	14904	15436	15965	16489	17010
1020	10952	11511	12066	12616	13161	13703	14240	14772	15301	15825	16346
1030	10294	10854	11408	11958	12504	13045	13582	14115	14643	15168	15688
1040	9643	10203	10757	11307	11853	12394	12931	13464	13992	14517	15037
1050	8998	9558	10112	10662	11208	11749	12286	12819	13348	13872	14392
1060	8360	8919	9474	10024	10569	11111	11648	12180	12709	13233	13754
1070	7727	8286	8841	9391	9937	10478	11015	11547	12076	12600	13121
1080	7100	7659	8214	8764	9310	9851	10388	10921	11449	11974	12494
1090	6479	7038	7593	8143	8689	9230	9767	10300	10828	11352	11873
1100	5864	6423	6977	7528	8073	8614	9151	9684	10213	10737	11257
1110	5254	5813	6368	6918	7463	8005	8542	9074	9603	10127	10648
1120	4649	5209	5763	6313	6859	7400	7937	8470	8998	9523	10043
1130	4050	4610	5164	5714	6260	6801	7338	7871	8399	8924	9444
1140	3457	4016	4570	5121	5666	6207	6744	7277	7806	8330	8850
1150	2868	3427	3982	4532	5078	5619	6156	6689	7217	7742	8262
1160	2285	2844	3398	3949	4494	5035	5572	6105	6634	7158	7678
1170	1706	2265	2820	3370	3916	4457	4994	5527	6055	6580	7100
1180	1133	1692	2246	2797	3342	3884	4420	4953	5482	6006	6527
1190	564	1123	1678	2228	2774	3315	3852	4385	4913	5437	5958
1200	0	559	1114	1664	2210	2751	3288	3821	4349	4874	5394
1210	116	0	555	1105	1650	2192	2729	3261	3790	4314	4835
1220	233	116	0	550	1096	1637	2174	2707	3235	3760	4280
1230	349	233	117	0	546	1087	1624	2157	2685	3210	3730
1240	466	350	234	117	0	541	1078	1611	2139	2664	3184
1250	583	467	351	234	117	0	537	1070	1598	2123	2643
1260	701	584	468	351	234	117	0	533	1061	1586	2106
1270	818	702	585	469	352	235	118	0	529	1053	1573
1280	936	820	703	586	470	353	235	118	0	524	1045
1290	1054	938	821	704	588	470	353	236	118	0	520
1300	1172	1056	939	823	706	589	471	354	236	118	0
1310	1290	1174	1058	941	824	707	590	472	354	236	118
1320	1409	1293	1176	1059	943	825	708	591	473	355	237
1330	1528	1411	1295	1178	1061	944	827	709	592	474	356
1340	1647	1530	1414	1297	1180	1063	946	828	711	593	475
1350	1766	1649	1533	1416	1299	1182	1065	947	830	712	594
1360	1885	1769	1652	1536	1419	1302	1184	1067	949	831	713
1370	2005	1888	1772	1655	1538	1421	1304	1186	1069	951	833
1380	2124	2008	1892	1775	1658	1541	1424	1306	1189	1071	952
1390	2245	2128	2012	1895	1778	1661	1544	1426	1309	1191	1073
1400	2365	2248	2132	2015	1898	1781	1664	1546	1429	1311	1193
1410	2485	2369	2252	2136	2019	1902	1784	1667	1549	1431	1313
1420	2606	2490	2373	2256	2139	2022	1905	1788	1670	1552	1434
1430	2727	2610	2494	2377	2260	2143	2026	1908	1791	1673	1555
1440	2848	2732	2615	2498	2381	2264	2147	2030	1912	1794	1676
1450	2969	2853	2736	2620	2503	2386	2268	2151	2033	1915	1797
1460	3091	2974	2858	2741	2624	2507	2390	2272	2155	2037	1919
1470	3212	3096	2980	2863	2746	2629	2512	2394	2276	2159	2040
1480	3334	3218	3102	2985	2868	2751	2634	2516	2398	2280	2162
1490	3457	3340	3224	3107	2990	2873	2756	2638	2521	2403	2285
1500	3579	3463	3346	3230	3113	2996	2878	2761	2643	2525	2407

CAUTION: *If in Modes 3, 4 or 5, a correction factor, K, from Table 5.2 must be applied.*

PRESENT BORON CONCENTRATION (ppmB)

DESIRED BORON CONCENTRATION (ppmB)

	1300	1310	1320	1330	1340	1350	1360	1370	1380	1390	1400
1110	10648	11164	11676	12185	12690	13191	13688	14182	14672	15159	15642
1120	10043	10560	11072	11581	12085	12586	13084	13577	14068	14554	15037
1130	9444	9961	10473	10982	11486	11987	12485	12978	13469	13955	14438
1140	8850	9367	9879	10388	10893	11394	11891	12385	12875	13361	13844
1150	8262	8778	9291	9799	10304	10805	11303	11796	12286	12773	13256
1160	7678	8195	8707	9216	9721	10222	10719	11213	11703	12189	12672
1170	7100	7616	8129	8637	9142	9643	10141	10634	11124	11611	12094
1180	6527	7043	7555	8064	8569	9070	9567	10061	10551	11037	11521
1190	5958	6474	6987	7495	8000	8501	8998	9492	9982	10469	10952
1200	5394	5910	6423	6931	7436	7937	8434	8928	9418	9905	10388
1210	4835	5351	5864	6372	6877	7378	7875	8369	8859	9346	9829
1220	4280	4796	5309	5817	6322	6823	7321	7814	8304	8791	9274
1230	3730	4246	4759	5267	5772	6273	6771	7264	7754	8241	8724
1240	3184	3701	4213	4722	5226	5728	6225	6719	7209	7695	8178
1250	2643	3159	3672	4180	4685	5186	5684	6177	6667	7154	7637
1260	2106	2622	3135	3643	4148	4649	5147	5640	6130	6617	7100
1270	1573	2090	2602	3111	3616	4117	4614	5108	5598	6084	6567
1280	1045	1561	2074	2582	3087	3588	4085	4579	5069	5556	6039
1290	520	1037	1549	2058	2563	3064	3561	4055	4545	5031	5514
1300	0	516	1029	1537	2042	2543	3041	3534	4024	4511	4994
1310	118	0	512	1021	1526	2027	2524	3018	3508	3995	4478
1320	237	119	0	509	1013	1514	2012	2505	2996	3482	3965
1330	356	237	119	0	505	1006	1503	1997	2487	2973	3457
1340	475	356	238	119	0	501	998	1492	1982	2469	2952
1350	594	475	357	238	119	0	497	991	1481	1968	2451
1360	713	595	476	357	239	119	0	494	984	1470	1953
1370	833	714	596	477	358	239	120	0	490	977	1460
1380	952	834	716	597	478	359	239	120	0	487	970
1390	1073	954	836	717	598	479	359	240	120	0	483
1400	1193	1074	956	837	718	599	480	360	240	120	0
1410	1313	1195	1076	958	839	719	600	480	361	241	120
1420	1434	1316	1197	1078	959	840	721	601	481	361	241
1430	1555	1436	1318	1199	1080	961	842	722	602	482	362
1440	1676	1557	1439	1320	1201	1082	963	843	723	603	483
1450	1797	1679	1560	1442	1323	1203	1084	964	845	725	604
1460	1919	1800	1682	1563	1444	1325	1206	1086	966	846	726
1470	2040	1922	1804	1685	1566	1447	1327	1208	1088	968	848
1480	2162	2044	1926	1807	1688	1569	1449	1330	1210	1090	970
1490	2285	2166	2048	1929	1810	1691	1571	1452	1332	1212	1092
1500	2407	2289	2170	2051	1932	1813	1694	1574	1454	1334	1214
1510	2530	2411	2293	2174	2055	1936	1816	1697	1577	1457	1337
1520	2652	2534	2416	2297	2178	2059	1939	1820	1700	1580	1460
1530	2776	2657	2539	2420	2301	2182	2062	1943	1823	1703	1583
1540	2899	2781	2662	2543	2424	2305	2186	2066	1946	1826	1706
1550	3022	2904	2786	2667	2548	2429	2309	2190	2070	1950	1830
1560	3146	3028	2909	2791	2672	2552	2433	2313	2194	2074	1953
1570	3270	3152	3033	2915	2796	2676	2557	2437	2318	2198	2077
1580	3394	3276	3157	3039	2920	2801	2681	2562	2442	2322	2202
1590	3519	3400	3282	3163	3044	2925	2806	2686	2566	2446	2326
1600	3643	3525	3407	3288	3169	3050	2930	2811	2691	2571	2451

CAUTION: *If in Modes 3, 4 or 5, a correction factor, K, from Table 5.2 must be applied.*

PRESENT BORON CONCENTRATION (ppmB)

DESIRED BORON CONCENTRATION (ppmB)

	1400	**1410**	**1420**	**1430**	**1440**	**1450**	**1460**	**1470**	**1480**	**1490**	**1500**
1210	9829	10308	10785	11257	11727	12193	12657	13117	13573	14027	14478
1220	9274	9754	10230	10703	11172	11639	12102	12562	13019	13473	13923
1230	8724	9204	9680	10153	10622	11089	11552	12012	12469	12922	13373
1240	8178	8658	9134	9607	10077	10543	11006	11466	11923	12377	12828
1250	7637	8117	8593	9066	9535	10002	10465	10925	11382	11836	12286
1260	7100	7580	8056	8529	8998	9465	9928	10388	10845	11299	11749
1270	6567	7047	7523	7996	8466	8932	9395	9855	10312	10766	11217
1280	6039	6518	6995	7468	7937	8404	8867	9327	9784	10237	10688
1290	5514	5994	6470	6943	7413	7879	8342	8802	9259	9713	10164
1300	4994	5474	5950	6423	6892	7359	7822	8282	8739	9193	9643
1310	4478	4957	5433	5906	6376	6842	7305	7765	8222	8676	9127
1320	3965	4445	4921	5394	5864	6330	6793	7253	7710	8164	8614
1330	3457	3936	4412	4885	5355	5821	6284	6744	7201	7655	8106
1340	2952	3431	3908	4381	4850	5317	5780	6240	6697	7150	7601
1350	2451	2930	3407	3880	4349	4815	5279	5739	6195	6649	7100
1360	1953	2433	2909	3382	3852	4318	4781	5241	5698	6152	6603
1370	1460	1939	2416	2888	3358	3824	4288	4748	5204	5658	6109
1380	970	1449	1926	2398	2868	3334	3798	4257	4714	5168	5619
1390	483	963	1439	1912	2381	2848	3311	3771	4228	4682	5132
1400	0	480	956	1429	1898	2365	2828	3288	3745	4199	4649
1410	120	0	476	949	1419	1885	2348	2808	3265	3719	4170
1420	241	121	0	473	943	1409	1872	2332	2789	3243	3693
1430	362	242	121	0	470	936	1399	1859	2316	2770	3221
1440	483	363	242	121	0	466	930	1389	1846	2300	2751
1450	604	484	363	242	121	0	463	923	1380	1834	2285
1460	726	605	485	364	243	122	0	460	917	1371	1821
1470	848	727	607	486	365	243	122	0	457	911	1361
1480	970	849	729	608	487	365	244	122	0	454	905
1490	1092	971	851	730	609	487	366	244	122	0	451
1500	1214	1094	973	852	731	610	488	367	245	122	0
1510	1337	1216	1096	975	854	732	611	489	367	245	123
1520	1460	1339	1219	1098	977	855	734	612	490	368	245
1530	1583	1462	1342	1221	1100	978	857	735	613	491	369
1540	1706	1586	1465	1344	1223	1102	980	858	736	614	492
1550	1830	1709	1589	1468	1347	1225	1104	982	860	738	615
1560	1953	1833	1712	1591	1470	1349	1228	1106	984	862	739
1570	2077	1957	1836	1715	1594	1473	1351	1230	1108	986	863
1580	2202	2081	1961	1840	1719	1597	1476	1354	1232	1110	987
1590	2326	2206	2085	1964	1843	1722	1600	1478	1356	1234	1112
1600	2451	2330	2210	2089	1968	1846	1725	1603	1481	1359	1237
1610	2576	2455	2335	2214	2093	1971	1850	1728	1606	1484	1361
1620	2701	2580	2460	2339	2218	2096	1975	1853	1731	1609	1487
1630	2826	2706	2585	2464	2343	2222	2100	1979	1857	1734	1612
1640	2952	2831	2711	2590	2469	2347	2226	2104	1982	1860	1738
1650	3078	2957	2837	2716	2595	2473	2352	2230	2108	1986	1863
1660	3204	3083	2963	2842	2721	2599	2478	2356	2234	2112	1989
1670	3330	3210	3089	2968	2847	2726	2604	2482	2360	2238	2116
1680	3457	3336	3215	3095	2973	2852	2731	2609	2487	2365	2242
1690	3583	3463	3342	3221	3100	2979	2857	2736	2614	2492	2369
1700	3710	3590	3469	3348	3227	3106	2984	2863	2741	2619	2496

OP/2/A/6100/22
Enclosure 4.3
Section 5.1

CAUTION: *If in Modes 3, 4 or 5, a correction factor, K, from Table 5.2 must be applied.*

PRESENT BORON CONCENTRATION (ppmB)

DESIRED BORON CONCENTRATION (ppmB)	1500	1510	1520	1530	1540	1550	1560	1570	1580	1590	1600
1310	9127	9575	10019	10461	10900	11337	11770	12200	12628	13054	13476
1320	8614	9062	9507	9949	10388	10824	11257	11688	12116	12541	12964
1330	8106	8554	8998	9440	9879	10315	10749	11179	11607	12032	12455
1340	7601	8049	8494	8936	9375	9811	10244	10675	11103	11528	11950
1350	7100	7548	7993	8434	8874	9310	9743	10174	10601	11027	11449
1360	6603	7050	7495	7937	8376	8812	9246	9676	10104	10529	10952
1370	6109	6557	7002	7443	7882	8319	8752	9183	9610	10036	10458
1380	5619	6067	6511	6953	7392	7829	8262	8693	9120	9546	9968
1390	5132	5580	6025	6467	6906	7342	7775	8206	8634	9059	9481
1400	4649	5097	5542	5984	6423	6859	7292	7723	8151	8576	8998
1410	4170	4617	5062	5504	5943	6379	6813	7243	7671	8096	8519
1420	3693	4141	4586	5028	5467	5903	6336	6767	7195	7620	8043
1430	3221	3668	4113	4555	4994	5430	5864	6294	6722	7147	7570
1440	2751	3199	3643	4085	4524	4961	5394	5825	6252	6678	7100
1450	2285	2732	3177	3619	4058	4494	4928	5358	5786	6211	6634
1460	1821	2269	2714	3156	3595	4031	4464	4895	5323	5748	6171
1470	1361	1809	2254	2696	3135	3571	4004	4435	4863	5288	5711
1480	905	1352	1797	2239	2678	3114	3548	3978	4406	4831	5254
1490	451	899	1343	1785	2224	2660	3094	3524	3952	4377	4800
1500	0	448	893	1334	1773	2210	2643	3074	3501	3927	4349
1510	123	0	445	887	1326	1762	2195	2626	3054	3479	3901
1520	245	123	0	442	881	1317	1750	2181	2609	3034	3457
1530	369	246	123	0	439	875	1309	1739	2167	2592	3015
1540	492	369	246	123	0	436	870	1300	1728	2153	2576
1550	615	493	370	247	124	0	433	864	1292	1717	2139
1560	739	617	494	371	247	124	0	431	858	1284	1706
1570	863	741	618	495	371	248	124	0	428	853	1276
1580	987	865	742	619	496	372	248	124	0	425	848
1590	1112	989	866	743	620	496	373	249	124	0	422
1600	1237	1114	991	868	745	621	497	373	249	125	0
1610	1361	1239	1116	993	870	746	622	498	374	250	125
1620	1487	1364	1241	1118	995	871	747	623	499	375	250
1630	1612	1489	1366	1243	1120	997	873	749	625	500	375
1640	1738	1615	1492	1369	1246	1122	998	874	750	626	501
1650	1863	1741	1618	1495	1371	1248	1124	1000	876	752	627
1660	1989	1867	1744	1621	1498	1374	1250	1126	1002	878	753
1670	2116	1993	1870	1747	1624	1500	1377	1253	1128	1004	879
1680	2242	2120	1997	1874	1750	1627	1503	1379	1255	1130	1006
1690	2369	2246	2124	2001	1877	1754	1630	1506	1382	1257	1133
1700	2496	2374	2251	2128	2004	1881	1757	1633	1509	1384	1260
1710	2623	2501	2378	2255	2132	2008	1884	1760	1636	1512	1387
1720	2751	2628	2505	2382	2259	2135	2012	1888	1764	1639	1514
1730	2879	2756	2633	2510	2387	2263	2139	2015	1891	1767	1642
1740	3007	2884	2761	2638	2515	2391	2267	2143	2019	1895	1770
1750	3135	3012	2889	2766	2643	2519	2396	2272	2148	2023	1898
1760	3263	3141	3018	2895	2771	2648	2524	2400	2276	2152	2027
1770	3392	3269	3147	3024	2900	2777	2653	2529	2405	2280	2156
1780	3521	3398	3276	3152	3029	2906	2782	2658	2534	2409	2285
1790	3650	3528	3405	3282	3158	3035	2911	2787	2663	2538	2414
1800	3780	3657	3534	3411	3288	3164	3041	2917	2792	2668	2543

CAUTION: *If in Modes 3, 4 or 5, a correction factor, K, from Table 5.2 must be applied.*

PRESENT BORON CONCENTRATION (ppmB)

DESIRED BORON CONCENTRATION (ppmB)	1600	1610	1620	1630	1640	1650	1660	1670	1680	1690	1700
1410	8519	8939	9356	9771	10183	10592	11000	11404	11807	12207	12604
1420	8043	8462	8880	9294	9707	10116	10523	10928	11330	11730	12128
1430	7570	7990	8407	8821	9234	9643	10050	10455	10858	11257	11655
1440	7100	7520	7937	8352	8764	9174	9581	9986	10388	10788	11185
1450	6634	7054	7471	7886	8298	8707	9114	9519	9922	10321	10719
1460	6171	6590	7008	7422	7835	8244	8651	9056	9458	9858	10256
1470	5711	6130	6548	6962	7375	7784	8191	8596	8998	9398	9796
1480	5254	5674	6091	6505	6918	7327	7734	8139	8542	8941	9339
1490	4800	5220	5637	6052	6464	6874	7281	7685	8088	8488	8885
1500	4349	4769	5186	5601	6013	6423	6830	7235	7637	8037	8434
1510	3901	4321	4738	5153	5565	5975	6382	6787	7189	7589	7987
1520	3457	3876	4294	4708	5121	5530	5937	6342	6744	7144	7542
1530	3015	3435	3852	4266	4679	5088	5495	5900	6303	6702	7100
1540	2576	2996	3413	3827	4240	4649	5056	5461	5864	6263	6661
1550	2139	2559	2977	3391	3803	4213	4620	5025	5427	5827	6225
1560	1706	2126	2543	2958	3370	3780	4187	4592	4994	5394	5791
1570	1276	1695	2113	2527	2940	3349	3756	4161	4563	4963	5361
1580	848	1268	1685	2099	2512	2921	3328	3733	4136	4535	4933
1590	422	842	1260	1674	2086	2496	2903	3308	3710	4110	4508
1600	0	420	837	1252	1664	2074	2481	2886	3288	3688	4085
1610	125	0	417	832	1244	1654	2061	2466	2868	3268	3666
1620	250	125	0	415	827	1237	1644	2048	2451	2851	3248
1630	375	251	125	0	412	822	1229	1634	2036	2436	2834
1640	501	376	251	126	0	410	817	1222	1624	2024	2421
1650	627	502	377	251	126	0	407	812	1214	1614	2012
1660	753	628	503	378	252	126	0	405	807	1207	1605
1670	879	754	629	504	378	252	126	0	402	802	1200
1680	1006	881	756	630	505	379	253	127	0	400	798
1690	1133	1008	883	757	632	506	380	253	127	0	398
1700	1260	1135	1010	884	759	633	507	380	254	127	0
1710	1387	1262	1137	1011	886	760	634	508	381	254	127
1720	1514	1389	1264	1139	1013	888	761	635	509	382	255
1730	1642	1517	1392	1267	1141	1015	889	763	636	510	383
1740	1770	1645	1520	1395	1269	1143	1017	891	764	638	511
1750	1898	1773	1648	1523	1397	1272	1145	1019	893	766	639
1760	2027	1902	1777	1651	1526	1400	1274	1148	1021	894	767
1770	2156	2031	1906	1780	1655	1529	1403	1276	1150	1023	896
1780	2285	2160	2035	1909	1784	1658	1532	1405	1279	1152	1025
1790	2414	2289	2164	2038	1913	1787	1661	1535	1408	1281	1154
1800	2543	2418	2293	2168	2042	1916	1790	1664	1537	1411	1284
1810	2673	2548	2423	2298	2172	2046	1920	1794	1667	1540	1413
1820	2803	2678	2553	2428	2302	2176	2050	1924	1797	1670	1543
1830	2933	2808	2683	2558	2432	2306	2180	2054	1927	1801	1674
1840	3064	2939	2814	2688	2563	2437	2311	2184	2058	1931	1804
1850	3194	3069	2944	2819	2693	2567	2441	2315	2189	2062	1935
1860	3325	3200	3075	2950	2824	2698	2572	2446	2320	2193	2066
1870	3457	3332	3207	3081	2956	2830	2704	2577	2451	2324	2197
1880	3588	3463	3338	3213	3087	2961	2835	2709	2582	2455	2328
1890	3720	3595	3470	3344	3219	3093	2967	2841	2714	2587	2460
1900	3852	3727	3602	3476	3351	3225	3099	2973	2846	2719	2592

CAUTION: *If in Modes 3, 4 or 5, a correction factor, K, from Table 5.2 must be applied.*

PRESENT BORON CONCENTRATION (ppmB)

DESIRED BORON CONCENTRATION (ppmB)	1700	1710	1720	1730	1740	1750	1760	1770	1780	1790	1800
1510	7987	8382	8775	9166	9554	9940	10324	10706	11086	11463	11839
1520	7542	7937	8330	8721	9109	9495	9879	10261	10641	11018	11394
1530	7100	7495	7888	8279	8667	9053	9437	9819	10199	10576	10952
1540	6661	7056	7449	7840	8228	8614	8998	9380	9760	10137	10513
1550	6225	6620	7013	7404	7792	8178	8562	8944	9324	9701	10077
1560	5791	6187	6580	6970	7359	7745	8129	8511	8890	9268	9643
1570	5361	5756	6149	6540	6928	7314	7698	8080	8460	8837	9213
1580	4933	5328	5721	6112	6500	6886	7270	7652	8032	8409	8785
1590	4508	4903	5296	5687	6075	6461	6845	7227	7607	7984	8360
1600	4085	4481	4874	5264	5653	6039	6423	6805	7184	7562	7937
1610	3666	4061	4454	4844	5233	5619	6003	6385	6764	7142	7517
1620	3248	3643	4036	4427	4815	5202	5586	5967	6347	6725	7100
1630	2834	3229	3622	4012	4401	4787	5171	5553	5932	6310	6685
1640	2421	2817	3210	3600	3989	4375	4759	5141	5520	5898	6273
1650	2012	2407	2800	3191	3579	3965	4349	4731	5111	5488	5864
1660	1605	2000	2393	2783	3172	3558	3942	4324	4703	5081	5456
1670	1200	1595	1988	2379	2767	3153	3537	3919	4299	4676	5052
1680	798	1193	1586	1976	2365	2751	3135	3517	3896	4274	4649
1690	398	793	1186	1576	1965	2351	2735	3117	3496	3874	4249
1700	0	395	788	1179	1567	1953	2337	2719	3099	3476	3852
1710	127	0	393	784	1172	1558	1942	2324	2704	3081	3457
1720	255	128	0	391	779	1165	1549	1931	2311	2688	3064
1730	383	255	128	0	388	775	1159	1540	1920	2298	2673
1740	511	383	256	128	0	386	770	1152	1532	1909	2285
1750	639	511	384	256	128	0	384	766	1145	1523	1898
1760	767	640	512	385	257	128	0	382	761	1139	1514
1770	896	769	641	513	385	257	129	0	380	757	1133
1780	1025	898	770	642	514	386	258	129	0	378	753
1790	1154	1027	899	772	644	515	387	258	129	0	375
1800	1284	1156	1029	901	773	645	516	388	259	129	0
1810	1413	1286	1159	1031	903	775	646	517	388	259	130
1820	1543	1416	1289	1161	1033	905	776	647	518	389	260
1830	1674	1546	1419	1291	1163	1035	906	778	649	519	390
1840	1804	1677	1549	1421	1293	1165	1037	908	779	650	520
1850	1935	1807	1680	1552	1424	1296	1167	1039	910	781	651
1860	2066	1938	1811	1683	1555	1427	1298	1170	1041	912	782
1870	2197	2070	1942	1814	1686	1558	1430	1301	1172	1043	913
1880	2328	2201	2074	1946	1818	1690	1561	1432	1303	1174	1045
1890	2460	2333	2205	2078	1950	1821	1693	1564	1435	1306	1177
1900	2592	2465	2337	2210	2082	1953	1825	1696	1567	1438	1309
1910	2724	2597	2470	2342	2214	2086	1957	1828	1699	1570	1441
1920	2857	2730	2602	2474	2346	2218	2090	1961	1832	1703	1573
1930	2990	2862	2735	2607	2479	2351	2223	2094	1965	1836	1706
1940	3123	2996	2868	2740	2612	2484	2356	2227	2098	1969	1839
1950	3256	3129	3001	2874	2746	2617	2489	2360	2231	2102	1972
1960	3390	3262	3135	3007	2879	2751	2622	2494	2365	2236	2106
1970	3524	3396	3269	3141	3013	2885	2756	2628	2499	2369	2240
1980	3658	3530	3403	3275	3147	3019	2890	2762	2633	2503	2374
1990	3792	3665	3537	3409	3281	3153	3025	2896	2767	2638	2508
2000	3927	3799	3672	3544	3416	3288	3159	3031	2902	2772	2643

CAUTION: *If in Modes 3, 4 or 5, a correction factor, K, from Table 5.2 must be applied.*

PRESENT BORON CONCENTRATION (ppmB)

DESIRED BORON CONCENTRATION (ppmB)

	1800	**1810**	**1820**	**1830**	**1840**	**1850**	**1860**	**1870**	**1880**	**1890**	**1900**
1610	7517	7891	8262	8631	8998	9364	9727	10088	10448	10805	11161
1620	7100	7473	7845	8214	8581	8946	9310	9671	10030	10388	10744
1630	6685	7059	7430	7799	8166	8532	8895	9256	9616	9973	10329
1640	6273	6647	7018	7387	7754	8120	8483	8844	9204	9561	9917
1650	5864	6237	6608	6977	7345	7710	8073	8434	8794	9151	9507
1660	5456	5830	6201	6570	6937	7303	7666	8027	8387	8744	9100
1670	5052	5425	5796	6165	6533	6898	7261	7623	7982	8339	8695
1680	4649	5023	5394	5763	6130	6496	6859	7220	7580	7937	8293
1690	4249	4623	4994	5363	5730	6096	6459	6820	7180	7537	7893
1700	3852	4225	4596	4966	5333	5698	6061	6423	6782	7140	7495
1710	3457	3830	4201	4570	4938	5303	5666	6028	6387	6744	7100
1720	3064	3437	3808	4177	4545	4910	5273	5635	5994	6351	6707
1730	2673	3046	3418	3787	4154	4519	4883	5244	5603	5961	6316
1740	2285	2658	3029	3398	3766	4131	4494	4856	5215	5572	5928
1750	1898	2272	2643	3012	3379	3745	4108	4469	4829	5186	5542
1760	1514	1888	2259	2628	2996	3361	3724	4085	4445	4802	5158
1770	1133	1506	1877	2246	2614	2979	3342	3704	4063	4420	4776
1780	753	1126	1498	1867	2234	2599	2963	3324	3683	4041	4396
1790	375	749	1120	1489	1857	2222	2585	2946	3306	3663	4019
1800	0	373	745	1114	1481	1846	2210	2571	2930	3288	3643
1810	130	0	371	741	1108	1473	1836	2198	2557	2915	3270
1820	260	130	0	369	736	1102	1465	1826	2186	2543	2899
1830	390	260	130	0	367	732	1096	1457	1816	2174	2530
1840	520	391	261	130	0	365	729	1090	1449	1807	2162
1850	651	521	391	261	131	0	363	725	1084	1442	1797
1860	782	652	522	392	262	131	0	361	721	1078	1434
1870	913	784	654	523	393	262	131	0	359	717	1073
1880	1045	915	785	655	524	394	263	131	0	357	713
1890	1177	1047	917	787	656	525	394	263	132	0	356
1900	1309	1179	1049	919	788	657	526	395	264	132	0
1910	1441	1311	1181	1051	920	790	659	528	396	264	132
1920	1573	1444	1314	1183	1053	922	791	660	529	397	265
1930	1706	1576	1446	1316	1186	1055	924	793	661	530	398
1940	1839	1709	1579	1449	1319	1188	1057	926	794	663	531
1950	1972	1843	1713	1583	1452	1321	1190	1059	928	796	664
1960	2106	1976	1846	1716	1586	1455	1324	1193	1061	930	798
1970	2240	2110	1980	1850	1720	1589	1458	1327	1195	1063	931
1980	2374	2244	2114	1984	1854	1723	1592	1461	1329	1197	1065
1990	2508	2379	2249	2118	1988	1857	1726	1595	1464	1332	1200
2000	2643	2513	2383	2253	2123	1992	1861	1730	1598	1466	1334
2010	2778	2648	2518	2388	2258	2127	1996	1865	1733	1601	1469
2020	2913	2783	2653	2523	2393	2262	2131	2000	1868	1737	1605
2030	3049	2919	2789	2659	2528	2397	2266	2135	2004	1872	1740
2040	3184	3055	2925	2794	2664	2533	2402	2271	2139	2008	1876
2050	3320	3191	3061	2930	2800	2669	2538	2407	2275	2144	2012
2060	3457	3327	3197	3067	2936	2805	2674	2543	2412	2280	2148
2070	3593	3463	3333	3203	3073	2942	2811	2680	2548	2417	2285
2080	3730	3600	3470	3340	3210	3079	2948	2817	2685	2553	2421
2090	3867	3737	3607	3477	3347	3216	3085	2954	2822	2690	2558
2100	4004	3875	3745	3615	3484	3353	3222	3091	2960	2828	2696

CAUTION: *If in Modes 3, 4 or 5, a correction factor, K, from Table 5.2 must be applied.*

PRESENT BORON CONCENTRATION (ppmB)

DESIRED BORON CONCENTRATION (ppmB)

	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000
1710	7100	7454	7806	8156	8504	8850	9195	9538	9879	10219	10557
1720	6707	7061	7413	7763	8111	8458	8802	9145	9486	9826	10164
1730	6316	6670	7022	7372	7720	8067	8412	8755	9096	9435	9773
1740	5928	6282	6634	6984	7332	7678	8023	8366	8707	9047	9385
1750	5542	5896	6248	6598	6946	7292	7637	7980	8321	8661	8998
1760	5158	5512	5864	6214	6562	6908	7253	7596	7937	8277	8614
1770	4776	5130	5482	5832	6180	6527	6871	7214	7555	7895	8233
1780	4396	4750	5102	5452	5800	6147	6492	6835	7176	7515	7853
1790	4019	4373	4725	5075	5423	5769	6114	6457	6798	7138	7475
1800	3643	3997	4349	4699	5047	5394	5739	6082	6423	6762	7100
1810	3270	3624	3976	4326	4674	5021	5365	5708	6049	6389	6727
1820	2899	3253	3604	3955	4303	4649	4994	5337	5678	6018	6355
1830	2530	2883	3235	3585	3934	4280	4625	4968	5309	5648	5986
1840	2162	2516	2868	3218	3566	3913	4257	4600	4942	5281	5619
1850	1797	2151	2503	2853	3201	3548	3892	4235	4576	4916	5254
1860	1434	1788	2139	2490	2838	3184	3529	3872	4213	4553	4890
1870	1073	1426	1778	2128	2476	2823	3168	3511	3852	4191	4529
1880	713	1067	1419	1769	2117	2464	2808	3151	3492	3832	4170
1890	356	709	1061	1411	1760	2106	2451	2794	3135	3474	3812
1900	0	354	706	1056	1404	1750	2095	2438	2779	3119	3457
1910	132	0	352	702	1050	1397	1741	2084	2426	2765	3103
1920	265	133	0	350	698	1045	1389	1732	2074	2413	2751
1930	398	265	133	0	348	695	1039	1382	1724	2063	2401
1940	531	398	266	133	0	346	691	1034	1375	1715	2053
1950	664	532	399	266	133	0	345	688	1029	1368	1706
1960	798	665	533	400	267	134	0	343	684	1024	1361
1970	931	799	667	534	401	267	134	0	341	681	1018
1980	1065	933	801	668	535	402	268	134	0	339	677
1990	1200	1068	935	802	669	536	402	268	134	0	338
2000	1334	1202	1070	937	804	671	537	403	269	135	0
2010	1469	1337	1205	1072	939	805	672	538	404	270	135
2020	1605	1472	1340	1207	1074	941	807	673	539	405	270
2030	1740	1608	1475	1342	1209	1076	943	809	675	540	406
2040	1876	1743	1611	1478	1345	1212	1078	944	810	676	541
2050	2012	1879	1747	1614	1481	1348	1214	1080	946	812	677
2060	2148	2016	1883	1750	1617	1484	1351	1217	1083	948	814
2070	2285	2152	2020	1887	1754	1621	1487	1353	1219	1085	950
2080	2421	2289	2157	2024	1891	1757	1624	1490	1356	1222	1087
2090	2558	2426	2294	2161	2028	1895	1761	1627	1493	1359	1224
2100	2696	2564	2431	2298	2165	2032	1898	1765	1630	1496	1361
2110	2834	2701	2569	2436	2303	2170	2036	1902	1768	1634	1499
2120	2971	2839	2707	2574	2441	2308	2174	2040	1906	1772	1637
2130	3110	2977	2845	2712	2579	2446	2312	2178	2044	1910	1775
2140	3248	3116	2983	2851	2718	2584	2451	2317	2183	2048	1914
2150	3387	3255	3122	2989	2856	2723	2590	2456	2322	2187	2053
2160	3526	3394	3261	3129	2996	2862	2729	2595	2461	2326	2192
2170	3666	3533	3401	3268	3135	3002	2868	2734	2600	2466	2331
2180	3805	3673	3540	3408	3275	3141	3008	2874	2740	2605	2471
2190	3945	3813	3680	3548	3415	3281	3148	3014	2880	2745	2611
2200	4085	3953	3821	3688	3555	3421	3288	3154	3020	2886	2751

CAUTION: *If in Modes 3, 4 or 5, a correction factor, K, from Table 5.2 must be applied.*

PRESENT BORON CONCENTRATION (ppmB)

DESIRED BORON CONCENTRATION (ppmB)

	2000	2010	2020	2030	2040	2050	2060	2070	2080	2090	2100
1810	6727	7063	7397	7730	8061	8391	8719	9045	9370	9693	10015
1820	6355	6692	7026	7359	7690	8019	8347	8674	8998	9322	9643
1830	5986	6322	6657	6989	7321	7650	7978	8304	8629	8952	9274
1840	5619	5955	6289	6622	6953	7283	7611	7937	8262	8585	8907
1850	5254	5590	5924	6257	6588	6918	7246	7572	7897	8220	8542
1860	4890	5226	5561	5894	6225	6554	6882	7209	7533	7857	8178
1870	4529	4865	5200	5532	5864	6193	6521	6847	7172	7495	7817
1880	4170	4506	4840	5173	5504	5834	6162	6488	6813	7136	7458
1890	3812	4148	4483	4815	5147	5476	5804	6130	6455	6778	7100
1900	3457	3793	4127	4460	4791	5121	5448	5775	6100	6423	6744
1910	3103	3439	3773	4106	4437	4767	5095	5421	5746	6069	6391
1920	2751	3087	3421	3754	4085	4415	4743	5069	5394	5717	6039
1930	2401	2737	3071	3404	3735	4065	4393	4719	5044	5367	5689
1940	2053	2389	2723	3056	3387	3717	4044	4371	4696	5019	5340
1950	1706	2042	2377	2709	3041	3370	3698	4024	4349	4672	4994
1960	1361	1698	2032	2365	2696	3025	3353	3680	4004	4328	4649
1970	1018	1355	1689	2022	2353	2682	3010	3337	3661	3985	4306
1980	677	1013	1348	1681	2012	2341	2669	2996	3320	3643	3965
1990	338	674	1008	1341	1672	2002	2330	2656	2981	3304	3626
2000	0	336	671	1003	1334	1664	1992	2318	2643	2966	3288
2010	135	0	334	667	998	1328	1656	1982	2307	2630	2952
2020	270	135	0	333	664	993	1321	1648	1972	2296	2617
2030	406	271	135	0	331	661	989	1315	1640	1963	2285
2040	541	406	271	136	0	330	657	984	1309	1632	1953
2050	677	542	407	272	136	0	328	654	979	1302	1624
2060	814	679	543	408	272	136	0	326	651	974	1296
2070	950	815	680	545	409	273	137	0	325	648	970
2080	1087	952	817	681	546	410	273	137	0	323	645
2090	1224	1089	954	818	683	547	410	274	137	0	322
2100	1361	1227	1091	956	820	684	548	411	274	137	0
2110	1499	1364	1229	1094	958	822	686	549	412	275	138
2120	1637	1502	1367	1231	1096	960	823	687	550	413	276
2130	1775	1640	1505	1370	1234	1098	962	825	688	551	414
2140	1914	1779	1644	1508	1373	1237	1100	964	827	690	552
2150	2053	1918	1782	1647	1511	1375	1239	1102	966	829	691
2160	2192	2057	1922	1786	1650	1514	1378	1242	1105	968	830
2170	2331	2196	2061	1926	1790	1654	1518	1381	1244	1107	970
2180	2471	2336	2201	2065	1929	1793	1657	1521	1384	1247	1109
2190	2611	2476	2341	2205	2069	1933	1797	1661	1524	1387	1249
2200	2751	2616	2481	2345	2210	2074	1937	1801	1664	1527	1389
2210	2891	2757	2621	2486	2350	2214	2078	1941	1805	1667	1530
2220	3032	2897	2762	2627	2491	2355	2219	2082	1945	1808	1671
2230	3173	3038	2903	2768	2632	2496	2360	2223	2086	1949	1812
2240	3315	3180	3045	2909	2774	2638	2501	2365	2228	2091	1953
2250	3457	3322	3186	3051	2915	2779	2643	2506	2370	2233	2095
2260	3599	3464	3328	3193	3057	2921	2785	2648	2512	2375	2237
2270	3741	3606	3471	3335	3200	3064	2927	2791	2654	2517	2379
2280	3884	3749	3613	3478	3342	3206	3070	2933	2797	2659	2522
2290	4026	3892	3756	3621	3485	3349	3213	3076	2940	2802	2665
2300	4170	4035	3900	3764	3628	3492	3356	3220	3083	2946	2808

CAUTION: *If in Modes 3, 4 or 5, a correction factor, K, from Table 5.2 must be applied.*

PRESENT BORON CONCENTRATION (ppmB)

DESIRED BORON CONCENTRATION (ppmB)

	2100	2110	2120	2130	2140	2150	2160	2170	2180	2190	2200
1910	6391	6711	7029	7347	7662	7976	8289	8600	8910	9219	9526
1920	6039	6359	6678	6995	7310	7624	7937	8248	8558	8867	9174
1930	5689	6009	6327	6645	6960	7274	7587	7898	8208	8517	8824
1940	5340	5661	5979	6296	6612	6926	7239	7550	7860	8168	8475
1950	4994	5314	5633	5950	6265	6580	6892	7204	7513	7822	8129
1960	4649	4969	5288	5605	5921	6235	6548	6859	7169	7477	7784
1970	4306	4626	4945	5262	5578	5892	6205	6516	6826	7134	7441
1980	3965	4285	4604	4921	5237	5551	5864	6175	6485	6793	7100
1990	3626	3946	4264	4582	4897	5211	5524	5835	6145	6454	6761
2000	3288	3608	3927	4244	4559	4874	5186	5498	5807	6116	6423
2010	2952	3272	3591	3908	4223	4537	4850	5161	5471	5780	6087
2020	2617	2937	3256	3573	3889	4203	4516	4827	5137	5445	5752
2030	2285	2605	2923	3240	3556	3870	4183	4494	4804	5112	5419
2040	1953	2274	2592	2909	3225	3539	3852	4163	4473	4781	5088
2050	1624	1944	2263	2580	2895	3210	3522	3834	4143	4452	4759
2060	1296	1616	1935	2252	2567	2882	3194	3506	3815	4124	4431
2070	970	1290	1608	1926	2241	2555	2868	3179	3489	3798	4105
2080	645	965	1284	1601	1916	2231	2543	2855	3164	3473	3780
2090	322	642	960	1278	1593	1907	2220	2531	2841	3150	3457
2100	0	320	639	956	1272	1586	1898	2210	2519	2828	3135
2110	138	0	319	636	951	1266	1578	1890	2199	2508	2815
2120	276	138	0	317	633	947	1260	1571	1881	2189	2496
2130	414	276	138	0	316	630	943	1254	1564	1872	2179
2140	552	415	277	139	0	314	627	938	1248	1556	1863
2150	691	553	416	277	139	0	313	624	934	1242	1549
2160	830	693	555	416	278	139	0	311	621	930	1237
2170	970	832	694	556	417	278	139	0	310	618	925
2180	1109	972	834	695	557	418	279	140	0	308	615
2190	1249	1112	974	835	697	558	419	280	140	0	307
2200	1389	1252	1114	976	837	698	559	420	280	140	0
2210	1530	1392	1254	1116	978	839	700	560	421	281	141
2220	1671	1533	1395	1257	1118	980	841	701	562	422	281
2230	1812	1674	1536	1398	1260	1121	982	842	703	563	422
2240	1953	1816	1678	1540	1401	1262	1123	984	844	704	564
2250	2095	1957	1820	1681	1543	1404	1265	1126	986	846	706
2260	2237	2099	1962	1823	1685	1546	1407	1268	1128	988	848
2270	2379	2242	2104	1966	1827	1688	1549	1410	1270	1130	990
2280	2522	2384	2246	2108	1970	1831	1692	1552	1413	1273	1133
2290	2665	2527	2389	2251	2113	1974	1835	1695	1556	1416	1276
2300	2808	2671	2533	2394	2256	2117	1978	1839	1699	1559	1419
2310	2952	2814	2676	2538	2399	2261	2122	1982	1842	1703	1562
2320	3096	2958	2820	2682	2543	2404	2265	2126	1986	1846	1706
2330	3240	3102	2964	2826	2687	2549	2410	2270	2130	1991	1850
2340	3384	3247	3109	2970	2832	2693	2554	2415	2275	2135	1995
2350	3529	3391	3253	3115	2977	2838	2699	2559	2420	2280	2139
2360	3674	3536	3398	3260	3122	2983	2844	2704	2565	2425	2285
2370	3819	3682	3544	3406	3267	3128	2989	2850	2710	2570	2430
2380	3965	3827	3690	3551	3413	3274	3135	2996	2856	2716	2576
2390	4111	3973	3836	3697	3559	3420	3281	3142	3002	2862	2722
2400	4257	4120	3982	3844	3705	3566	3427	3288	3148	3008	2868

CHG V
TMAS
- 07/13/99

Table 5.2
Makeup Concentration Equations

To determine the boric acid flow rate:

To determine the boric acid flow rate for a desired VCT makeup boron concentration, use the following equation:

$$\frac{\text{Desired VCT boron concentration (ppmB)} \times \text{Total blender flow rate (gpm)}}{\text{Boric acid tank boron concentration (ppmB)}}$$

To set the potentiometer on NVSS5450, use the following equation:

$$\text{Potentiometer setting} = \frac{\text{Boric acid flow rate (gpm)}}{4}$$

Current total blender flow rate in automatic is 90 gpm.

NOTE: If the unit has operated continuously for several months, significant Boron 10 depletion may have occurred. The effective boron concentration of the NC system may be lower than indicated by Chemistry samples. NC temperature should be carefully monitored following VCT makeups.

For diluting or borating while in Modes 3, 4 or 5:

Use the correction factor, K, for a dilution/boration performed in Modes 3, 4 or 5. Obtain the volume of water/boric acid for the desired dilution/boration from Table 5.1. Then apply the appropriate K listed below to the volume from Table 5.1.

Plant Conditions			Correction
Pressure (psig)	Tavg (°F)	Pressurizer Level	Factor (K)
2235	557 - 588	Normal Operating	1.00
1600	500	No-Load	1.05
1200	450	No-Load	1.10
800	400	No-Load	1.16
400	350	No-Load	1.18
400	300	No-Load	1.20
400	300	Solid Water	1.35
400	200	No-Load	1.28
400	200	Solid Water	1.40
400	100	Solid Water	1.47