JOB PERFORMANCE MEASURE

TASK CONDITIONS:

1. You are the Unit One Unit Supervisor.
2. Both units are at 100% power in a normal electrical lineup.
3. The State Estimator alarm is operable and indicates a potential degraded grid condition based on a Braidwood Unit Two trip.
4. The unit NSOs provide the following indication readings to you:

   - State Estimator predicted voltage is 343.8 KV for BOTH units
   - Bus 143 1EI-AP055 indicates 4280 Volts
   - Bus 143 1II-AP051 and 1II-AP194 indicate 700 amps
   - Bus 144 1EI-AP087 indicates 4280 Volts
   - Bus 144 1II-AP083 and 1II-AP198 indicate 700 amps
   - Bus 243 2EI-AP055 indicates 4350 Volts
   - Bus 243 2IIAP051 and 2II-AP194 indicate 650 amps
   - Bus 244 2EI-AP087 indicates 4350 Volts
   - Bus 244 2II-AP083 and 2II-AP198 indicate 650 amps

INITIATING CUES:

Implement 0BwOA ELEC-1 and determine the operability status of BOTH unit offsite circuits.

TASK TITLE: **Determine Operability of Offsite Circuits per 0BwOA ELEC-1 for Abnormal Grid Conditions.**

JPM No.: **S-107** REV: **2013 NRC**

TPO No.: T.OA01A-03. K&A No.: 2.1.25

K&A IMP: 4.2

TASK No.: S-TS-006, Ensure compliance with all Tech Spec LCOs.

TRAINEE: _____ SRO

EVALUATOR: _____ DATE: _____

The Trainee: PASSED _____ this JPM. TIME STARTED: _____

FAILED _____ TIME FINISHED: _____

JPM TIME: _____ MINUTES

CRITICAL ELEMENTS: **(*) 3, 4, 5** COMPLETION TIME: **15 MINUTES**

CRITICAL TIME: **N/A** ALTERNATE PATH: YES

EVALUATION METHOD:
X PERFORM
___ SIMULATE

LOCATION:
___ IN PLANT
X SIMULATOR
___ CONTROL ROOM

GENERAL REFERENCES:

1. 0BwOA ELEC-1 ABNORMAL GRID CONDITIONS rev. 8.
2. Technical Specifications and Bases.

MATERIALS:

1. 0BwOA ELEC-1 Rev. 8.
2. Calculator.
3. Technical Specifications and Bases.

TASK STANDARDS:

1. Determine operability status of both units' offsite circuits.

TASK CONDITIONS:

1. You are are the Unit One Unit Supervisor.
2. Both units are at 100% power in a normal electrical lineup.
3. The State Estimator alarm is operable and indicates a potential degraded grid condition based on a Braidwood Unit Two trip.
4. The unit NSOs provide the following indication readings to you:

   - State Estimator predicted voltage is 343.8 KV for BOTH units
   - Bus 143 1EI-AP055 indicates 4280 Volts
   - Bus 143 1II-AP051 and 1II-AP194 indicate 700 amps
   - Bus 144 1EI-AP087 indicates 4280 Volts
   - Bus 144 1II-AP083 and 1II-AP198 indicate 700 amps
   - Bus 243 2EI-AP055 indicates 4350 Volts
   - Bus 243 2IIAP051 and 2II-AP194 indicate 650 amps
   - Bus 244 2EI-AP087 indicates 4350 Volts
   - Bus 244 2II-AP083 and 2II-AP198 indicate 650 amps

INITIATING CUES:

1. Implement 0BwOA ELEC-1 and determine the operability status of BOTH unit offsite circuits.

RECORD START TIME _____

NOTE: Ensure examinee has access to a calculator and that the Technical Specifications and Bases are available.

	PERFORMANCE STEP	STANDARD	Circle applicable
1.	Obtain copy of 0BwOA ELEC-1 **CUE: Give student procedure.**	Obtain and review procedure:	SAT UNSAT N/A **Comments:**
2.	Determine Type of State Estimator Alarm • Alarm Operable (from task conditions) • Predicted grid voltage (from task conditions) • Abnormal grid: predicted (from task conditions) • Predicted due to a Braidwood Unit trip (from task conditions) NOTE: The examinee enters the information into the blanks provided in the procedure and performs the calculations per procedure.	Determine Type of State Estimator Alarm: • State Estimator - OPERABLE • Record State Estimator actual/predicted grid voltage: • Unit 1: 343.8 KV • Unit 2: 343.8 KV • Abnormal grid – PREDICTED CONDITION • Abnormal grid predicted due to BRAIDWOOD UNIT TRIP	SAT UNSAT N/A **Comments:**
***3.**	**Check 4KV Non-ESF Loading (goes to Attachment A)**	Check 4KV Non-ESF Loading (goes to **Attachment A**): • CALCULATE Unit 1 4 KV Non-ESF Bus Loading: • Bus 143 loading: 0.00173 x 4280 V x 700 amps = **5183 ± 1 Kva**. • Bus 144 loading: 0.00173 x 4280 V x 700 amps = **5183 ± 1 Kva**. • CALCULATE Unit 2 4 KV Non-ESF Bus Loading • Bus 243 loading: 0.00173 x 4350 V x 650 amps = **4892 ± 1 Kva** • Bus 244 loading: 0.00173 x 4350 V x 650 amps = **4892 ± 1 Kv**	SAT UNSAT N/A **Comments:**

***4.**	**Determine Minimum Switchyard Voltage.**	Determine Minimum Switchyard Voltage: • Record Unit 1 minimum switchyard voltage (given that both units are in normal electrical lineup so dual SAT operation applies) per Figure 0BwOA ELEC-1-1: **344 KV (range of 343.9 to 344.1 KV acceptable)** • Record Unit 2 minimum switchyard voltage (given that both units are in normal electrical lineup so dual SAT operation applies) per Figure 0BwOA ELEC-1-1: **343.4 (range of 343.2 to 343.5 acceptable**. • Records same values on page 5 (step 2b) main body of procedure.	SAT UNSAT N/A **Comments:**
***5.**	**Determine if minimum required switchyard voltage is greater than state estimator predicted** **NOTE: provide candidate with access to Technical Specifications and Bases.**	DETERMINE if minimum required switchyard voltage is greater than state estimator predicted:: • **Identifies that Unit 1 minimum required switchyard voltage IS GREATER THAN STATE ESTIMATOR PREDICTED THEREFORE UNIT 1 OFFSITE CIRCUITS MUST BE DECLARED INOPERABLE.** • **Identifies that Unit 2 minimum required switchyard voltage IS LESS THAN STATE ESTIMATOR PREDICTED THEREFORE UNIT 2 OFFSITE CIRCUITS ARE OPERABLE.** • **IDENTIFIES THAT 1BwOL 3.8.1, LCOAR AC SOURCES OPERATING TECH SPEC 3.8.1 must be entered.** • **IDENTIFIES THAT 2BwOL 3.8.1, LCOAR AC SOURCES OPERATING TECH SPEC 3.8.1 must be entered (for Unit 1 SATs inoperable as RESERVE for Unit 2).**	SAT UNSAT N/A **Comments:**

CUE: THIS COMPLETES THIS JPM.

RECORD STOP TIME _____

COMMENTS:

SIMULATOR SETUP INSTRUCTIONS

JPM NO: SIM-408P

REQUIRED SIMULATOR MODE (S): Any 100% power IC.

MALFUNCTION #'S:

N/A Technical Data provided in Cue Sheet.

COMMENTS:

A. PURPOSE

This procedure provides actions required during predicted or actual abnormal grid conditions.

B. SYMPTOMS OR ENTRY CONDITIONS

1) This procedure should be entered if the Station is notified that the State Estimator alarm indicates:

   - o Potential degraded grid conditions.
   - o Actual degraded grid condition.

2) This procedure should be entered if the station is notified that the State Estimator is inoperable.

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

****
* NOTE *
* With this procedure in effect, the *
* Emergency Director shall: *
* *
* • Evaluate for Emergency Plan *
* conditions *
* • Perform a risk assessment *
****

****
* NOTE *
* If the SWYD Ring Bus is split, *
* predicted voltages may differ *
* between units. This may result in *
* different operability and required *
* actions. *
****

1 DETERMINE TYPE OF STATE ESTIMATOR ALARM:

a. State Estimator - OPERABLE

a. Perform the following:

1) Request NDO provide actual and predicted Braidwood SWYD voltage from offline studies.

2) Limit production risk activities.

3) Check ring busses intact.

4) Maximize DG availability.

5) Perform risk assessment for work in progress.

6) Cancel or reschedule plant work as appropriate.

7) Initiate restoration of components, systems, and protective functions as appropriate.

Step continued on next page

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

Step 1 (continued)

8) Contact Electric Operations/NDO for grid updates ONCE PER HOUR.

9) Evaluate operability of offsite power sources using input from:

   o NDO
   o PED
   o TSO

10) Initiate AC power availability surveillances:

   - 1BwOSR 3.8.1.1, OFFSITE AC POWER AVAILABILITY SURVEILLANCE
   - 2BwOSR 3.8.1.1, OFFSITE AC POWER AVAILABILITY SURVEILLANCE

11) <u>WHEN</u> actual and predicted SWYD voltage value is provided by the NDO, **GO TO** Step 1b.

b. Record State Estimator actual/predicted grid voltage:

   - Unit 1 _____ kv
   - Unit 2 _____ kv

c. Abnormal grid - <u>PREDICTED CONDITION</u>

c. **GO TO** Step 2 (Page 5).

Step continued on next page

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
Step 1 (continued)		
d.	Abnormal grid predicted due to - BRAIDWOOD UNIT TRIP	d. Perform the following: 1) Check ring buses intact. 2) Maximize availability of DG(s) for required ESF Bus(es). 3) Limit production risk activities. 4) Perform a risk assessment for work in progress. 5) Contact Electric Operations/NDO for grid updates ONCE PER HOUR. 6) **GO TO** Step 3 (Page 8).

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

2 CHECK 4KV NON-ESF LOADING:

a. Calculate minimum required switchyard voltage for 4kv Non-ESF bus loading per - ATTACHMENT A (Page 9)

b. Record minimum required switchyard voltage calculated per ATTACHMENT A, Step 3 (Page 10):

- Unit 1 _____ kv
- Unit 2 _____ kv

c. Minimum required switchyard voltage (Step 2b) - GREATER THAN STATE ESTIMATOR PREDICTED (Step 1b (Page 3)):

o Unit 1
o Unit 2

c. Perform the following:

1) Check ring busses intact.

2) Maximize availability of DG(s) for required ESF Bus(es).

3) Limit production risk activities.

4) Perform a risk assessment for work in progress.

5) Exit the following LCOs if entered as a result of this procedure:

- 1BwOL 3.8.1, LCOAR AC SOURCES OPERATING TECH SPEC LCO 3.8.1
- 2BwOL 3.8.1, LCOAR AC SOURCES OPERATING TECH SPEC LCO 3.8.1

6) Contact Electric Operations/NDO for grid updates ONCE PER HOUR.

Step continued on next page

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

Step 2 (continued)

7) **GO TO** Step 3 (Page 8).

d. Declare the affected qualified offsite circuits inoperable:

- o Modes 1 thru 4:
  - 1BwOL 3.8.1, LCOAR AC SOURCES OPERATING TECH SPEC LCO 3.8.1
  - 2BwOL 3.8.1, LCOAR AC SOURCES OPERATING TECH SPEC LCO 3.8.1
- o Modes 5 and 6:
  - 1BwOL 3.8.2, LCOAR AC SOURCES SHUTDOWN TECH SPEC LCO 3.8.2
  - 2BwOL 3.8.2, LCOAR AC SOURCES SHUTDOWN TECH SPEC LCO 3.8.2

e. Perform the following within 1 HOUR:

- 1BwOSR 3.8.1.1, OFFSITE AC POWER AVAILABIITY WEEKLY SURVEILLANCE
- 2BwOSR 3.8.1.1, OFFSITE AC POWER AVAILABIITY WEEKLY SURVEILLANCE

Step continued on next page

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
Step 2 (continued)		
f. Perform the following:		
1) Check ring busses intact.		1) Attempt to restore ring bus.
2) Maximize availability of DG(s) for required ESF Bus(es).		
3) Limit production risk activities.		
4) Perform a risk assessment for work in progress.		
g. Consider shutting down unnecessary 4kv Non-ESF loads: o CW Pumps(S) o WS Pump(s) o VA Chiller(s) o VS Chiller(s) o Non-essential building feeds.		
h. Consider balancing 4kv Non-ESF loads between units: o WS Pump(s) o SAC(s) o Common electrical buses		
i. Transformer loading - ADJUSTED		i. Perform the following: 1) Contact Reg Assurance to determine if NOED required. 2) **GO TO** Step 3 (Next Page).
j. **RETURN TO** Step 2a (Page 5)		

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED
3	**CHECK GRID STATUS:**	
	a. Station notified that State Estimator alarm - RESET	a. **RETURN TO** Step 1 (Page 2). WHEN the station has been notified that the State Estimator alarm has reset, **GO TO** Step 3b.
	b. Restore any loads required for normal operation	
	c. Exit the following LCOs if entered as a result of this procedure: • 1BwOL 3.8.1, LCOAR AC SOURCES OPERATING TECH SPEC LCO 3.8.1 • 2BwOL 3.8.1, LCOAR AC SOURCES OPERATING TECH SPEC LCO 3.8.1	
4	**RETURN TO PROCEDURE AND STEP IN EFFECT**	

-END-

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

ATTACHMENT A (PG 1 OF 3)
MINIMUM SWITCHYARD VOLTAGE CALCULATION

****
* NOTE *
* The highest indicating phase on the *
* voltmeter should be used in the *
* following steps. *
****

****
* NOTE *
* Use the ammeter for the source (UAT *
* or SAT) that is feeding the 4KV *
* Non-ESF Bus. *
****

1 CALCULATE UNIT 1 4KV NON-ESF BUS LOADING:

a. Bus 143 loading:

0.00173 X (_____ volts) X (_____ amps) =
(1EI-AP055) (1II-AP051 or 1II-AP194)

_____ Kva

b. Bus 144 loading:

0.00173 X (_____ volts) X (_____ amps) =
(1EI-AP087) (1II-AP083 or 1II-AP198)

_____ Kva

2 CALCULATE UNIT 2 4KV NON-ESF BUS LOADING:

a. Bus 243 loading:

0.00173 X (_____ volts) X (_____ amps) =
(2EI-AP055) (2II-AP051 or 2II-AP194)

_____ Kva

b. Bus 244 loading:

0.00173 X (_____ volts) X (_____ amps) =
(2EI-AP087) (2II-AP083 or 2II-AP198)

_____ Kva

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

ATTACHMENT A (PG 2 OF 3)
MINIMUM SWITCHYARD VOLTAGE CALCULATION

3 **DETERMINE MINIMUM SWITCHYARD VOLTAGE:**

a. Record Unit 1 minimum switchyard voltage:

- IF Unit 1 is in dual SAT operation, THEN record Unit 1 minimum switchyard voltage per Figure 0BwOA ELEC-1-1 (Page 12) using the HIGHER bus loading from ATTACHMENT A, Step 1a (Previous Page) or ATTACHMENT A, Step 1b (Previous Page):

  Unit 1 _____ Kv

- IF Unit 1 is in single SAT operation, THEN perform the following:

  a) Determine total Non-ESF bus loading (ATTACHMENT A, Step 1a (Previous Page) + ATTACHMENT A, Step 1b (Previous Page)):

  _____ Kva + _____ Kva
  (Step 1a) (Step 1b)
  = _____ Kva

  b) Record minimum switchyard voltage per Figure 0BwOA ELEC-1-2 (Page 13) using the TOTAL bus loading from the previous step:

  Unit 1 _____ Kv

Step continued on next page

STEP	ACTION/EXPECTED RESPONSE	RESPONSE NOT OBTAINED

ATTACHMENT A (PG 3 OF 3)
MINIMUM SWITCHYARD VOLTAGE CALCULATION

Step 3 (continued)

b. Record Unit 2 minimum switchyard voltage:

- IF Unit 2 is in dual SAT operation, THEN record Unit 2 minimum switchyard voltage per Figure 0BwOA ELEC-1-1 (Next Page) using the HIGHER bus loading from ATTACHMENT A, Step 2a (Page 9) or ATTACHMENT A, Step 2b (Page 9):

  Unit 2 _____ Kv

- IF Unit 2 is in single SAT operation, THEN perform the following:

  a) Determine total Non-ESF bus loading (ATTACHMENT A, Step 2a (Page 9) + ATTACHMENT A, Step 2b (Page 9)):

  _____ Kva + _____ Kva
  (Step 2a) (Step 2b)
  = _____ Kva

  b) Record minimum switchyard voltage per Figure 0BwOA ELEC-1-3 (Page 14) using the TOTAL bus loading from the previous step:

  Unit 2 _____ Kv

c. Record the values obtained in the previous steps in MAIN BODY, Step 2b (Page 5).

-END-

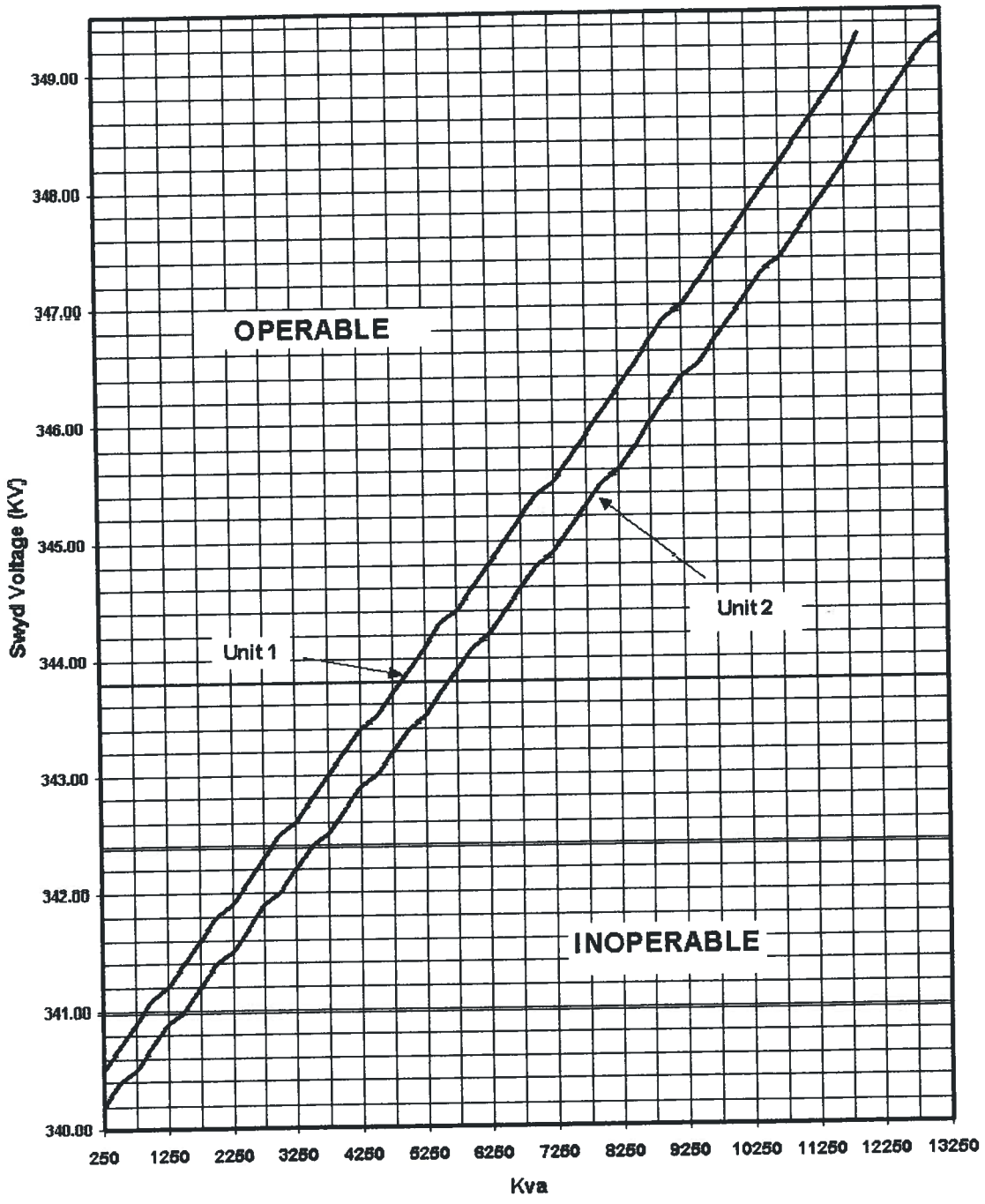

FIGURE OBwOA ELEC-1-1
SWITCHYARD VOLTAGE VS NON-ESF LOAD

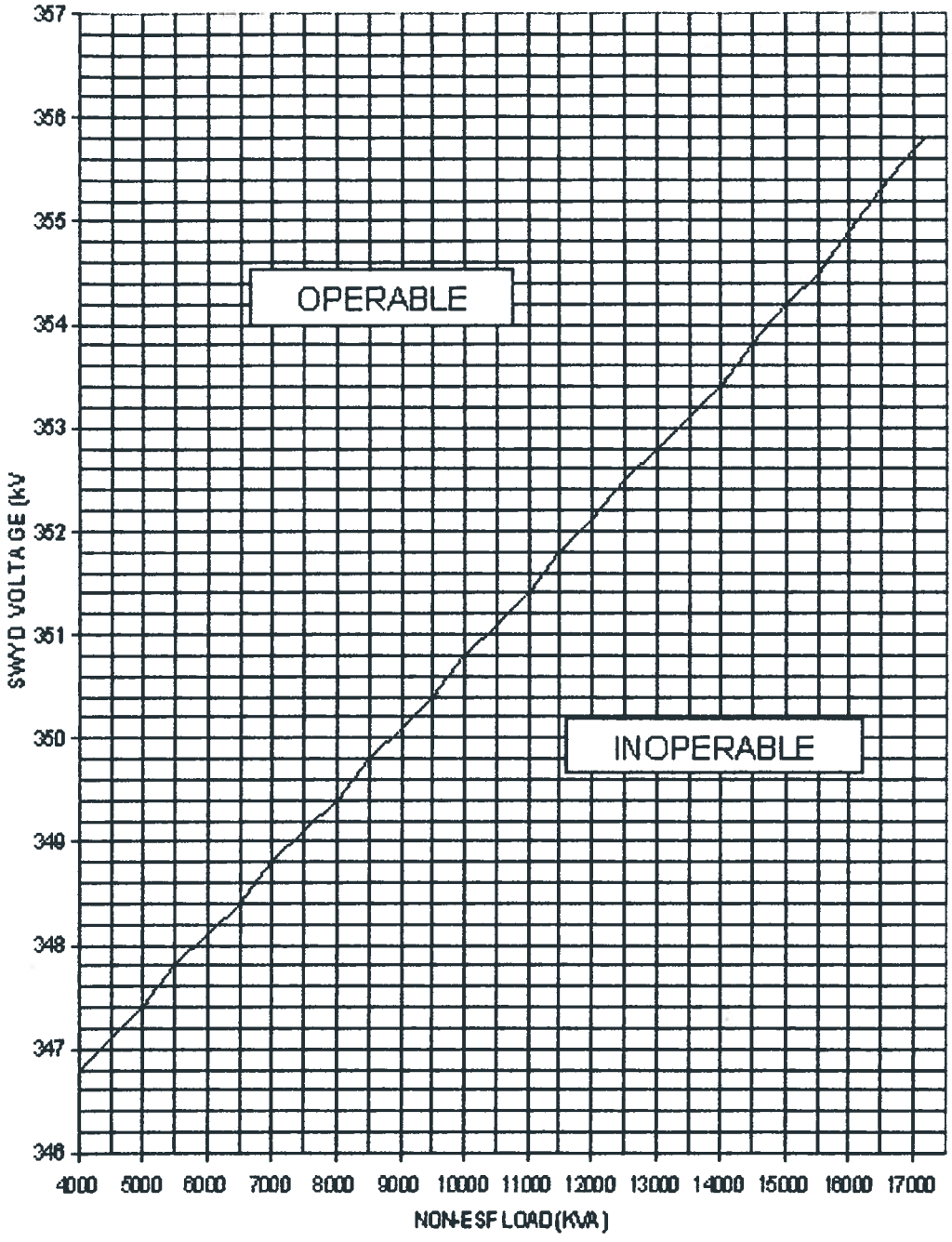

FIGURE OBwOA ELEC-1-2
SWITCHYARD VOLTAGE VS NON-ESF LOAD UNIT 1 SINGLE SAT OPERATION

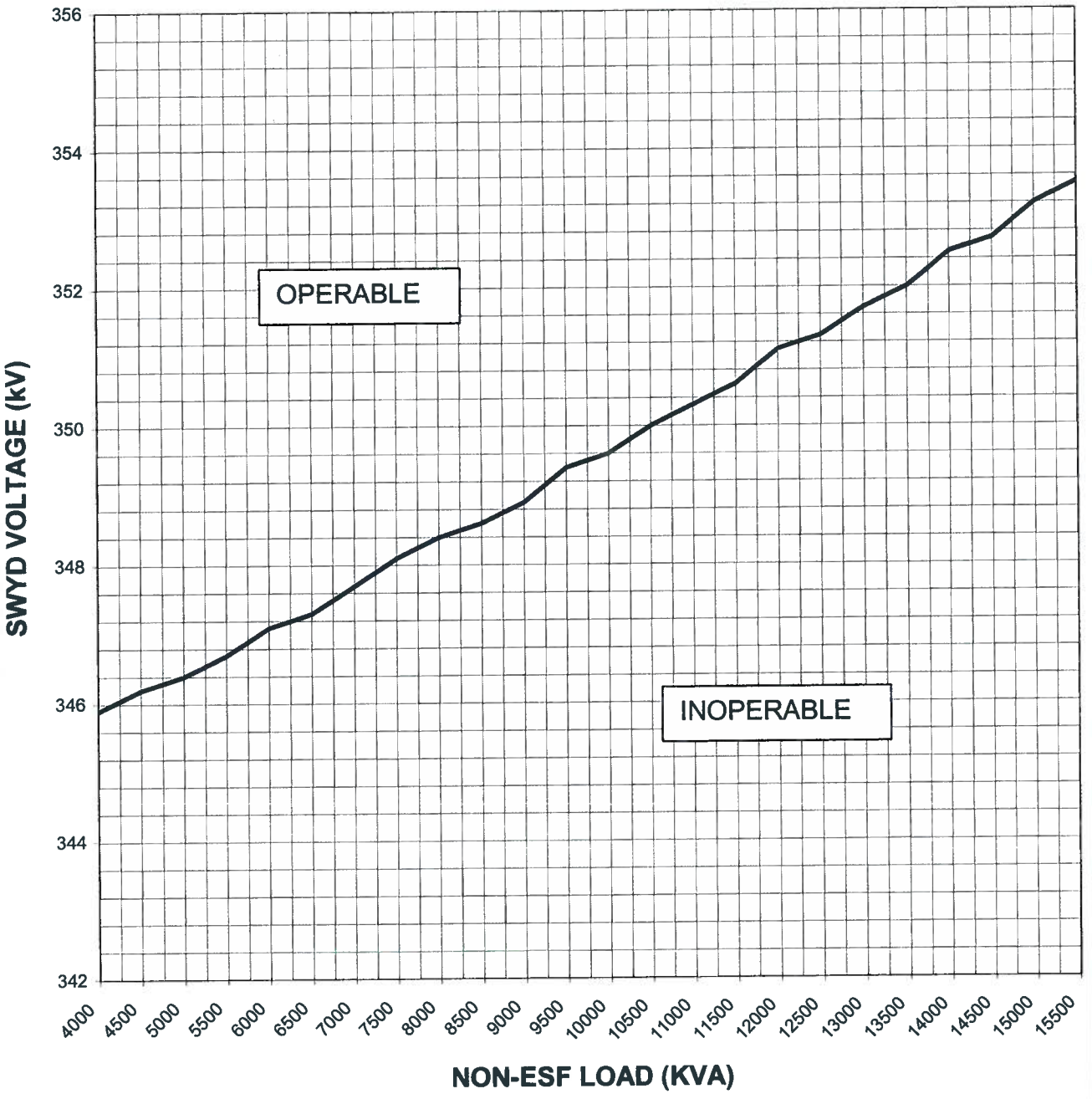

FIGURE OBwOA ELEC-1-3
SWITCHYARD VOLTAGE VS NON-ESF LOAD UNIT 2 SINGLE SAT OPERATION

TASK CONDITIONS:

INITIAL CONDITIONS:

1. Unit 1 is at 98.0% power, 1500 EFPH Cycle 17, 1040 ppm boron, with CB D at 200 steps.
2. Tave is 0.5°F greater than Tref.
3. The QNE has advised Control Bank D should be withdrawn 13 steps to the desired target for proper long term fuel burn up.
4. The RO has completed the following:
   - Calculated the expected final Tave-Tref error that will result from the rod movement.
   - Calculate reactivity change to match Tave to Tref following the manual rod withdrawal.

INITIATING CUES:

1. The RO has provided you with:
   - The Reactivity Change Determination Form, Attachment 1 of OP-AP-300-1004 for the reactivity addition following the rod movement, and
   - A copy of the procedure that will be used for the reactivity addition and asked you to approve the reactivity plan.

TASK TITLE: Review/Approve Reactivity Change

JPM No.:	**S-111A**	REV:	**2013 NRC**
TPO No.:	4.C.CV-04	K&A No.:	2.1.43
TASK No.:	R-CV-003, Perform boron dilution of the RC System	K&A IMP:	4.1/4.3

EXAMINEE: _____ RO SRO

EVALUATOR: _____ DATE:_____

The Examinee: PASSED _____ this JPM. TIME STARTED: _____

FAILED _____ TIME FINISHED:_____

JPM TIME:_____ MINUTES

CRITICAL ELEMENTS: **(*) 3,4,5,6,7** APPROX COMPLETION TIME: **15 MINUTES**

CRITICAL TIME: **N/A**

EVALUATION METHOD:
_**X**_ PERFORM
___ SIMULATE

LOCATION:
___ IN PLANT
_X_ SIMULATOR ___

GENERAL REFERENCES:

1. OP-AP-300-1004, Rev.2, Pwr Boration and Dilution Requirements
2. BwCB-1 (Various), Braidwood Curve Book
3. Operator Aid (01-18) REMA Unit 1 Reactivity Parameters

MATERIALS:

1. OP- AP-300-1004, Rev.2, Boration and Dilution Requirements (**Note: have 2 copies of Att.1**)
2. BwCB-1 (Various), Braidwood Curve Book
3. Operator Aid (01-18) REMA Unit 1 Reactivity Parameters
4. BwOP CV-5, Operation of the Reactor Makeup System in the Dilute Mode, Alternate Dilute Mode, Batch Dilution Method, rev. 25.
5. 1BwGP 100-8, Rev. 28, Generic Reactor Control Guidance, step F.10.

TASK STANDARDS:

1. Calculate the reactivity change required to match Tave to Tref.
2. Complete the Reactivity Change Determination Form.

TASK CONDITIONS:

1. Unit 1 is at 98.0% power, 1500 EFPH Cycle 17, 1040 ppm boron, with CB D at 200 steps.
2. Tave is currently 0.5°F greater than Tref.
3. The QNE has advised Control Bank D should be withdrawn 13 steps to the desired target for proper long term fuel burn up.
4. The RO has completed the following:
   - Calculated the expected final Tave-Tref error that will result from the rod movement.
   - Calculate reactivity change to match Tave to Tref following the manual rod withdrawal.

INITIATING CUES:

1. The RO has provided you with:
   - The Reactivity Change Determination Form, Attachment 1 of OP-AP-300-1004 for the reactivity addition following the rod movement, and
   - A copy of the procedure that will be used for the reactivity addition and asked you to approve the reactivity plan.

EVALUATOR NOTE: These steps may be performed in any order.

RECORD START TIME _____

Note to evaluator: Provide the first completed copy of OP-AP-300-1004 Att. 1 with the procedure. Later, when (if) examinee directs the RO to correct the calculation, provide the second copy of Att. 1.

	PERFORMANCE STEP	STANDARD	Circle applicable
1.	Refer to • OP-AP-300-1004, Rev 2, Pwr Boration and Dilution Requirements • Operator Aid, Unit 1 Reactivity Parameters **NOTE: Provide the attached Operator Aid for Unit 1 Cycle 17 1000-2000 EFPH, OP-AP-300-1004, 1BwGP 100-8 step F.10 and BwOP CV-5. Inform the examinee that the Operator Aid is current for the purposes of this calculation.**	Reviews: • OP-AP-300-1004, Rev 2, Pwr Boration and Dilution Requirements • Operator Aid, Unit 1 Reactivity Parameters	SAT UNSAT N/A **Comments:**
2.	Determine temperature change calculated for the 13 step rod withdrawal is correct.	• Determines that the ROs calculation for the change in Tave due to stepping rods out is correct.	SAT UNSAT N/A **Comments:**
***3.**	**Determine total temperature error that must be compensated** **NOTE: IF examinee fails to identify the temperature error, skip to JPM step 6.** **NOTE: It is possible the examinee will identify the procedure error first (see step 6). If this occurs, instruct the examinee to make a pen/ink correction and to continue the review of the proposed reactivity change.**	• **Determines Tave-Tref existing difference of 1.0°F plus 0.5°F after withdrawing rods 13 steps for a total 1.5 °F.**	SAT UNSAT N/A **Comments:**
***4.**	**Determine amount of boron or dilution required to match temperature**	• **From Operator aid: boration amount for a 1.0°F temperature drop is 25 to 26 gallons boric acid. The total gallons boric acid required is 1.5 times (25-26) = 37.5 to 39 gallons boric acid.**	SAT UNSAT N/A **Comments:**

***5.**	**Directs the RO to correct the calculation based on:** • **Total Tave difference of 1.5°F**	**Directs the RO to correct the calculation.** • **Determines corrected Attachment 1 calculation is acceptable.**	SAT UNSAT N/A **Comments:**
***6.**	**Identifies that the procedure the RO plans to use is incorrect.** NOTE: per step 4.4 of OP-AP-300-1004 it is the US responsibility to ensure all planned MCR borations and dilutions are performed using the governing procedure. **Cue: If examinee identified the calculation error but NOT the procedure error, provide corrected Attachment 1 VERSION 1 for approval. If candidate approves VERSION 1, this is failure criteria.** **If examinee correctly identified BOTH errors, provide corrected Attachment 1 VERSION 2 completed (boric acid calculation of 37.5-39 gallons).**	• **Identifies that BwOP CV-5 would result in dilution and directs the RO to use BwOP CV-6.**	SAT UNSAT N/A **Comments:**
***7.**	**Approves reactivity change (VERSION 2)**	• **Signs as SRO approval on Attachment 1 after BOTH the calculation error and procedure error are corrected.**	SAT UNSAT N/A **Comments:**

CUE: THIS COMPLETES THIS JPM.

RECORD STOP TIME _____
COMMENTS:

NOTE: Update JPM with current cycle reactivity numbers, or specify cycle and unit prior to use.

JPM NO: R-111A

REQUIRED SIMULATOR MODE(S): N/A

MALFUNCTION #'S: N/A

COMMENTS:

Exelon Nuclear **BRAIDWOOD STATION**	PROCEDURE **BwOP CV-5**	
	UNIT NO.	REVISION NO. **25**

PROCEDURE TITLE:

OPERATION OF THE REACTOR MAKEUP SYSTEM IN THE DILUTE MODE/ALTERNATE DILUTE MODE/BATCH DILUTION METHOD

Rev	Summary	IR# / EC# (if applicable)
25	Step reformat and clarification (F.4a-e).	PCRA 1310727-02

OPERATION OF THE REACTOR MAKEUP SYSTEM IN THE DILUTE MODE/ALTERNATE DILUTE MODE/BATCH DILUTION METHOD

A. STATEMENT OF APPLICABILITY

This procedure describes the method to be used to operate the Reactor Makeup System in the DILUTE MODE/ALTERNATE DILUTE MODE/BATCH DILUTION METHOD for Power Level Changes, Temperature Control, ΔI Control and RCS dilution in MODES 1-5.

B. REFERENCES

1. Procedures:

   a. BwOP CV-7, Operation of the Reactor Makeup System in the Auto Makeup or Manual MODE.

   b. _BwGP 100-1A1, UNIT 1/2 Main Control Board Manual/Auto Controller Setpoints.

   c. _BwOS NR-1, Power History Surveillance.

   d. BwCB-1/2, Figure 5, Temperature Coefficient vs. Moderator Temperature.

   e. BwCB-1/2, Figure 10, Differential Boron Worth at HFP ARO Equilibrium Xenon.

   f. BwCB-1/2, Figure 12, Boron Dilution Rate Nomograph.

   g. BwCB-1/2, Table 3-1, Braidwood Boration Dilution Tables.

   h. BwCB-1/2, Table 4-1, Cycle Specific Physics Data.

   i. OP-AP-300, Reactivity Management.

2. Station Drawing: M-64 (M-138), Diagram of Chemical & Volume Control and Boron Thermal Regeneration UNIT 1 and UNIT 2.

3. Tech Specs:

   a. 3.1.1

   b. 3.4.4

B. 4. Technical Requirements Manual TLCOs:

a.	3.1.a	f.	3.1.f
b.	3.1.b	g.	3.1.g
c.	3.1.c	h.	3.1.h
d.	3.1.d	i.	3.1.i
e.	3.1.e	j.	3.1.j

5. Station Commitment:

020-251-85-066, Step F.3.c. and the related CAUTION.

C. PREREQUISITES

1. The Primary Water System is available to the Boric Acid Blender.

2. Instrument Air and Electrical Power are available to the CV System.

3. At least 1 Reactor Coolant Pump must be operating with the corresponding loop stop valves open to provide coolant mixing when the Reactor Coolant Boron Concentration is being altered.

4. The UNIT is in MODES 1-5.

5. RMCS is aligned for Auto Makeup Mode per BwOP CV-7, Operation of the Reactor Makeup System in the Auto Makeup or Manual MODE.

D. PRECAUTIONS

1. During normal Reactor Operation, except during boration or dilution, the Reactor Coolant Make-up System should be operated in the AUTO MODE, with the boron concentration adjusted to equal the concentration of the Reactor Coolant System.

2. Dilution of the RCS may be performed only when the Reactor is substantially subcritical (The Total Dilution will not cause the Shutdown Margin to be exceeded), or with Control Rods above the Low Insertion Limit, when At Power.

D. 3. The effects of dilution must be observed in terms of resulting Control Rod motion or changes in Coolant Tave or Source Range Counts. STOP the operation if the expected response does not occur, and take corrective action.

4. Operation of the Reactor Makeup System in the ALT DIL MODE should be limited to approximately 1 hour, to prevent Hydrogen depletion in the RCS. The one hour limitation may be exceeded during PHYSICS TESTS. A longer Alternate Dilute may be desired to provide better reactivity control. This time should be limited as much as practical without impacting the testing.

5. The PW Predet Counter Window must be reclosed after setting the PW Flow Counter, to prevent continued flow.

6. Curves are validated within engineering tolerances for steady state conditions. Some differences between the calculated values and the actual values required will vary depending on plant conditions.

7. CVCS was designed to operate with 75 gpm letdown. CVCS letdown flow rates greater than design may limit normal dilution flow rate due to back pressure from the VCT spray nozzles.

8. Improperly high or low primary water temperature could adversely affect RCP seals. Ensure the Primary Water Heat Exchanger is maintaining 100°F - 110°F if in operation when performing large amounts of VCT makeup. High makeup flowrate will compound the problem.

9. For RCS chemistry control it is desired to perform all steady state dilutions to the top of the VCT. Transient conditions, including ramping of the Unit may require faster responses and although Chemistry would prefer dilution to the top of the VCT, dilution to the bottom or alternate dilution is at the preference of the Reactor Operator.

10. If a dilution of greater than or equal to 2,000 gallons occurs, or is expected to occur within the next 8 hours, NOTIFY Chemistry to evaluate the effects of the dilution on RCS lithium and hydrogen concentrations and to make chemical action request(s), if needed.

11. When Letdown flow is diverted to the HUTS, locally monitor the AB feed filter DP as necessary. Contact the Operations Supervisor if the DP is above 20 psid. When AB feed filter ΔP reaches 25 psid, the filter should be changed.

12. If AB feed filter ΔP reaches 40 psid while letdown flow is being diverted to the HUT, IMMEDIATELY STOP letdown flow to the HUT. The AB feed demineralizer and filter may then by bypassed at the direction of an Operations Supervisor and the activity continued.

E. LIMITATIONS AND ACTIONS

1. Reactivity Management SOS Expectations:

   a. When utilizing a second SRO as a Reactivity Manager (RM), the following expectations must be adhered to:

      - The Unit Supervisor must be aware of the reactivity plan.
      - The RM is not required to inform the Unit Supervisor of every manipulation that is within the plan. Any deviation or unexpected response MUST be communicated to the Unit Supervisor.
      - The RM provides the PEER check for reactivity manipulations.
      - The NSO and RM must verbalize the reactivity manipulation.

2. Upon VCT level decreasing to 5% (both _LT112 and _LT185), Charging Pump Suction will automatically transfer to the RWST.

3. Shutdown Margin SHALL be within the limits specified in the COLR in MODES 1-5.

4. PW Flow Deviation Alarm with PW Flow ± 8 GPM from setpoint, after 30 seconds.

   a. _CV110B, Boric Acid Blender to Chg Pps Vlv, Closes.

   b. _CV111B, Boric Acid Blender to VCT Vlv, Closes.

E. 5. VCT Pressure Guidelines and Setpoints:

a. VCT normal system pressure range is 15 psig to 65 psig.

b. Do not decrease VCT pressure below 15 psig with RCPs in operation, as this may adversely affect RCP seal operation.

c. Nominal VCT pressure should be maintained between 15 psig to 25 psig whenever a gas blanket is established.

d. Ideal VCT pressure for chemistry consideration should be maintained between 15 psig to 22 psig. This is for optimum hydrogen concentration when a hydrogen blanket has been established in order to minimize the effects of accelerated stress corrosion cracking of the RCS.

e. Over pressurizing the VCT can cause the VCT 75 psig relief to lift inducing a loss of inventory to the RHUT.

f. When establishing a nitrogen or hydrogen blanket or during degassing operations VCT pressure may be maintained at approximately 30 psig.

g. If no RCPs are in operation, then VCT pressure can be maintained between 5 psig and 10 psig. This is also desirable during degassing operations or VCT float operation.

h. Certain plant conditions may require RCS dissolved hydrogen concentration to be increased to no greater than 50 cc/Kg, to achieve an increase in RCS dissolved hydrogen, volume control tank pressure may be raised to approximately 30 psig.

F. MAIN BODY

1. DETERMINE the desired amount of PW to be added by performing one of the following methods:

   - For MODES 1 and 2, Effects of previously performed dilutions.

   - For MODES 1 and 2, Braidwood Boration Dilution Tables (BwCB-1/2 Table 3-1):

     1) Determine the desired RCS temperature change based on Auctioneered Hi T_{avg}/T_{ref} error from: _TR-412, _TI-412, _TI-422, _TI-432, _TI-442, T0499, T0496 or other appropriate indications.

     2) Determine "Previous Cumulative EFPH" from _BwOS NR-1, Power History Surveillance step F.3.

     3) Determine Isothermal Temperature Coefficient (ITC) from BwCB-1/2 Fig 5.

     4) Determine the required reactivity change ($\Delta\rho$) in PCM by the following:

        $\Delta\rho$ = ITC * temperature change

     5) Determine Differential Boron Worth (DBW) from BwCB-1/2 Fig 10.

     6) Determine the required RCS Critical Boron (C_B) concentration change in PPM by the following:

        ΔC_B = $\Delta\rho$ / DBW

     7) Determine the current RCS boron concentration from the most recent representative sample.

     8) Determine the total amount of dilution required to accomplish the desired RCS temperature change from BwCB-1/2 Table 3-1 using the appropriate RCS temperature and boron concentration.

F. 1. ○ For Modes 3 through 5, Braidwood Boration Dilution Tables (BwCB-1/2 Table 3-1):

1) Determine the current RCS boron concentration from the most recent representative sample.

2) Determine the total amount of dilution required to accomplish the desired RCS boron concentration change from BwCB-1/2 Table 3-1 using the appropriate RCS temperature and boron concentration.

3) For expected changes in RCS Boron concentration of greater than 200 ppm, PERFORM the following:

a) Reduce the dilution to 80% of the total number of gallons calculated.

b) WAIT for a period of 2 hours for complete mixing to occur.

c) START the RCS sample purge and maintain for 1 hour.

d) NOTIFY Chemistry Department to determine RCS Boron concentration.

e) RECALCULATE the remaining dilution required per step F.1.

○ Attachment 1, ReMA Form of procedure OP-AP-300-1003, PWR REACTIVITY MANEUVER.

○ _BwGP 100-4T2, LOAD SWING INSTRUCTION SHEET.

○ Operator Aid, OP-AA-115-101.

NOTE
The Reactivity Change Determination Form is not required if a ReMA, Op Aid, Load Swing Instruction Sheet, or similar type of prepared reactivity plan is used per OP-AP-300-1004.

2. If required, COMPLETE Attachment 1, Reactivity Change Determination Form of procedure OP-AP-300-1004, PWR BORATION AND DILUTION REQUIREMENTS.

*** CAUTION**

The PREDET Counter Window must be closed to prevent continued flow.

CAUTION

Primary water flowrates are inaccurate if flowrate is ≤ 32 gpm. If the desired flowrate is less than 32 gpm, the BATCH dilution method should be utilized.

NOTE

Steps F.3 dilutes using the AUTOMATIC functions. When performing a dilution of ≥ 300 gallons, the automatic functions should be used.
Step F.4. dilutes using the BATCH dilution method.

NOTE

If Reactor Power or Tave makes an unexpected change, the Control Rods move in an unexpected direction, or the Rod Insertion Limit is reached, the dilution must be stopped IMMEDIATELY.

NOTE

If letdown flow is directed to the VCT, normal dilution flow rate is limited by system back pressure. If the desired PW flow rate is >80 gpm, it may be necessary to direct a portion of letdown flow to the HUTs to prevent a PW Flow Deviation Alarm.

F. 3. DILUTE/ALT DILUTE in automatic by performing the following:

a. DETERMINE desired PW flow rate.

b. ADJUST the Setpoint on _FK-111, PW/Total Flow Cont Pot, to the value corresponding to the desired PW flow rate.

*F. 3. c. SET _FY-0111, Primary Water Control Predet Counter as follows:

1) DEPRESS and HOLD the RESET pushbutton WHILE opening the setpoint window.

2) SET the thumbwheels to the desired volume (right most digit is gallons).

3) WHILE holding the RESET pushbutton DEPRESSED, CLOSE the setpoint window.

d. PLACE the MAKEUP CONT Switch in the STOP position.

e. PLACE the MODE SELECT Switch in the DIL Position, for normal dilution or ALT DIL Position for alternate dilution.

f. PLACE the MAKEUP CONT Switch to the START position to commence the dilution.

g. VERIFY that the following occurs:

- _CV111B, Boric Acid Blender to VCT Vlv, OPENS.
- _CV111A, PW Boric Acid Blender Vlv, MODULATES OPEN.
- _CV110B, Boric Acid Blender to Chg Pps Vlv, OPENS (in the ALT DIL MODE only).
- 0PW02PA/B, PW Makeup Pp 0A/B is in OPERATION.
- Proper PW/Total Flow on _FR-110, Rx Makeup Flow recorder.

F. 3. h. CONTROL Volume Control Tank level by one of the following methods:

- ○ VERIFY/ADJUST automatic control of M/A station _LK-112, VCT Lvl Cont _CV112A, setpoint by performing the following:

  a) VERIFY/PLACE M/A station _LK-112, VCT Lvl Cont _CV112A, in AUTO.

  b) VERIFY/ADJUST the M/A station setpoint on _LK-112, VCT Lvl Cont _CV112A, to the desired value.

- ○ MANUALLY ADJUST _LK-112, VCT Lvl Cont _CV112A, by performing the following:

  a) PLACE M/A station on _LK-112, VCT Lvl Cont _CV112A, in MANUAL.

  b) DEPRESS the RAISE PUSHBUTTON on _LK-112, VCT Lvl Cont _CV112A, to the desired demand.

i. WHEN the desired amount of dilution has been achieved, PLACE the MAKE-UP CONT Switch to the STOP position.

j. VERIFY the following actions have occurred:

- ● VERIFY/CLOSE, _CV111A, PW to Boric Acid Blender Vlv.
- ● VERIFY/CLOSE, _CV111B, Boric Acid Blender to VCT Vlv.
- ● VERIFY/CLOSE, _CV110B, Boric Acid Blender to Chg Pps Vlv.
- ○ VERIFY/STOP 0PW02PA/B, PW Makeup Pp 0A/B, if started during the performance of this procedure.

k. GO TO step F.5.

F. 4. For BATCH DILUTION METHOD perform the following (otherwise N/A):

a. CONTROL Volume Control Tank level by one of the following methods:

- VERIFY/ADJUST automatic control of M/A station _LK-112, VCT Lvl Cont _CV112A, setpoint by performing the following:

  a) VERIFY/PLACE M/A station _LK-112, VCT Lvl Cont _CV112A, in AUTO.

  b) VERIFY/ADJUST the M/A station setpoint _LK-112, VCT Lvl Cont _CV112A, to the desired value and adjust as necessary throughout the evolution.

- MANUALLY ADJUST _LK-112, VCT Lvl Cont _CV112A, by performing the following:

  a) PLACE M/A station on _LK-112, VCT Lvl Cont _CV112A, in MANUAL.

  b) DEPRESS the RAISE PUSHBUTTON on _LK-112, VCT Lvl Cont _CV112A, to the desired demand and adjust as necessary throughout the evolution.

b. IF desired, PERFORM the following to RESET PW Total Flow Totalizer to ZERO:

1) DEPRESS and HOLD the RESET pushbutton.

2) VERIFY PW Total Flow Totalizer resets to ZERO.

3) RELEASE the RESET pushbutton.

c. IF desired to dilute using the upper nozzle of the VCT, THEN OPEN _CV111B, Boric Acid Blender to VCT.

d. IF desired to dilute using the outlet of the VCT, THEN OPEN _CV110B, Boric Acid Blender to Chg Pps Vlv.

e. OPEN _CV111A, PW to Boric Acid Blender Vlv.

f. WHEN the desired amount of Primary Water has been added, CLOSE _CV111A, PW to Boric Acid Blender Vlv.

g. VERIFY/CLOSE _CV110B, Boric Acid Blender to Chg Pps Vlv.

h. VERIFY/CLOSE _CV111B, Boric Acid Blender to VCT.

F. 4. i. VERIFY/PLACE the following valves in the AUTO position:

- _CV111A, PW to Boric Acid Blender Vlv.
- _CV111B, Boric Acid Blender to VCT Vlv.
- _CV110B, Boric Acid Blender to Chg Pps Vlv.

5. If desired, VERIFY/RESTORE _LK-112 to AUTO by performing the following:

a. VERIFY/VCT level or pressure is at the desired value.

b. VERIFY/DEPRESS the LOWER PUSHBUTTON ON _LK-112, VCT Lvl Cont _CV112A, to 0 demand. (Only required if manual level control was selected.)

c. VERIFY/PLACE M/A station _LK-112, VCT Lvl Cont _CV112A, in AUTO.

d. VERIFY/ADJUST _LK-112, VCT Lvl Cont _CV112A to the desired corresponding level setpoint.

e. VERIFY/PLACE C/S for _CV112A in AUTO at _PM05J.

6. IF desired, PERFORM the following to RESET PW Total Flow Totalizer to ZERO:

a. DEPRESS and HOLD the RESET pushbutton.

b. VERIFY PW Total Flow Totalizer resets to ZERO.

c. RELEASE the RESET pushbutton.

7. MONITOR the following as appropriate.

- Reactor Power
- T_{ave}
- Control Rod position
- SR count rate

F. 8. If desired, RETURN the Reactor Makeup System to AUTO as follows:

a. If necessary, DETERMINE the existing RCS Boron Concentration from the Chemistry Department.

NOTE
When the MODE SELECT Switch is in AUTO, an internal Setpoint in the Process Racks is used to cause _FK-111 to control total makeup flow at 120 gpm. The potentiometer for _FK-111 is not used in this mode.

b. DETERMINE the desired Boric Acid Flow Rate from BwCB-1/2 Figure 16, Braidwood Blended Flow Table.

c. SET _FK-110, Boric Acid Flow to Blender, to the value corresponding to the desired flow rate and VERIFY that the controller is in AUTO.

d. VERIFY/PLACE the following valves in the AUTO position:

- _CV111A, PW to Boric Acid Blender Vlv.
- _CV111B, Boric Acid Blender to VCT Vlv.
- _CV110A, VA to Blender Vlv.
- _CV110B, Boric Acid Blender to Chg Pps Vlv.

e. VERIFY that _AB03P, Boric Acid Xfer Pp C/S is NOT in the PULL OUT position.

NOTE
A Unit Makeup will Auto start the 0A PW Pump while a Unit 2 Makeup will Auto start the 0B PW Pump.

f. VERIFY that 0PW02PA/PB, PW Pump 0A/B Pp C/S for the affected unit is NOT in the PULL OUT position.

g. PLACE the MAKEUP CONT Switch in the STOP position.

h. PLACE the MODE SELECT Switch in the AUTO position.

i. PLACE the MAKEUP CONT Switch in the START position.

F. 9. IF RCS Boron Concentration was changed by greater than 20 ppm, equalize Boron Concentration between the Pressurizer and the loops, OPEN the Pressurizer Spray Valves by either (otherwise N/A):

- PLACE B/U Htr Grps A/B/D Contactor CONTROL Switch to the ON position, at _PM05J.

- IF the RCS is water solid, OPEN _RY455B/C, Pressurizer Spray Valve, in manual.

10. IF RCS Boron Concentration was changed by greater than 20 ppm, perform the following (otherwise N/A):

a. NOTIFY the Chemistry Department to sample the following after approximately 1 hour:

- The Reactor Coolant System

- The Pressurizer

b. When the RCS and Pressurizer Boron Concentrations are within 20 ppm of each other, PERFORM the following:

1) PLACE B/U Htrs Grp A/B/D Contactor CONTROL Switch to the desired position.

2) VERIFY that _RY455B/C, Pressurizer Spray Valve, is in the proper position.

~~PWR BORATION AND DILUTION REQUIRMENTS~~

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~~1.PURPOSE~~

~~1.1.The purpose of this T&RM is to define responsibilities and provide guidance for PWR boration and dilution evolutions.~~

~~2.TERMS AND DEFINITIONS~~

~~2.1.**Approved (Governing) Procedure:** as used in this document, refers to a procedure approved for use at the station, or to a document whose generation is described in and directed by a procedure approved for use at the station.~~

~~2.2.**Licensed Operator:** is synonymous with Reactor operator (RO), Senior Reactor Operator (SRO), or Nuclear Station Operator (NSO).~~

~~2.3.**Steady-State:** Reactivity Core Characteristics that are stable and behaving as expected per the core burn-up plot with stable Xenon conditions.~~

~~2.4.**Non-Transient Conditions:** Operations within normal station administrative parameters and guidance.~~

~~2.5.**Deboration**: Removal of Boric Acid from the letdown fluid by deborating demineralizers, the effluent of which is returned to the RCS. For the intent of this procedure is synonymous with Dilution.~~

~~3.RESPONSIBILITIES~~

~~3.1.Operations is responsible for all Boration and Dilutions of the Reactor Coolant System.~~

~~4.MAIN BODY~~

~~4.1.Operations shall **PERFORM** borations and dilutions in a deliberate, carefully controlled manner while constantly monitoring nuclear instrumentation and redundant indications of reactor power level, neutron flux, and coolant temperature (SOER 96-02).~~

~~4.2.The effects of boration or dilution must be observed in terms of resulting Control Rod motion, changes in Coolant Tave or Source Range Counts or change in Heatup/Cooldown Rate. **STOP** the operation if the expected response does not occur and take corrective action.~~

~~4.3.Operations shall **PERFORM** peer checking of all Main Control Room, MCR, non-transient boration and dilution evolutions. When utilizing a second SRO to support reactivity management functions related to the primary (Primary SRO), the following expectations must be adhered to:~~

~~•The Unit Supervisor must be aware of the reactivity plan.~~

~~•The Primary SRO is not required to inform the Unit Supervisor of every manipulation that is within the plan. Any deviation or unexpected response MUST be communicated to the Unit Supervisor.~~

~~•The US/Primary SRO may provide the PEER check for reactivity manipulations.~~

~~NOTE: Boration and/or dilution while **shutdown**, where adequate shutdown margin **is assured**, does **not** require the supervisor to be proximate to the reactor operator.~~

~~4.4.The Unit Supervisor shall **ENSURE** all planned MCR borations and dilutions are performed by the Licensed Operator in accordance with the governing procedure or Operator Aid. In plant activities affecting reactivity equipment shall be directed by a licensed operator.~~

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~~NOTE: If a ReMA was developed for a planned Reactivity Change, Attachment 1, Reactivity Change Determination Form is not required.~~

~~4.5.Attachment 1, Reactivity Change Determination Form, shall be used:~~

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~~•To ensure proper Technical Human Performance during reactivity maneuver planning.~~

~~•For reactivity changes that do **not** involve planned turbine load changes.~~

~~•To document each Reactivity manipulation **OR**, an entire shift of Reactivity manipulations during steady-state conditions as determined by the SRO.~~

~~•Alone or in conjunction with a ReMA per Shift Manager discretion.~~

~~4.5.1.Completed forms shall be forwarded to the Shift Manager.~~

~~4.6. All Reactivity manipulations shall be documented in the Unit Operator Logs.~~

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~~5.**DOCUMENTATION** – None~~

~~6.**REFERENCES**~~

~~6.1.INPO SOER 96-02, "Design and Operating Considerations for Reactor Cores"~~

~~7.~~ ~~ATTACHMENTS~~

~~7.1. Attachment 1 – Reactivity Change Determination Form~~**ATTACHMENT 1**
REACTIVITY CHANGE DETERMINATION FORM

Station: **Braidwood** **Unit:** **1** 2 **Time:** **Now** **Date:** **Today**

Desired change:
(Parameter, Magnitude, and Direction: Reactor Power, Rod Position, RCS Temp, Delta I, etc.)

(Withdraw control bank D 13 steps per QNE for core burnup). Compensate for rod withdrawal to match Tave to Tref.

Reason for Change:
(Temperature control, flux control, fuel burn up)

Temperature Control

What is the method and amount required for the reactivity change?
(Bleed Tank Volume, Gallons of Dilution/Boration/Blended Flow, Rod Insertion/Rod Withdrawal steps/percent)

boration of 26 gallons per BwOP CV-5

Inputs:
(ReMA Thumbrules, ReMA maneuver guidance, Curve Book Figure/Table, Computer based trend plot, RCS Cb, EFPD – Preparer and Reviewer should use independent inputs when possible)

Approved operator aid for current cycle and EFPH

Calculation of change:
(E.G. Bwd/Byr: ReMA Thumbrule identifies 20 gallons BA = 1.0°F RCS temp reduction. *Desired change* = 0.5°F drop. *Calculation of change:* (20 gal/1.0°F) * 0.5°F = 10 gal., previously used borations and dilutions)
(TMI: Procedure 1102-4 Power Operations Fig. 1, Volume of Deminerlized Water for 1% Rod Insertion)

(13 steps)($1^{o}F$/13 steps) = $1^{o}F$ Tave rise

$$\frac{(26\ \text{gallons})}{1^{o}F} \times 1^{o}F = 26\ \text{gallons to match Tave to Tref}$$

JN	***SB***	
Preparer	**Reviewer**	**Approver**

(RO) (RO/SRO) (SRO)

Shift Manager Notified: Yes No

~~PWR BORATION AND DILUTION REQUIRMENTS~~

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~~1.PURPOSE~~

~~1.1.The purpose of this T&RM is to define responsibilities and provide guidance for PWR boration and dilution evolutions.~~

~~2.TERMS AND DEFINITIONS~~

~~2.1.**Approved (Governing) Procedure:** as used in this document, refers to a procedure approved for use at the station, or to a document whose generation is described in and directed by a procedure approved for use at the station.~~

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~~2.3.**Steady-State:** Reactivity Core Characteristics that are stable and behaving as expected per the core burn-up plot with stable Xenon conditions.~~

~~2.4.**Non-Transient Conditions:** Operations within normal station administrative parameters and guidance.~~

~~2.5.**Deboration**: Removal of Boric Acid from the letdown fluid by deborating demineralizers, the effluent of which is returned to the RCS. For the intent of this procedure is synonymous with Dilution.~~

~~3.RESPONSIBILITIES~~

~~3.1.Operations is responsible for all Boration and Dilutions of the Reactor Coolant System.~~

~~4.MAIN BODY~~

~~4.1.Operations shall **PERFORM** borations and dilutions in a deliberate, carefully controlled manner while constantly monitoring nuclear instrumentation and redundant indications of reactor power level, neutron flux, and coolant temperature (SOER 96-02).~~

~~4.2.The effects of boration or dilution must be observed in terms of resulting Control Rod motion, changes in Coolant Tave or Source Range Counts or change in Heatup/Cooldown Rate. **STOP** the operation if the expected response does not occur and take corrective action.~~

~~4.3.Operations shall **PERFORM** peer checking of all Main Control Room, MCR, non-transient boration and dilution evolutions. When utilizing a second SRO to support reactivity management functions related to the primary (Primary SRO), the following expectations must be adhered to:~~

~~•The Unit Supervisor must be aware of the reactivity plan.~~

~~•The Primary SRO is not required to inform the Unit Supervisor of every manipulation that is within the plan. Any deviation or unexpected response MUST be communicated to the Unit Supervisor.~~

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~~NOTE: Boration and/or dilution while **shutdown**, where adequate shutdown margin **is assured**, does **not** require the supervisor to be proximate to the reactor operator.~~

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~~•To ensure proper Technical Human Performance during reactivity maneuver planning.~~

~~•For reactivity changes that do **not** involve planned turbine load changes.~~

~~•To document each Reactivity manipulation **OR**, an entire shift of Reactivity manipulations during steady-state conditions as determined by the SRO.~~

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~~4.5.1.Completed forms shall be forwarded to the Shift Manager.~~

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~~5.**DOCUMENTATION** – None~~

~~6.**REFERENCES**~~

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Desired change:
(Parameter, Magnitude, and Direction: Reactor Power, Rod Position, RCS Temp, Delta I, etc.)

(Withdraw control bank D 13 steps per QNE for core burnup). Compensate for rod withdrawal to match Tave to Tref.

Reason for Change:
(Temperature control, flux control, fuel burn up)

Temperature Control

What is the method and amount required for the reactivity change?
(Bleed Tank Volume, Gallons of Dilution/Boration/Blended Flow, Rod Insertion/Rod Withdrawal steps/percent)

boration of 38 gallons per BwOP CV-5

Inputs:
(ReMA Thumbrules, ReMA maneuver guidance, Curve Book Figure/Table, Computer based trend plot, RCS Cb, EFPD – Preparer and Reviewer should use independent inputs when possible)

Approved operator aid for current cycle and EFPH

Calculation of change:
(E.G. Bwd/Byr: ReMA Thumbrule identifies 20 gallons BA = 1.0°F RCS temp reduction. *Desired change* = 0.5°F drop. *Calculation of change:* (20 gal/1.0°F) * 0.5°F = 10 gal., previously used borations and dilutions)
(TMI: Procedure 1102-4 Power Operations Fig. 1, Volume of Deminerlized Water for 1% Rod Insertion)
(13 steps)(1°F/13 steps) = 1°F Tave rise; Total error = 0.5°F (current) + 1.0°F = 1.5°F

(25 to 26 gallons) x 1.5°F = 37.5 to 39 gallons to match Tave to Tref
1°F

JN ***SB***
Preparer **Reviewer** **Approver**

(RO) (RO/SRO) (SRO)

Shift Manager Notified: Yes No

~~PWR BORATION AND DILUTION REQUIRMENTS~~

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~~NOTE: If a ReMA was developed for a planned Reactivity Change, Attachment 1, Reactivity Change Determination Form is not required.~~

~~4.5.Attachment 1, Reactivity Change Determination Form, shall be used:~~

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~~•To ensure proper Technical Human Performance during reactivity maneuver planning.~~

~~•For reactivity changes that do **not** involve planned turbine load changes.~~

~~•To document each Reactivity manipulation **OR**, an entire shift of Reactivity manipulations during steady-state conditions as determined by the SRO.~~

~~•Alone or in conjunction with a ReMA per Shift Manager discretion.~~

~~4.5.1.Completed forms shall be forwarded to the Shift Manager.~~

~~4.6. All Reactivity manipulations shall be documented in the Unit Operator Logs.~~

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~~5.**DOCUMENTATION** – None~~

~~6.**REFERENCES**~~

~~6.1.INPO SOER 96-02, "Design and Operating Considerations for Reactor Cores"~~

~~7.~~ ~~ATTACHMENTS~~

~~7.1. Attachment 1 – Reactivity Change Determination Form~~**ATTACHMENT 1**
REACTIVITY CHANGE DETERMINATION FORM

Station: **Braidwood** **Unit:** **1** 2 **Time:** **Now** **Date:** **Today**

Desired change:
(Parameter, Magnitude, and Direction: Reactor Power, Rod Position, RCS Temp, Delta I, etc.)

(Withdraw control bank D 13 steps per QNE for core burnup). Compensate for rod withdrawal to match Tave to Tref.

Reason for Change:
(Temperature control, flux control, fuel burn up)

Temperature Control

What is the method and amount required for the reactivity change?
(Bleed Tank Volume, Gallons of Dilution/Boration/Blended Flow, Rod Insertion/Rod Withdrawal steps/percent)

boration of 38 gallons per BwOP CV-6

Inputs:
(ReMA Thumbrules, ReMA maneuver guidance, Curve Book Figure/Table, Computer based trend plot, RCS Cb, EFPD – Preparer and Reviewer should use independent inputs when possible)

Approved operator aid for current cycle and EFPH

Calculation of change:
(E.G. Bwd/Byr: ReMA Thumbrule identifies 20 gallons BA = 1.0°F RCS temp reduction. *Desired change* = 0.5°F drop. *Calculation of change:* (20 gal/1.0°F) * 0.5°F = 10 gal., previously used borations and dilutions)
(TMI: Procedure 1102-4 Power Operations Fig. 1, Volume of Deminerlized Water for 1% Rod Insertion)
(13 steps)(1°F/13 steps) = 1°F Tave rise; Total error = 0.5°F (current) + 1.0°F = 1.5°F

(25 to 26 gallons) x 1.5°F = 37.5 to 39 gallons to match Tave to Tref
1°F

JN	***SB***	
Preparer	**Reviewer**	**Approver**

(RO) (RO/SRO) (SRO)

Shift Manager Notified: Yes No

Exelon Nuclear **BRAIDWOOD STATION**	PROCEDURE **1BwGP 100-8**	
	UNIT NO. **1**	REVISION NO. **28**

PROCEDURE TITLE:

GENERIC REACTOR CONTROL GUIDANCE

Rev	Summary	IR# / EC# (if applicable)
27	Add Rod Step and Ramping “Hard Cards” as attachments	PCRA 1134211-20
28	Add note and new step for limiting power to ≤ 100.0% using LEFM	PCRA 1230957-41

GENERIC REACTOR CONTROL GUIDANCE

A. STATEMENT OF APPLICABILITY

This procedure establishes the guidance necessary for controlling the reactor. The guidance includes ΔI Control, Temperature Control, Full Power Maintenance, Coastdown Operation, Positive MTC Operation, Rod Control Operation during normal conditions, and Minor Load Adjustments (< 2%).

B. REFERENCES

1. Westinghouse Generic Load Follow Strategy Report. – 5.0.300.

2. Westinghouse Operating Instruction 0-5, Reduced Temperature Return to Power.

3. Westinghouse Nuclear Fuel Division, Limitations and Conditions for Westinghouse Fuel Operation.

4. Braidwood Curve Book (BwCB-1).

5. Nuclear Fuel Services Special Report PWR Axial Xenon Oscillations, dated December 1988.

6. NFM Letter: NFM-MW: 01-0166, “Validity of Loop Average Temperature”, dated May 29, 2001.

7. NFS Letter PND/056/88, Naughton to Querio, dated 8-29-88.

8 NFS Letter PSS: 98-086, Policy for Operation at Hot Full Power, from D.R. Redden to B. Wegner, dated June 25, 1998.

9. Technical Specifications:

   a. LCO 3.1.3, Moderator Temperator Coefficient (MTC).

   b. LCO 3.1.4, Rod Group Alignment Limits.

   c. LCO 3.2.3, Axial Flux Difference (AFD).

   d. LCO 3.2.4, Quadrant Power Tilt Ratio (QPTR).

10. Station Commitments:

    a. 456-200-93-04301, Step D.3.

C. PREREQUISITES

None.

D. PRECAUTIONS

1. Core control and behavior must be fully understood at all times. In the event a situation arises that is not fully understood, it is the responsibility of every member of the Control Room team to question the indication. The Shift Manager SHALL be directly involved in the resolution of the concern.

2. Prior to raising power above 50%, reasonable ΔI stability needs to exist. If ΔI has been drifting away from target excessively, power should not be raised until ΔI can be ensured to remain within BwCB-1, Figure 19 limits when the power rise is performed. Contact QNE for additional guidance.

* 3. ΔI may be extremely positive at low power levels. ΔI will be more positive the higher Control Bank D is maintained (above mid-plane). During reactor startup/power ascension (10^{-8} amps to 15% RTP) Controlling Bank (Bank C or D) must be maintained slightly above core mid-plane (115 steps) and withdrawn as power rises. Inserting/maintaining Controlling Bank (Bank C or D) below mid-plane will result in flux response converse to expected (i.e., rods out, ΔI more negative).

4. If the Nuclear Instrumentation input to the process computer is interrupted, or the process computer is rebooted, the Iodine and Xenon programs should be considered suspect. Reactor Engineering should be consulted prior to using these points. AFD cals and Power Range ACOTS are examples of activities that can interrupt the input to the process computer.

E. LIMITATIONS AND ACTIONS

1. Maintain rod position within the limits for control bank insertion, sequence, and overlap per Tech Spec LCO 3.1.6.

2. Maintain rod position within the limits for control bank withdrawal per Tech Spec LCO 3.1.3 when applicable.

3. Operate within the limits and restrictions specified for ΔI per Tech Spec LCO 3.2.3 when PDMS is inoperable.

E. 4. The following guidelines are broken into sections covering parameters that should always be maintained during steady state operation. Steady State Operation is defined as:

- ΔI within $\pm$ 3% of Target.
- Average T_{ave} within $\pm$ 4ºF of T_{ref}
- Generator online.
- No load changes in progress.

5. ΔI shall be maintained within the Admin limit specified in BwCB-1, Figure 19 by the operator during steady-state operations. If ΔI deviates outside this limit or if a ΔI oscillation occurs, immediate operator action is required to restore ΔI to within its administrative limits. This administrative limit applies regardless of whether or not PDMS is OPERABLE, but is not applicable during coastdown operations.

6. During power operation, control rods should be used mainly for ΔI control and boron concentration should be adjusted for maintaining T_{ave}. Caution should be used when CBD is below 130 steps. ΔI control is typically reduced as CBD is inserted below 130 steps until CBC reaches a bite position. If an unexpected flux profile occurs, contact Reactor Engineering.

   If control rod withdrawal limits are implemented to maintain the Moderator Temperature Coefficient (MTC) within the COLR Limits, then the control strategy should be developed based on the limits imposed.

7. Perform Section 5.c, "Bang-Bang", under the direction of a Qualified Nuclear Engineer only.

8. Average T_{ave} should be maintained within 3ºF of T_{ref} during steady state and routine operation. If a T_{ave} - T_{ref} deviation of $\geq$4ºF occurs, take action to restore Average T_{ave}. This administrative limit does not apply during coastdown if there was a cycle specific coastdown evaluation performed.

9. Coastdown occurs when the core burnup reaches a point where maximum power can no longer be maintained. To compensate for fuel depletion, load reductions or Average T_{ave} drooping are required.

10. If the Process Computer Xenon Follow program has been suspended or interrupted for any reason within the past 72 hours do not use it's output without approval from a Qualified Nuclear Engineer. The U1500 series computer points are all governed by this program. The PDMS Monitor Xe 24 Hour Trend Screen is also available.

F. MAIN BODY

0. Procedure Overview

a. The steps of this procedure are independent of each other. Perform the applicable step(s).

b. The steps of the procedure perform the following:

Step F.1: ΔI Control During Steady State Power Operation

Step F.2: ΔI Control During Power Ascension Following Startup

Step F.3: ΔI Control During Power Descension

Step F.4: ΔI Control During Xenon Oscillations

Step F.5: ΔI Control During Load Follow Operations Using the Spinning Reserve Strategy (SPINR)

Step F.6: RCS Temperature Control

Step F.7: Full Power Maintenance

Step F.8: Generic Coastdown Guidelines

Step F.9: Core Control Considerations for Operation with a Positive Moderator Temperature Coefficient (PMTC)

Step F.10: Rod Control Operation

Step F.11: Minor Load Adjustments

NOTE
Initiate boration/dilution operations early to allow sufficient time (ie., approximately 7 minutes) for the operation to take effect.

F. 1. ΔI Control During Steady State Power Operation:

It is the NSOs responsibility to ensure that ΔI is maintained near the Target Value. ΔI should be maintained within ± 3% of the Target Value.

This applies to all power levels at steady state operation. Reactor Engineering guidance, however, may be implemented prior to a measurement of ΔI for the purpose of generating new ΔI Targets. Under these situations, ΔI may be allowed to be "off" target, but within 3%, in order to position control banks at the appropriate bite position.

Maintaining ΔI near target, regardless of whether or not PDMS is OPERABLE, maintains core power distribution and the associated peaking factors in a desired condition. It is highly unlikely any PDMS Limits will be exceeded if ΔI is maintained within limits. Maintaining ΔI near target at all times helps prevent divergent power distribution oscillations during steady state and undesirable power distributions following transient conditions. Furthermore, should PDMS become INOPERABLE at any time, ΔI needs to be under control when the AFD LCO becomes applicable.

Several different factors influence power distribution and hence ΔI. The most important of these factors are listed below and should be considered when controlling ΔI.

a. Rod Position

1) In general, rod withdrawal alone causes ΔI to become more positive. Rod withdrawal, coupled with boration to maintain T_{ave}, will have an enhanced effect on ΔI.

2) In general, rod insertion alone causes ΔI to become more negative. Rod insertion, coupled with dilution to maintain T_{ave}, will have an enhanced effect on ΔI.

3) Exceptions to these rules sometimes occur when a given control bank is inserted below midcore position. In this case, further rod insertion may have a reduced effect on ΔI, and even result in ΔI becoming more positive. This is usually seen when CBD is inserted below 130 steps down to about 90 steps or until CBC reaches a bite position. Once CBC reaches a bite position, further rod insertion should once again cause ΔI to become more negative.

F. 1. b. Turbine (or Steam Dump) Power

1) A rise in turbine power causes ΔI to become more negative. A rise in turbine power coupled with rod withdrawal to maintain T_{ave}, will have a reduced effect on ΔI. In fact, the net effect may be a positive movement of ΔI. A rise in turbine power, coupled with a dilution to maintain T_{ave}, will have an enhanced effect on negative movement of ΔI.

2) A reduction in turbine power causes ΔI to become more positive. A reduction in turbine power coupled with rod insertion to maintain T_{ave}, will have a reduced effect on ΔI. In fact, the net effect may be a negative movement of ΔI. A reduction in turbine power, coupled with a boration to maintain T_{ave}, will have an enhanced effect on positive movement of ΔI.

3) The reason for these effects is that the incremental change in density of water is greater at higher temperature. These effects are greater at end of core life because MTC is more negative.

c. Temperature (Boration and Dilution)

1) A T_{ave} rise due to a dilution causes ΔI to move negative. A dilution, coupled with rod insertion to maintain T_{ave}, will have an enhanced effect on negative movement of ΔI.

2) A T_{ave} drop due to a boration causes ΔI to move positive. A boration, coupled with rod withdrawal to maintain T_{ave}, will have an enhanced effect on positive movement of ΔI.

3) The reason for these effects is that the incremental change in density of water is greater at higher temperature. These effects are greater at end of core life because MTC is more negative.

F. 1. d. Xenon Distribution

1) As ΔI is caused to move positive (through any of the above means), the neutron flux rises in the top of the core, causing a rise in Xenon burnout and a rise in Iodine production. Since the production of Xenon from Iodine is a delayed process, the initial result is a reduction of Xenon in the top of the core. This causes a further rise in power in the top of the core. At the same time, the bottom of the core is undergoing the exact opposite phenomena. The resulting effect of a rising ΔI is an initial further rise in ΔI.

As the raised Iodine concentration's production of Xenon in the top of the core catches up to the burnout and decay of Xenon, the Xenon concentration in the top of the core will begin rising again back toward its equilibrium value for the core conditions. The bottom of the core is again undergoing the exact opposite phenomena. The net result is an axial oscillation with a period of approximately 26 hours. This oscillation usually is convergent.

2) A negative movement in ΔI (through any of the above means) will result in the opposite phenomena.

e. Burnup

The beginning of life ΔI is largely dependent on the axial burnup distribution of the fuel assemblies reloaded into the core. The ΔI then usually drops early in cycle life since the Integral Fuel Burnable Absorber (IFBA) burns out heaviest in the bottom of the core. After the fuel depletion in the bottom of the core is matched by the IFBA burnup in the top of the core, ΔI will reach its minimum value for the cycle and then move positive throughout most of the remainder of the fuel cycle. Exceptions to this general rule occur when the fuel loaded into the core from the previous fuel cycle had experienced an abnormal axial burnup profile.

During coastdown, ΔI continues to move positive until end of cycle. This is because power is incrementally reduced to maintain T_{ave} while control rods are maintained nearly fully withdrawn.

The effects of the normal ΔI control methods (rod motion, turbine load changes, and boron concentration changes) vary during core life. In general, the effects of all 3 methods rises over core life because the core power distribution shifts from the middle of the core to the extreme ends at end of life. This accentuates the temperature effects between the top and bottom of the cores and it raises the differential rod worth at the nearly fully withdrawn position.

F. 1. f. Crud Induced Power Shift (CIPS)

The presence of boron-holding crud can affect the power of the afflicted assemblies and the core average ΔI.

Axial Offset Anomaly (AOA) crud is now known as Crud Induced Power Shift (CIPS). During the first third of the fuel cycle, the crud formations have not attained the critical thickness to trap boron and lithium. However, once the critical thickness is reached and boron and lithium are trapped in the crud, the boron absorbs neutrons and suppresses the neutron flux and power in the crud region. A mild case of CIPS will shift the ΔI more negative by up to 3%. Moderate to severe cases of CIPS can shift ΔI more negative by ~ 4% to over 10%. Over time and burnup, this flux suppression results in less burnup in the upper regions of the affected fuel. Left unperturbed, the boron in the CIPS crud becomes depleted (B-10 depletion) and can have a lessened effect on core power shape over time.

Boron-depleted CIPS crud can undergo a significant change from physical, chemical, or thermal perturbations. The boron in the crud, or even the crud itself, can be displaced. These perturbations result from changes to power level, RCS T_{ave}, pH or lithium concentrations, or by mechanical agitation (rod exercises or trips). If the crud structure remains intact, the return to normal full power conditions will result in fresh boron from the RCS, with little B-10 depletion, returning to the crud. This has a renewed, enhanced suppression effect on the CIPS fuel in upper core region.

If the crud structure is not preserved and the crud is physically removed from the CIPS fuel, the boron cannot quickly return and the upper portions of the CIPS fuel becomes more reactive. The net effect of the crud removal can result in a ΔI shift in the positive direction. In summary, if CIPS crud is present, the core ΔI can shift in either a more negative or more positive direction depending upon what happens to the crud.

As indicated above, the boron can be released from the CIPS crud at reduced powers. This can have a significant positive impact on the reactivity of the upper portions of the core after a power reduction. Under “moderate” CIPS and changing xenon conditions, the control rods may have insufficient worth to counteract the positive reactivity additions occurring in the upper regions of the fuel. In this case, ΔI may rise regardless of the control rod movements.

The loss of CIPS crud after a shutdown can also have positive reactivity effects on the core. Both the SDM and ECC can be affected in a non-conservative manner. Existing margins and methodologies normally provide adequate compensation for the additional positive reactivity. However, Reactor Engineering can help quantify the effects of CIPS and provide guidance on how to treat these situations on a case-by-case basis.

F. 2. ΔI Control During Power Ascension Following Startup:

a. VERIFY/PLACE Control Bank D (by boration/dilution) well above the RIL but low enough to maintain ΔI within the Tech Spec limits.

b. DETERMINE the change in boron concentration required to accomplish the desired power level change, accounting for Xenon, rod position, and Power defect (BwCB-1, Figures 2, 7, 8a, 8c, and 17a).

c. DETERMINE the number of gallons of Primary Water required to reach the new boron concentration (BwCB-1, Table 3-1).

NOTE

The dilution rate or control rod position may need to be changed periodically to maintain ΔI within the Tech Spec band about the Target/AFD Control Band.

d. INITIATE the dilution required to achieve the desired power change and yet maintain ΔI within the Tech Spec limits.

e. Once the power level is reached, ADJUST the boron concentration to compensate for Xenon building/burnout and to maintain ΔI at or near the Target/AFD Control Band Value.

F. 3. ΔI Control During Power Descension:

NOTE

Proper control of the axial power distribution during reductions in power followed by a return to full power requires more than just maintaining ΔI near the Target Value. The core average flux shape needs to maintained to prevent a ΔI oscillation after the power reduction is complete. The core average flux shape can be monitored through Computer point PDMA02, which is in terms of Axial Offset. Axial Offset can be correlated to ΔI by the following relationship:

Axial Offset = 100% * ΔI / Power (%)

Consequently, the "Target Value" for Axial Offset is a constant value and does not change with a change in power level as the ΔI Target Value does.

The insertion of Control Bank D causes the top Power Range detectors to be shadowed and may result in a lower NIS axial offset as provided by PDMA02.

For this reason, during a downpower maneuver, it is generally advantageous to control ΔI **lower** than the Target Value to be able to maintain the core average Axial Offset (Computer point PDMA02) at a nearly constant value. A general rule of thumb-rule would be to control ΔI the same amount **below** the Target Value as computer point PDMA02 rises **above** its pre-ramp value. This strategy should be pursued unless ΔI is about to exceed one of the limits specified in this procedure, at which time ΔI should be controlled to within those limits.

NOTE

Rapid power reductions or rejections may require immediate boration and Control Rod insertion in order to maintain ΔI within RAOC Limits.

a. DETERMINE the change in boron concentration required to accomplish the desired power level change, accounting for Xenon, rod position, and Power Defect (BwCB-1, Figures 2, 7, 8a, 8c, and 17a).

F. 3. b. DETERMINE the number of gallons of boric acid required to reach the new boron concentration (BwCB-1, Table 3-1).

NOTE

The boration rate or Control Rod position may need to be changed periodically to maintain ΔI within the admin band about the Target value.

c. DETERMINE and INITIATE the boration rate required to achieve the desired power change in the desired time interval and yet maintain ΔI within the admin band about the Target value (BwCB-1, Figure 19).

d. ONCE the power level is reached, ADJUST the boron concentration as necessary to maintain ΔI on the Target Value.

F. 4. ΔI Control During Xenon Oscillations:

CAUTION

One key point associated with any of these methods is to initiate all control actions early to allow sufficient time for the required boration or dilution operations. Furthermore, these methods are more tolerant of early control initiation rather than delayed action. Therefore, when in doubt, begin the control actions early. The resulting residual oscillations will usually be much less severe if you do.

a. Half - Cycle Dampening:

The half-cycle dampening method of ΔI control is more of a maintenance strategy than a control strategy. This method is based on the maintenance of the Iodine and Xenon concentrations in their equilibrium condition. This is accomplished by maintaining ΔI on or near target at all times. For those occasions when ΔI is off target, this control strategy calls for action to restore ΔI to target (See Figure 3). In general, this method can restore ΔI to its equilibrium condition slightly faster than Hook 'n Drag, but this method is more costly in terms of boric acid and primary water use.

1) MONITOR actual and target ΔI values on an hourly basis using PPC, process computer delta flux program, or some other method whenever a ΔI oscillation is in progress.

NOTE

Changing T_{ave} several degrees can also supplement the suppression of the ΔI oscillation. Reducing T_{ave} will cause ΔI to become more positive (less negative) and raising T_{ave} will cause ΔI to become more negative (less positive).

2) As ΔI reaches the Target Value and continues to move in the positive direction, TAKE MANUAL control of the rods and STEP them inward in small increments at frequent intervals to maintain ΔI on the Target Value. IF ΔI is moving in the negative direction, STEP rods outward in small increments.

CAUTION

With Rods in Manual, T_{ave} must be controlled with dilution/boration operations.

F. 4. a. 3) DILUTE/BORATE as necessary to maintain T_{ave} equal to T_{ref}.

4) ONCE Xenon has peaked (approximately 7 hours), MANUALLY ADJUST rods outward/inward in small increments at frequent intervals to maintain ΔI on the Target Value.

5) DETERMINE whether the amplitude of the negative and positive ΔI peaks are dampening. IF they are not dampening, CONTACT Reactor Engineering.

6) BORATE/DILUTE as necessary to maintain T_{ave} equal to T_{ref}.

NOTE

As the Xenon oscillation is suppressed, the frequency and/or magnitude of rod motion needed to maintain ΔI on the Target Value will drop.

7) PLACE rods in AUTO, or as determined by the Unit Supervisor, once the oscillation has been suppressed and ΔI is on the Target Value (approximately 14 hours after initial rod movement).

F. 4. b. Hook 'n Drag

The Hook 'n Drag method of ΔI control is based on the mechanics of harmonic oscillation. It is used to stress ΔI back to its target after a ΔI oscillation already exists. This is accomplished by decelerating ΔI when ΔI is already accelerating toward its target (See Figure 4). In general, this method restores ΔI to its equilibrium conditions slower than Half Cycle Dampening, but this method is much less costly in terms of boric acid and primary water use.

1) MONITOR actual and target ΔI values on an hourly basis using PPC, process computer delta flux program, or some other method whenever a ΔI oscillation is in progress.

NOTE

Changing T_{ave} several degrees can also supplement the suppression of the ΔI oscillation. Reducing T_{ave} will cause ΔI to become more positive (less negative) and raising T_{ave} will cause ΔI to become more negative (less positive).

2) AFTER ΔI rounds the top peak of the oscillation and accelerates down toward the Target Value, TAKE MANUAL control of the rods and STEP them outward in small increments at frequent intervals to slow ΔI's descent on the Target Value. IF ΔI is moving in the positive direction, STEP rods inward in small increments.

CAUTION

With rods in MANUAL, T_{ave} must be controlled with dilution/boration operations.

3) DILUTE/BORATE as necessary to maintain T_{ave} equal to T_{ref}.

4) ONCE ΔI has passed the target and shows signs of decelerating on its own (approximately 7 hours) CEASE rod motion. The use of rod motion just prior to a peak is limited to those times when ΔI would otherwise exceed an established limit.

NOTE

As the Xenon oscillation is suppressed, the frequency and/or magnitude of rod motion needed to maintain ΔI on the Target Value will reduce.

F. 4. b. 5) PLACE rods in AUTO, or as determined by the Unit Supervisor once the oscillation has been suppressed and ΔI is on the Target Value (up to 48 hours after initial rod movement).

CAUTION

Perform the following section under the direction of a Qualified Nuclear Engineer.

NOTE

The following steps suppress axial Xenon oscillations by utilizing the Bang-Bang method. This control procedure must be used judiciously, because timing is essential. Half Cycle Dampening is the preferred control method. The Bang-Bang method of control is based on the theory that during a Xenon oscillation, there are two relatively short periods of time during which a single rod control action results in simultaneous stressing of the Xenon and Iodine offsets. This behavior is predictable only during unforced oscillations.

NOTE

The Bang-Bang method can be initiated at either a positive ΔI peak or a negative ΔI peak. Perform step F.4.c.1) if performing at a positive peak and step F.4.c.2) if performing at a negative peak.

c. Use of the Bang-Bang method to control an axial Xenon oscillation.

1) Bang-Bang at a positive ΔI peak (ΔI is above target value).

a) FOLLOW the free oscillation as ΔI starts to approach its positive peak. By considering the rate of change of the ΔI slope with time, ESTIMATE when ΔI will be one hour before the peak.

NOTE

Pauses between rod motion increments should be limited to ensure the maximum effect of the dampening sequence.

NOTE

Begin this control action 10 to 15 minutes early to account for delays in changing boron concentrations. It is much better to begin this step too early than too late. It is better to not start than to start too late.

NOTE

Step F.4.c.1)c) may be skipped at the discretion of a Qualified Nuclear Engineer. It may be possible to maintain ΔI on target without performing step F.4.c.1)c) depending on the magnitude of the oscillation.

F. 4. c. 1) b) WHEN ΔI is approximately one hour before the peak, or as determined by a QNE, INSERT the control rods in 10 step increments WHILE monitoring reactor response for the desired/expected results until ΔI is at its target value (±0.25% AFD) or per the QNE. COMPENSATE for rod insertion by dilution.

c) MAINTAIN the control rod position and ALLOW ΔI to drift in the negative direction. WHEN ΔI has drifted below the target value by an amount approximately equal to the amount it was above target in step F.4 .c.1)b), ADJUST the boron concentration to WITHDRAW control rods to return ΔI to its target value.

d) MAINTAIN ΔI at its target value by movement of control rods WHILE maintaining temperature through boration or dilution as appropriate.

F. 4. c. 2) Bang-Bang at a negative ΔI peak (ΔI is below target value).

a) FOLLOW the free oscillation as ΔI starts to approach its negative peak. By considering the rate of change of the ΔI slope with time, ESTIMATE when ΔI will be one hour before the peak.

NOTE

Pauses between rod motion increments should be limited to ensure the maximum effect of the dampening sequence.

NOTE

Begin this control action 10 to 15 minutes early to account for delays in changing boron concentrations. It is much better to begin this step too early than too late. It is better to not start than to start too late.

NOTE

Step F.4.c.2)c) may be skipped at the discretion of a Qualified Nuclear Engineer. It may be possible to maintain ΔI on target without performing step F.4.c.2)c) depending on the magnitude of the oscillation.

b) WHEN ΔI is approximately one hour before the peak, or as determined by a QNE, WITHDRAW the control rods until ΔI is at its target value (±0.25% AFD) or per the QNE. COMPENSATE for rod withdrawal by boration.

c) MAINTAIN the control rod position and ALLOW ΔI to drift in the positive direction. WHEN ΔI has drifted above the target value by an amount approximately equal to the amount it was below target in step F.4.c.2)b), ADJUST the boron concentration to as needed to INSERT control rods to return ΔI to its target value.

d) MAINTAIN ΔI at its target value by movement of control rods WHILE maintaining temperature through boration or dilution as necessary.

F. 4. d. PDMS Xenon Mode:

The PDMS Xenon Mode method of ΔI control is a combination of the Hook 'n Drag and Bang-Bang methods. The Xenon Mode control method provides a method by which the spatial xenon trends can be anticipated and therefore controlled efficiently. The use of this method is predicated on the availability of an operable PDMS Monitor display. If PDMS is unavailable in the Main Control Room, a Qualified Nuclear Engineer shall access the Xenon Mode display from another available workstation (See Figure 6).

NOTE

The axes of the Xenon Mode display are reversed (negative values on the top and right sides and positive values on the bottom and left sides of the origin).

The Xenon Mode display will show the current $d(\Delta Xe)/dt$ value as a function of ΔXe as a small square with a "tail" indicating the previous 24 hours. With an undamped axial xenon oscillation occurring, the small square will move in a circle around the origin (central point) in the clockwise direction. The larger the oscillation, the larger the circle. Rod insertion has the effect of causing the current value to move vertically down and rod withdrawal has the effect of causing the current value to move vertically up on the display.

NOTE

Although rod motion can be initiated at any time within the yellow (upper right/bottom left) quadrants of the Xenon Mode display, optimal results are obtained when rod motion is initiated when the current value has left the green portion of the "Bow Tie" (the green and yellow interface).

NOTE

The PDMS displays only update once per minute. Therefore, actions should be performed in a controlled manner, allowing for the display to register feedback prior to initiating subsequent action.

F. 4. d. 1) WHEN the current value, as indicated by the small square, leaves the green portion of the "Bow Tie", PERFORM the following:

a) IF the current value is at the top of the display (negative d(ΔXe)/dt), THEN INSERT the control rods until the current value is approximately moved half-way toward the origin. Compensate for rod insertion by boron dilution.

b) IF the current value is at the bottom of the display (positive d(ΔXe)/dt), THEN WITHDRAW the control rods until the current value is approximately moved half-way toward the origin. Compensate for rod withdrawal by boration.

2) AFTER the small square traverses its arc 180° and reaches the opposite edge of the green portion of the "Bow Tie", PERFORM the following:

a) IF the current value is at the bottom of the display (positive d(ΔXe)/dt), THEN WITHDRAW the control rods until the current value is at approximately the origin. Compensate for rod withdrawal by boration.

b) IF the current value is at the top of the display (negative d(ΔXe)/dt), THEN INSERT the control rods until the current value is at approximately the origin. Compensate for rod insertion by boron dilution.

3) PLACE rods in AUTO, or as determined by the Unit Supervisor, once the oscillation has been suppressed and ΔI is on the Target Value (up to 14 hours after initial rod movement).

F. 5. ΔI Control During Load Follow Operations Using the Spinning Reserve Strategy (SPINR):

NOTE

This method minimizes boron concentration changes in order to promote rapid return to power. The following steps should be used when a rapid return to power is expected during the load follow. Normal load follow operations can be done by using the applicable portions of F.2 and F.3.

NOTE

Maintaining ΔI more negative than the target following the power descension will provide additional reactivity from rods to facilitate a rapid return to power when desired.

a. For a power descension, ALLOW rods to insert as Turbine Power drops to force ΔI more negative than the Target.

b. ONCE the desired power is reached, ADJUST the boron concentration as necessary to maintain ΔI within BwCB-1, Figure 19 limits. USE the applicable portions of steps F.2 and F.3.

NOTE

After the power ascension, maintaining ΔI more positive than the Target will offset the preferential burnup in the bottom of the core as a result of the highly negative ΔI from the reduced power level. This should be performed if SPINR is used frequently, otherwise control ΔI within the operating band about Target value.

c. For a power ascension, ALLOW rods to step out to facilitate the power change and to force ΔI more positive than the Target.

NOTE

A dilution may be required in addition to rod movement to accomplish the power change. Use applicable portions of steps F.2 and F.3 as necessary.

F. 5. d. MAINTAIN ΔI more positive than the Target for as long a period as it was kept more negative.

e. ONCE the power level is reached, ADJUST the boron concentration as necessary to compensate for the changing Xenon concentrations.

f. RETURN ΔI to the Target Value once the preferential burnup has been offset.

F. 6. RCS Temperature Control:

NOTE

According to Nuclear Fuel Management (NFM), RCS T_{ave} is assumed to be maintained either by the Reactor Control system in automatic or with a similar strategy via manual control.

a. For steady-state and routine operation, MAINTAIN the following conditions:

- The reactor is designed and expected to be operated with average T_{ave} equal $\pm$ 1°F to Design Average Temperature for the Cycle (as established in Fig. 35 of BwCB-1).
- Auctioneered High T_{ave} within dead band of automatic rod control.
- Average T_{ave} should not be allowed to exceed 588°F.

b. Philosophy behind T_{ref} bias:

The rod control system design for Braidwood uses High Auctioneered Temperature Average (HI T_{ave}) being compared to T_{ref} (as determined by turbine power) to move control rods in or out of the core depending on the polarity of the temperature mismatch error, T_{err}. Since each loop has a different full-power $T_{ave,}$ the average of all four loop T_{aves} (AVG-T_{ave}) will always be less than the HI-T_{ave} value. This results in the Unit running slightly less than the design full-power T_{ave} when HI T_{ave} and T_{ref} are matched (i.e. 0 deg F T_{err}) thus producing less S/G pressure. By using a T_{ref} bias (which accounts for the offset of loop T_{ave} differences at full-power), the AVG-T_{ave} will be closer to the design T_{ave} of the core for a given cycle.

For Unit 1 and Unit 2 (when at full-power), matching HI-T_{ave} to T_{ref}, should result in AVG-T_{ave} matching core design T_{ave}.

Per the core design philosophy, while at full power, units are expected to be operated at their respective design core average temperatures - AVG T_{ave} (587 F for Unit 1, 581 F for Unit 2). Based on current BWD configurations, this results in an approximate 0 deg F T_{err} for Unit 1 and Unit 2.

F. 6. c. IF Average T_{ave} is > 3°F from T_{ref} but within 4°F of T_{ref}, TAKE ACTION to return Average T_{ave} to be within 3°F of T_{ref} as conditions allow (generally within 24 hours).

d. IF Average T_{ave} is > 4°F from T_{ref}, TAKE ACTION to restore Average T_{ave} to be within 4°F of T_{ref}.

e. Under coastdown conditions or other special circumstances, specific neutronic and safety analyses may be performed to allow Average T_{ave} to differ from T_{ref} by more than 4°F. These analyses and temporary Average T_{ave} limitations will be identified on a cycle-specific basis, typically via a ReMa form.

This guidance reflects administrative controls for the Operations Department to support assumptions contained in the nuclear core design basis. These are not Tech Spec limits.

The 3°F tolerance, however, does not apply to long term operation. Long term operation at a Average T_{ave} different than assumed during the fuel cycle design can lead to fuel burnup that does not conform to the cycle specific safety analysis. Small variations from the set temperature, with plant operation following good industry standard, are allowed. It is acceptable if the difference between the nominal average temperature of the plant and nominal designed temperature is less than 1°F, as long as the design temperature band of 575°F to 588°F, used in the safety analysis is maintained.

Although not usually a safety concern, Average T_{ave} should be maintained within 4°F of T_{ref}. Should Average T_{ave} deviate by more than 4°F, action should be taken to restore Average T_{ave}, although it should be understood that the severity of a mismatch of greater than 4°F is less at reduced power.

F. 6. f. The following methods of temperature control are at the disposal of the NSO:

1) To raise T_{ave}:

- DILUTE the RCS.
- WITHDRAW control rods.
- RAISE DEHC ramp rate when ramping down.
- LOWER DEHC ramp rate when ramping up.
- Momentarily HOLDING a ramp when ramping up.
- REDUCE Turbine load.

2) To reduce T_{ave}:

- BORATE the RCS.
- INSERT control rods.
- RAISE DEHC ramp rate when ramping up.
- REDUCE DEHC ramp rate when ramping down.
- Momentarily HOLDING a ramp when ramping down.
- RAISE Turbine load.

g. Although entirely optional, BwCB-1, Figure 35, can be used to estimate a bounding value for the amount of boration or dilution necessary to offset the changes in reactivity due to power defect when anticipating a power change.

F. 7. Full Power Maintenance:

NOTE

Thermal power for each unit shall be maintained < 100% RTP, normally indicated by the 1 hour and 8 hour calorimetric. In order to maintain thermal power as close to 100% RTP without exceeding 100% RTP, the following guidance is provided.

a. Steam Generator Blowdown:

When Steam Generator Blowdown is raised from 0 gpm to 300 gpm total flow, the indications for calorimetric power will initially drop approximately 0.1% RTP. This effect is transitory in nature and lasts approximately 10 minutes. This effect is caused by the sluggishness of the Feed Reg system in maintaining Steam Generator level. After the initial drop in indicated power, steam generator levels will be restored and the secondary side of the plant will reach equilibrium, with the net effect of saturated water being taken from the Steam Generator and ultimately returned to the condenser. The long term net effect of initiating 300 gpm blowdown flow is a rise in thermal power of 0.5%. For this reason, thermal power should be confirmed to be less than 100% RTP by an appropriate amount prior to raising steam generator blowdown flow. The thermal power will change proportionally to changes to steam generator blowdown flow.

When Steam Generator Blowdown is isolated from an initial flow rate of 300 gpm total flow, the indications for calorimetric power will initially rise approximately 0.1% RTP. This effect is transitory in nature and lasts approximately 10 minutes. This effect is caused by the sluggishness of the Feed Reg system in maintaining Steam Generator level. After the initial rise in indicated power, steam generator levels will be restored and the secondary side of the plant will reach equilibrium. The long term net effect of isolating 300 gpm blowdown flow is a drop in thermal power of 0.5%. Should Steam Generator Blowdown be isolated for a significant period of time, consideration may be given to raising turbine load as applicable to maintain full power. The effects of re-initiating Steam Generator Blowdown, however, must be considered per the above paragraph. The thermal power will change proportionally to changes to steam generator blowdown flow.

F. 7. b. Aux Feed:

When Aux Feed flow is initiated at 1320 gpm to the Steam Generators with the turbine on line, the initial indications from NIS will be a drop in power because of the drop in T_{cold}, although the post transient actual thermal power will rise approximately 3% RTP. More importantly, however, the Aux Feed flow to the Steam Generator amounts to unmeasured mass input into the heat balance and the calorimetric calculation will be non-conservative by that amount. For this reason, a derate of the unit is appropriate for any Aux Feed flow during power operation.

The opposite occurs when Aux Feed flow is terminated.

c. DEHC Programming While at Steady State

Unless DEHC is being programmed for another operation, a 5 MW ramp down at 5 mw/min should be programmed into DEHC as a contingency for an unexpected fast moving reactivity event with the potential to overpower the reactor. This ramp is not intended to replace ramps directed by annunciator response or BwOAs for specific equipment malfunctions. This contingency should be included as part of an early shift reactivity briefing by the Reactor Operators and the Unit Supervisor. This is a desired state whenever the unit is operating near a power limit or restriction.

d. LEFM Full Power Operation

- Limit calorimetric to ≤ 100.0% on LEFM and Venturi.
- If the LEFM fails, maintain Venturi power at or below the Venturi power level just prior to the LEFM failure and less than 100.0%.

F. 8. Generic Coastdown Guidelines:

Coastdown occurs when the core burnup reaches a level where maximum power cannot be maintained. During this period, T_{ave} can be expected to drop approximately 1°F every day. To compensate for fuel depletion, load reductions of about 1 to 2% per day may be required after T_{ave} has dropped to 2°F below T_{ref}. If a cycle specific coastdown evaluation has been performed, T_{ave} may be allowed to drop below T_{ref} by whatever the nuclear design and safety analysis will support. This information will be provided on a cycle specific basis.

a. Boron concentration should be diluted as low as achievable (approximately 10 ppm or less).

NOTE
Deviations may be required due to unexpected situations, at which point a Qualified Nuclear Engineer should be consulted. (QNE)

b. MAINTAIN the following AT ALL TIMES:

- ΔI within 2% of its positive limit or as directed by a QNE.
- T_{ave} within ± 5°F of T_{ref} (based on computer points T0496, T0499, U0689 and main control board indications). A cycle specific Safety Analysis value for maximum deviation may replace this value.

  The following computer points can be used for monitoring maximum deviation:

  U9010 T_{min} from Calorimetric Power (10 min)

  U9011 T_{min} from NIS Power (10 min)

  U9012 T_{ave} - T_{min} (from 10 min Cal Power)

  U9013 T_{ave} - T_{min} (from NIS Power)
- Control Bank D should be maintained between 210 and 220 steps or as directed by a QNE.
- Rod Control in Manual.
- Boron concentration diluted as low as achievable depending on above parameters.

F. 8. c. Steady-State Conditions

1) During coastdown rods will be maintained at approximately 215 steps withdrawn in manual control. This partial insertion will give the operators control over ΔI during Xenon oscillations. RODS SHOULD NOT BE USED TO MAINTAIN ΔI ON THE TARGET VALUE. Instead, operators should allow ΔI to slowly drift positive while rods are held constant. Control rods may then be inserted to maintain ΔI at least 2% from its positive limit or as directed by a QNE.

2) Operators should minimize control rod motion during coastdown as axial Xenon oscillations are easily induced. Operators should minimize control rod motion to a maximum of two steps per shift unless absolutely needed for the maintenance of ΔI within its limits. It is recommended the operators review the ΔI trend during the past 8 hours prior to rod motion to determine if rod motion will propel an existing oscillation. Remember, the differential worth of Control Bank D is much greater at end-of-cycle conditions than at any other time during the cycle. This is due to the axial flux profile being biased toward the top of the core (as indicated by a positive Target Axial Offset) and rod worth is proportional to the square of the flux. This limitation on rod motion, however, does not preclude the performance of quarterly rod exercises.

3) Power should not be reduced by more than 1% per shift if possible. This will minimize the change to ΔI. Also, remember that Xenon reactivity will initially rise following a load reduction.

4) If possible, load reductions should be performed while ΔI is either constant or lowering. This will tend to dampen any ΔI swings.

5) Control Bank D should be maintained between 210 and 220 steps. When the steady state rod position approaches 210 steps, Reactor Engineering will update the ΔI Target values so that CBD may be further withdrawn. Control rods should be used for ΔI maintenance only, control rods should not be moved for Temperature control.

6) MWe 'OUT' is the preferred choice of operation during steady-state operation at coastdown. However, the choice is entirely up to the NSO, Unit Supervisor, and Shift Manager as to which MODE they wish to operate at. MWe 'OUT' is preferred so that secondary perturbations will have a reduced effect on the reactor.

F. 8. d. Non-Steady State Condition

The reactor will become increasingly more of a challenge to control due to two factors:

#1. The inability to dilute out the soluble boron due to the very low boron concentration.

#2. The "double hump" shape of the reactor flux due to the center of the core being more highly burned.

Phenomena that will be experienced during coastdown will be a raised sensitivity to Xenon oscillations, sagging T_{ave}, and a steadily rising AFD. The guidelines presented below are intended to reduce Xenon induced AFD oscillations in light of the reduction of suppression capability and to maximize fuel economy.

1) Due to the inherent Xenon instability of the reactor in End of Life conditions, Control Rod motion will have a greater effect on AFD and may induce an AFD oscillation. For this reason, Control Rods should not be used to control T_{ave} or to maintain AFD on target. Control Rod motion should only be used to stabilize AFD oscillations.

2) Changes in turbine power should also be limited to small periodic increments since these changes will have an impact on AFD oscillations. Therefore, power changes should not normally exceed 8 MWe per shift.

3) Due to the double humped shape of the flux in the core, the top and bottom of the core becomes de-coupled, Control Bank D (CBD) differential worth becomes very high, and T_{ave} changes have a much larger effect on AFD. For these reasons, AFD oscillations are capable of being initiated very easily. Therefore, Control Rod motion and substantial power changes should be avoided. During coastdown, AFD oscillations tend to become divergent; thus actions to dampen oscillations should be performed as early as practical.

F. 8. d. 4) Control Bank D should be maintained at approximately 215 (210-220) steps in order to have sufficient differential rod worth to dampen an AFD oscillation but not add too much negative reactivity. The following parameters should be monitored: Reactor Power, Average T_{ave} Mismatch, CBD Position and AFD, to identify a developing oscillation such that the least amount of Control Rod motion, or preferably, strategic power reductions can be used to minimize the oscillation. Generally, Control Rod usage should be limited to 2 steps per shift, if at all possible.

5) In the event and AFD oscillation is induced, use either the half-cycle dampening technique or the "Hook and Drag" technique described in Section 4 of this procedure to stress AFD to its last known steady state value. Power reductions may be used to stress AFD positive instead of CBD withdrawal when CBD is greater than 215 steps. A 1-to-3 MWe load reduction will cause AFD to rise 0.05 to 0.10%.

e. Summary of Recommendations:

The following table summarizes the recommendations contained in these guidelines:

Control Rod Motion	Limit to 2 steps/shift and attempt to maintain at approximately 215 (210-220) steps withdrawn.
Turbine Load	Reduce in 1 - 2 Mwe increments at 0.1 - 0.2 MWe/min when AFD is steady or lowering.
RCS T_{ave} (U8062 for Avg Tave - T_{ref}) or U9010 = T_{min} (10 min cal) U9011 = T_{min} = (NIS) U9012 = T_{ave} - T_{min} (10 min Cal) U9013 = T_{ave} - T_{min} (NIS)	Allow to drop up to 3.5 - 4.0°F (or as specified in the cycle specific NF safety analysis) from Tref before initiating a turbine load reduction.
AFD	Use CBD motion if AFD is near 2% of the RAOC upper limit, or as determined by a QNE.

F. 9. Core Control Considerations for Operation with a Positive Moderator Temperature Coefficient (PMTC):

Technical Specification LCO 3.1.3 allows a MTC of up to +7 pcm/°F. A cycle specific value will be contained in the Core Operating Limits Report (COLR). The MTC will vary with reactor power and burnup, becoming less positive with rising power levels (see Figure 1). The expected maximum values to be seen will be +3 to +5 pcm/°F. Figures 1 and 2 were calculated using data from a +2.5 pcm/°F design. These are considered representative of MTC behavior.

It is important to remember that reactor behavior is governed by Isothermal Temperature Coefficient (ITC), of which the MTC is one component. ITC is typically 1.5 to 2 pcm/°F more negative/less positive than the MTC due to the Doppler contribution. Figure 2 demonstrates ITC behavior. It should be noted that ITC will likely be negative for power operation, with the exception of low power levels early in the cycle life.

Control of reactor power will likely be more difficult at low power levels when ITC is positive. The response to temperature changes will only feedback to change the temperature more, in the same direction. To help deal with the concerns, the following guidance is given. Additional guidance can be obtained from Reactor Engineering, as needed.

a. Only one method of positive reactivity addition should be used at a time, if possible.

b. T_{ave} - T_{ref} mismatch should be kept at a minimum. This will reduce the correction made by control rod motion, as temperature deviations will tend to build on themselves.

c. Make power changes slowly and deliberately. When making changes, pause between reactivity maneuvers to regain stability.

d. Steam demand will still drive reactor power, however with a +MTC, rising steam demand (causing a T_{ave} drop) will reduce reactor power.

e. With the Steam Dumps in the Steam Pressure Mode, keeping some demand on the Steam Dumps, when making load changes, can help to keep RCS temperature more stable.

f. With the Steam Dumps in the T_{ave} Mode, Turbine load can be adjusted to maintain T_{ave} /T_{ref} mismatch within limits.

g. Monitor the IR startup meters to anticipate the need for reactivity changes.

F. 9. h. On the computer or PPC, trend the heatup/cooldown rate (U0800R) and an Intermediate Range NI Channel for current temperature and power trends.

i. Changes in feedwater flow should be communicated to the NSO controlling the reactor to anticipate the pending temperature change. Communication between the Primary NSO and Secondary NSO is vital.

NOTE

The following step provides guidance for operation of the Rod Control System. The steps should only be used for normal operation and should not preclude the actions required to mitigate a transient.

F. 10 Rod Control Operation:

a. Automatic Rod Control:

1) VERIFY TURBINE LOW POWER INTLK C5 (1-BP-5.7) NOT ILLUMINATED.

2) VERIFY that the Rod Control direction lights are not ILLUMINATED:

- RODS IN
- RODS OUT

3) VERIFY T_{ave} within +/- 1°F of Tref.

4) VERIFY/PLACE the Rod Bank Select switch in the AUTO position.

5) MONITOR rod control for proper response.

b. Manual Rod Control:

1) VERIFY automatic rod motion is not required.

2) PLACE Rod Bank Select switch to the MAN position.

3) Using the IN-HOLD-OUT switch, MOVE the control rods to the desired position.

4) MONITOR the following for the effects of the rod motion:

- Tave
- Pressurizer Pressure
- Pressurizer Level
- Reactor Power

5) WHEN manual rod control is no longer required, RETURN Rod Control to AUTO per Step 10.a.

F. 10. c. Steady State Manual Control Rod Operations:

1) The Reactor Operator at the controls shall exercise extreme caution when manually withdrawing control rods for steady state operations.

2) When manually withdrawing control rods in a critical reactor, the Reactor Operator at the controls SHALL stop rod withdrawal at least every three steps and check for expected response on nuclear instruments, rod position and reactor coolant temperature indication.

3) The Shift Manager/Unit Supervisor may suspend the three-step pull-and-wait when the reactivity computer is in service during the performance of physics testing or during a reactor start-up when reactor power is below the point of adding heat.

4) This sequence of actions SHALL be followed during 1BwOSR 3.1.4.2, Movable Control Assemblies Surveillance, verification of rod operability in the applicable Rod abnormal operating procedures and any troubleshooting activities at power.

5) All manual control rod manipulations shall be done in accordance with OP-AP-300-1001, PWR Control Rod Movement Requirements.

NOTE
The Load Swing Instruction Sheet, 1BwGP 100-4T2 is not required to be filled out when making minor (< 2%) load changes.

F. 11. Minor Load Adjustments:

- DEHC in AUTO:

  1) DETERMINE the required load change.

  2) SELECT SETPOINT.

  3) ENTER the desired Megawatt value into the REF DEMAND window.

  4) SELECT left ENTER.

  5) VERIFY the correct value appears in the REFERENCE DEMAND window on graphic 5501.

  6) ENTER the desired MW/MIN rate into the RATE window.

  7) SELECT right ENTER.

  8) VERIFY the correct value appears in the RATE window on graphic 5501.

  9) SELECT GO/HOLD.

  10) SELECT GO.

  11) VERIFY that load begins to rise or lower as desired.

  12) MONITOR the following:

  - Reactor Power
  - Tave
  - Calorimetric Power

  13) ADJUST RCS Boron Concentration per BwOP CV-5 or CV-6, as necessary, to maintain ΔI within Limits of BwCB-1, Fig. 19.

F. 11. ○ DEHC in MANUAL:

1) DETERMINE the required load change.

2) Momentarily DEPRESS then RELEASE either of the following to manually adjust turbine load:

- ○ GOVERNOR V up arrow.
- ○ GOVERNOR V down arrow.

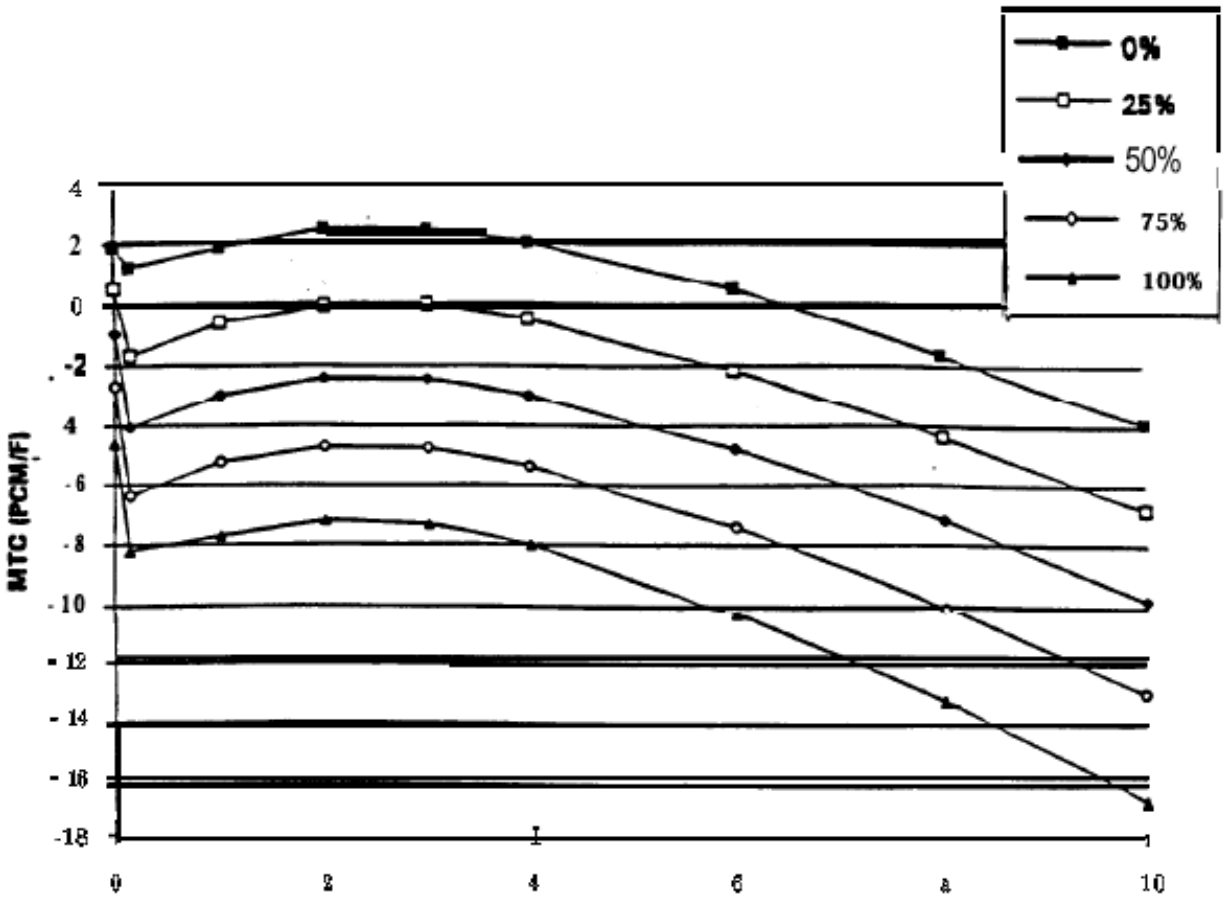
3) MONITOR the following:

- Reactor Power
- Tave
- Calorimetric Power
- Governor Valve Position

4) ADJUST RCS Boron Concentration per BwOP CV-5 or CV-6, as necessary, to maintain ΔI within Limits of BwCB-1, Fig. 19.

FIGURE 1

** MTC vs BURNUP AS A FUNCTION OF POWER



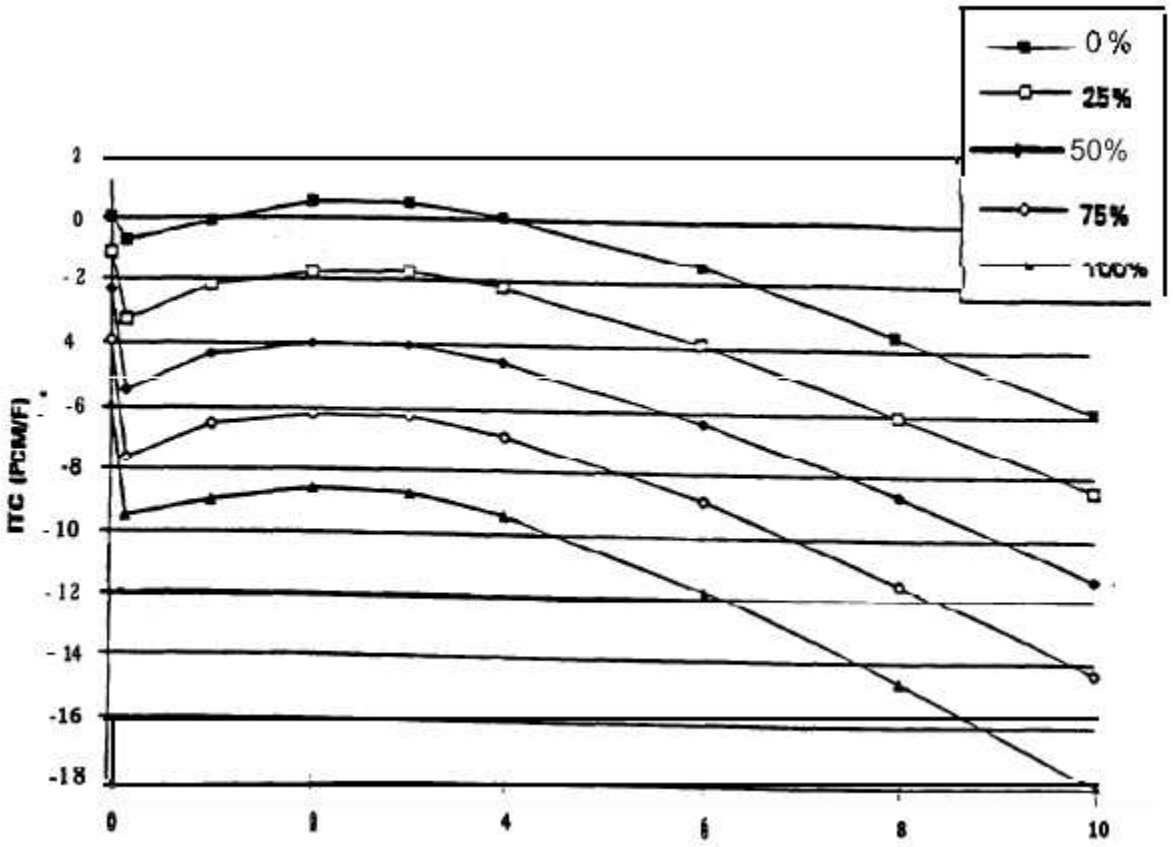
BURNUP (GWD/MTU)

1 GWD/MTU = 24 EFPD

** This graph should be used for guidance only. It is a generic graph, and does not represent the exact conditions and responses of Unit 1 core. Contact Reactor Engineering for further guidance.

FIGURE 2

** ITC vs. BURNUP AS A FUNCTION OF POWER



BURNUP (GWD/MTU)

1 GWD/MTU = 24 EFPD

** This graph should be used for guidance only. It is a generic graph, and does not represent the exact conditions and responses of Unit 1 Core. Contact Reactor Engineering for further guidance.

FIGURE 3

Half-Cycle Dampening

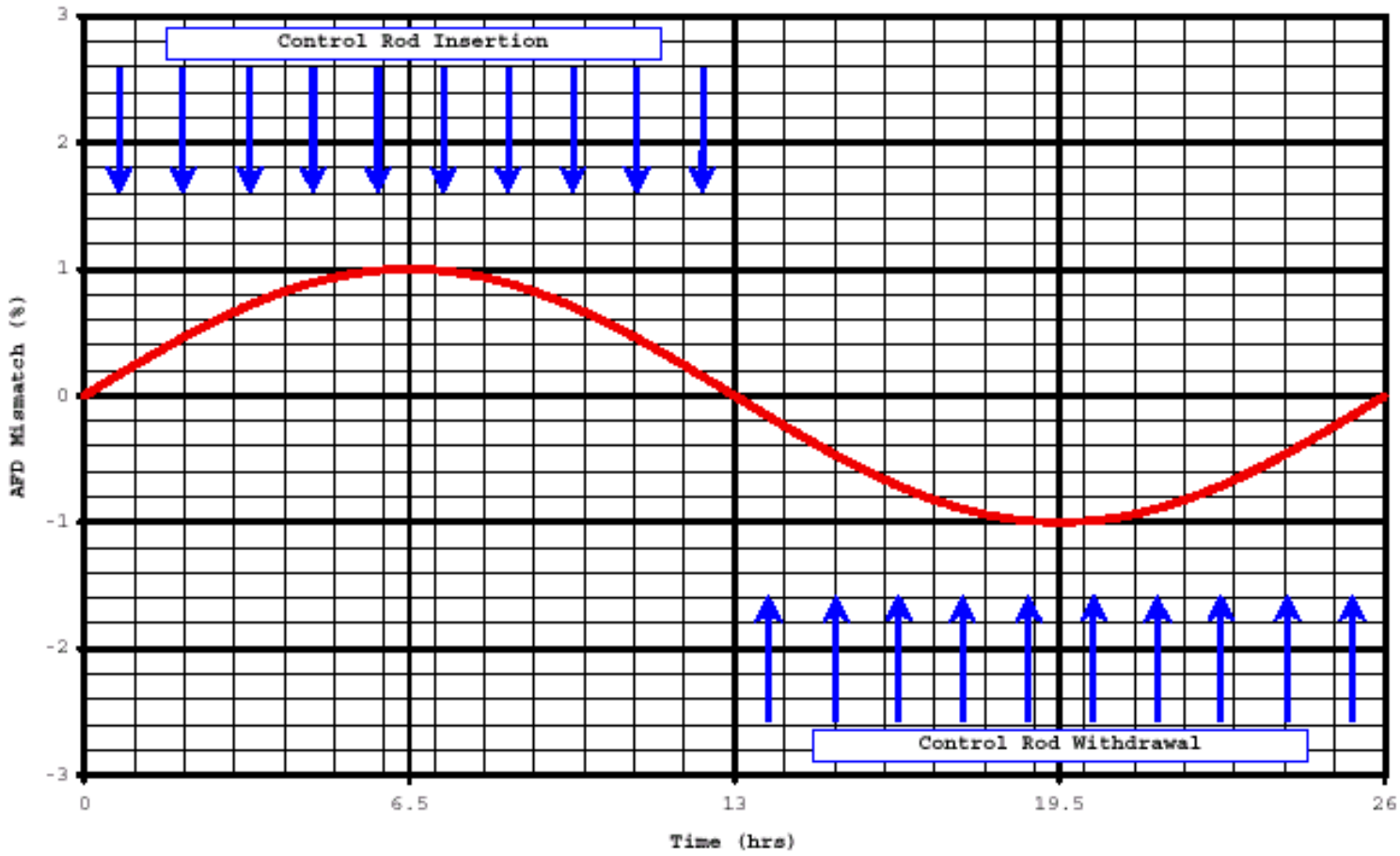


FIGURE 4

Hook 'n Drag

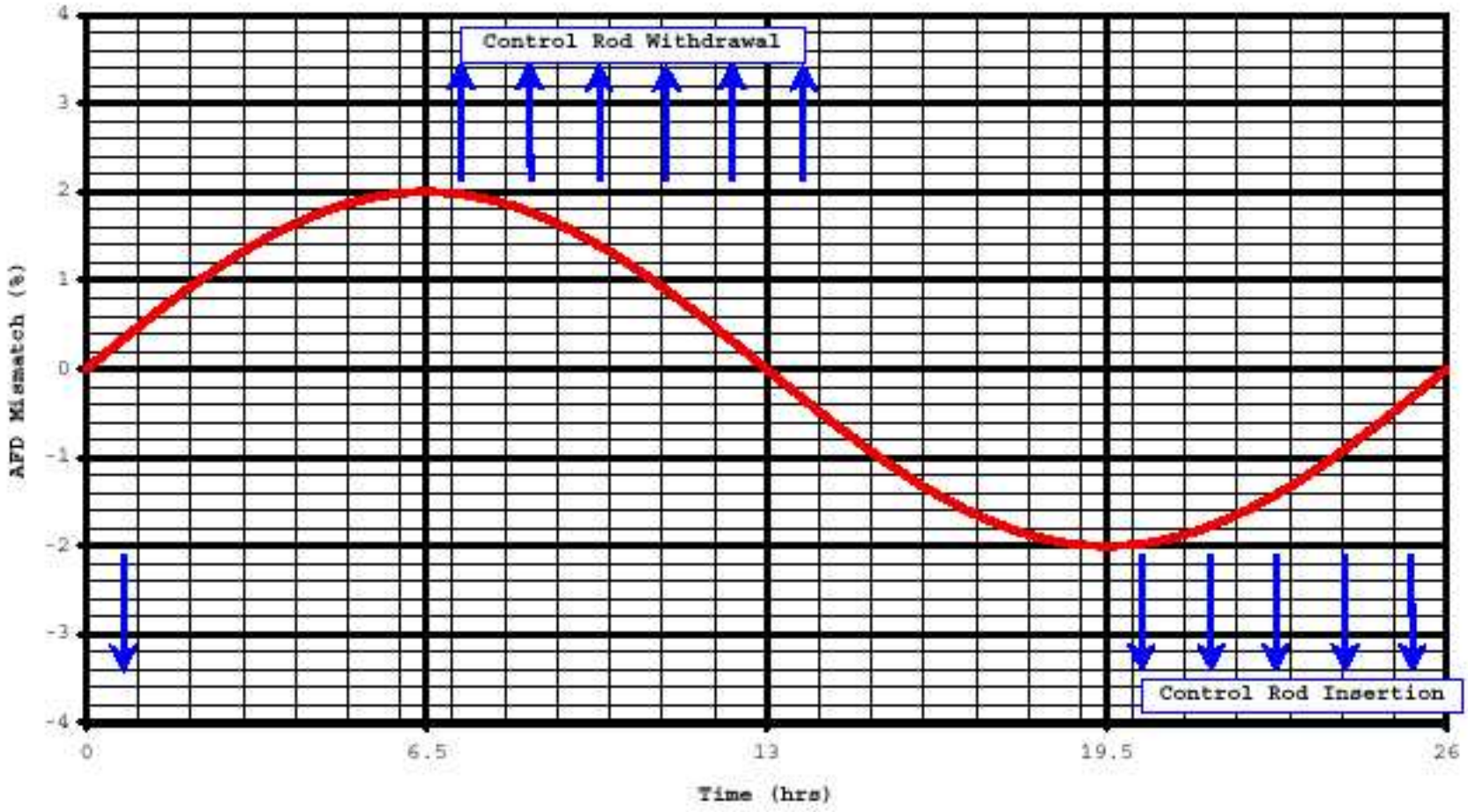


FIGURE 5

Bang – Bang

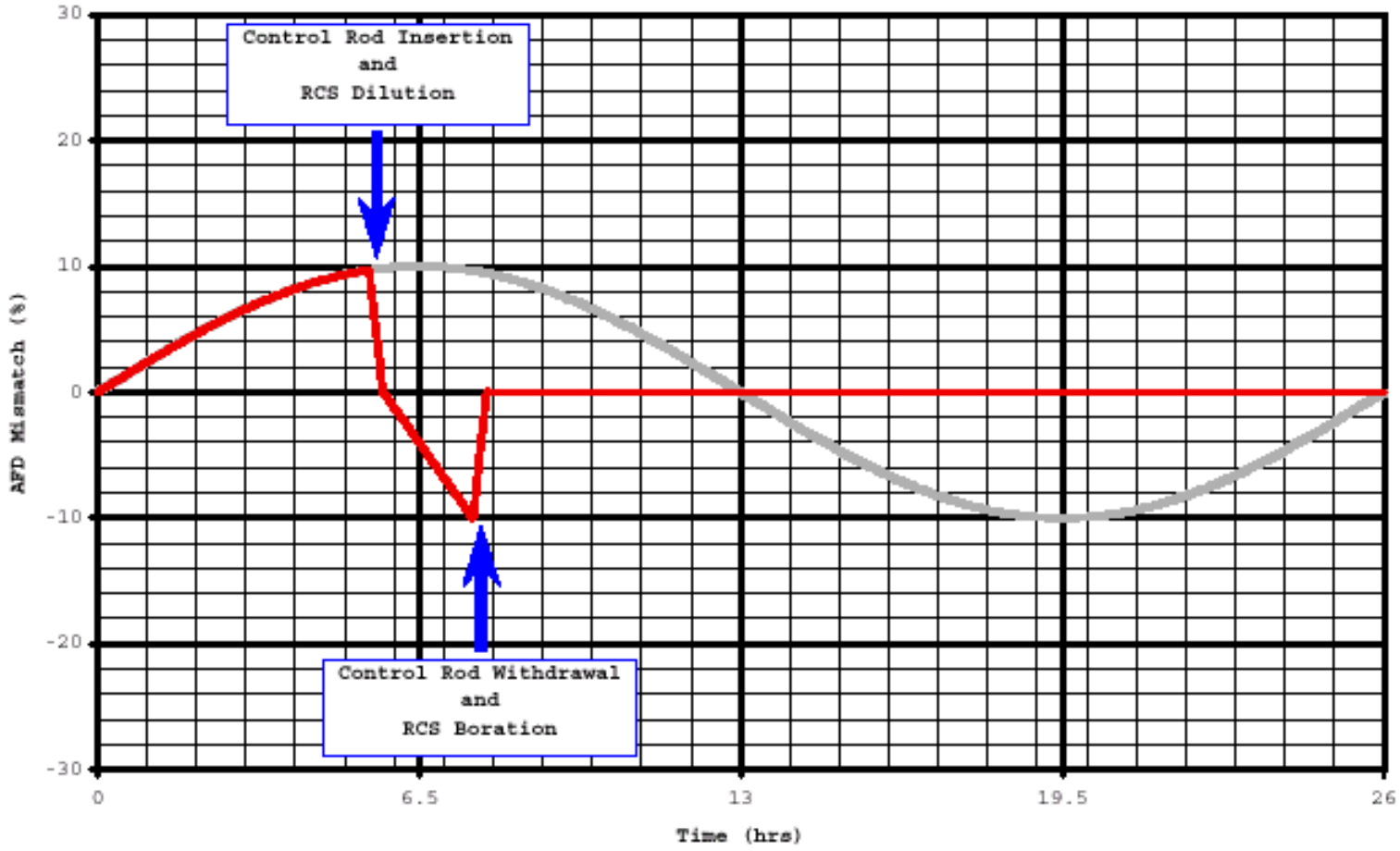
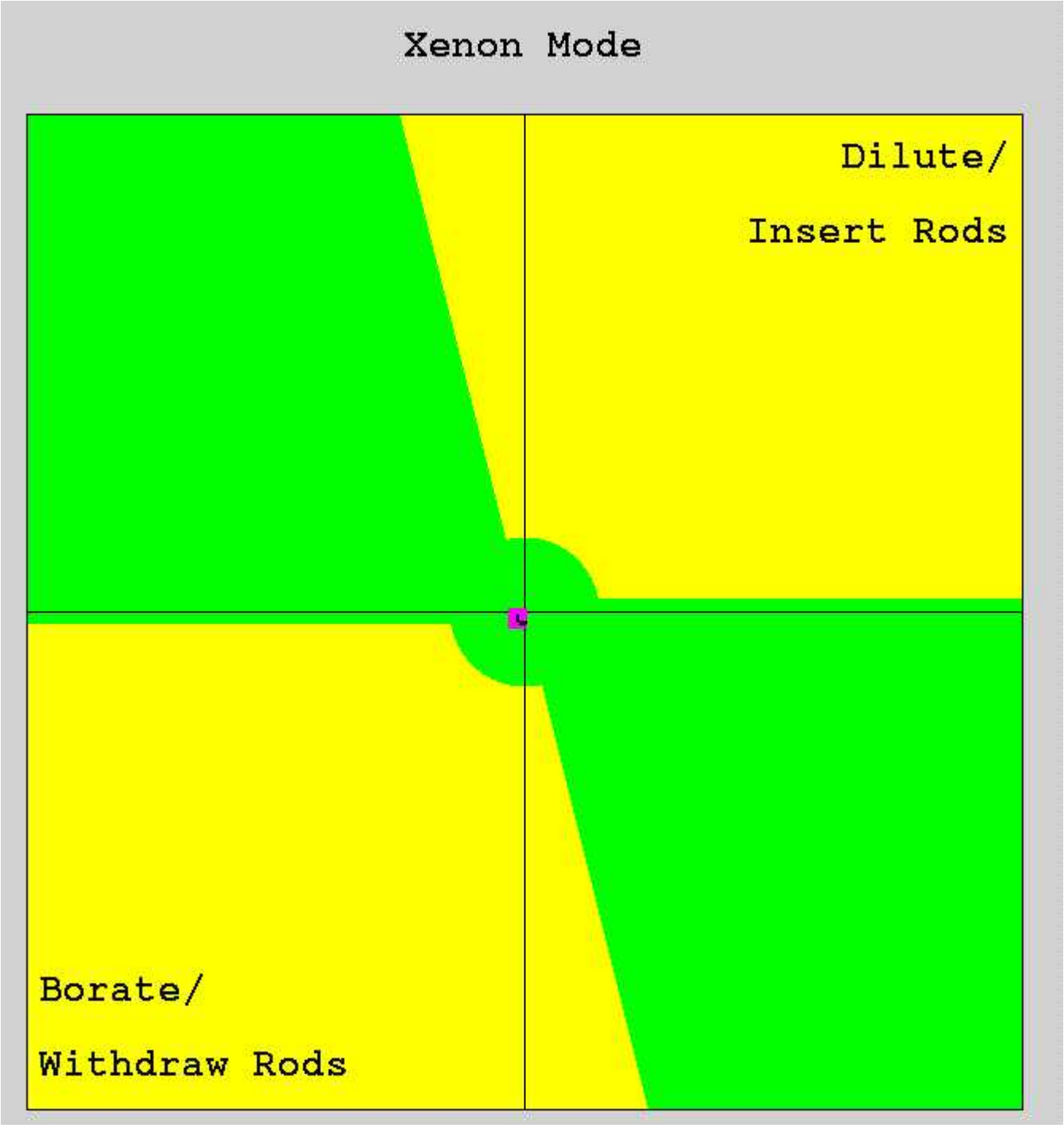


FIGURE 6

Xenon Mode Using PDMS



ATTACHMENT A

ROD CONTROL HARD CARD

NOTE

A review of the reactivity plan MUST be conducted and permission MUST be given by the UNIT SUPERVISOR prior to using this card for Manual Rod Control.

CAUTION

Caution should be used when CBD is below 130 steps. ΔI control is typically reduced as CBD is inserted below 130 steps until CBC reaches a bite position.

1. MANUAL ROD CONTROL:

   a. VERIFY automatic rod motion is not required.

   b. PLACE Rod Bank Select switch to the MAN position.

   c. Using the IN-HOLD-OUT switch, MOVE the control rods to the desired position.

   d. MONITOR the following for the effects of the rod motion:

      - Tave
      - Pressurizer Pressure
      - Pressurizer Level
      - Reactor Power

   e. If it is desired to return to Automatic Rod Control perform the following:

      1) VERIFY TURBINE LOW POWER INTLK C5 (1-BP-5.7) NOT ILLUMINATED.

      2) VERIFY that the Rod Control direction lights are not ILLUMINATED:

         - RODS IN
         - RODS OUT

      3) VERIFY Tave within +/- 1□F of Tref.

      4) VERIFY/PLACE the Rod Bank Select switch in the AUTO position.

      5) MONITOR rod control for proper response.

ATTACHMENT B

RAMPING HARD CARD

NOTE
This Hard card should only be used for emergent conditions with approval of the UNIT SUPERVISOR.

1. RECORD the desired MW LOAD _____MW and desired RAMP RATE _____MW/Min.

2. PROGRAM a new MW load on turbine, perform the following on graphic 5501:

   a. SELECT SETPOINT.

   b. ENTER desired MWs into the REF DEMAND window.

   c. SELECT left ENTER.

   d. VERIFY the correct value appears in the REFERENCE DEMAND window on graphic 5501.

   e. ENTER desired rate into the RATE window.

   f. SELECT right ENTER.

   g. VERIFY the correct value appears in the RATE window on graphic 5501.

   h. SELECT EXIT.

   i. SELECT GO/HOLD.

   j. VERIFY GO/HOLD illuminates orange.

   k. VERIFY HOLD indicator illuminates red.

   l. INFORM the crew of the pending ramp and rate with an UPDATE.

   m. SELECT GO.

   n. VERIFY GO indicator illuminates red while main turbine ramps.

(Final)

Exelon SM
Nuclear

PWR BORATION AND DILUTION REQUIRMENTS

1. PURPOSE

1.1. The purpose of this T&RM is to define responsibilities and provide guidance for PWR boration and dilution evolutions.

2. TERMS AND DEFINITIONS

2.1. **Approved (Governing) Procedure:** as used in this document, refers to a procedure approved for use at the station, or to a document whose generation is described in and directed by a procedure approved for use at the station.

2.2. **Licensed Operator:** is synonymous with Reactor operator (RO), Senior Reactor Operator (SRO), or Nuclear Station Operator (NSO).

2.3. **Steady-State:** Reactivity Core Characteristics that are stable and behaving as expected per the core burn-up plot with stable Xenon conditions.

2.4. **Non-Transient Conditions:** Operations within normal station administrative parameters and guidance.

2.5. **Deboration**: Removal of Boric Acid from the letdown fluid by deborating demineralizers, the effluent of which is returned to the RCS. For the intent of this procedure is synonymous with Dilution.

3. RESPONSIBILITIES

3.1. Operations is responsible for all Boration and Dilutions of the Reactor Coolant System.

4. MAIN BODY

4.1. Operations shall **PERFORM** borations and dilutions in a deliberate, carefully controlled manner while constantly monitoring nuclear instrumentation and redundant indications of reactor power level, neutron flux, and coolant temperature (SOER 96-02).

4.2. The effects of boration or dilution must be observed in terms of resulting Control Rod motion, changes in Coolant Tave or Source Range Counts or change in Heatup/Cooldown Rate. **STOP** the operation if the expected response does not occur and take corrective action.

4.3. Operations shall **PERFORM** peer checking of all Main Control Room, MCR, non-transient boration and dilution evolutions. When utilizing a second SRO to support reactivity management functions related to the primary (Primary SRO), the following expectations must be adhered to:

- The Unit Supervisor must be aware of the reactivity plan.
- The Primary SRO is not required to inform the Unit Supervisor of every manipulation that is within the plan. Any deviation or unexpected response MUST be communicated to the Unit Supervisor.
- The US/Primary SRO may provide the PEER check for reactivity manipulations.

NOTE: Boration and/or dilution while **shutdown**, where adequate shutdown margin **is assured**, does **not** require the supervisor to be proximate to the reactor operator.

4.4. The Unit Supervisor shall **ENSURE** all planned MCR borations and dilutions are performed by the Licensed Operator in accordance with the governing procedure or Operator Aid. In plant activities affecting reactivity equipment shall be directed by a licensed operator.

NOTE: If a ReMA was developed for a planned Reactivity Change, Attachment 1, Reactivity Change Determination Form is not required.

4.5. Attachment 1, Reactivity Change Determination Form, shall be used:

- To ensure proper Technical Human Performance during reactivity maneuver planning.
- For reactivity changes that do **not** involve planned turbine load changes.
- To document each Reactivity manipulation **OR**, an entire shift of Reactivity manipulations during steady-state conditions as determined by the SRO.
- Alone or in conjunction with a ReMA per Shift Manager discretion.

4.5.1. Completed forms shall be forwarded to the Shift Manager.

4.6. All Reactivity manipulations shall be documented in the Unit Operator Logs.

5. **DOCUMENTATION** – None

6. **REFERENCES**

6.1. INPO SOER 96-02, “Design and Operating Considerations for Reactor Cores”

7. ATTACHMENTS

7.1. Attachment 1 – Reactivity Change Determination Form

ATTACHMENT 1
REACTIVITY CHANGE DETERMINATION FORM

Station: _____ Unit: 1 2 Time: _____ Date: _____

Desired change:
(Parameter, Magnitude, and Direction: Reactor Power, Rod Position, RCS Temp, Delta I, etc.)

Reason for Change:
(Temperature control, flux control, fuel burn up)

What is the method and amount required for the reactivity change?
(Bleed Tank Volume, Gallons of Dilution/Boration/Blended Flow, Rod Insertion/Rod Withdrawal steps/percent)

Inputs:
(ReMA Thumbrules, ReMA maneuver guidance, Curve Book Figure/Table, Computer based trend plot, RCS Cb, EFPD – Preparer and Reviewer should use independent inputs when possible)

Calculation of change:
(E.G. Bwd/Byr: ReMA Thumbrule identifies 20 gallons BA = 1.0°F RCS temp reduction. *Desired change* = 0.5°F drop. *Calculation of change:* (20 gal/1.0°F) * 0.5°F = 10 gal., previously used borations and dilutions)
(TMI: Procedure 1102-4 Power Operations Fig. 1, Volume of Deminerlized Water for 1% Rod Insertion)

_____	_____	_____
Preparer (RO)	**Reviewer** (RO/SRO)	**Approver** (SRO)

Shift Manager Notified: Yes No

OPERATOR AID POSTINGS

1. PURPOSE

1.1. The purpose of this instruction is to describe the methodology for the authorization, documentation, and review of Operator Aids.

1.2. Existing Operator Aids approved under a previous revision or version of this procedure need not be re-issued upon approval of this procedure. However, any future update to an existing operator aid shall be performed in accordance with this procedure.

2. TERMS AND DEFINITIONS

2.1. **Operator:** An operator is broadly defined as anyone authorized to operate equipment associated with plant operation. In addition to Operations Department personnel, this definition includes Chemistry Technicians, Nuclear Engineers, System Engineers, Instrument Maintenance Technicians or other station personnel.

2.2. **Operator Aids:** Information including sketches, notes, graphs, lists, drawings and other documents used to assist operators in performing assigned duties associated with plant operation. Operator aids are NOT to be used in place of approved procedures or controlled drawings.

2.3. **Unauthorized Operator Aid:** Uncontrolled, unauthorized direction, instruction, or information needed for plant operation located in the plant. Examples could include dyno-tape providing equipment manipulation instruction, graffiti that provides fuse ID numbers, etc.

2.4. **Station Work Aid:** Photographs and associated drawings, which are placed within the plant for the purpose of assisting station personnel in locating plant equipment in the performance of their duties. This type of information is not considered an Operator Aid and therefore the requirements of this instruction do not apply.

3. RESPONSIBILITIES

3.1. Operations Management: Administers this procedure and approves new or revised Operator Aids.

3.2. Initiating Department: Ensures that the current revision of an Operator Aid is being utilized. Performs an annual review of Operator Aids being utilized and verifies during this annual review that copies of Operator Aids derived from procedures contain current information.

3.3. WEC SRO: Administers an annual review of Operator Aids and informs the appropriate group or department of any Operator Aid removal and the reason for removal.

4. MAIN BODY

4.1. PREPARE the Operator Aid with consideration for the following:

- Does the Operator Aid replicate information from a procedure?
- Should the information be incorporated into a procedure?
- Could the Operator Aid be eliminated with better labeling or a permanent placard?
- Is the information clearly presented?
- Are there any potential human error traps in the wording?
- Is the information legible?
- Do the words “Operator Aid” appear prominently?
- Is color-coding appropriate for the conventions of the station?
- Can the Operator Aid be positioned/mounted without interfering with other components?
- Is the material used for the Operator Aid suitable for the environmental conditions?

4.2. **ASSIGN** each Operator Aid a Designated Number that shall be annotated on the Operator Aid.

4.3. **COMPLETE** Attachment 1 or electronic equivalent and submit it to the Department Head for review and approval.

4.4. **SUBMIT** the Operator Aid and other applicable documentation for approval to a manager in Operations.

4.5. **LOG** the Operator Aid in the Operator Aid Log, Attachment 2, or electronic equivalent.

4.6. Post the Operator Aid in the intended location(s).

4.7. **PLACE** the master copy of the Operator Aid along with its approval form in the Operator Aid Log.

4.8. **IF** the Operator Aid is posted in the control room, **THEN Route** a copy to the Simulator Fidelity Coordinator.

4.9. **PERFORM** the following when an Operator Aid is no longer needed as deemed by the applicable Department Head or Annual Review:

4.9.1. **LOG** the removal of the Operator Aid on Attachment 2.

4.9.2. The WEC SRO shall **REMOVE** the master copy of the Operator Aid along with the Attachment 1 from the Operator Aid book **and ENSURE** copies are removed from all locations.

4.10. **PERFORM** an annual review of Operator Aids.

4.10.1. The Operator Aid Log in the WEC shall be reviewed to ensure only approved Operator Aids are in the book. This shall be done by comparing the Operator Aid Log to the Operator Aids in the WEC book.

4.10.2. Operations crew management will direct any department that has Operator Aids to review them. This review shall be returned to the Unit Supervisor in a timely manner.

4.10.3. The in-plant operators will conduct a field walkdown of accessible areas of the plant for authorized Operator Aids. This walkdown will check applicable items from 4.1.

4.11. Identification and removal of Unauthorized Operator Aids

4.11.1. All marker or other graffiti should be removed with appropriate cleaning solution, or paint/cover the affected area per the appropriate plant program.

4.11.2. Dyno-tape labels or other unauthorized information determined to be necessary to plant operation should be incorporated into the appropriate plant procedure(s) or replaced with an appropriate, approved labels or documents.

4.12. **FORWARD** copies of all added, revised, or removed Operator Aids to the Simulator Fidelity Coordinator if an electronic database version is not being maintained.

5. DOCUMENTATION - None

6. REFERENCES

6.1. INPO 01-002, "Guidelines for the Conduct of Operations at Nuclear Power Stations."

7. ATTACHMENTS

7.1. Attachment 1, Operator Aid Review and Approval

7.2. Attachment 2, Operator Aid Log

ATTACHMENT 1
Operator Aid Review and Approval
Page 1 of 1

	Rev. No. 65	Op Aid # 01-018
Operator Aid Title:	**Unit 1 Reactivity Parameters**	
Description/Use: Include primary posting locations.	**Operator "Aid Book, Effective 3/16/2013 – 6/1/2013**	
Permanent Sign/Label Required: ☐ Yes ☒ No	If Yes, Label Request Submittal Date:	

BRAIDWOOD UNIT 1 CYCLE 17
REACTIVITY PARAMETERS
BURNUP RANGE 1000 EFPH TO 2000 EFPH

VALUES AT 100% POWER STEADY STATE

Dilution amount for a 1 degree temperature rise:	**166 to 141**	**gal PW**
Boration amount for a 1 degree temperature reduction:	**26 to 25**	**gal Boron**
Control Rod insertion for a 1 degree temperature reduction:	**12 to 13**	**steps**
Temperature drop for a 1% power rise:	**0.9 to 1**	**deg F**
Dilution amount for a 1% power rise:	**157 to 138**	**gal PW**
Boration amount for a 1% power reduction:	**25 to 24**	**gal Boron**
Control Rod insertion for a 1% power reduction:	**12**	**steps**

All values are based on Curvebook PREDICTED VALUES and should be used as a GUIDELINE only. Interpolation between burnups may be necessary for increased accuracy. The calculations have been performed within the burnup range specified, however they are still valid within one week of the specified burnup range.

Comments:
Differential Boron Worth = -6.91 to -6.93 pcm/ppm ITC = -16.21 to -15.12 pcm/degF
Information on load follows and ramp backs can be found in the beacon load follow operator aid.
Number of gallons of PW to offset 1 gallon of BA = 6.54 to 5.86 gal.
Minimum BAST volume required to borate to cold shutdown = 9802 gal BA

Originator Name:	(Print) Matthew Loula	
Department Head Approval:	(Signature/Date)	3/1/2013
Operations Head Approval:	(Signature/Date)	3/1/2013

Review Items:

- Does this Operator Aid replicate information from a procedure? ☐ Yes ☒ No
- Should this be incorporated into a procedure? ☐ Yes ☒ No
- Could it be eliminated with better labeling or a placard? ☐ Yes ☒ No

Attach this form to the original Operator Aid placed in the WEC Book. Copies shall be made and distributed as appropriate.

Note: The calculations have been performed across the burnup range specified, however the calculations are still valid within one week of the specified burnup range002E

ATTACHMENT 2
Operator Aid Log
Page 1 of 1

OPERATOR AID NUMBER (sequential)	TITLE/DESCRIPTION	REASON FOR POSTING	LOCATION	ORIGINATOR NAME/DATE	POSTED BY NAME/DATE	REMOVED BY NAME/DATE

TASK CONDITIONS:

1. You are the Unit 1 Unit Supervisor.
2. Unit 1 is at 100% power.
3. The plant process computer has been inoperable for the last 30 minutes.
4. PDMS is inoperable.

INITIATING CUES:

1. The Unit 1 Assist NSO has completed 1BwOSR 3.2.4.1, UNIT ONE QUADRANT POWER TILT RATIO (QPTR) CALCULATION.
2. The Shift Manager has directed you to perform the supervisory review of 1BwOSR 3.2.4.1.
3. Inform the Shift Manager when you have completed the review of 1BwOSR 3.2.4.1.

TASK TITLE: **Review QPTR Calculation**

JPM No.: **S-205** REV: **2013 NRC**
Task No.: S-AM-123 K&A No.: 2.2.42
Objective No.: 8E.AM-123 K&A IMP: 4.6

EXAMINEE:_____ SRO

EVALUATOR:_____ DATE:_____

The Examinee: PASSED _____ this JPM. TIME STARTED:_____

FAILED _____ TIME FINISHED: _____

JPM TIME:_____ MINUTES

CRITICAL ELEMENTS: **(*) 4, 5, 7, 8** APPROX COMPLETION TIME: 15 MINUTES

CRITICAL TIME: **NA**

EVALUATION METHOD:
__X__ PERFORM
___ SIMULATE

LOCATION:
___ IN PLANT
__X__ SIMULATOR

GENERAL REFERENCES:

1. 1BwOSR 3.2.4.1, UNIT ONE QUADRANT POWER TILT RATIO (QPTR) CALCULATION, Rev. 6
2. Operator Aid for 100% Power NIS Detector Currents
3. Technical Specifications

MATERIALS:

1. 1BwOSR 3.2.4.1
2. Operator Aid for values used in QPTR Calculation.
3. Calculator
4. Technical Specifications and Bases

TASK STANDARDS:

1. Determine QPTR for each NI detector.
2. Determine N42 upper detector QPTR is unacceptable.

TASK CONDITIONS:

1. You are the Unit 1 Unit Supervisor.
2. Unit 1 is at 100% power.
3. The plant process computer has been inoperable for the last 30 minutes.
4. PDMS is inoperable.

INITIATING CUES:

1. The Unit 1 Assist NSO has completed 1BwOSR 3.2.4.1, UNIT ONE QUADRANT POWER TILT RATIO (QPTR) CALCULATION.

   CUE: Hand examinee completed copy of 1BwOSR 3.2.4.1. and Operator Aid 01-009
2. The Shift Manager has directed you to perform the supervisory review of 1BwOSR 3.2.4.1.
3. Inform the Shift Manager when you have completed the review of 1BwOSR 3.2.4.1.

RECORD START TIME: _____

EVALUATOR NOTE: This JPM is performed by having the student review the Data Sheet D-3, Unit 1 QPTR calculation using NIS meters. The data sheet is complete but N42 upper detector QPTR was calculated in error. The examinee must locate the error, determine the QPTR for channel N-42 is outside the acceptance criteria, and provide the correct Tech Spec required action to the SM.			
	PERFORMANCE STEP	**STANDARD**	**CIRCLE APPLICABLE**

1.	Refer to 1BwOSR 3.2.4.1, UNIT ONE QUADRANT POWER TILT RATIO (QPTR) CALCULATION.
	
	CUE: All Prerequisites, Precautions, Limitations and actions were met for the performance of this surveillance.
	CUE: LCOAR 3.2.4 has NOT been entered.
	PDMS is inoperable. Surveillance is performed as a normal weekly.
		Refer to 1BwOSR 3.2.4.1.
		• VERIFY all applicable Prerequisites, Precautions, and Limitations and Actions are satisfactorily addressed.
		• Review surveillance applicability (from statement of applicability)
		  • NIS Power Range Tilts alarm is OPERABLE.
		  • QPTR has been within limit.
		  • Process computer is NOT available.
			SAT UNSAT N/A
			Comments:

2.	Review completed data sheet D-3. **CUE: LCOAR 3.2.4 has NOT been entered.**	Review data sheet D-3: • Being completed once per 7 days (normal interval). • Date: Today. • Time: 45 minutes ago. • Channels indication reliable: Yes. • Instrument Readings: 100%.	SAT UNSAT N/A **Comments:**
3.	Review data sheet D-3 detector currents.	Review data sheet D-3: • ALL present Upper and Lower Detector Currents are recorded correctly from NIS drawer front indications • ALL 100% detector Upper and Lower currents are recorded correctly from Operator Aid Book.	SAT UNSAT N/A **Comments:**

EVALUATOR NOTE: JPM page 6 contains a key of correct QPTR calculations.			
	PERFORMANCE STEP	**STANDARD**	**CIRCLE APPLICABLE**
***4.**	**Review the calculations to obtain the normalized detector currents and compare them to the calculated values on the data sheet.**	Review the calculated Normalized Detector Currents for each detector by dividing its present detector current reading by the 100% detector current value. **Normalized detector current for N42 Upper Detector is in error.**	SAT UNSAT N/A **Comments:**
***5.**	**Review the calculations to obtain the average normalized currents and compare them to the values on the data sheet.**	Calculate the Average Normalized Current by summing the upper (lower) normalized detector currents and dividing by 4. **The average normalized current in is error.**	SAT UNSAT N/A **Comments:**
6.	Review the calculations to obtain QPTR for each detector and compare them to the QPTR values listed on the data sheet.	Calculate the QPTR for each detector by dividing each Normalized Detector Current by the Average Normalized Current Each of the QPTR calculations is in error.	SAT UNSAT N/A **Comments:**
***7.**	**Identify N42 Upper Detector QPTR is unacceptable (surveillance acceptance criteria).** **CUE: As SM, acknowledge the required initiation of LCOAR 1BwOL 3.2.4.**	Determine QPTR is unacceptable: • Identify N42 Upper Detector QPTR is >1.02 and is unacceptable. • Determine ALL other channels QPTR is acceptable. ○ Immediately notify the Shift Manager or Designee to initiate LCOAR (1BwOL 3.2.4)	SAT UNSAT N/A **Comments:**
***8.**	**Cue: As SM, direct the examinee to identify any required actions to be completed this shift as a result of the QPTR result.**	• **Determines power must be reduced to not greater than 91% within 2 hours (from time of completion of the surveillance).**	SAT UNSAT N/A **Comments:**

CUE: THIS COMPLETES THIS JPM.

RECORD STOP TIME: _____

COMMENTS:

SIMULATOR SETUP INSTRUCTIONS

- Verify/perform TQ-BR-201-0113, BRAIDWOOD TRAINING DEPARTMENT SIMULATOR EXAMINATION SECURITY ACTIONS CHECKLIST. NOTE: This JPM may be performed in a classroom.
- Establish the conditions of IC 21, 100% power, steady state, equilibrium xenon.
- Complete items on Simulator Ready for Training Checklist.
- Place simulator in RUN.

COMMENTS

- Provide examinee copy of 1BwOSR 3.2.4.1, UNIT ONE QUADRANT POWER TILT RATIO (QPTR) CALCULATION, Rev. 6
- Ensure copy of Operator Aid for current values to be used in QPTR Calculation available.

KEY – DO NOT GIVE TO EXAMINEE

QUADRANT POWER TILT RATIO CALCULATION
NIS METERS

Being performed once per:

☒ 7 Days (normal interval) ☐ Shiftly
☐ 12 Hours (with BwVSR 3.2.4.2.) ☐ Other: _____

Date: Today	Time: 30 minutes ago			
Channel	N41	N42	N43	N44
Is the channel operable?	☒ Y ☐ N	☒ Y ☐ N	☒ Y ☐ N	☒ Y ☐ N
Instrument reading	100%	100%	100%	100%
UPPER DETECTORS (A)				
Present upper detector current	192	187	190	185
100% upper detector current	194	181	192	186
Normalized detector current	.990	**1.033**	.990	.995
Average normalized current	**1.002**			
Upper power tilt ratio (¢≤1.02)	¢ **.988**	¢ **1.031**	¢ **.988**	¢ **.993**
LOWER DETECTORS (B)				
Present lower detector current	170	150	165	165
100% lower detector current	170	153	165	168
Normalized detector current	1.00	.980	1.00	.982
Average normalized current	.991			
Lower power tilt ratio (¢≤1.02)	¢ 1.009	¢ .989	¢ 1.009	¢ .991

Attach additional copies of this page as necessary.

KEY – DO NOT GIVE TO EXAMINEE

ATTACHMENT 10
SURVEILLANCE WO DISPOSITION SHEET
(APPLICABLE TO MID-WEST SITES ONLY)
Page 1 of 1

Unit: ***1*** Procedure: ***1BwOSR 3.2.4.1***

PMID/RQ: ***123456*** Work Order #: ***N/A***

PMID/RQ Title: ***QPTR CALCULATION***

PMID/RQ Due Date: ***TODAY*** PMID/RQ Late Date: ***N/A***

Signature/Authorization Approval Review:	**Name**	**Date**	**Time**
Shift Authorization to Start Work:	***Joe Supervisor***	***Today***	***1 hr ago***
Work Started	***John NSO***	***Today***	***1 hr ago***
Work Stopped:	***John NSO***	***Today***	***30 min. ago***
Supv Review of Work Completion:			
ANI Review of work package:			

Surveillance Found Within Acceptance Criteria YES NO

Surveillance Left Within Acceptance Criteria YES NO

("Work Started" date (above shall be the credit date unless otherwise explained)
Complete one of the following:

Verify Credit Date Below:

Credit Surveillance per another WO# _____
If crediting 'per another WO', verify credit date is 'Work Started' date of referenced WO.

_____

- ☐ Complete Sat – Credit Surveillance
- ☐ Complete w/ Portions Unsat – Credit Surveillance
- ☐ No Work Performed – Credit Surveillance
- ☐ Failed – Do Not Credit (Surv Due/Late Dates will NOT advance)
- ☐ No Work Performed – Do Not Credit (Surv Due/Late Dates will NOT advance)
- ☐ Comments _____

ADDITIONAL REVIEW OF RESULTS (IF REQUIRED)

Title	Signature	Date

Exelon Generation **BRAIDWOOD STATION**	PROCEDURE **1BwOSR 3.2.4.1**	
	UNIT NO. **1**	REVISION NO. **8**

PROCEDURE TITLE:

UNIT ONE
QUADRANT POWER TILT RATIO (QPTR) CALCULATION

Rev	Summary	IR# / EC# (if applicable)
8	Fix typo in first note on last page: Change “DMV” to “DVM”. Add applicable step #s to Station Commitments wherever BwVSR 3.2.4.2 referenced, changed to NF-AP-545.	PCRA 1230954-13

UNIT ONE
QUADRANT POWER TILT RATIO (QPTR) CALCULATION

A. STATEMENT OF APPLICABILITY

This procedure outlines the steps necessary to verify the QUADRANT POWER TILT RATIO is ≤ 1.02. It is applicable in MODE 1 above 50% RATED THERMAL POWER when the Power Distribution System (PDMS) is inoperable and shall be performed:

1. Once per 7 days.

* 2. Once per shift when the NIS Power Range Tilts alarm is INOPERABLE as directed by 1BwOL 3.2.4 and 1BwOSR 0.1-1,2,3.

3. Once per 12 hours when QUADRANT POWER TILT RATIO is not within limits as directed by LCOAR 1BwOL 3.2.4.

B. REFERENCES

1. Tech Spec LCO 3.2.4.

2. Tech Spec Surveillance Requirements:

   a. 3.2.4.1.

   b. 3.2.4.2.

3. TRM TLCO 3.3.h.

4. Station Procedures:

   a. 1BwOSR 0.1-1,2,3, Unit One MODES 1, 2 & 3 Shiftly & Daily.

   b. 1BwOL 3.2.4, LCOAR - Power Distribution Limits - QPTR.

   c. 1BwOL TRM 3.3.h, Technical Requirements Manual (TRM) LCOAR - Power Distribution Monitoring System (PDMS)

   d. NF-AP-545, QPTR Checkout Using Incores.

5. Station Commitments:

   a. 456-200-87-38101, limitation to check the operability of the QPTR Alarm anytime QPTR exceeds 1.02. Step E.3.

   b. 456-130-98-3.2.4-0100 "Specific SAR Commitment" (Regarding shiftly surveillance interval when the power range tilts alarm is inoperable). Steps A.2, E.3.

C. PREREQUISITES

1. Receive permission to perform this surveillance from the Shift Manager or designee prior to performance by having the Data Package Cover Sheet signed and dated.

2. Reactor power should be constant while recording NIS data.

3. The latest 100% Power NIS Detector Currents are available (from Station Nuclear Engineer or Operator Aid).

D. PRECAUTIONS

Static electricity may cause the needles on the NIS Meters to indicate abnormally. If the NIS Meters are being used to perform this surveillance, the meter faces should be wiped with a damp cloth or equivalent to remove the static charge prior to taking the reading.

E. LIMITATIONS AND ACTIONS

1. As stated in Tech Spec LCO 3.2.4.

2. In the event the Acceptance Criteria (¢) is not met during the performance of this surveillance, IMMEDIATELY notify the Shift Manager or designee to initiate LCOAR 1BwOL 3.2.4.

* 3. Anytime the calculated QPTR exceeds 1.02, the NIS Power Range Tilts alarm OPERABILITY should be reviewed. If the alarm is not illuminated the required frequency of this surveillance shall be increased from once per 7 days to once per shift in accordance with 1BwOL 3.2.4.

4. The process computer point calculation is the most accurate method of calculating QPTR and should normally be used. During the performance of AFD calibrations on the excore detectors the process computer point method will not be correct until ALL drawers are calibrated. During this calibration period QPTR MUST be calculated using the NIS meter method.

5. If the Power Range channel is inoperable but individual detector current indication is reliable, performance of NF-AP-545 is not required. Detector current indication can be considered reliable if detector degradation or failure is not indicated, the detector signal cable is attached to the 1PM07J drawer, and proper high voltage is applied to the detector. In this condition, the QPTR alarm may be inoperable but the neutron flux input to QPTR is available. QPTR can be calculated using the individual detector current meter indications.

F. MAIN BODY

NOTE

All data taken/calculated will be recorded on the appropriate Data sheet.

1. VERIFY all applicable Prerequisites, Precautions, and Limitations and Actions are satisfactorily addressed.

2. INDICATE the applicability of this surveillance on the appropriate Data Sheet (REFER to Statement of Applicability):

   a. Being performed once per 7 days.

   b. Being performed once per shift.

   c. Being performed once per 12 hrs with NF-AP-545.

   d. Other (Specify).

3. RECORD the Date and Time.

4. RECORD the OPERABILITY status of the NIS drawer by checking the appropriate box on the Data Sheet.

NOTE

With one Power Range Channel INOPERABLE and THERMAL POWER is > 50% but ≤ 75%, the QPTR may be calculated using the three OPERABLE channels. With one Power Range channel input to QPTR INOPERABLE with THERMAL POWER > 75%, the QPTR shall be calculated using the three OPERABLE channels taking data when directed by Reactor Engineering during performance of NF-AP-545.

5. RECORD the indicated Reactor Power from the operable NIS drawer front panel PERCENT FULL POWER meters on the appropriate Data Sheet. RECORD "N/A" for the INOPERABLE Power Range channel data.

NOTE

Step F.6 and F.7 are independent of each other. Perform the applicable step.
Step F.6 will use the process computer to determine the QPTR.
Step F.7 will use installed NIS Meters or DVMs to determine QPTR.

F. 6. DETERMINE the QPTR using process computer points as follows (N/A if determined with the NIS meters):

N/A

a. Perform the following for the Upper Detectors:

1) RECORD present computer point reading.

2) DIVIDE the sum of the computer points by the number of operable channels to obtain the average computer point reading.

$$\text{Average Computer Point Reading} = \frac{\text{Sum of Computer Points}}{\text{Number of Operable NIS Channels}}$$

3) DIVIDE the Computer Point Reading by the Average Computer Point Reading to determine the Quadrant Power Tilt Ratio.

$$\text{Power Tilt Ratio} = \frac{\text{Computer Point Reading}}{\text{Average Computer Point Reading}}$$

b. Perform the following for the Lower Detectors:

1) RECORD present computer point reading.

2) DIVIDE the sum of the computer points by the number of operable channels to obtain the average computer point reading.

$$\text{Average Computer Point Reading} = \frac{\text{Sum of Computer Points}}{\text{Number of Operable NIS Channels}}$$

3) DIVIDE the Computer Point Reading by the Average Computer Point Reading to determine the Quadrant Power Tilt Ratio.

$$\text{Power Tilt Ratio} = \frac{\text{Computer Point Reading}}{\text{Average Computer Point Reading}}$$

F. 7. DETERMINE the QPTR using installed NIS Meters or DVMs

NOTE

Step 7.a will install DVMs, N/A step if using installed NIS Meters.
Step 7.b will determine the QPTR using installed NIS Meters or DVMs.
Step 7.c will remove DVMs, N/A step if using installed NIS Meters.

NOTE

The following annunciator(s) may actuate during connection of the DVMs. This list is not all inclusive but if the annunciator(s) does not reset when the DVM is disconnected, investigate the cause before going to the next drawer.

10A04	PWR RNG UPPER DET FLUX DEV HIGH
10B04	PWR RNG LOWER DET FLUX DEV HIGH
10C04	PWR RNG CHANNEL DEV
10B05	PWR RNG FLUX HIGH ROD STOP

CAUTION

NIA

To minimize the effect of meter loading to the drawer, Fluke 8840A DVMs shall be used. If there are not enough 8840As available, Fluke 8505A and Fluke 8502 may be substituted. Other DVM may also be used with the consent of NIS System Engineer or backup. In addition, shielded test leads shall be used to avoid EMF induction to the reactor protection system circuitry.

CAUTION

A Reactor Trip could occur if a 2 of 4 coincidence is made up due to a channel trip on the power range detector being measured. The DVM MUST be initially set to the millivolt range for detector current readings to prevent a channel trip.

If the current as seen on the face meter is low (at low powers), it is permissible to down range the detector meter current selector switch for better resolution.

CAUTION

Ensure that the DVM leads to be used have no flaws in their insulation. Also ensure that any contact points between the leads and the drawer are properly protected to ensure that chafing of the leads' insulation does not occur. If the DVM leads become shorted to ground after connection, the associated power range channel will be made inoperable.

N/A

CAUTION

Power range cables can become snagged while opening the drawers. Open the rear cabinet doors to 1PM07J and station a person at the rear of the drawers to ensure that all cables are free while opening the drawer. Minimize motion of the cables, since the cable may become disconnected from its connector if excessive motion occurs. This could make the drawer inoperable.

N/A

F. 7. a. NOTIFY IMD to perform the following for each Power Range "B" drawer:

1) CAREFULLY OPEN the Power Range Nuclear Instrumentation Channel "B drawer.

2) CONNECT a DVM between the red and black test jacks of the detector current meter for each of the eight Power Range detectors.

3) ROLL the Power Range "B" drawers carefully as far into the 1PM07J panel as possible. Avoid crimping or damaging the DVM leads. If possible, slightly engage the seismic screws on the front of the drawers.

4) SECURE the DVM leads to 1PM07J.

5) COMPLETE the appropriate sections of the DVM Calibration Table.

N/A

F. 7. b) DETERMINE the QPTR using NIS meters or DVM as follows (N/A if determined with the computer points):

1) Perform the following for the Upper Detectors:

a) RECORD each present detector current.

b) RECORD the latest 100% Power NIS detector current (from Reactor Engineering or the Operator Aid).

c) DIVIDE the present detector current by the 100% detector current to obtain the normalized detector current.

$$\text{Normalized Detector Current} = \frac{\text{Present Detector Current}}{\text{100\% Detector Current}}$$

d) DIVIDE the sum of the normalized detector currents by the number of operable channels to obtain the average normalized current.

$$\text{Average Normalized Current} = \frac{\text{Sum of Normalized Detector Currents}}{\text{Number of Operable NIS Channels}}$$

e) DIVIDE the Normalized Detector Current by the Average Normalized Current to determine the Quadrant Power Tilt Ratio.

$$\text{Power Tilt Ratio} = \frac{\text{Normalized Detector Current}}{\text{Average Normalized Current}}$$

F. 7. b. 2) Perform the following for the Lower Detectors:

a) RECORD each present detector current.

b) RECORD the latest 100% Power NIS detector current (from Reactor Engineering or the Operator Aid).

c) DIVIDE the present detector current by the 100% detector current to obtain the normalized detector current.

$$\text{Normalized Detector Current} = \frac{\text{Present Detector Current}}{\text{100\% Detector Current}}$$

d) DIVIDE the sum of the normalized detector currents by the number of operable channels to obtain the average normalized current.

$$\text{Average Normalized Current} = \frac{\text{Sum of Normalized Detector Currents}}{\text{Number of Operable NIS Channels}}$$

e) DIVIDE the Normalized Detector Current by the Average Normalized Current to determine the Quadrant Power Tilt Ratio.

$$\text{Power Tilt Ratio} = \frac{\text{Normalized Detector Current}}{\text{Average Normalized Current}}$$

F. 7. c. PERFORM the following to RESTORE each Power Range "B" Drawers:

NOTE

The following steps are applicable if DVMs are to be used to indicate detector current. Mark this section N/A if current meters installed in the drawers are to be used.

CAUTION

Power Range cables can become snagged while opening the drawers. Open the rear cabinet doors to 1PM07J and station a person at the rear of the drawers to ensure that all cables are free while opening the drawer. Minimize motion of the cables, since the cable may become disconnected from its connector if excessive motion occurs. This could make the drawer inoperable.

1) CAREFULLY OPEN the Power Range "B" drawers.

2) REMOVE the DVM leads.

3) CAREFULLY CLOSE and SECURE the Power Range "B" drawers.

4) REMOVE all material installed to secure equipment.

5) COMPLETE the appropriate sections of the DVM Calibration Table.

G. ACCEPTANCE CRITERIA

No Quadrant Power Tilt Ratio shall exceed 1.02.

UNIT ONE
QUADRANT POWER TILT RATIO CALCULATION
COMPUTER POINTS

NOTE

The process computer point calculation is the most accurate method of calculating QPTR and should normally be used. During the performance of AFD calibrations on the excore detectors the process computer point method will not be correct until ALL drawers are calibrated. During this calibration period QPTR MUST be calculated using the NIS meter method.

Being performed once per:

☐ 7 Days (normal interval) ☐ Shiftly
☐ 12 Hours (with NF-AP-545) ☐ Other: _____

Date:	Time:			
Channel	N41	N42	N43	N44
Is the channel operable?	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
Instrument reading	%	%	%	%
Upper Detectors (A)				
Computer point	N0041	N0043	N0045	N0047
Present computer point reading				
Average computer point reading				
Upper power tilt ratio (¢≤1.02)	¢	¢	¢	¢
Lower Detectors (B)				
Computer point	N0042	N0044	N0046	N0048
Present computer point reading				
Average computer point reading				
Lower power tilt ratio (¢≤1.02)	¢	¢	¢	¢

Date:	Time:			
Channel	N41	N42	N43	N44
Is the channel operable?	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
Instrument reading	%	%	%	%
Upper Detectors (A)				
Computer point	N0041	N0043	N0045	N0047
Present computer point reading				
Average computer point reading				
Upper power tilt ratio (¢≤1.02)	¢	¢	¢	¢
Lower Detectors (B)				
Computer point	N0042	N0044	N0046	N0048
Present computer point reading				
Average computer point reading				
Lower power tilt ratio (¢≤1.02)	¢	¢	¢	¢

ATTACH additional copies of this page as necessary.

UNIT ONE
QUADRANT POWER TILT RATIO CALCULATION
NIS METERS

Being performed once per:

☒ 7 Days (normal interval) ☐ Shiftly
☐ 12 Hours (with NF-AP-545) ☐ Other: _____

Date: ***Today***	Time: ***30 minutes ago***			
Channel	N41	N42	N43	N44
Is the channel indication reliable?	☒ Y ☐ N	☒ Y ☐ N	☒ Y ☐ N	☒ Y ☐ N
Instrument reading	***100***%	***100***%	***100***%	***100***%
Upper Detectors (A)				
Present upper detector current	***192***	***187***	***190***	***185***
100% upper detector current	***194***	***181***	***192***	***186***
Normalized detector current	***.990***	***.968***	***.988***	***.993***
Average normalized current	***.985***			
Upper power tilt ratio (¢≤1.02)	¢ ***1.005***	¢ ***.983***	¢ ***1.003***	¢ ***1.008***
Lower Detectors (B)				
Present lower detector current	***170***	***150***	***165***	***165***
100% lower detector current	***170***	***153***	***165***	***168***
Normalized detector current	***1.00***	***.980***	***1.00***	***.982***
Average normalized current	***.991***			
Lower power tilt ratio (¢≤1.02)	¢ ***1.009***	¢ ***.989***	¢ ***1.009***	¢ ***.991***

Date:	Time:			
Channel	N41	N42	N43	N44
Is the channel indication reliable?	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N	☐ Y ☐ N
Instrument reading	%	%	%	%
Upper Detectors (A)				
Present upper detector current				
100% upper detector current				
Normalized detector current				
Average normalized current				
Upper power tilt ratio (¢≤1.02)	¢	¢	¢	¢
Lower Detectors (B)				
Present lower detector current				
100% lower detector current				
Normalized detector current				
Average normalized current				
Lower power tilt ratio (¢≤1.02)	¢	¢	¢	¢

ATTACH additional copies of this page as necessary.

UNIT ONE
DVM CALIBRATION TABLE

DVM		QA#	Cal Date	Due Date	Initials	IV
N41	Top					
	Bottom					
N42	Top					
	Bottom					
N43	Top					
	Bottom					
N44	Top					
	Bottom					

N/A

DVM		Leads Installed Name/Date	IV Name/Date	Leads Removed Name/Date	IV Name/Date
N41	Top				
	Bottom				
N42	Top				
	Bottom				
N43	Top				
	Bottom				
N44	Top				
	Bottom				

~~7.2.~~

Formatted: Bullets and Numbering

ATTACHMENT 1
Operator Aid Review and Approval
Page 1 of 1

	Rev. 73				Op Aid # 01-009			
Operator Aid Title:	Unit 1 NIS Operator Aid							
Description/Use:	Operator Aid Book, Effective 3/22/2013-5/30/2013							
Permanent Sign/Label Required: ☐ Yes ☒ No					If Yes, Label Request Submittal Date: N/A			
Setpoint	Detector							
	N31				N32			
High Flux at Shutdown (CPS) Setpoint Reset	60		51		60		51	
Level Trip (CPS) Setpoint Reset	1×10^5		5×10^4		1×10^5		5×10^4	
	N35				N36			
High Flux at Shutdown (CPS) Setpoint Reset	5.85×10^{-5}		4.98×10^{-5}		5.67×10^{-5}		4.81×10^{-5}	
Level Trip (CPS) Setpoint Reset	7.30×10^{-5}		6.21×10^{-5}		7.07×10^{-5}		6.00×10^{-5}	
	N41		N42		N43		N44	
	A	B	A	B	A	B	A	B
100% Full Power (μamps) Meters	194	170	181	153	192	165	186	168
Overpower Trip Low Range	25%		25%		25%		25%	
Overpower Trip High Range	109%		109%		109%		109%	
Incore/Excore Offset Ratios	K0554		K0552		K0551		K0553	
	20.171		18.812		18.753		19.454	
Preparer's Name:	*Matthew Loula* 3/22/2013							
Department Head Approval:	*Marri Marchionda-Palmer* 3/22/2013							
Shift Manager Approval:	*Joe Klevorn* 3/23/2013							

Review Items:

- Does this Operator Aid replicate information from a procedure? ❑ Yes ☒ No
- Should this be incorporated into a procedure? ❑ Yes ☒ No
- Could it be eliminated with better labeling or a placard? ❑ Yes ☒ No

JOB PERFORMANCE MEASURE

TASK CONDITIONS:

1. You are the Unit 1 Unit Supervisor.
2. Both Units are at full power.
3. The current time is 0700 today. Due to scheduled work on the liquid release line, release #L-13-002 must be COMMENCED by 0900 today using the low flow release path.

INITIATING CUES:

1. The Shift Manager has handed you a portion of a 0WX01T liquid release package, #L-13-002, completed through section G.6, and has directed you to complete Section H. All previous sections of the release package have been successfully completed.

2. Notify the Shift Manager when Section H of the release package is complete.

TASK TITLE: **Prepare/Perform a Liquid Radwaste Release**

JPM No.: **S-302** REV: **2013 NRC**
TPO No.: 8C.HP-001 K&A No.: 2.3.6
TASK No.: S-HP-001, Authorize a liquid radwaste release K&A IMP: 3.8

EXAMINEE: _____ SRO

EVALUATOR: _____ DATE: _____

The Examinee: PASSED _____ this JPM. TIME STARTED: _____

FAILED _____ TIME FINISHED: _____

JPM TIME: _____ MINUTES

CRITICAL ELEMENTS: **(*) 3, 7** APPROX COMPLETION TIME: **30 MINUTES**

CRITICAL TIME: **NA**

EVALUATION METHOD:
X PERFORM
___ SIMULATE

LOCATION:
___ IN PLANT
X SIMULATOR
X CLASSROOM

GENERAL REFERENCES:

1. BwOP WX-501T1, Rev. 66, Liquid Release Tank 0WX01T Release Form
2. BwOP WX-501T2, Rev 6, Liquid Release Window Determination
3. BwOP WX-501T3, Rev 1, Authorization to Release Outside of Release Window

MATERIALS:

1. BwOP WX-501T1, Rev. 66, Liquid Release Tank 0WX01T Release Form
2. BwOP WX-501T2, Rev 6, Liquid Release Window Determination
3. BwOP WX-501T3, Rev 1, Authorization to Release Outside of Release Window
4. Computer with network access.

TASK STANDARDS:

1. Complete Section G of a liquid release tank release form in accordance with BwOP WX-501T1.
2. Determine release start time is outside release start time window.

TASK CONDITIONS:

1. You are the Unit 1 Unit Supervisor.
2. Both Units are at full power.
3. The current time is 0700 today. Due to scheduled work on the liquid release line, release #L-13-002 must be COMMENCED by 0900 today using the low flow release path.

INITIATING CUES:

1. The Shift Manager has handed you a portion of a 0WX01T liquid release package, #L-13-002, completed through section G.6, and has directed you to complete Section H. All previous sections of the release package have been successfully completed.

2. Notify the Shift Manager when Section H of the release package is complete.

RECORD START TIME _____

Note: Provide the examinee with a copy of BwOP WX-501T1 completed through Step G.5.

	PERFORMANCE STEP	STANDARD	Circle applicable
1.	Obtain and record current Kankakee River flow data **NOTE: The USGS internet site can be accessed from the computer desk top from workgroup apps menu or by using normal internet access.** **NOTE: After examinee locates Kankakee river flow on usgs web site, indicator, provide following cue:** **CUE: Kankakee river stream flow is 5680 cfs at 0700 on today's date AND the Kankakee River is currently NOT at flood stage.** **NOTE: If examinee attempts to access the Unit 1 US turnover, provide the following cue:** **CUE: Kankakee river flow has been logged in the Unit 1 US turnover.**	Obtain and record current Kankakee River flow data by performing the following: • Access the United States Geological Survey internet site (usgs.gov). • Access water watch-current stream flow conditions for Illinois • Access USGS 05527500 Kankakee River near Wilmington Il flow • Record discharge flow ○ Record Kankakee River flow in Unit 1 US turnover	SAT UNSAT N/A **Comments:**
2.	Determine CW blowdown flow **NOTE: After examinee locates CW blowdown flow indicator, provide following cue:** **CUE: CW blowdown flow is 22,000 gpm.**	Determine CW blowdown flow per BwOP WX-501T2 as follows: ○ Record liquid release #L-13-002 • Obtain and record current Kankakee River flow (5680 cfs) • Record CW blowdown flow ○ F2400 ○ OUR-CW032	SAT UNSAT N/A **Comments:**

	PERFORMANCE STEP	STANDARD	Circle applicable
*3	**Determine the Liquid Release Window per BwOP WX-501T2** **CUE: After examinee locates correct procedure, provide copy.** **NOTE: After examinee locates liquid release spread sheet, inform student to use spreadsheet on computer desktop.** **NOTE: A completed copy of the liquid release spread sheet is located on page 7.** **CUE: If examinee asks where release duration information is to be obtained from, inform the examinee "the release duration is per BwOP WX-501T1".** **CUE: As Shift Manager inform the examinee to use the release duration specified in BwOP WX-501T1.**	Determine the Liquid Release Window per BwOP WX-501T2 as follows: • Access Liquid Release Window spread sheet (k:/shift/excel/liquid release) ○ Enter arrival date at Wilmington (tomorrow's date) • Enter river flow rate (5680 cfs) • Enter release duration (638 mins from BwOP WX-501T1 step D.6.f.2) • Enter blowdown flow rate (22,000 gpm)	SAT UNSAT N/A **Comments:**
4.	Maximum Release Rate **CUE: The RETDAS computer output values for Radioactive Release rate and most limiting are both 50 gpm.**	Determine Maximum Release Rate (BwOP WX-501T1 H.1.e.2)): • Records Chemistry release rate from step C.10.b (50 gpm) • Record Radioactive Release rate (50 gpm) • N/A step H.1.e.2)c) • Record the most limiting value (50 gpm)	

5.	Record the Liquid Release Window times	• Record the Liquid Release Window times on BwOP WX-501T1 (step H.1.f)
		  • Target start time (1215)
		  • Start after time (1115)
		  • Start before time (1300)
		  • Start after time recorded in step D.3.h (N/A)	

6.	Evaluate the expected time of release **CUE: Dechlorination skid is in operation.**	Evaluate the expected time of release so that both biocide treatment and the release can be accommodated by performing the following: • Check if dechlorination skid in operation • Verify CW blowdown flow ≥ 8000 gpm (22,000 from previous cue)	SAT UNSAT N/A **Comments:**

	PERFORMANCE STEP	**STANDARD**	**Circle applicable**
***7.**	**Identify release will not start within desired time** **CUE: Acknowledge as SM notification of release performed outside start time window. Inform examinee another supervisor will perform BwOP WX-501T3.**	Perform the following: • Determine release will be performed outside of release start time window (from initiating cue, release must start at 0900) • Determine BwOP WX-501T3 must be completed prior to authorizing release ○ Notify SM release will be performed outside of release start time window OR ○ Notify SM to delay release until work completed OR ○ Notify SM to delay work until release completed within desired time window.	SAT UNSAT N/A **Comments:**

CUE: THIS COMPLETES THIS JPM.

RECORD STOP TIME _____

COMMENTS:

SIMULATOR/CLASSROOM SETUP GUIDE:

- Verify/copy Liquid Release Window spreadsheet to computer desktop prior to administering JPM. Spreadsheet is located at k:/shift/excel/liquid release.
- Clear data from INPUTS field of Liquid Release Window spread sheet prior to administering JPM.
- Clear computer history of recently accessed documents, programs, and web sites visited prior to administering JPM by performing the following:
  - Right mouse click on task bar
  - Select properties
  - Select advanced tab
  - Select clear
- **Delete Liquid Release Window spreadsheet from computer desktop after administering JPM to all candidates.**

COMMENTS:

- BwOP WX-501T1, Rev. 66.
- BwOP WX-501T2, Rev 6.
- BwOP WX-501T3, Rev 1.

KEY KEY

INPUTS		
Arrival Date at Wilmington	mm/dd/yyyy	Tomorrow
River Flow Rate	CFS	5680
Release Duration	Minutes	638
Blowdown Rate (F2400)	GPM	22000
CALCULATED RESULTS		
Blowdown Time To River	Minutes	120
River Time To Wilmington Intake	Minutes	420
Blowdown Peak Time To Wilmington Intake	Minutes	859
Margin	Minutes	98
Start After Time (= Peak Arrives at 10 PM)	Time	Today 1115
Normal Start (= Center of Peak occurs at 2:30 AM)	Time	Today 1215
Start BeforeTime (= Peak Departs at 7 AM)	Time	Today 1300

KEY KEY

Exelon Nuclear **BRAIDWOOD STATION**	PROCEDURE NO. **BwOP WX-501T1**	
	UNIT NO.	REVISION NO. **66**

PROCEDURE TITLE:

LIQUID RELEASE TANK 0WX01T RELEASE FORM

Rev	Summary	IR# / EC# (if applicable)
63	Tank specific alarms created for individual Release Tanks 0WX01T & 0WX26T. BwAR 0PL01J-7-A9 replaced by BwAR 0PL01J-7-B1 and BwAR 0PL01J-7-B2. References to alarm revised in BwOP WX-501T1/526T1. BwAR 0PL01J-7-A9 deleted.	EC 385919 PCRA 1230957-23
64	Corrected nomenclature for 0PR052	PCRA 1306712-02
65	Add Administrative steps and Attachment to comply with requirements of CC-AA-112	CA 1182804-33
66	Updated attachment to comply with CC-AA-112. No Tech Eval required. Multiple editorial issues fixed.	PCRA 1306712-02, 1321744-02, 1323031-02, 1314053-02, 1319267-02, CA 1312921-04

LIQUID RELEASE TANK 0WX01T RELEASE FORM

NOTE

If performing partial procedure to fill Release Tank with WM GO TO Step H.27 or perform BwOP WX-174 to dilute/fill from PW.

Release Number L - __*13*____ - __*002*__

A. OPERATING DEPARTMENT RESPONSIBILITY RADWASTE OPERATOR

NOTE

- Desired level is 85% to 90% for Release Package initiation.
- A Release Package may be initiated anytime a release is deemed appropriate with Operations Supervision permission.
- The mixer should not be run when level is < 70%.
- Consideration should be given future water management needs when initiating a package with level < 85%.

NOTE

If a liquid release is being performed per BwOP TR-21, Transferring the Clean Water Storage Tank to CW Blowdown, a liquid release from 0WX01T is not permitted.

JO __1. VERIFY 0WX01T is Recirculating per BwOP WX-171.

Tank Recirculation Started __Today__/__14 hrs ago__
Date Time

JO __2. RECORD 0WX01T Tank Level (0LR-WX028, Release Tank 0WX01T, Level Indication).

0WX01T Tank Level __***58.5***__ %

JO __3. COMPLETE the entries in the Liquid Release Log in the RWCR.

A ***JO*** 4. VERIFY/RECORD the Release Number from the Liquid Release Log in the space provided on page 1.

NOTE

The minimum mixing time required for an accurate sample is 5 minutes, if recirculating with the mixer ON or 60 minutes, if recirculating with the mixer OFF. After meeting time requirements, Chemistry can be called for a sample.

JO 5. WHEN the minimum mixing time requirements have been satisfied, NOTIFY Chemistry that a Release Package in progress requires 0WX01T sampling.

NOTE

If more than 25% of the volume in the Release Tank is water that was drained or processed out of one or more systems to support Refueling or Forced Outage activities, it is "Outage Water".

JO 6. Is the water in this tank considered to be outage water?

☐ YES ☐ NO

JO 7. Is 0WX01T level greater than 80% (From Step A.2.)?

☐ YES (GO TO STEP A.8.) ☐ NO (MARK STEP A.8. "N/A".)

NOTE

If more than 55 gallons of caustic has accumulated at the Release Tank Chemical Addition area (426' by 1A FW Pp), a caustic add should be performed unless directed otherwise by the Shift Supervisor based on release priority.

N/A 8. Is it desired to add caustic to 0WX01T?

☐ YES ☐ NO

JO 9. VERIFY/DELIVER this release package to the non-outage Unit Supervisor.

B. OPERATING DEPARTMENT RESPONSIBILITY – UNIT SUPERVISOR

NOTE

A TSS analysis is required on ALL tanks released on the first day of the sampling week that releases are performed. The first release tank of the month requires Oil and Grease sampling. These sample analysis add 4-5 hours to the processing time. All chemistry analysis calculations require second verification (If there is only one Chem Tech Available, the verification occurs the following shift). A release package can process through Chemistry in as little as 4 hours if there are two Chem Techs, there are no higher priorities, no caustic add is required, and 0PR01J is operable.

NOTE

Consideration should be given to scheduled activities that may impact operability/availability of 0PR01J and 0PR10J.

1. AAR 0BwOS RETS 2.1-1a in effect for:

JS___ ● 0RE-PR001 ☐ YES ☒ NO

VERIFICATION ***WS***___

JS___ ● 0RE-PR010 ☐ YES ☒ NO

VERIFICATION ***WS***___

NOTE

Two release path options are available. Generally, the Low Flow release would primarily be used when liquid radwaste inventory is high (i.e. outage). The Ultra Low Flow release rate is the preferred path and is correlated to the current river flow. This path would primarily be used when liquid radwaste inventory is normal. Contact Ops Supervisor for determination of which release flow path to use based on current liquid radwaste inventory, conditions, equipment availability, etc.

B. 2. SELECT which release path will be used for the release:

- ○ Low Flow Release Path
- ○ Ultra Low Flow Release Path

NOTE

Prior to forwarding this Release Package to the Chemistry Department, Step F.1. and F.2. may be performed if operating conditions permit.

3. OPS Supervisor: I have reviewed Parts A and B and have verified them accurate and complete.

Joe Supervisor / today / 13 hrs ago
OPS Supervisor Date Time

JS 4. NOTIFY the RADWASTE OPERATOR that his release package is ready for prompt delivery to Chemistry.

C. CHEMISTRY DEPARTMENT RESPONSIBILITY

NOTE
100% level for the 0WX01T release tank is 32,900 gallons.

NOTE
If 0RE-PR001 is inoperable under AAR 0BwOS RETS 2.1-1a, analyses other than isotopics required in this package, i.e., Tritium, Boron, O & G (if required), and TSS (if required) must be run and the numbers reported on one of two samples that meet the 30% acceptance criteria.

JT ___ 1. To verify a request has been made to add caustic to 0WX01T Release Tank, verify yes applies to all statements specified in step A.7 and A.8.

❍ All statements are yes, a chemical addition has been requested, GO TO step C.2.

☒ Not all statements apply. A chemical addition will not be performed, GO TO step C.3.

2. Caustic addition to 0WX01T.

a. Sample and analyze 0WX01T for boron concentration:

_____ ● Sampled by _____

_____ ● Time/Date _____/_____

_____ ● Results _____ ppm (Record boron value in step C.9).

_____ b. Submit a chemical addition using BwCP 340-1T4 for caustic to 0WX01T based on the following chart.

N/A

PPM BORON	GALLONS OF CAUSTIC
≤200	0
200	5
>200 ≤ 400	10
>400 ≤ 600	15
>600 ≤ 800	20
>800 ≤ 1000	25
>1000 ≤ 1200	30
>1200 ≤ 1400	35
>1400 ≤ 1600	40
>1600 ≤ 1800	45

C. 2. c. PERFORM either of the following:

❍ Chemical Addition:

_____ a) SUBMIT Chem Add to Operations for _____ gallons caustic. Submitted by:

_____ Time/Date _____/_____

_____ b) RECORD the Time and Date the caustic addition was completed:

_____ Time/Date _____/_____

_____ c) WHEN the notification has been received that the caustic addition is complete, GO TO step C.3.

OR

_____ ❍ OPS Supervisor notified that no caustic is to be added based on boron concentration. OPS Supervisor notified:

_____ Time/Date _____/_____ by Chem Tech

_____ GO TO Step C.3.

N/A

C. 3. Sampling the Release Tank.

NOTE

After obtaining a sample of the Release Tank, the analysis listed in Section C. (excluding sections C.1 and C.2) can be performed in any order necessary to perform the analysis in a safe and timely fashion. It is not necessary to complete one analysis before starting another. The sequence of performing the analysis is left to the discretion of individual performing the tasks.

	1st set		2nd set (If Required)	
	1st Sample	2nd Sample (If Required)	1st Sample	2nd Sample (If Required)
Sampled by	***JT***		***JT***	
Date	today		today	
Sample Time	13 hrs ago		12.5 hrs ago	

JT a. One liter in a poly bottle for isotopic analysis, tritium analysis, and boron analysis using appropriate Chemistry procedures and 250 ml for the "monthly save" (monthly composites).

C/M b. For the first release package of the month, ANALYZE sample for Oil and Grease as directed per BwCP 323-18.

NOTE

Additional release packages sampled on the same day as those analyzed in Step C.3.c. will require TSS samples also.

C/M c. For the day of the first release package of the week, obtain a sample for Total Suspended Solids (TSS) analysis for ALL releases as directed per BwCP 323-18.

C. 4. ISOTOPIC SAMPLING CHECK

JT __ ☒ IF the Radwaste Effluent Process Monitor, 0RE-PR001 is operable per AAR 0BwOS RETS 2.1.-1a (see Step B.1.) then N/A Step C.5.

N/A __ ❍ IF Radwaste Effluent Process Monitor, ORE-PR001 is not operable per AAR 0BwOS RETS 2.1.-1a (see Step B.1.) then Perform Step C.5.

NOTE

IF an Isotopic Verification is to be performed then an independent sample of sufficient volume for an Isotopic must be taken by an independent qualified individual.

5. ISOTOPIC VERIFICATION

N/A __ a. VERIFY that Cobalt 60 (Co-60) activities are within 30% of each other by PERFORMING the following calculation:

N A

$A/B \leq 1.30$

Where:

A = The Larger Co-60 activity, μCi/g = _____.
B = The Smaller Co-60 activity, μCi/g = _____.

_____ ÷ _____ = _____ (≤1.30)
(A) (B) (A/B)

C. 5. b. PERFORM either of the following:

N/A ___ ❍ IF the activities are NOT within 30% of each other, GO TO step C.5.c.

N/A ___ ❍ IF the activities are within 30% of each other, N/A Steps C.5.c. through C.5.g. and GO TO Step C.6.

c. If the activities were not within 30% of each other, PERFORM the following:

N/A ___ 1) DISCARD any results obtained for O & G, TSS, boron, and tritium on these samples.

N/A ___ 2) INFORM OPS Supervision.

N/A ___ 3) OBTAIN another set of INDEPENDENT samples.

N/A ___ 4) PERFORM an isotopic analysis on each of the second set of samples.

N/A ___ 5) VERIFY that Cobalt 60 (Co-60) activities are within 30% of each other by PERFORMING the following calculation:

A/B ≤ 1.30

Where:

A = The Larger Co-60 activity, μCi/g = _____.
B = The Smaller Co-60 activity, μCi/g = _____.

_____	÷	_____	=	_____
(A)		(B)		(A/B) (≤1.30)

N/A ___ d. A second INDEPENDENT set of samples has been obtained, analyzed and the Co-60 activities verified to be within 30% of each other. (Check one of the following.)

☐ YES, GO TO Step C.6.

☐ NO, INFORM Operations Supervision and Chemistry Supervision immediately. Save other analysis results, i.e., Tritium, boron, O & G (if required) and TSS (if required) obtained on the second set of samples.

_____/_____
Signature Date

NOTE

Chemistry and OPS Supervision will attempt to resolve the activity mismatch. Further INDEPENDENT sampling and isotopic analyses may be necessary. Radiation Protection Supervision may need to be consulted to re-evaluate the 30% acceptance criteria.

C____5. e. Radiation Protection has waived 30% acceptance criteria.

N A

_____/_____/_____
Rad. Protection Supervisor Date Time

_____/_____/_____
OPS Supervisor Date Time

f. If Radiation Protection waives the 30% acceptance criteria, report analysis results for Tritium, boron, O & G (if required) and TSS (if required) obtained on the second set of samples.

g. If Radiation Protection does not waive the 30% acceptance criteria, discard analysis results for Tritium, boron, O & G (if required) and TSS (if required) obtained on the second set of samples. Notify OPS Supervisor that this package is terminated and return to him. Chemistry Supervision will begin an investigation to determine the difference.

JT 6. Radionuclide Analysis Performed (Isotopic report(s) attached).

JT 7. PERFORM the following:

- ANALYZE sample for tritium using appropriate Chemistry procedures.
- RECORD the results from the completed BwCP 220-2T1 or applicable procedure.

PARAMETER	FREQUENCY	LIMIT	RESULTS
Tritium	Each Batch	None	***0.3333*** µCi/g

- PLACE a copy of the completed Data Sheet that contains Tritium results in the Release Package for Radiation Protection.

JT 8. Composite sample drawn, labeled with sample time, date and assigned release number and placed in designated sample storage area.

C ***JT*** 9. ANALYZE sample for boron concentration, if not previously obtained in step C.2, using appropriate Chemistry procedure, and RECORD the results below.

PARAMETER	FREQUENCY	POST DILUTION DISCHARGE LIMIT	TANK CONCENTRATION
Boron	Each Batch	≤ 1 ppm	_____ ppm

JT 10. Maximum Discharge Rate based on Water Quality Chemical Analysis.

a. PERFORM the following calculation for each analysis:

$$\frac{A \times B}{C} = \text{MAXIMUM DISCHARGE RATE (GPM)}$$

Where:

A = Kankakee River Flowrate = 91,392 gpm.
B = Parameter Limit = 1 ppm
C = Tank Concentration (from Step C.9.)

(***91392*** (GPM) (A) X ***1*** (PPM) (B)) ÷ ***1464.6*** (PPM) (C) =

62.4 GPM (Maximum Discharge Rate)

NOTE

When using the Low Flow release path, the MAXIMUM RELEASE RATE SHALL NOT exceed 50 gpm. When using the Ultra Low Flow release path, the MAXIMUM RELEASE RATE SHALL NOT exceed 20 gpm.

C. 10. b. REFER to step B.2. to determine which release path will be used for this release. Then complete one of the following:

○ The Low Flow release path will be used. RECORD the calculated Maximum Discharge Rate from step C.10.a. or 50 gpm, whichever is less.

_____***50***_____ GPM (≤ 50 gpm)

○ The Ultra Low Flow release path will be used. RECORD the calculated Maximum Discharge Rate from step C.10.a. or 20 gpm, whichever is less.

_____**N/A**_____ GPM (≤ 20 gpm)

NOTE

All required NPDES LIMITS must be satisfied in the release tank prior to a release.

C ***N/A*** 11. ANALYZE sample as required by the NPDES Permit for Total Suspended Solids and Oil and Grease using appropriate Chemistry procedures. RECORD the results from the completed analyses below and on the NPDES Weekly Data Sheet. N/A this Step and C.12 if NPDES sampling has been satisfied.

	1st set		2nd set (If Required)	
	1st Sample	2nd Sample(If Required)	1st Sample	2nd Sample (If Required)
Sampled by				
Date				
Sample Time				

PARAMETER	FREQUENCY	LIMIT	RESULTS
Total Suspended Solids	Per Current NPDES Permit	≤ 30 ppm	_____ ppm
Oil and Grease	Per Current NPDES Permit	≤ 20 ppm	_____ ppm

12. Is the Release Tank within all specified NPDES limits as determined in Step C.11?

_____ ☐ YES The release tank is approved for Chemical Release. GO TO Step C.13.

_____ ☐ NO a. IMMEDIATELY NOTIFY the OPS Supervisor.

b. OPS Supervisor notified:

_____/_____/_____
(Print Name) Date Time

c. RETURN this procedure to Operations for release cancellation.

C. 13. Chemistry Department: I have reviewed Part C and have verified it is accurate and complete.

_____/_____/_____
Chemistry Department Date Time

_____/_____/_____
Verification Date Time

JT 14. PROMPTLY DELIVER this release package to Rad Protection for processing (ENSURE receipt is acknowledged).

D. RAD PROTECTION DEPARTMENT RESPONSIBILITY

RADIONUCLIDE ANALYSIS

NOTE

If 0RE-PR001 (Liquid Radwaste Release Monitor) is out-of-service, two release tank samples must be obtained and analyzed. For all release calculations the isotopic with the highest total activity SHALL be used. If an isotope appears on only one of the two analyses, then ensure that isotope is included in the calculations.

NOTE

Verification is required if manual calculations are performed. If a computerized release program is used, attach the printout and N/A the appropriate verification spaces.

NOTE

Rad Protection or Operations is to notify Chemistry when a release package is cancelled prior to release so that the NPDES data sheets can be updated as required.

RT __ 1. OBTAIN and REVIEW the Isotopic(s) for the tank to be released and ENCLOSE in this release form.

RT __ 2. PERFORM the following:

RT __ a. CALL the Unit Supervisor and VERIFY that there are no "Liquid Release in Progress" placards for the 0WX01T on panel 0PM01J.

Joe Supervisor	Today	10 hrs ago
Name of Verifier	Date	Time

RT __ b. VERIFY that the status of the 0RE-PR001 and 0RE-PR010 monitors are the same as indicated in Step B.1.

☒ Yes. The status for both monitors is the same as indicated in Step B.1. CONTINUE processing this package.

○ No. The status for one or both monitors is not the same as indicated in Step B.1. OBTAIN guidance from Operations on whether or not processing of this package should be continued.

NOTE

0WX01T has capacity of 32,900 gallons. Tank level is recorded in Step A.2

D. 3. PERFORM the following to calculate the H-3 activity of this release:

RT __ a. ***58.5%*** (Step A.2) x 329 gal / 1% = ***19246.5*** gallons

NOTE

The units in step C.7, μCi/g, are equivalent to μCi/ml as seen in the following step.

RT __ b. ***3.33E-1*** μCi /ml X 3785 ml/gal x ***19246.5*** gal x 1E-06 Ci/μCi = ***24.3*** Ci
(step C.7) (step D.3.a)

Performed by: ***RT*** / ***today***
Initials Date

Verification : ***VT*** / ***today***
Initials Date

c. PERFORM one of the following:

RT __

○ If the H-3 activity is greater than or equal to 100 Ci, INFORM the Operations and Chemistry that the entire requested volume cannot be released in a 24 hour period and cancel this release package.

N/A _____/_____/_____
Supervisor Notified Date Time

☒ If H-3 activity is less than 100 Ci then continue to next step.

D ***RT*** 3. d. RECORD the appropriate information in the Liquid Release Tritium Tracking log for this release package: Release Number, H-3 Concentration and Tank gallons. The Liquid Release Tritium Tracking Log is located at L:/Shared/8931/Liquid Release Information/Liquid Release Tritium Tracking Log.

NOTE
Information required in Step D.3.e can be obtained from the Liquid Release Tritium Tracking Log or by contacting Radwaste Operations.

RT __ e. RECORD the following information for all liquid Rad Waste discharges completed in the last 24 hours. (N/A this step if no releases in last 24 hours.)

Release # _____***L-13-001***_____

Date & Time release stopped ___***yesterday @ 1700***_____

Actual Gallons Released _____***9990***_____

Tritium Activity (uCi/ml) ____***13.6 Ci*** _____

RT __ f. CALCULATE H-3 activity released in last 24 hours. (N/A this step if no releases in the last 24 hours.)

3.60E-1 μCi /ml X 3785 ml/gal x ***9990*** gal x 1E-06 Ci/μCi = ___***13.6***__ Ci

Performed by: ___***RT*** ___/___***today*** _
Initials Date

Verification : ____***VT*** ____/_***today*** ___
Initials Date

D ***RT*** 3. g. PERFORM one of the following:

○ If there was a release in the last 24 hours, CALCULATE the total Tritium activity using the following equation:

24.3 Ci H-3 + ***13.6*** Ci H-3 = ***37.9*** Ci H-3
(Step D.3.b.) (Step D.3.f.)

Performed by: ***RT*** / ***today***
Initials Date

Verification : ***VT*** / ***today***
Initials Date

○ IF no release in the last 24 hours, H-3 Activity = _____Ci H-3.
(Step D.3.b.)

RT __ h. PERFORM one of the following (and INITIAL appropriate bullet):

☒ Results of D.3.g are LESS than 100 Ci – CONTINUE with discharge.

○ Results of D.3.g are GREATER than or EQUAL to 100 Ci
- INFORM Operations Field Supervisor that this release cannot start within 24 hours of the completion of the last release.

N/A _____/_____/_____
Supervisor Notified Date Time

RECORD release start time (24 hours AFTER completion of last release.

N/A _____

RT __ i. RECORD anticipated H-3 activity from Step D.3.b. and the sum of the anticipated H-3 activity plus the activity released in the last 24 hours from Step D.3.g. in the Liquid Release Tritium Tracking Log.

NOTE

If 0RE-PR001 is inoperable and AAR 0BwOS RETS 2.1-1a has been initiated, Steps D.4.b–c., are not required and may be marked N/A.

D. 4. PERFORM the following:

RT __ a. CALL the Assist NSO (x2207 or x2208).

RT __ b. REQUEST and RECORD the 3 most recent 10 minute average readings from RM-11 for the 0RE-PR001 (0PS101).

#1 __***2.02E-7***_ μCi/ml

#2 __***2.02E-7***__ μCi/ml

#3 __***2.02E-7***_ μCi/ml

RT __ c. RECORD the maximum background for 0RE-PR001 obtained from 3 average readings in Step D.4.b. above = ***2.02E-7*** μCi/ml

RT __ d. OBTAIN the current 0RE-PR010 reading: ___***8.12E-7***_____ μCi/ml

RT __ e. RECORD the Time and Date the readings were obtained:

Time: _***Now***____ Date: _***today***___

_____***Joe Operator*** _____
Operator Contacted

RT __ 5. INDICATE which release path will be used for this release (refer to step B.2):

☒ Low Flow (Maximum Release Rate = 50 gpm)

○ Ultra Low Flow (Maximum Release Rate = 20 gpm)

NOTE

If the RETDAS computerized release program is available, you may attach the printout to this form and indicate "see attached" in the calculation spaces in D.6.a below. If no quantifiable peaks are found in the radionuclide analysis, write "NQPF" in the Table in Step D.6.a. Actual release data will be completed in Section J.

D. ⊘ 6. Radioactive Release Rate Determination:

RT __ a. To ensure compliance of the planned release with 10CFR20 limits, PERFORM one of the following:

RT __ ☒ IF using RETDAS computerized release program and the RETDAS data farmer link is operable, ENTER all data into the RETDAS software to complete the "Liquid Pre-Release Permit Report". IF the data farmer link in the RETDAS computerized release program is operable, no verification of the Liquid Pre-Release Permit Report is needed. IF any isotopes were MANUALLY entered into RETDAS, have another qualified individual VERIFY all MANUALLY entered isotopes are correct.

Isotopic data entered by: ____***RT*** ___ Date / Time: ***today*** / ***Now***

Isotopic data verified by: ___***N/A***___ Date / Time: _____/_____

REVIEW the "Limits Analysis" section of the Liquid Pre-Release Permit Report.

D ***N/A*** 6. a. ○ IF using RETDAS computerized release program and the RETDAS data farmer link is not operable, ENTER all data into the RETDAS software to complete the "Liquid Pre-Release Permit Report" and MANUALLY enter the isotopic information into RETDAS. Have another qualified individual VERIFY all MANUALLY entered isotopes are correct.

REVIEW the "Limits Analysis" section of the Liquid Pre-Release Permit Report.

Isotopic data entered by: _____ Date / Time: _____/_____

Isotopic data verified by: _____ Date / Time: _____/_____

N/A ○ IF the RETDAS computerized release program is not operable, CONTACT Qualified R. P. Management individual to COMPLETE the following table. If an isotope is not present, you may leave the space blank.

NOTE

DWC values are listed in 10CFR20, Appendix B Table 2, Column 2. For ODCM Limit, take ten times the DWC value for each isotope listed for column 3. (i.e. the DWC value for Co-58 is 2E-5 μCi/ml.) The ODCM Limit for noble gas isotopes is 2E-4 μCi/ml per CY-BR-170-301, ODCM Chapter 12, Radioactive Effluent Technical Standard step 12.3.1.a.

NOTE

Columns 5 and 6 cannot be completed until the mathematical operations in Step D.6.g are performed. The appropriate values can then be entered into the table.

#1 Isotope	#2 Undiluted Tank Activity (μCi/ml)	#3 ODCM Limit (μCi/ml)	#4 $\left(\frac{\text{Column \#2}}{\text{Column \#3}}\right)$ x 100%	#5 Diluted Activity (μCi/ml)	#6 Unrestricted Area DWC Fraction
Na-24		5.0 E-4			
Cr-51		5.0 E-3			
Mn-54		3.0 E-4			
Co-57		6.0 E-4			
Co-58		2.0 E-4			
Fe-59		1.0 E-4			
Co-60		3.0 E-5			
Zn-65		5.0 E-5			
Br-82		4.0 E-4			
Kr-85		2.0 E-4			
Sr-92		4.0 E-4			
Nb-95		3.0 E-4			
Zr-95		2.0 E-4			
Zr-97		9.0 E-5			
Ag-110m		6.0 E-5			
Tc-99m		1.0 E-2			
Sn-113		3.0 E-4			
Sb-122		1.0 E-4			
Sb-124		7.0 E-4			
Sb-125		3.0 E-4			
Sb-126		7.0 E-4			
Cs-136		6.0 E-4			
I-131		1.0 E-5			
I-133		7.0 E-5			
Xe-133		2.0 E-4			
Xe-133m		2.0 E-4			
Cs-134		9.0 E-6			
Xe-135		2.0 E-4			
Cs-137		1.0 E-5			
Cs-138		4.0 E-3			
Ba-140		8.0 E-5			
La-140		9.0 E-5			
Ce-144		3.0 E-5			
H-3		1.0 E-2			
Total		Total			

See Attached

(2) Sum of column #2 does NOT include Tritium
(4) Sum of column #4 DOES include Tritium

Completed by: _____ Date/Time: _____
Print/Sign

Data Calculations Verified by: _____ Date/Time: _____
Print/Sign

NOTE

If the RETDAS computerized release program is available, the total tank curies, excluding noble gas and tritium, are less than the administrative limit if no warning is displayed in the Limits Analysis section of the prerelease permit.

D. 6. b. PERFORM one of the following:

RT __ ☒ The total tank curies excluding noble gas and tritium are less than the administrative limit. MARK the remainder of Step D.6.b N/A and PROCEED to Step D.6.c.

N/A __ ○ The total tank curies excluding noble gas and tritium are equal to or greater than the administrative limit. CONTACT the Ops Field Supervisor to receive permission to release the tank.

Will the tank be released? YES / NO (Circle one.)

_____***N/A*** _____/_____/_____
Supervisor Contacted Date Time

NOTE

If the RETDAS computerized release program is available, you may mark Step D.6.c N/A.

NOTE

The value to be used for Circulating Water Blowdown Rate in the following step is 8,000 GPM.

NOTE

Release may be performed using the Low Flow release path or the Ultra Low Flow release path. When using the Ultra Low Flow release path, N/A step D.6.c-e. If the Ultra Low Flow release path is used, **20 GPM** will be used as the value of the maximum release rate. Use this value as applicable in steps D.6.f-D.6.g.

D____6. c. When using the Low Flow release path, PERFORM the following calculation to DETERMINE the Radioactive Release Rate:

N/A

$$Radioactive\ Release\ Rate = \left[\frac{Circulating\ Water\ Blowdown\ Rate\ (8{,}000\ gpm)}{Total\ of\ Column\ 4} \right] / 0.02$$

(8000 GPM ÷ _____ (Total of Column 4)) ÷ 0.02 = _____ GPM (Release Rate)

Performed by: _____/_____
Initials Date

Verification: _____/_____
Initials Date

NOTE
If the RETDAS computerized release program is available, RECORD values for D.6.d. from the RETDAS permit.

D ***RT*** 6. d. Maximum Release Rate Determination:

1) RECORD the Chemistry Release Rate from step C.10.b. or RETDAS permit:

___***50***___ GPM

2) RECORD the Radioactive Release Rate from step D.6.c. or RETDAS permit:

___***50***___ GPM

NOTE
The maximum release rate SHALL NOT exceed 50 gpm. DO NOT record a value greater than 50 gpm in the following step.

RT __ e. RECORD the most limiting (smallest) value from step D.6.d. as the Maximum Release Rate below:

Maximum Release Rate = ___*50*___ GPM (≤ 50 gpm)

NOTE

If the RETDAS computerized release program is available, you may N/A steps D.6.f.1) and RECORD values for D.6.f.2) from the RETDAS permit.

D. 6. f. PERFORM the following:

N/A 1) Calculate the minimum release duration using formula below:

(___***N/A***____ GAL - 3300 GAL) ÷ __***N/A***____ GPM = __***N/A***_____MIN
(Step D.3.a.) (Step D.6.e. or 20 GPM) (Min Release Duration)

Performed by: ___***N/A***___/_____
Initials Date

Verification: ___***N/A***___/_____
Initials Date

RT 2) RECORD the Minimum Release Duration (from Step D.6.f.1) or the RETDAS permit:

___***638***_____ MIN

NOTE

If the RETDAS Computerized Release Program is available, steps D.6.g.1) - 4) may be marked N/A.

D. 6. g. Calculation of DILUTED ACTIVITY and UNRESTRICTED AREA DWC FRACTION (Verification):

N/A 1) COMPLETE columns #5 and #6 of Step D.6.a. using the following equations on a radionuclide basis:

$$\text{Diluted Activity} = \left[\frac{\text{Analyzed Tank Activity } (\mu\text{Ci/ml}) \text{ (Column 2)} \times \text{Max. Release Rate (gpm)}}{\text{Max. Release Rate (gpm)} + \text{Circ Water Blowdown Rate (8,000 gpm)}} \right]$$

N/A

DWC Fraction = Diluted Activity (from above calculation) / Tech Spec Limit (Column 3)

N/A 2) RECORD the results of the previous step in the applicable rows of columns #5 and #6.

N/A 3) SUM the results of columns #5 and #6.

N/A 4) RECORD the values obtained on the appropriate TOTAL row of the table.

RT (5) PERFORM one of the following:

○ IF RETDAS is not used, VERIFY that the sum of column # 6 of D.6.a is less than 0.5. IF not, NOTIFY the Ops Supervisor and CANCEL this release package.

_____***N/A***_____/_____/_____
Ops Supervisor Date Time

☒ IF RETDAS is used, VERIFY that the sum of column # 6 labeled "Percent of 10 x EC" is less than 5.00 E + 1. IF not, NOTIFY the Ops Supervisor and CANCEL this release package.

_____***Joe Supervisor***_____/_____***today***_/_____***now***__
Ops Supervisor Date Time

NOTE

If 0RE-PR001 is inoperable and AAR 0BwOS RETS 2.1-1a has been initiated, Step D.7. is not required and may be N/Ad. Step D.7.a is not required if the RETDAS release software is operational and may be N/A'd. Ops Shift Management personnel may request performance of step D.7 to facilitate post maintenance testing.

D. 7. RADWASTE EFFLUENT MONITOR SETPOINT:

a. DETERMINE the Alert Alarm and High Alarm setpoints for the Liquid Radwaste Effluent Monitor (0RE-PR001) using the following equation:

N/A _ 1) RECORD the 0RE-PR001 maximum background from Step D.4.c.

_____ μCi/ml

N/A __ 2) PERFORM the following calculation:

(_____ μCi/ml x 1.5) + _____ μCi/ml =
(Step D.6.a Col 2 Total) (Step D.7.a.1)

_____ μCi/ml Calculated 0RE-PR001 Setpoint

Performed by: _____/_____
Initials Date

Verification: _____/_____
Initials Date

N/A __ 3) RECORD the calculated 0RE-PR001 setpoint:

_____ μCi/ml (Step D.7.a.2 results)

N/A __ 4) COMPARE the calculated 0RE-PR001 setpoint to each of the current 0RE-PR001 monitor setpoints. These setpoints are:

8.64E-05 μCi/ml for the **HIGH** setpoint
4.32E-05 μCi/ml for the **ALERT** setpoint

D. 7. a. 5) PERFORM either of the following:

N/A ❍ If the calculated value is less than the current monitor HIGH setpoint, RECORD the current monitor setpoints as the Release setpoints.

N/A ❍ If the calculated value is greater than the current monitor HIGH setpoint, RECORD the calculated value as the Release HIGH setpoint, and 50% of the calculated HIGH setpoint as the ALERT setpoint.

b. RECORD 0RE-PR001 Monitor Liquid Release setpoints from RETDAS Permit or as calculated in D.7.a.5):

RT Chan Item 9 (HIGH Alarm Setpoint) ***1.31E-4*** µCi/ml

RT Chan Item 10 (ALERT Alarm Setpoint) ***6.56E-5*** µCi/ml

NOTE

If 0RE-PR010 is inoperable and AAR 0BwOS RETS 2.1-1a has been initiated, Step D.8. is not required and may be N/Ad. Step D.8.a is not required if the RETDAS Release software is operational. Mark the step(s) N/A as necessary. Ops Shift Management personnel may request performance of step D.8. to facilitate post maintenance testing.

D. 8. STATION BLOWDOWN MONITOR SETPOINT:

N/A _ a. DETERMINE the Alert Alarm and High Alarm setpoints for the Station Blowdown Monitor (0RE-PR010) using the following equation:

N/A __ 1) RECORD the current 0RE-PR010 reading from Step D.4.d.:

_____ µCi/ml

N/A __ 2) PERFORM the following calculation:

(1.25 x _____ / _____ GPM) ÷ (8,000 + _____)
(Total Col #2 Step D.6.a) (Step D.6.e or 20 GPM) (Step D.6.e. or 20GPM.)

= _____ µCi/ml 0RE-PR010 Calculated Setpoint

Performed by: _____/_____
Initials Date

Verification: _____/_____
Initials Date

N/A __ 3) RECORD the Calculated 0RE-PR010 setpoint:

_____ µCi/ml (Step D.8.a.2. results)

N/A __ 4) COMPARE the calculated 0RE-PR010 Setpoint to each of the current monitor setpoints. These setpoints are:

1.07E-06 µCi/ml for the **HIGH** setpoint
7.46E-07 µCi/ml for the **ALERT** setpoint

D. 8. a. 5) PERFORM either of the following:

N/A ❍ IF the calculated value is less than the current monitor HIGH setpoint, RECORD the current monitor setpoints as the Release setpoints.

N/A ❍ IF the calculated value is greater than the current monitor HIGH setpoint, RECORD the calculated value as the Release HIGH setpoint, and 70% of the HIGH value for the ALERT setpoint.

b. RECORD 0RE-PR010 Monitor Liquid Release setpoints as determined in step D.8.a.5) or from the RETDAS release software:

RT Chan Item 9 (HIGH Alarm Setpoint) ***8.19E-6*** μCi/ml

RT Chan Item 10 (ALERT Alarm Setpoint) ***5.73E-6*** μCi/ml

NOTE

The following step is to ensure the permit number created for this release has been committed to the database.

9. PERFORM the following: (This step may be N/A if this package was not generated with RETDAS.)

RT a. CLOSE RETDAS.

RT b. REOPEN RETDAS and CLICK on release ID magnifying glass and select appropriate release tank. Then CLICK on permit number magnifying glass and VERIFY the permit number is in the database.

RT c. CLOSE RETDAS.

NOTE
If 0RE-PR001 is inoperable and AAR 0BwOS RETS 2.1-1a has been initiated, verification is required for Step D.10.

D. ~~10.~~ APPROVAL FOR RADIOLOGICAL RELEASE:

RT __ ● Radiation Protection: I have reviewed Part D and have verified it is accurate and complete.

Performed by ___***Rhonda Technician***_____/***today***/_***1 hr ago***
Radiation Protection Date Time

Verified by: _____***Ralph Technician***__/__ ___***today***/_***1 hr ago***
Date Time

RT __11. FORWARD to HPS/RPS for review.

RT __12. FORWARD Release Package to the OPS Supervisor or contact OPS Supervisor for instructions to forward this package.

E. OPERATING/CHEMISTRY DEPARTMENT RESPONSIBILITY

NOTE

TSS is required for the first release of the week.
Oil and Grease is required for the first release of the month.
The week is defined as Monday thru Sunday.

1. Control Room Supervisor:

a. Is this the first release for the week/month?

☐ YES GO TO Step E.1.b

☒ NO N/A steps E.1.b thru E.5 then GO TO Section F.

b. Are required analyses complete with results within the limits in step C.11?

☐ YES N/A steps E.2 thru E.5 then GO TO Section F.

☐ NO RETURN this release package to Chemistry to perform Step E.2 thru E.5.

N/A 2. ANALYZE sample as required by the NPDES Permit for Total Suspended Solids and Oil and Grease per appropriate procedures. RECORD the results from the completed analyses below and on the NPDES Weekly Data Sheet. N/A this step and E.3 if NPDES sampling has been satisfied.

N/A

	1st set		2nd set (If Required)	
	1st Sample	2nd Sample(If Required)	1st Sample	2nd Sample (If Required)
Sampled by				
Date				
Sample Time				

PARAMETER	FREQUENCY	LIMIT	RESULTS
Total Suspended Solids	Per Current NPDES Permit	≤ 30 ppm	_____ ppm
Oil and Grease	Per Current NPDES Permit	≤ 20 ppm	_____ ppm

E ***N/A*** 3. Is the Release Tank within all specified NPDES limits as determined in steps C.11 and E.2?

N/A ☐ YES The release tank is approved for Chemical Release, perform Step E.4,

N/A ☐ NO a. IMMEDIATELY NOTIFY the OPS Supervisor.

b. OPS Supervisor notified:

_____/_____/_____
(Print Name) Date Time

c. RETURN this procedure to Operations for release cancellation.

N/A

4. Chemistry Department: I have reviewed Part E and have verified it is accurate and complete.

_____/_____/_____
Chemistry Department Date Time

_____/_____/_____
Verification Date Time

5. Promptly DELIVER this release package to the Control Room Supervisor for processing. (ENSURE receipt is acknowledged.)

NOTE

A Check Source Check is a verification of Detector Response. Even if Detector response is immediately evident when a "Hot" Release Tank is first lined up to 0PR01J, ODCM RETS 2.1.B-1 requires a Source Check. If a Check Source Test fails when High Activity is present, it is caused by the program function of 0PR01J. To pass the Check Source Test, the Activity has to stabilize or be missed, and repeated attempts may have to be performed until successful.

NOTE

If 0RE-PR001 is inoperable and AAR 0BwOS RETS 2.1-1a has been initiated Step F.1. is not required.

F. OPERATING DEPARTMENT RESPONSIBILITY

US 1. Perform 0BwOS RETS 2.1.B-1, "Unit Common Pre-Release Source Check of Liquid Effluent Monitor 0PR01J."

Time: ***30 min ago*** Date: ***today***

2. Control Room Supervisor: I have verified that either the 0BwOS RETS 2.1.B-1 Acceptance Criteria has been met, or 0RE-PR001 is inoperable.

Ulyses Supervisor _____ ***today*** / ***25 min ago***
Control Room Supervisor Date Time

NOTE

Two release path options are available. Generally, the Low Flow release would primarily be used when liquid radwaste inventory is high (i.e. outage). The Ultra Low Flow release rate is the preferred path and is correlated to the current river flow. This path would primarily be used when liquid radwaste inventory is normal. Contact Ops Supervisor for determination of which release flow path to use based on current liquid radwaste inventory, conditions, equipment availability, etc.

F JO 3. Before proceeding, VERIFY that no other liquid release packages are in progress which would interfere with this one (current releases, interlock checks, etc).

JO 4. CONTACT OPS Supervisor for release flow rate path.

5. INDICATE which release flow rate path will be used (Ref. step B.2):

JO ❍ Low Flow

N/A ❍ Ultra Low Flow.

NOTE

If 0RE-PR010 is inoperable and AAR 0BwOS RETS 2.1-1a has been initiated, Step F.6. is not required.

F. ~~6.~~ PERFORM the following from the RM-11 Console to OBTAIN 0RE-PR010 (0PS110) setpoints:

JO ___ a. DEPRESS Grid 1 key.

JO ___ b. KEY in 110.

JO ___ c. DEPRESS SEL key.

JO ___ d. VERIFY 0PR10J (0PS110) selected.

JO ___ e. DEPRESS CHAN ITEMS key.

JO ___ f. RECORD the following CHAN ITEMS:

JO ___ - Chan Item 9 (HIGH Alarm Setpoint) __*8.19*$^{-6}$_____ μCi/ml

JO ___ - Chan Item 10 (ALERT Alarm Setpoint) __*5.73*$^{-6}$_____ μCi/ml

NOTE
If 0RE-PR001 is inoperable and AAR 0BwOS RETS 2.1-1a has been initiated, Step F.7. is not required.

F. ~~7.~~ PERFORM the following from the RM-11 Console to OBTAIN 0RE-PR001 (0PS101) setpoints:

JO ___ a. DEPRESS Grid 1 key.

JO ___ b. KEY in 101.

JO ___ c. DEPRESS SEL key

JO ___ d. VERIFY 0PR01J (0PS101) selected.

JO ___ e. DEPRESS CHAN ITEMS key.

JO ___ f. RECORD the following CHAN ITEMS:

JO ___ - Chan Item 9 (HIGH Alarm Setpoint) ____*1.31E-4*_____ μCi/ml

JO ___ - Chan Item 10 (ALERT Alarm Setpoint) ___*6.56E-5*_____ μCi/ml

F. 8. PERFORM the following to prepare for release.

a. VERIFY 0BwOSR 0.1-0 daily channel check is complete on:

NOTE
If 0RE-PR001 is inoperable and AAR 0BwOS RETS 2.1-1a has been initiated, the following step is not required.

JO ___ ○ Rad Monitor 0RE-PR001: Liquid Radwaste Effluent.

NOTE
If 0RE-PR010 is inoperable and AAR 0BwOS RETS 2.1-1a has been initiated, the following step is not required.

JO ___ ○ Rad Monitor 0RE-PR010: Station Blowdown.

NOTE
0UR-CW032 is inoperable and AAR 0BwOS RETS 2.1-1a has been initiated, the following step is not required.

JO ___ ○ Station Blowdown Line Monitor Loop 0UR-CW032.

JO ___ b. OPEN 0WX354, Release Tk Dsch to Process Rad Mon System (TB 401' J-18 between tanks).

VERIFICATION *JB* ___

NOTE

If 0RE-PR001 is inoperable and AAR 0BwOS RETS 2.1-1a has been initiated, Steps F.9. and F.10. are not required.

NOTE

For a release through the low flow rate path COMPLETE Step F.9. and mark Step F.10. N/A. If a Ultra Low Flow rate release, GO TO Step F.10. and mark Step F.9. N/A.

NOTE

If the 0PR01J is in High Alarm at this point in the procedure due to high background, it will be necessary to reset the HIGH alarm setpoint to a value higher than the background. This will allow the 0AOV-WX896 to open to test the interlock function. Otherwise, Step F.9.f. is not required.

NOTE

Upon receipt of a high radiation signal at 0PR01J, the Release Tank Discharge Valves, 0WX353 and 0WX896 will remain closed until the high radiation signal seal-in is reset at 0PL01J.

F. 9. VERIFY valve 0AOV-WX896, Release Tank Disch Isolation Valve, automatically closes on high radiation by PERFORMING the following Steps:

RO/JO a. VERIFY/RESET CIRC WTR BLOWDOWN FLOW LOW annuciator 0PL01J-7-B6.

RO/JO b. VERIFY/CLOSE 0AOV-WX897, Flow Control Radwaste Effluent Discharge Valve.

RO/JO c. VERIFY/CLOSE 0AOV-WX890, Release Tk Pp 0WX53P Dsch Isol.

RO/JO d. VERIFY/OPEN 0AOV-WX889, Release Tk Pp 0WX01P Dsch Isol.

RO/JO e. VERIFY/START 0WX01P, Release Tank Pump.

CAUTION

Some actions possible in the Supervisor Mode may have serious detrimental effects on system operation. Therefore use caution when in this mode and do not leave the RM-11 console unattended when it is in this mode.

F. 9. f. IF the 0PR01J is in HIGH alarm, PERFORM the following CHANGE the HIGH alarm setpoint to a value higher than background. This will allow the RELEASE TANK 0WX01T DISCHARGE HEADER RADIATION HIGH alarm (Window 77B01 on 0PL01J) to be reset and, the 0AOV-WX896 valve to be opened after its seal-in has been reset. This can be accomplished as follows:

N A

_____ 1) VERIFY/PLACE the RM-11 Console in SUPERVISOR MODE.

_____ 2) DEPRESS Grid 1 key.

_____ 3) KEY in 101.

_____ 4) DEPRESS SEL key.

_____ 5) VERIFY 0PR01J (0PS101) selected.

_____ 6) DEPRESS CHAN ITEM key.

_____ 7) KEY in 9.

_____ 8) DEPRESS SEL key (CHAN ITEM 9 should be displayed in reverse characters.)

_____ 9) KEY in a HIGH alarm setpoint USING the format XYZ ± AB (i.e. a value of 3.76E-10 would be entered as 376-10).

_____ 10) DEPRESS the ENTER key. (The new value will be displayed after a short delay.)

RO/JO (g.) VERIFY/CLEAR RELEASE TANK 0WX01T DISCHARGE HEADER RADIATION HIGH Annunciator (Window 77B01 on 0PL01J).

NOTE

Upon receipt of a high radiation signal at 0PR01J, the Release Tank Discharge Valves, 0WX353 and 0WX896 will remain closed until the high radiation signal seal-in is reset at 0PL01J.

F JO 9. h. OPEN 0AOV-WX896, Release Tank Disch Isolation Valve.

i. PERFORM the following to AUTO CLOSE valve 0AOV-WX896, Release Tank Disch Isolation Valve, by LOWERING the Liquid Radwaste Effluent monitor 0RE-PR001 HIGH alarm setpoint to a value below the current activity as follows:

JO ___ 1) VERIFY/PLACE the RM-11 Console in SUPERVISOR MODE.

JO ___ 2) DEPRESS Grid 1 key.

JO ___ 3) KEY in 101.

JO ___ 4) DEPRESS SEL key.

JO ___ 5) VERIFY 0PR01J (0PS101) selected.

JO ___ 6) DEPRESS CHAN ITEM key.

JO ___ 7) KEY in 9.

JO ___ 8) DEPRESS SEL key (CHAN ITEM 9 should be displayed in reverse characters.)

JO ___ 9) RECORD the current activity reading:

____*8.12E-7*_____

JO ___ 10) KEY in a HIGH alarm setpoint USING the format XYZ ± AB (i.e. a value of 3.76E-10 would be entered as 376-10), below the current activity value (from the upper right corner of the display) USING the format XYZ ± AB for XYZ E ± AB (i.e. a value of 3.76E-10 would be entered as 376-10).

JO ___ 11) RECORD the new HIGH alarm setpoint that was entered (channel item 9):

__*1.31E-7*_____

JO ___ 12) DEPRESS the ENTER key.

JO ___ 13) ACKNOWLEDGE the alarm at the RM-11 console.

F ***RO/JO*** 9. j. VERIFY 0AOV-WX896, Release Tank Disch Isolation Valve, Auto Closes.

RO/JO k. VERIFY RELEASE TANK 0WX01T DISCHARGE HEADER RADIATION HIGH alarm (Window 77B01 at 0PL01J) annunciates at 0PL01J and ACKNOWLEDGE.

RO/JO l. PLACE key locked switch for 0AOV-WX896, Release Tank Disch Isolation Valve, in CLOSE.

CAUTION

Some actions possible in the Supervisor Mode may have serious detrimental effects on system operation. Therefore use caution when in this mode and do not leave the RM-11 console unattended when it is in this mode.

JO ___ m. VERIFY/ADJUST the ALERT Alarm and HIGH Alarm setpoints for 0RE-PR001 (0PS101) to the values specified by Rad Protection in Step D.7.b. USING the instructions that follow.

JO ___ 1) VERIFY/PLACE the RM-11 Console in SUPERVISOR MODE.

JO ___ 2) DEPRESS Grid 1 key.

JO ___ 3) KEY in 101.

JO ___ 4) DEPRESS SEL key.

JO ___ 5) VERIFY 0PR01J (0PS101) selected.

JO ___ 6) DEPRESS CHAN ITEM key.

JO ___ 7) KEY in 10.

JO ___ 8) DEPRESS SEL key (CHAN ITEM 10 should be displayed in reverse characters.)

JO ___ 9) KEY in the new ALERT alarm setpoint USING the format XYZ ± AB (i.e. a value of 3.76E-10 would be entered as 376-10)

JO ___ 10) DEPRESS the ENTER key. (The new value will be displayed after a short delay.)

F *JO* 9. m. 11) VERIFY the new ALERT alarm setpoint is displayed.

VERIFICATION *JH*

JO 12) KEY in 9.

JO 13) DEPRESS SEL key (CHAN ITEM 9 should be displayed in reverse characters.)

JO 14) KEY in the new HIGH alarm setpoint USING the format XYZ ± AB (i.e. a value of 3.76E-10 would be entered as 376-10).

JO 15) DEPRESS the ENTER key. (The new value will be displayed after a short delay.)

JO 16) VERIFY the new HIGH alarm setpoint is displayed.

VERIFICATION *JH*

JO n. VERIFY/CLEAR RELEASE TANK 0WX01T DISCHARGE HEADER RADIATION HIGH annunciator (Window 77B01 at 0PL01J).

NOTE

If the 0PR01J is in High Alarm at this point in the procedure due to high background, it will be necessary to reset the HIGH alarm setpoint to a value higher than the background. This will allow the 0AOV-WX353 to open to test the interlock function. Otherwise, Step F.10.f. is not required.

F. 10. VERIFY valve 0AOV-WX353, Release Tank Disch Isolation Valve, automatically closes on high radiation by PERFORMING the following Steps for a release through the Ultra Low Flow rate path:

N/A

_____ a. VERIFY sufficient blowdown flow is established.

_____ b. VERIFY/CLOSE 0AOV-WX302, Flow Control Radwaste Effluent Discharge Valve.

_____ c. VERIFY/CLOSE 0AOV-WX890, Release Tk Pp 0WX53P Dsch Isol.

_____ d. VERIFY/OPEN 0AOV-WX889, Release Tk Pp 0WX01P Dsch Isol.

_____ e. VERIFY/START 0WX01P, Release Tank Pump.

CAUTION

Some actions possible in the Supervisor Mode may have serious detrimental effects on system operation. Therefore use caution when in this mode and do not leave the RM-11 console unattended when it is in this mode.

F. 10. f. IF the 0PR01J is in HIGH alarm, CHANGE the HIGH alarm setpoint to a value higher than background. This will allow the RELEASE TANK 0WX01T DISCHARGE HEADER RADIATION HIGH alarm (Window 77B01 on 0PL01J) to be reset, and the 0AOV-WX353 valve to be opened after its seal-in has been reset. This can be accomplished as follows (N/A if 0PR01J is not in alarm):

N/A

_____ 1) VERIFY/PLACE the RM-11 Console in Supervisor Mode.

_____ 2) DEPRESS Grid 1 key.

_____ 3) KEY in 101.

_____ 4) DEPRESS SEL key.

_____ 5) VERIFY 0PR01J (0PS101) selected.

_____ 6) DEPRESS CHAN ITEM key.

_____ 7) KEY in 9.

_____ 8) DEPRESS SEL key (CHAN ITEM 9 should be displayed in reverse characters).

_____ 9) KEY in a new HIGH alarm setpoint USING the format XYZ ± AB (i.e. a value of 3.76E-10 would be entered as 376-10).

_____ 10) DEPRESS the ENTER key (The new value will be displayed after a short delay).

F____10. g. VERIFY/CLEAR RELEASE TANK 0WX01T DISCHARGE HEADER RADIATION HIGH Annunciator (Window 77B01 on 0PL01J).

NOTE

Upon receipt of a high radiation signal at 0PR01J, the Release Tank Discharge Valves, 0WX353 and 0WX896 will remain closed until the high radiation signal seal-in is reset at 0PL01J.

_____ h. OPEN 0AOV-WX353, Release Tank Disch Isolation Valve. (The key to operate the 0AOV-WX353 valve control switch must be obtained from the OPS Supervisor or Shift Manager.)

i. PERFORM the following to AUTO CLOSE valve 0AOV-WX353, Release Tank Disch Isolation Valve, by LOWERING the Liquid Radwaste Effluent monitor 0RE-PR001 HIGH alarm setpoint to a value below the current activity as follows:

_____ 1) VERIFY/PLACE the RM-11 Console in SUPERVISOR MODE.

_____ 2) DEPRESS the Grid 1 key.

_____ 3) KEY in 101.

_____ 4) DEPRESS SEL key.

_____ 5) VERIFY 0PR01J (0PS101) selected.

_____ 6) DEPRESS CHAN ITEM key.

_____ 7) KEY in 9.

_____ 8) DEPRESS SEL key CHAN ITEM 9 should be displayed in reverse characters.)

_____ 9) KEY in a new HIGH alarm setpoint below the current activity value (from the upper right corner of the display) USING the format XYZ ± AB for XYZ E ± AB (i.e. a value of 3.76E-10 would be entered as 376-10).

_____ 10) RECORD the new HIGH alarm setpoint that was entered (channel item 9). _____

_____ 11) DEPRESS the ENTER key.

_____ 12) ACKNOWLEDGE the alarm at the RM-11 console.

_____ j. VERIFY 0AOV-WX353, Release Tank Disch Isolation Valve, Auto Closes.

F ____ 10. k. VERIFY RELEASE TANK 0WX01T DISCHARGE HEADER RADIATION HIGH alarm annunciates at 0PL01J and ACKNOWLEDGE. (Window 77B01 on 0PL01J)

_____ l. PLACE key locked switch for 0AOV-WX353, Release Tank Disch Isolation Valve, in CLOSE.

CAUTION

Some actions possible in the Supervisor Mode may have serious detrimental effects on system operation. Therefore use caution when in this mode and do not leave the RM-11 console unattended when it is in this mode.

N A

_____ m. VERIFY/ADJUST the ALERT Alarm and HIGH Alarm setpoints for 0RE-PR0[illegible]0PS101) to the values specified by Rad Protection in Step D.7.b. USING the instructions that follow.

_____ 1) VERIFY/PLACE the RM-11 Console in SUPERVISOR MODE.

_____ 2) DEPRESS the Grid 1 Key.

_____ 3) KEY in 101.

_____ 4) DEPRESS SEL key.

_____ 5) VERIFY 0PR01J (0PS101) selected.

_____ 6) DEPRESS CHAN ITEMS.

_____ 7) KEY in 10.

_____ 8) DEPRESS SEL key (CHAN ITEM 10 should be displayed in reverse characters.)

_____ 9) KEY in the new ALERT alarm setpoint USING the format XYZ ± AB (i.e. a value of 3.76E-10 would be entered as 376-10).

_____ 10) DEPRESS the ENTER key. The new value will be displayed after a short delay.

_____ 11) VERIFY the new ALERT alarm setpoint is displayed.

VERIFICATION _____

_____ 12) KEY in 9.

F____10. m. 13) DEPRESS SEL key (CHAN ITEM 9 should be displayed in reverse characters.)

_____ 14) KEY in the new HIGH alarm setpoint USING the format XYZ ± AB (i.e. a value of 3.76E-10 would be entered as 376-10).

_____ 15) DEPRESS the ENTER key (the new value will be displayed after a short delay).

_____ 16) VERIFY the new HIGH alarm setpoint is displayed.

VERIFICATION _____

N A

_____ n. VERIFY/CLEAR RELEASE TANK 0WX01T DISCHARGE HEADER RADIATION HIGH annunciator (Window 77B01 at 0PL01J).

NOTE
Step F.11. is not required if 0RE-PR010 is inoperable and AAR 0BwOS RETS 2.1-1a has been initiated or if ALERT ALARM AND HIGH ALARM setpoints have not changed from Step D.8.b.

F____11. VERIFY/ADJUST the ALERT and HIGH setpoints for 0RE-PR010 to the values specified by Rad Protection in Step D.8.b. using the instructions that follow.

_____ a. VERIFY/PLACE the RM-11 Console in Supervisor Mode.

_____ b. DEPRESS the Grid 1 key.

_____ c. KEY in 110.

_____ d. DEPRESS SEL key.

_____ e. VERIFY 0PR10J (0PS110) selected.

_____ f. DEPRESS CHAN ITEM key.

_____ g. KEY in 10.

_____ h. DEPRESS SEL key (CHAN ITEM 10 should be displayed in reverse characters.)

_____ i. KEY in the new ALERT alarm setpoint USING the format XYZ ± AB (i.e. a value of 3.76E-10 would be entered as 376-10).

_____ j. DEPRESS the ENTER key (The new value will be displayed after a short delay).

_____ k. VERIFY the new ALERT alarm setpoint is displayed.

VERIFICATION _____

_____ l. KEY in 9.

_____ m. DEPRESS SEL key (CHAN ITEM 9 should be displayed in reverse characters).

N A

F ____ 11. n. KEY in the new HIGH alarm setpoint USING the format XYZ ± AB (i.e. a value of 3.76E-10 would be entered as 376-10).

_____ o. PRESS the ENTER key (The new value will be displayed after a short delay).

_____ p. VERIFY the new HIGH alarm setpoint is displayed.

JO __ 12. PLACE the RM-11 Console in the NORMAL MODE.

13. RECORD the following data in the space provided.

JO __ a. Circulating Water Blowdown Rate ___***25400***_____ gpm
(0UR-CW032 at PNL 0PM01J, or computer Point F2400)

JO __ b. VERIFY CW BLOWDOWN RATE IS EQUAL TO OR GREATER THAN 8,000 gpm.

14. Control Room Supervisor: I have reviewed Part F and have verified it is accurate and complete.

_____***Joe Supervisor***_____/ ***today***/ ***15 min ago***
Control Room Supervisor Date Time

G. SHIFT MANAGER OR SRO RESPONSIBILITY

SM __ 1. VERIFY that Steps B.3., C.13., D.10., E.4 (if applicable), and F.14 are signed.

NOTE

Biocide treatment of CW requires isolation of CW blowdown, if the dechlorination skid is not operational. The expected time of release and release duration must be considered so that both biocide treatment and the release can be accommodated.

2. VERIFY that the actual Circulating Water Blowdown Rate is equal to or greater than 8,000 gpm (0UR-CW032 at PNL 0PM01J, or Computer Point F2400).

Shift Manager / *today*
SHIFT MANAGER or SRO Date

SM __ 3. Have an NSO PERFORM the following to ESTABLISH the required conditions for liquid release:

a. LOGIN to the alarm Agent website as follows: (N/A if already logged in.)

1) ACCESS the alarm Agent website at one of the following:

JO __ ☒ www.AlarmAgent.com

_____ ○ BS0.ALARMAGENT.com

JO __ 2) CLICK on 'User Login'.

JO __ 3) ENTER one of the following combinations of User/Passwords to login:

☒ USER: braidwoodops, Password: braidwoodops

○ USER: braidwoodops2, Password: braidwoodops2

○ USER: braidwoodops3, Password: braidwoodops3

○ USER: braidwoodops4, Password: braidwoodops4

JO __ 4) CLICK 'Submit'.

JO __ 5) VERIFY no active alarm in the Notification Groups for the Vacuum Breaker. (Verifies no vault level alarm.)

NOTE

Some Vacuum Breaker Vaults may have duplicate entries for the RTUs. These entries always show OFFLINE when checking RTU status. If a duplicate entry is displayed and there is an online RTU in the Vacuum Breaker Vault, these duplicate entries may be ignored. Select "Next RTU" tab to continue with Vacuum Breaker Vault check.

G ***JO*** 3. a. 6) SELECT "View RTU status".

JO __ 7) From "Select RTU" dropdown menu, SELECT Vacuum Bkr Vault 01.

JO __ 8) CLICK "View Status".

b. CHECK the following for the CW Blowdown Vacuum Breaker vault monitoring status RTUs status:

1) Under Last Know RTU STATE:

JO __ - Last Contact with RTU within previous 24 hours

JO __ - RTU online – Yes

2) Under Channel State:

JO __ - Channel 1 – 'No water in vault, Normal" (N/A for Interim Remediation Pump) or water detected in Vault, Alarm, Now Normal

JO __ - AC Power – 'Power On'

JO __ - Battery – 'Battery OK

3) SELECT 'Next RTU' to obtain the information for the next RTU.

JO __ c. When the CW Blowdown Vacuum Breaker vault RTUs have been VERIFIED acceptable, CONTINUE with the procedure.

G ***SM*** 4. PLACE a placard stating "Liquid Release in Progress" at 0PM01J.

5. APPROVAL FOR RELEASE: ***Shift Manager*** / ***today*** / ***5 min ago***
SHIFT MANAGER or SRO Date Time

6. COMMENTS ***none***

H. OPERATING DEPARTMENT RESPONSIBILITY - Discharging Release Tank 0WX01T to Circulating Water Blowdown Line

NOTE

DO NOT release 0WX01T if Kankakee River Gage Height is ≥ 6.50 feet (flood stage).

NOTE

If during the release, Circ Water Blowdown flow (Computer Point F2400) is reduced to <8,000 gpm, terminate the release. If during the release, Circ Water Blowdown flow is reduced to <7,000 gpm (low flow interlock setpoint), VERIFY the release is terminated. If Circ Water Blowdown flow can be re-established ≥8,000 gpm, the release may be restarted at step G.2 provided that the following conditions are met:

- Shift Manager permission is obtained.
- All applicable Steps are re-initialed/re-verified as necessary.
- No additions have been made to the Release Tank.
- Release totalizers have not been reset and the original totalizer readings are used to calculate the gallons released.

NOTE

If Station Blowdown Line Flow Monitor (CW-032) is inoperable, effluent releases via this pathway may continue for up to 30 days provided the flow rate is estimated at least once per 4 hours during actual releases.

NOTE

If this procedure is aborted before any effluent is released, VERIFY/PERFORM Steps H.24 through Step I. before exiting this procedure.

NOTE

The purpose of the release window is to minimize the interaction with the City of Wilmington Water Department intake periods. Release window is not applicable when using the Ultra Low Flow release path through the diffuser.

NOTE
Rad Protection or Operations is to notify Chemistry when a release package is cancelled prior to release so that the NPDES data sheets can be updated as required.

H. 1. Ops Supervisor performs the following:

NOTE
Kankakee River Flow rate is normally obtained via the internet site for the U.S. Geological Survey (usgs.gov), WILMINGTON DATA (from the appropriate Unit Supervisor). If data is unavailable, RECORD most recent data from the Unit Supervisor turnover.

a. OBTAIN and RECORD current Kankakee River flow data:

- USGS website;

_____ - Stream Flow: _____ CFS

_____ - At Date: _____/_____/_____

_____ - At Time: _____

- IF Kankakee River flow data is NOT available from the USGS website, CONTACT Chemistry/Environmental for concurrence to release using alternate river flow data provided by Chemistry/Environmental:

_____ a) River flow rate provided by Chemistry/Environmental

_____ CFS

_____ b) Chemistry/Environmental Personnel providing data:

Name: _____

Time: _____

Date: _____

_____ b. RECORD the Kankakee River flow rate and the source of the data obtained in step H.1.a. in the Unit Supervisor Turnover.

NOTE

Steps H.1.c and H.1.d can be marked N/A if the Ultra Low Flow Release Path is not being used.

H. 1. c. When using the Ultra Low flow path, CALCULATE Release flow Rate.

1) OBTAIN and RECORD the current lake blowdown flow from Plant Parameter Displays Trend ID BRW01V_F2400.

Lake Blowdown Flow: _____GPM

2) RECORD the release tank H-3 concentration from step C.7:

Release tank H-3 concentration: _____ uCi/ml

3) When using the Ultra Low Flow release path, PERFORM the following calculation to determine the maximum release rate.

$$\text{Ultra Low Flow Path Release Rate} = \frac{\text{River Flow (cfs)} \times \text{Lake Blowdown Flow (gpm)} \times 2.15\text{E-}08}{\text{Release Tank H-3 Concentration (uCi/ml)}}$$

Ultra Low Flow Path Release Rate = _____ GPM

d. VERIFY that the value calculated for the Ultra Low Flow Path Release Rate is less than 20 gpm. IF NOT, use 20 gpm as the maximum release rate.

H. 1. e. DETERMINE the following:

_____ 1) Liquid Release Window per BwOP WX-501T2, Liquid Release Window Determination. (Can be N/A if using the Ultra Low Flow Flowpath through the diffuser.)

2) Maximum Release Rate:

_____ a) RECORD the Chemistry Release Rate from step C.10.b. or RETDAS permit:

_____ GPM

NOTE
N/A step H.1.e.2)b) if using the Ultra Low Flow path through the diffuser.
N/A step H.1.e.2)c) if using the Low Flow Path.

_____ b) RECORD the Radioactive Release Rate from step D.6.c or RETDAS permit if using the Low Flow path:

_____ GPM

_____ c) RECORD the Radioactive Release Rate from step H.1.c if using the Ultra Low Flow path:

_____ GPM

NOTE
The maximum release rate SHALL NOT exceed 50 gpm for the Low Flow path or 20 gpm for the Ultra Low Flow path.

_____ d) RECORD the most limiting (smallest) value from step H.1.e.2) a)-c) as the Maximum Release Rate below:

Maximum Release Rate = _____ GPM (≤ 50 gpm or ≤ 20 gpm)

H. 1. f. RECORD the Liquid Release Window times (N/A if using the Ultra Low Flow path through the diffuser):

_____ ● Target Start Time: _____

_____ ● Start After _____

_____ ● Start Before _____

_____ ● Start after time recorded in Step D.3.h. (Applies to second bullet only if D.3.h. has a specified time, otherwise N/A.)

g. EVALUATE the expected time of release so that both biocide treatment and the release can be accommodated considering:

_____ ● CW Biocide treatment requires associated Unit CW blowdown isolated, if the dechlorination skid is not operational.

_____ ● At least 8000 GPM CW blowdown flow is required for the Liquid release.

NOTE
Steps H.1.h and H.1.i can be marked N/A if the Ultra Low Flow Release Path through the diffuser is being used.

h. VERIFY release will start within release start time window recorded in step H.1.f. If release cannot start within times recorded in step H.1.f. this step is N/A. GO TO step H.1.i.

_____/_____/_____
OPS Supervisor Date Time

i. To start release outside of release start time window recorded in step H.1.f. VERIFY Authorization to Release Outside of Release Window, BwOP WX-501T3, is completed and retained with this package.

_____/_____/_____
OPS Supervisor Date Time

CAUTION

Changes in CW Blowdown flow will affect the backpressure in the blowdown line. Lowering pressure or flow may result in exceeding the liquid release rate limit.

H. 1. j. VERIFY the following:

- BwOP CW-12 is NOT being performed.
- CW Blowdown line backpressure has been established per BwOP CW-12. (Backpressure is not required if CW Blowdown Booster Pumps are not in operation.)

_____/_____/_____
OPS Supervisor Date Time

NOTE

If this procedure must be exited prior to its completion, the following temporary alteration must be restored per Step H.26. prior to exit.

2. PERFORM the following if AAR 0BwOS RETS 2.1-1a is in effect for 0RE-PR001 (refer to Step B.1.):

NOTE

To comply with CC-AA-112, Attachment A must be filled out during installation and removal of TCC.

a. OBTAIN Shift Manager or designee permission to perform the following Temporary Electrical Alteration.

_____/_____/_____
Shift Manager/Designee Date Time

SUPERVISOR VERIFICATION _____

_____ b. REMOVE Relay Block K1 at 0PR01J (inside the AC Power Panel) to allow opening of 0AOV-WX896/353, Release Tank Disch Isolation Valve.

Supervisor Verification _____

H. 2 c. LOCALLY at 0PR01J place two placards stating "K1 RELAY REMOVED FOR LIQUID RELEASE":

_____ ● One on the AC Power Panel for 0PR01J

_____ ● One on the Rad Detector Cabinet for 0PR01J.

3. RECORD the following data in the space provided.

_____ a. Tank Level Start _____ %
(0LR-WX028, 0WX01T Level Indication at PNL 0PL01J)

_____ b. VERIFY level in Step H.3.a. is ±5% OF LEVEL RECORDED IN STEP A.2, or receive Supervisor approval to continue.

c. RESET the Batch Totalizer reading to zero at PNL 0PL01J for the flowpath being used (This step may be marked N/A if Batch Totalizer is inoperable):

_____ ○ 0FQI-WX001A, Ultra Low Flow

_____ ○ 0FQI-WX630A, Low Flow

d. RESET the Cumulative Totalizer reading to zero at PNL 0PL01J for the flowpath being used (This step may be marked N/A if Cumulative Totalizer is inoperable):

_____ ○ 0FQI-WX001B, Ultra Low Flow

_____ ○ 0FQI-WX630B, Low Flow

CAUTION

Failure to record and use the correct maximum permissible release rate may result in violation of NPDES and/or 10CFR20 release criteria.

NOTE

When using the Low Flow release path, the MAXIMUM RELEASE RATE SHALL not exceed 50 gpm. Do NOT record a value greater than 50 gpm in the following step when using the Low Flow release path. When using the Ultra Low Flow release path, the MAXIMUM RELASE RATE SHALL NOT exceed 20 gpm. Do NOT record a value greater than 20 gpm in the following step when using the Ultra Low Flow release path.

H____3. e. Maximum Release Rate from H.1.e.2)d)
_____ GPM

SUPERVISOR VERIFICATION _____

_____4. STOP 0WX36M, Release Tank Mixer (if applicable).

NOTE
If 0RE-PR001 is inoperable and AAR 0BwOS RETS 2.1-1a has been initiated, Step F.1 is not required.

H____5. VERIFY Steps F.1. and F.2. have been completed within the previous 24 hrs (IF NOT, RE-PERFORM Steps F.1 and F.2.).

NOTE
If 0RE-PR001 is inoperable and AAR 0BwOS RETS 2.1-1a has been initiated, verification is required in steps H.6. through H.13.

NOTE
If any CW Blowdown vault alarms while a release is in progress, immediately STOP the release.

_____6. VERIFY/CLOSE 0AOV-WX834, Release Tank Inlet Isolation Valve for Release Tank 0WX01T.

SUPERVISOR VERIFICATION _____

_____7. VERIFY/CLOSE 0AOV-WX017, Release Tank Recycle Valve (Release Tank Discharge to Turbine Building Equipment Drain Tank Isolation Valve).

SUPERVISOR VERIFICATION _____

_____8. VERIFY/CLOSE 0AOV-WX910, Release Tank Pump Disch Valve (Release Tank Discharge to Regeneration Waste Drain Tank).

SUPERVISOR VERIFICATION _____

_____9. VERIFY/CLOSE 0AOV-WX302, Release Tank Discharge Control Valve/(Ultra Low Flow Path).

SUPERVISOR VERIFICATION _____

_____10. VERIFY/CLOSE, 0AOV-WX897, Release Tank Discharge Flow Control valve/(Low Flow Path).

SUPERVISOR VERIFICATION _____

H____11. VERIFY/OPEN 0AOV-WX889, Release Tank Pump 0WX01P Discharge Isolation Valve.

SUPERVISOR VERIFICATION _____

NOTE
The Release Tank Pump trips at approximately 15% tank level.

NOTE
For releases through the low flow rate path, ≤ 50 GPM or as specified by OPS Supervisor, COMPLETE step H.12 and mark Step H.13 "N/A". For releases through the Ultra Low Flow rate path, mark Step H.12 "N/A" and GO TO step H.13.

NOTE
While releasing from the 0WX01T, high radiation from the 0PR90J will not cause the Release Tank Discharge Valves (0WX353 and 0WX896) to auto-close, because the 0PR90J is associated with the 0WX26T only.

CAUTION
ALL Releases through the Low Flow flowpath SHALL be limited to <10,000 gallons. Secure the release prior to 10,000 gallons.

12. LOW FLOW RELEASE, PERFORM the following:

_____ a. VERIFY step F.9 has been completed. (N/A if 0RE-PR001 is inoperable and AAR 0BwOS RETS 2.1-1a has been initiated.)

_____ b. OBTAIN the key for 0AOV-WX896, Release Tank Outlet Valve.

NOTE

If Circ. Water Blowdown Flow Low and/or Release Tank Disch Header Radiation High alarms are lit, it may be necessary to reset the Rel. Tank Disch Header & Isolation Valves 0WX896 & 0WX353 by pressing their reset button prior to opening 0AOV-WX896.

NOTE

Upon receipt of a high radiation signal at 0PR01J, the Release Tank Discharge Valves, 0WX353 and 0WX896 will remain closed until the high radiation signal seal-in is reset at 0PL01J.

NOTE

NOTIFY the Shift Manager/Emergency Director to evaluate for Emergency Plan conditions if the maximum release rate is exceeded.

H____12. c. OPEN 0AOV-WX896, Release Tank Outlet Isolation Valve.

SUPERVISOR VERIFICATION _____

_____ d. VERIFY/CLOSE 0AOV-WX015, Release Tank 0WX01T Pump Recirc Valve.

SUPERVISOR VERIFICATION _____

CAUTION
The release rate shall NOT exceed 50 gpm.

H____12. e. THROTTLE OPEN 0AOV-WX897, Release Tank Discharge Flow Control Valve, with controller 0FK-WX630, TO OBTAIN a maximum discharge flowrate of less than the release rate specified in step H.3.e. _____ GPM by checking at least one of the following:

_____ ○ Low Flow Totalizer accumulating (0FQ-WX-630A, 0FIQ-WX-630B).

_____ ○ Low Flow Recorder rising (0FR-WX-630 Low Flow Indication).

_____ ○ 0WX01T Level Recorder lowering (0LR-WX028, 0WX01T Level Indication).

_____ ○ Computer Point (F0002) for release rate rising.

SUPERVISOR VERIFICATION _____

f. RECORD the following

_____ ● Release Start Time: _____:_____

_____ ● Date: _____

SUPERVISOR VERIFICATION _____

_____ g. THROTTLE OPEN 0AOV-WX897, Release Tank Discharge Flow Control Valve, with controller 0FK-WX630, To OBTAIN a release rate NOT to exceed the maximum release rate specified in step H.3.e:

SUPERVISOR VERIFICATION _____

NOTE

While releasing from the 0WX01T, high radiation from the 0PR90J will not cause the Release Tank Discharge Valves (0WX353 and 0WX896) to auto-close, because the 0PR90J is associated with the 0WX26T only.

CAUTION

Releases Not discharging via the Diffuser SHALL be limited to <10,000 gallons. If releasing via the alternate (old) discharge, secure prior to reaching 10,000 gallons.

Releases through the Ultra-Low Flow flowpath and the Diffuser do not have a total gallons release limit.

H. 13. ULTRA LOW FLOW RELEASE, PERFORM the following:

_____ a. VERIFY step F.10 has been completed. (N/A if 0RE-PR001 is inoperable and AAR 0BwOS RETS 2.1-1a has been initiated.)

_____ b. OBTAIN the key for 0AOV-WX353, Release Tank Outlet Valve.

NOTE

If Circ. Water Blowdown Flow Low and/or Release Tank Disch Header Radiation High alarms are lit, it may be necessary to reset the Rel. Tank Disch Header & Isolation Valves 0WX896 & 0WX353 by pressing their reset button prior to opening 0AOV-WX353.

NOTE

Upon receipt of a high radiation signal at 0PR01J, the Release Tank Discharge Valves, 0WX353 and 0WX896 will remain closed until the high radiation signal seal-in is reset at 0PL01J.

NOTE

NOTIFY the Shift Manager/Emergency Director to evaluate for Emergency Plan conditions if the maximum release rate is exceeded.

H____13. c. OPEN 0AOV-WX353, Release Tank Outlet Isolation Valve.

SUPERVISOR VERIFICATION _____

_____ d. VERIFY/CLOSE 0AOV-WX015, Release Tank 0WX01T Pump Recirc. Valve.

SUPERVISOR VERIFICATION _____

CAUTION
The Ultra Low release rate shall NOT exceed 20 gpm.

H____13. e. THROTTLE OPEN 0AOV-WX302, Release Tank Discharge Flow Control Valve, with controller 0FK-WX001, TO OBTAIN a maximum discharge flowrate of less than the release rate specified in step H.3.e. _____ GPM by checking at least one of the following:

_____ ○ Ultra Low Flow Totalizer accumulating (0FQI-WX001A, 0FQI-WX001B).

_____ ○ Ultra Low Flow Recorder rising (0FR-WX630 Ultra Low Flow Indication).

_____ ○ 0WX01T Level Recorder lowering (0LR-WX028, 0WX01T Level Indication).

_____ ○ Computer Point (F0001) for release rate rising.

SUPERVISOR VERIFICATION _____

f. RECORD the following:

_____ ● Release Start Time: _____:_____

_____ ● Date: _____

SUPERVISOR VERIFICATION _____

_____ g. THROTTLE OPEN 0AOV-WX302, Release Tank Discharge Flow Control Valve, with controller 0FK-WX001, TO OBTAIN a release rate NOT to exceed the maximum release rate specified in step H.3.e.

SUPERVISOR VERIFICATION _____

H____14. RECORD the Release Rate from the applicable recorder:

- ○ 0FR-WX630, Ultra Low Flow Indication _____ Gal/Min (≤ 20 gpm)
- ○ 0FR-WX630, Low Flow Indication _____ Gal/Min (≤ 50 gpm)

SUPERVISOR VERIFICATION _____
(LESS THAN MAXIMUM RATE DETERMINED IN STEP H.3.e.)

NOTE
Consider using a timer to calculate the end time of the release based on the flow recorded in step H.14. and the time recorded in H.12.f. or H.13.f.

15. VERIFY the following:

NOTE
If Batch and cumulative Totalizers are not operable, Step H.15.a. is not required. Gallons released shall be determined per note prior to Step H.19.e. if both Totalizers are not operable.

a. Batch Totalizer and/or Cumulative Totalizer readings accumulating. (It is acceptable, however, to observe no change in the readings at low release rates):

_____ ○ 0FQI-WX001A, Batch Totalizer (Ultra Low Flow)

_____ ○ 0FQI-WX001B, Cumulative Totalizer (Ultra Low Flow)

_____ ○ 0FQI_WX630A, Batch Totalizer (Low Flow)

_____ ○ 0FQI-WX630B, Cumulative Totalizer (Low Flow)

NOTE
If 0FR-WX630 ULTRA LOW FLOW or 0FR-WX630 LOW FLOW, as applicable, is inoperable and AAR 0BwOS RETS 2.1-1a has been initiated, Step H.15.b is not required.

_____ b. PERFORM a Channel Check per 0BwOSR 0.1-0 for 0FR-WX630 ULTRA LOW FLOW or 0FR-WX630 LOW FLOW, as applicable, by OBSERVING indication at 0PL01J.

NOTE
If 0UR-CW032 is inoperable and AAR 0BwOS RETS 2.1-1a has been initiated Step H.15.c. is not required.

H____15. c. PERFORM a channel check per 0BwOSR 0.1-0 for the Station Blowdown Flow Monitor by observing 0UR-CW032, indicated on Panel 0PM01J, or computer point F2400.

d. RECORD Station Blowdown Flowrate during release:

_____ ○ 0UR-CW032 _____ GPM

_____ ○ Computer Point _____ GPM

_____ e. RECORD Station Blowdown Flowrate once per 24 Hr. on continuous release:

_____ ○ 0UR-CW032 _____ GPM

_____ ○ Computer Point _____ GPM

NOTE
If the first attempt to notify the Control Room or the Shift Manager is unsuccessful, proceed with Step H.16 and continue to notify the Control Room and Shift Manager that the release is in progress.

_____ f. NOTIFY Control Room of release in progress.

_____ g. NOTIFY Shift Manager of release in progress.

H. 16. PERFORM the following rate checks. REFER to Liquid Release Rate Chart on next page.

a. For the Ultra Low Flow rate path check the flow rate by comparing a tank level (0LR-WX028, 0WX01T Level Indication) calculation over a 10 minute interval against computer point F0001 or Flow Recorder (0FR-WX-630 Ultra Low Flow Indication). PERFORM this check twice at the beginning of the release. Providing the flow rates are consistent and below the allowed release rate the release flow rate checks can be relaxed to once every 30 minutes. RECORD each flow rate obtained.

b. For the low flow rate release path check the flow rate by comparing a tank level (0LR-WX028, 0WX01T Level Indication) calculation over a 10 minute interval against computer point F0002 or Flow Recorder (0FR-WX630 Low Flow Indication). PERFORM this check twice at the beginning of the release. Providing the flow rates are consistent and below the allowed release rate the release flow rate checks can be relaxed to once every 30 minutes. RECORD each flow rate obtained.

TIME		Indicated Flow: Computer Point F0001/F0002 or Flow Recorder 0WX630 Ultra Low Flow/Low Flow (circle one)	0LR-WX028 Tank LEVEL (%)		Δ t	Δ l	329 X (Δl/Δt) = gpm	Operator*
Start	Stop		Start	Stop				
								_____
								_____
								_____
								_____
								_____
								_____
								_____
								_____
								_____
								_____
								_____
								_____
								_____
								_____

Where: Δ t = Stop Time - Start TIME
Δ l = Stop LEVEL - Start Level
329 = gallons per 1% tank level

* After each comparison of indicated flow vs. calculated flow, VERIFY the flowrate is less than the maximum release rate specified in step H.3.e., if not, IMMEDIATELY NOTIFY the OPS Supervisor.

Liquid Release Rate Chart

%Level Change	Time Change (Minutes)							
	5.00	10.00	15.00	20.00	25.00	30.00	35.00	40.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.50	32.90	16.45	10.97	8.23	6.58	5.48	4.70	4.11
1.00	65.80	32.90	21.9.	16.45	13.16	10.97	9.40	8.23
1.50	98.70	49.35	32.90	24.68	19.74	16.45	14.10	12.34
2.00	131.60	65.80	43.87	32.90	26.32	21.93	18.80	16.45
2.50	164.50	82.25	54.83	41.13	32.90	27.42	23.50	20.56
3.00	197.40	98.70	65.80	49.35	39.48	32.90	28.20	24.68
3.50	230.30	115.15	76.77	57.58	46.06	38.38	32.90	28.79
4.00	263.20	131.60	87.73	65.80	52.64	43.87	37.60	32.90
4.50	296.10	148.05	98.70	74.03	59.22	49.35	42.30	37.01
5.00	329.00	164.50	109.67	82.25	65.80	54.83	47.00	41.13
5.50	361.90	180.95	120.63	90.48	72.38	60.32	51.70	45.24
6.00	394.80	197.40	131.60	98.70	78.96	65.80	56.40	49.35
6.50	427.70	213.85	142.57	106.93	85.54	71.28	61.10	53.46
7.00	460.60	230.30	153.53	115.15	92.12	76.77	65.80	57.58
7.50	493.50	246.75	164.50	123.38	98.70	82.25	70.50	61.69
8.00	526.40	263.20	175.47	131.60	105.28	87.73	75.20	65.80
8.50	559.30	279.65	186.43	139.83	111.86	93.22	79.90	69.91
9.00	592.20	296.10	197.40	148.05	118.44	98.70	84.60	74.03
9.50	625.10	312.55	208.37	156.28	125.02	104.18	89.30	78.14
10.00	658.00	329.00	219.33	164.50	131.60	109.67	94.00	82.25
10.50	690.90	345.45	230.30	172.73	138.18	115.15	98.70	86.36
11.00	723.80	361.90	241.27	180.95	144.76	120.63	103.40	90.48
11.50	756.70	378.35	252.23	189.18	151.34	126.12	108.10	94.59
12.00	789.60	394.80	263.20	197.40	157.92	131.60	112.80	98.70
12.50	822.50	411.25	274.17	205.63	164.50	137.08	117.50	102.81
13.00	855.40	427.70	285.13	213.85	171.08	142.57	122.20	106.93
13.50	888.30	444.15	296.10	222.08	177.66	148.05	126.90	111.04
14.00	921.20	460.60	307.07	230.30	184.24	153.53	131.60	115.15
14.50	954.10	477.05	318.03	238.53	190.82	159.02	136.30	119.26
15.00	987.00	493.50	329.00	246.75	197.40	164.50	141.00	123.38
15.50	1019.90	509.95	339.97	254.98	203.98	169.98	145.70	127.49
16.00	1052.80	526.40	350.93	263.20	210.56	175.47	150.40	131.60
16.50	1085.70	542.85	361.90	271.43	217.14	180.95	155.10	135.71
17.00	1118.60	559.30	372.87	279.65	223.72	186.43	159.80	139.83
17.50	1151.50	575.75	383.83	287.88	230.30	191.92	164.50	143.94
18.00	1184.40	592.20	394.80	296.10	236.88	197.40	169.20	148.05
18.50	1217.30	608.65	405.77	304.33	243.46	202.88	173.90	152.16
19.00	1250.20	625.10	416.73	312.55	250.04	208.37	178.60	156.28
19.50	1283.10	641.55	427.70	320.78	256.62	213.85	183.30	160.39
20.00	1316.00	658.00	438.67	329.00	263.20	219.33	188.00	164.50
20.50	1348.90	674.45	449.63	337.23	269.78	224.82	192.70	168.61
21.00	1381.80	690.90	460.60	345.45	276.36	230.30	197.40	172.73
21.50	1414.70	707.35	471.57	353.68	282.94	235.78	202.10	176.84
22.00	1447.60	723.80	482.53	361.90	289.52	241.27	206.80	180.95
22.50	1480.50	740.25	493.50	370.13	296.10	246.75	211.50	185.06
23.00	1513.40	756.70	504.47	378.35	302.68	252.23	216.20	189.18
24.00	1579.20	789.60	526.40	394.80	315.84	263.20	225.60	197.40
24.50	1612.10	806.05	537.37	403.03	322.42	268.68	230.30	201.51
25.00	1645.00	822.50	548.33	411.25	329.00	274.17	235.00	205.63

Enter % Change **10.00** Enter Time **10.00** Flow Rate **329.00**

NOTE

Closing the 0AOV-WX889 will NOT isolate sample flow to the 0RE-PR001.

H. 17. IF the release MUST be interrupted to provide the operator a break when a relief is unavailable, THEN perform the following:

_____ a. Receive permission from the Shift Manager to secure the release for no more than 30 minutes.

_____ b. Make a log entry and an entry on the table in step H.16. denoting the time the release was stopped.

_____ c. OPEN 0AOV-WX015, Release Tank Pump 0WX01P Recirc Valve.

_____ d. NOTIFY Main Control Room of the following 0AOV-WX889 will be closed, suspending the release.

_____ e. CLOSE 0AOV-WX889, Release Tank Pump 0WX01P Discharge Isol Valve.

_____ f. VERIFY that the release has been stopped.

_____ g. MINIMIZE the pause in the release.

_____ h. NOTIFY Shift Manager that release will be started again.

_____ i. MAKE a log entry and an entry on the table in Step H.16. denoting the time which the release was restarted.

_____ j. OPEN 0AOV-WX889, Release Tank Pump 0WX01T Discharge Isol Valve.

H____17. k. VERIFY/OPEN 0AOV-WX353/896, Release Tank Discharge Isolation Valve, for the flow path being used.

_____ l. CLOSE 0AOV-WX015, Release Tank 0WX01T Pump Recirc Valve.

NOTE
Tripping the release tank pump and Closing the Release Tank Discharge Flow Control Valve will stop sample flow to the 0PR01J, thus causing it to interlock. Both actions should be performed with minimal delay to prevent reverse flow from the CW header through 0PR01J into the Release Tank.

_____18. WHEN the desired volume of water has been released from Release Tank 0WX01T, PERFORM the following:

a. NOTIFY the Main Control Room of the following:

_____ 1) The 0WX01T release will be complete.

_____ 2) 0PR01J will alarm due to loss of flow.

_____ b. TRIP Release Tank Pump 0WX01P.

NOTE
If 0RE-PR001 is inoperable and AAR 0BwOS RETS 2.1-1a has been initiated, verification is required for step H.18.c.

_____ c. CLOSE 0AOV-WX302/897, Release Tank Discharge Flow Control Valve.

SUPERVISOR VERIFICATION _____

H. 19. RECORD the following:

_____ a. Release Stop Time: _____:_____

_____ b. Date: _____

_____ c. Tank Level Final _____% (0LR-WX028, 0WX01T Level Indication)

NOTE
If Batch and Cumulative Totalizers are inoperable, GO TO step H.19.e and mark H.19.d as N/A.

d. Determine the volume of liquid released from the totalizers by performing the following:

_____ 1) RECORD the appropriate Batch Totalizer final reading:

_____ ○ 0FQI-WX630A (Low Flow) _____ (if operable)

_____ ○ 0FQI-WX001A (Ultra Low Flow) _____ (if operable)

_____ ○ MULTIPLY the Low Flow reading obtained by 10 (if applicable):

_____ x 10 = _____ Gallons Released (H.19.d.1)

_____ ○ DIVIDE the Ultra Low Flow reading obtained by 10 (if applicable).

_____ ÷ 10 = _____ Gallons Released (H.19.d.1)

H____19. d. 2) RECORD the appropriate CUMULATIVE TOTALIZER final reading:

_____ ○ 0FQI-WX630B (Low Flow) _____ (if operable)

_____ ○ 0FQI-WX001B (Ultra Low Flow) _____ (if operable)

_____ ○ MULTIPLY the reading obtained by 10 (if applicable).

_____ x 10 = _____ Gallons Released (H.19.d.2)

_____ ○ DIVIDE the Ultra Low Flow reading obtained by 10 (if applicable).

_____ ÷ 10 = _____ Gallons Released (H.19.d.2)

_____ 3) RECORD the Time and Date of the volume released calculation:

- Time: _____
- Date: _____

NOTE
The next step is only required if the Batch and Cumulative Totalizers are inoperable. (Otherwise, mark the next step N/A)

H. 19. e. Determine the volume of liquid released by performing a calculation based on the change in tank level by performing the following:

_____ 1) RECORD the value from step A.2: _____ Percent

_____ 2) RECORD the value from step H.19.c: _____ Percent

_____ 3) SUBTRACT step H.19.e.2) from H.19.e.1) and RECORD the Percent Level Change in the space below:

_____ Percent Level Change

_____ 4) MULTIPLY the Percent Change above by 329 to obtain the total number of gallons released and RECORD below:

_____ x 329 = _____ Gallons Released (H.19.e.3)

_____ 5) RECORD the Time and Date of the volume released calculation:

- Time: _____
- Date: _____

_____ f. NOTIFY the Shift Manager that the release is complete.

_____ g. NOTIFY the Control Room that the release is complete.

_____ h. LOG in Radwaste Operators Log the following:

- Release #
- Gallons released
- Date and Time release stopped

NOTE
If 0RE-PR001 is inoperable and AAR 0BwOS RETS 2.1-1a has been initiated, verification is required for steps H.20. and H.22.

H____20. VERIFY 0AOV-WX353, Release Tank Discharge Valve to Circ. Water Blowdown, LOCKED CLOSED.

SUPERVISOR VERIFICATION _____

_____21. RECORD time when key was removed from key lock switch for 0AOV-WX353, Release Tank Discharge Valve to Circ. Water Blowdown. _____:_____ (N/A if the Ultra Low Flow Flowpath was not used.)

_____22. VERIFY the 0AOV-WX896, Release Tank Discharge Valve to Circ. Water Blowdown, LOCKED CLOSED.

SUPERVISOR VERIFICATION _____

_____23. RECORD time when key was removed from key lock switch for 0AOV-WX896, Release Tank Discharge Valve to Circ. Water Blowdown. _____:_____ (N/A if the Low Flow flowpath was not used.)

_____24. CLOSE 0AOV-WX889 Release Tank Pp 0WX01P Discharge Isolation Valve.

_____25. CLOSE 0WX354, Release Tk Disch to Process Rad Mon System (TB 401' J-18 between tanks).

VERIFICATION _____

NOTE
Complete Attachment A to ensure compliance with CC-AA-112.

26. IF Relay Block K1 at 0PR01J was removed in step H.2., then:

_____ a. NOTIFY Shift Manager that the temporary Electrical Alteration is being restored.

_____ b. REPLACE Relay Block K1 at 0PR01J,

SUPERVISOR VERIFICATION _____

H____26. c. REMOVE the two placards stating "K1 RELAY REMOVED FOR LIQUID RELEASE", that were placed in Step H.2.c.

_____ d. If the Electrical Alteration cannot be restored, process a Temporary Configuration Change.

NOTE
If 0RE-PR001 is INOPERABLE and AAR BwOS RETS 2.1-1a has been initiated, steps H.27.a through H.27.q. may be omitted at Ops Supervisor discretion.

27. Backflush the 0PR01J radiation monitor as follows:

_____ a. VERIFY release tank 0WX01T is less than 96% (0LR-WX028, 0WX01T Level Indication).

_____ b. VERIFY/OPEN “NO EPN”, 0PR01J return to 0WX01T.

_____ c. VERIFY/CLOSE “NO EPN”, 0PR01J return to 0WX26T.

CAUTION
Do not back flush the Radiation Monitor for a period of time such that the Release Tank level exceeds 97% (0LR-WX028, 0WX01T Level Indication).

d. NOTIFY the Main Control Room of the following:

_____ ● 0PR01J will be flushed.

_____ ● 0PR01J will alarm on the RM-11.

_____ e. VERIFY/OPEN 0WM897, WM Header Isolation Valve.

_____ f. VERIFY/CLOSE 0WX354, Release Tank Discharge to Process Rad Monitor System. N/A if performed in step H.25.

VERIFICATION _____

_____ g. OPEN 0PR052, Rad Mon 0PR01J Bypass Valve.

_____ h. OPEN 0PR050, 0PR01J Backflush Isolation Valve.

_____ i. OPEN 0WM898, 0PR01J WM Supply Header Valve.

H____27. j. WAIT 1 minute.

_____ k. CLOSE 0PR5004, Skid 0PR01J Flow Isolation Valve.

NOTE
Expect Release Tank level to rise approximately 3% per hour.

_____ l. FLUSH 0PR01J, Radiation Monitor:

- For 15 minutes after release.
- Until the desired Release Tank level is obtained.

_____ m. CLOSE 0PR050, 0PR01J Backflush Isolation Valve.

_____ n. CLOSE 0WM898, 0PR01J WM Supply Header Valve.

_____ o. OPEN 0PR5004, Skid 0PR01J Flow Isolation Valve.

_____ p. CLOSE 0PR052, Rad Mon 0PR01J Bypass Valve.

_____28. OPS Supervisor: Update the Liquid Release Tritium Tracking Log columns for Date/Time Discharge complete, Actual Tritium Activity and Gallons Actual. (Log located at L:/Shared/8931/Liquid Release Information/Liquid release Tritium Tracking Log). IF the release was not performed, ENTER “CANCELLED” in the appropriate blanks.

NOTE
Step H.29 is not applicable if performing an extended purge to fill the Release Tank.

29. OPS Supervisor: I have reviewed Part H and have verified it is accurate and complete.

_____/_____/_____
OPS Supervisor Date Time

I. OPERATING DEPARTMENT RESPONSIBILITY

NOTE
If the current activity level recorded in step I.1. is greater than 1.31E-4 μCi/ml, INITIATE a work request to decontaminate the 0RE-PR001 sample chamber. If 0PR01J is in RETS, step I.1 may be N/Ad at Supervisor's discretion.

1. OBTAIN the current reading for 0RE-PR001 (0PS101) at the RM-11:

_____ a. VERIFY/SELECT Grid 1.

_____ b. KEY in 101.

_____ c. DEPRESS SEL key.

_____ d. DEPRESS CHAN ITEMS key.

_____ e. RECORD the current 0PR01J (0PS101) reading:

_____ μCi/ml Date: _____

NOTE
If 0RE-PR001 is inoperable and AAR 0BwOS RETS 2.1-1a has been initiated or if ALERT AND HIGH ALARM setpoints have not changed from Step D.7.a.4), Step I.2. is not required

2. SET the Rad Monitor 0RE-PR001 (0PS101) to the original setpoints as follows:

_____ a. VERIFY/PLACE the RM-11 Console in SUPERVISOR MODE.

_____ b. DEPRESS the Grid 1 Key.

_____ c. KEY in 101.

_____ d. DEPRESS SEL key.

_____ e. VERIFY 0PR01J (0PS101) selected.

_____ f. DEPRESS CHAN ITEMS.

_____ g. KEY in 10.

I ____2. h. DEPRESS SEL key (CHAN ITEM 10 should be displayed in reverse characters).

_____ i. KEY in the new ALERT alarm setpoint of 4.32E-5 μCi/ml USING the format XYZ ± AB (i.e. a value of 3.76E-10 would be entered as 376-10).

_____ j. DEPRESS the ENTER key. The new value will be displayed after a short delay.

_____ k. VERIFY the new ALERT alarm setpoint of 4.32E-05 μCi/ml is displayed.

VERIFICATION _____

_____ l. KEY in 9.

_____ m. DEPRESS SEL key (CHAN ITEM 9 should be displayed in reverse characters).

_____ n. KEY in the new HIGH alarm setpoint of 8.64E-5 μCi/ml USING the format XYZ ± AB (i.e. a value of 3.76E-10 would be entered as 376-10).

_____ o. DEPRESS the ENTER key (The new value will be displayed after a short delay).

_____ p. VERIFY the new HIGH alarm setpoint of 8.64E-5 μCi/ml is displayed.

VERIFICATION _____

_____ q. PLACE the RM-11 Console in the NORMAL MODE.

NOTE
If 0RE-PR010 is inoperable and AAR 0BwOS RETS 2.1-1a has been initiated or if ALERT AND HIGH ALARM setpoints have not changed from Step D.8.a.4), Step I.3. is not required

3. SET the Rad Monitor 0RE-PR010 (0PS110) to the original setpoints as follows:

_____ a. PLACE the RM-11 Console in SUPERVISOR MODE.

_____ b. DEPRESS the Grid 1 key.

_____ c. KEY in 110.

_____ d. DEPRESS SEL key.

l ____3. e. VERIFY 0PR10J (0PS110) selected.

_____ f. DEPRESS CHAN ITEM key.

_____ g. KEY in 10.

_____ h. DEPRESS SEL key (CHAN ITEM 10 should be displayed in reverse characters).

_____ i. KEY in the new ALERT alarm setpoint of 7.46E-7 μCi/ml USING the format XYZ ± AB (i.e. a value of 3.76E-10 would be entered as 376-10).

_____ j. DEPRESS the ENTER key (The new value will be displayed after a short delay).

_____ k. VERIFY the new ALERT alarm setpoint of 7.46E-7 μCi/ml is displayed.

VERIFICATION _____

_____ l. KEY in 9.

_____ m. DEPRESS SEL key (CHAN ITEM 9 should be displayed in reverse characters).

_____ n. KEY in the new HIGH alarm setpoint of 1.07E-6 μCi/ml USING the format XYZ ± AB (i.e. a value of 3.76E-10 would be entered as 376-10).

_____ o. DEPRESS the ENTER key (The new value will be displayed after a short delay).

_____ p. VERIFY the new HIGH alarm setpoint of 1.07E-6 μCi/ml is displayed.

VERIFICATION _____

_____ q. PLACE the RM-11 Console in the NORMAL MODE.

NOTE

DO NOT isolate Circulating Water Blowdown until at least three and one-half (3.5) hours after the release stop time recorded in step H.19.a. to ensure the entire release tank effluent has passed through the Circulating Water Blowdown pipe to the Kankakee River.

Control of Circulating Water Blowdown Flow Limitations may be transferred to an Equipment Status Tag for the purpose of completing this package. The Equipment Status Tag must specify the time and date for completion of the 3.5 hour flush requirement. This method is most applicable when performing multiple releases in one day. If control is transferred to an Equipment Status Tag, Step I.4. may be marked as "Condition Met".

I. 4. 3.5 hours or more after the time recorded in Step H.19.a., PERFORM the following:

_____ a. REMOVE the placard stating "Liquid Release in Progress" at 0PM01J.

b. RECORD the following for "Liquid Release in Progress" placard is removal at 0PM01J:

_____ ● Time: _____:_____

_____ ● Date: _____

_____ c. RESTORE CW Blowdown to desired flow.

_____5. FORWARD this form to Chemistry to complete Section J.

J. CHEMISTRY DEPARTMENT RESPONSIBILITY

NOTE

If a computerized release program is available, you may attach the printout to this form and indicate "see attached" in the calculation spaces in step J.1. below.

_____1. COMPLETE the table below for each isotope identified in step D.6.a.:

Isotope	Total Activity Released (μCi) *	Isotope	Total Activity Released (μCi)

Sum of activities above = _____

* OBTAIN by multiplying each number in column #2 of table in step D.6.a. by total volume released from step H.19.d. or H.19.e. (in ml)(ml=gal x 3785)

_____Total ml released = _____ ml

J. 2. VERIFY compliance with 10CFR50 dose limits, as specified in the ODCM:

_____ a. ENTER the final release into the RETDAS program to close the permit associated with this release.

_____ b. PRINT the closed permit for retention with this release package.

_____ c. REVIEW the closed permit to VERIFY compliance with 10CFR50 dose limits.

ATTACHMENT A
TCCP TRACKING LOG SHEET

TCC Description:

REMOVE Relay Block K1 at 0PR01J (inside the AC Power Panel) to allow opening of 0AOV-WX896/353, Release Tank Discharge Isolation Valve.

This TCC does not affect the Critical Control Room Drawings.

Installation/Removal functional test is not required.

This Procedurally Controlled TCC was implemented prior to 5/29/2001. Per the Fleet's Change Management Decision, this procedure does not need a Technical Evaluation.

(only one TCC/EPN per tracking sheet)

TCC INSTALLATION

TCC Expected Installation Date: _____

TCC Expected Removal Date: _____

Applicable Plant Mode Limitations: _____

Tech Eval Number: N/A

MR90 Applicable: NO

Expiration date (one refueling cycle): _____

Extension Allowed (per CC-AA-112, Attach 2): _____

Shift Manager Approval _____ _____
Signature Date

ATTACHMENT A (Cont.)
TCCP TRACKING LOG SHEET

TCC Installed by: _____ _____/_____
Print Name Initial Date

Independent Verification by: _____ _____/_____
Print Name Initial Date

Placards Installed per step H.2.c: _____ _____/_____
Print Name Initial Date

Logged in TCCP Log: _____ _____/_____
Print Name Initial Date

LCO/RETS Entered if applicable: _____ _____/_____
Print Name Initial Date

TCC REMOVAL

Shift Manager Approval _____ _____
Signature Date

TCC Removed by: _____ _____/_____
Print Name Initial Date

Independent Verification by: _____ _____/_____
Print Name Initial Date

Placards Removed per step H.26.c:_____ _____/_____
Print Name Initial Date

Logged out of TCCP Log: _____ _____/_____
Print Name Initial Date

LCO/RETS Exited if applicable: _____ _____/_____
Print Name Initial Date

TCC TRANSFER OF ACCOUNTABILITY to CC-AA-112
(if not removed by governing procedure)

Method used for accountability (EST, Clearance Order, etc.)

_____

Shift Manager Approval _____ _____
Signature Date

(Final)

LIQUID RELEASE WINDOW DETERMINATION

NOTE

Kankakee River Flow rate is normally obtained via the internet site for the U.S. Geological Survey (usgs.gov), WILMINGTON DATA (from the appropriate Unit Supervisor). If data is unavailable, RECORD most recent data from the Unit Supervisor turnover.

1. RECORD Liquid Release Number from BwOP WX-501T1:

   L - _____ - _____

2. OBTAIN and RECORD current (within last 24 hrs.) Kankakee River flow data:

   _____ CFS at Date: _____/_____/_____ at Time: _____

3. RECORD CW blowdown flow

   - O F2400 _____ GPM
   - O OUR-CW032 _____ GPM

4. PERFORM either of the following to determine the liquid release window:

   - O IF the Liquid Release Window Spreadsheet is available, GO TO Step 5.
   - O IF a manual Liquid Release Window calculation is to be performed, GO TO Step 6.

5. PERFORM the following to determine the Liquid Release Window using the Liquid Release Window Spreadsheet:

   a. ACCESS the Liquid Release Window spreadsheet at k:/shift/excel/liquid release.

   b. ENTER the following data in the appropriate sections of the spreadsheet:

      - Arrive Wilmington (This is normally the day AFTER the release will occur but may be on the second day after the release will occur if Blowdown Peak time to Wilmington intake exceeds 24 hours.)

      - River Flow rate recorded in Step 2.

      - Release duration:

        - From BwOP WX-501T1.

        - As directed by the Shift Manager.

      - CW Blowdown flow recorded in Step 3.

   c. GO TO Step 7.

6. PERFORM the following to manually calculate the Liquid Release Window:

   a. DETERMINE the length of time for CW blowdown to traverse the CW Blowdown piping:

      2,640,329 GALS (Volume of CW B/D Piping) ÷_____GPM **=**_____ MIN
      (Step 3 CW B/D flow)

   b. DETERMINE the time for the liquid release to travel from the outfall structure to the Wilmington Intake:

      $40523 \times (\underset{\text{(Step 2 cfs)}}{\_\_\_\_\_})^{-0.5286} = \_\_\_\_\_$ MINUTES

   c. RECORD the release duration in minutes:

      - From BwOP WX-501T1.

      - As directed by the Shift Manager.

      _____ MINUTES

6. d. DETERMINE the travel time from source to mid peak at Wilmington:

_____ + _____ + (_____ ÷ 2) =
(Step 6.a) (Step 6.b) (Step 6.c)

_____ MINUTES

NOTE

If the liquid release duration is within the range of 480 – 600 minutes, set the margin at 60 minutes. Always record the margin as a positive value.

e. DETERMINE the margin for start of the release:

540 min - _____ = _____MINUTES
(Step 6.c)

f. DETERMINE the target start time of the liquid release (results in the mid peak of the release reaching Wilmington at about 02:30 AM):

02:30 AM - _____ = _____ : _____
(Step 6.d) (round to nearest ¼ hour)

g. DETERMINE the Start After Time:

_____ : _____ - [_____ ÷ 2] = _____ : _____
(Step 6.f) (Step 6.e) (round to nearest ¼ hour)

h. DETERMINE the Start Before Time:

_____ : _____ + [_____ ÷ 2] = _____ : _____
(Step 6.f) (Step 6.e) (round to nearest ¼ hour)

7. RECORD the following in BwOP WX-501T1 as applicable:

- Target start time.
- Start After Time.
- Start Before Time.

AUTHORIZATION TO RELEASE OUTSIDE OF RELEASE WINDOW

Time/Date _____/_____

Release Number: _____

Process Tank Levels:

Release Tanks	0WX01T	_____%	0WX26T	_____%
HUTs	0A	_____%	0B	_____%
AB Monitor Tanks	1AB02T	_____%	2AB02T	_____%
WX Monitor Tanks	0A	_____%	0B	_____%
WF Tanks	0A	_____%	0B	_____%
WE Tanks	0A	_____%	0B	_____%
Chem Drain Tank	0WZ01T	_____%		
Chem/Regen Waste Drain Tank	0WX08T	_____%		
Regen Waste Drain Tank	0WX25T	_____%		

Describe conditions/evolutions in progress or expected (give time frame) that prevent releasing this tank within appropriate release time window:

_____

_____

_____

_____

Operations Supervisor: _____ Time/Date: _____/_____

Shift Manager: _____ Time/Date: _____/_____

Station Duty Officer: _____ Time/Date: _____/_____

Include this form with liquid release package. Forward copy of this form to RW Coordinator for trending purposes.

TASK CONDITIONS:

1. You are the Shift Emergency Director.
2. A RCS LOCA has occurred.
3. The TSC and OSC are NOT yet staffed.
4. An EO has received a life threatening injury and is incapacitated in the Unit 2 364' Curved Wall Area.
5. A rescue attempt must be made to rescue the injured person.
6. The estimated dose to an individual attempting the rescue is 50 Rem.
7. Joe Radworker, age 28, Employee ID Number 123456, has volunteered to rescue the injured person. Joe Radworker's current annual exposure is 24 mRem.

INITIATING CUES:

1. Authorize rescue of the injured person.
2. Notify the examiner when you have completed authorization of emergency exposure for rescue of the injured person.

TASK TITLE: **Emergency Dose Authorization**

JPM No.: **S-409**
Task No.: S-ZP-010
Objective No.: 7F.ZP-010-A

REV: **2013 NRC**
K/A No.: 2.4.38
K/A IMP: 4.4

EXAMINEE: _____ SRO

EVALUATOR: _____ DATE: _____

The Examinee: PASSED _____ this JPM.
FAILED _____

TIME STARTED: _____
TIME FINISHED: _____
JPM TIME: _____ MINUTES

CRITICAL ELEMENTS: **(*) 2, 4, 5**

APPROX COMPLETION TIME: 15 MINUTES

CRITICAL TIME: **N/A**

EVALUATION METHOD:
X PERFORM
___ SIMULATE

LOCATION:
X IN PLANT
X SIMULATOR

GENERAL REFERENCES:

1. EP-AA-113, PERSONNEL PROTECTIVE ACTIONS, REV 11.
2. EP-AA-113-F-02, AUTHORIZATION FOR EMERGENCY EXPOSURE, REV B.

MATERIALS:

1. EP-AA-113, PERSONNEL PROTECTIVE ACTIONS, REV 11.
2. EP-AA-113-F-02, AUTHORIZATION FOR EMERGENCY EXPOSURE, REV B.

TASK STANDARDS:

1. Determine emergency exposure is required to rescue injured worker.
2. Brief affected personnel of possible health effects of emergency exposure.
3. Authorize personnel exposure in excess of 10CFR20 limits.

TASK CONDITIONS:

1. You are the Shift Emergency Director.
2. A RCS LOCA has occurred.
3. The TSC and OSC are NOT yet staffed.
4. An EO has received a life threatening injury and is incapacitated in the Unit 2 364' Curved Wall Area.
5. A rescue attempt must be made to rescue the injured person.
6. The estimated dose to an individual attempting the rescue is 50 Rem.
7. Joe Radworker, age 28, Employee ID Number 123456, has volunteered to rescue the injured person. Joe Radworker's current annual exposure is 24 mRem.

INITIATING CUES:

1. Authorize rescue of the injured person.
2. Notify the examiner when you have completed authorization of emergency exposure for rescue of the injured person.

RECORD START TIME: _____

	PERFORMANCE STEP	STANDARD	CIRCLE APPLICABLE
1.	Refer to EP-AA-113, PERSONNEL PROTECTIVE ACTIONS. **CUE: Provide examinee copy of EP-AA-113.**	Refer to EP-AA-113: • Determines section 4.3 needs to be performed.	SAT UNSAT N/A **Comments:**
***2.**	**Determine emergency exposure is required.**	Determines emergency exposure is required per EP-AA-113, step 4.3.2: • From initiating cue, estimated dose during rescue is 50 Rem. • Determines 50 Rem is above 5 Rem limit.	SAT UNSAT N/A **Comments:**
	EVALUATOR NOTE: Page 6 contains a key of a correctly completed EP-AA-113-F-02 form.		
3.	Complete EP-AA-113-F-02, AUTHORIZATION FOR EMERGENCY EXPOSURE: **CUE: Provide examinee copy of EP-AA-113-F-02.** **CUE: If asked, Joe Radworker has NOT had a previous emergency exposure.**	Authorizes radiation exposure greater than 10CFR20 limits: • Complete EP-AA-113-F-02, AUTHORIZATION FOR EMERGENCY EXPOSURE: • Name: Joe Radworker • Date/Time: Today/Current Time • Social Security Number: 123-45-6789 • Current Annual Exposure: 24 mRem • Reason for request: Rescue of injured worker. • Requesting authorization to exceed: 25 Rem TEDE box checked. • Emergency worker signature. • Rad Protection Management Review complete.	SAT UNSAT N/A **Comments:**

	PERFORMANCE STEP	STANDARD	CIRCLE APPLICABLE

*4.	**Inform emergency personnel before the fact of possible health effects of anticipated exposure.**
	
	CUE: Joe Radworker has understood healh risks and has signed EP-AA-113-F-02.
	CUE: If asked, the Rad Protection Manager is not available.
		Informs emergency personnel before the fact of possible health effects of anticipated exposure.
		• Determines emergency exposure risks per EP-AA-113, Attachment 1:
		  • Determines health affects associated with whole body absorbed doses received within a few house per EP-AA-113:
		  • 2% of populations affected by prodromal effects.
		  • Determines risk of premature death based on workers age: (28 years old from initiating cue)
		  • 9.1 deaths/1000 persons
		  • Determines average years of life lost if premature death occurs based on workers age: (28 years old from initiating cue)
		  • 24 years
		• Briefs personnel on emergency exposure.
		• Ensures emergency worker acknowledges risks and signs EP-AA-113-F-02.
			SAT UNSAT N/A
			Comments:

*5	**Authorize exposure in excess of 10CFR20 limits.**	Authorizes exposure in excess of 10CFR20 limits: • Sign and date/time Station Emergency Director block on EP-AA-113-F-02.	SAT UNSAT N/A **Comments:**

CUE: THIS COMPLETES THIS JPM.

RECORD STOP TIME: _____

COMMENTS:

SIMULATOR SETUP INSTRUCTIONS

- Verify/perform TQ-BR-201-0113, BRAIDWOOD TRAINING DEPARTMENT SIMULATOR EXAMINATION SECURITY ACTIONS CHECKLIST.
- Complete items on Simulator Ready for Training Checklist.

COMMENTS

- Provide copy of EP-AA-113, PERSONNEL PROTECTIVE ACTIONS, REV 11.
- Provide copy of EP-AA-113-F-02, AUTHORIZATION FOR EMERGENCY EXPOSURE, REV B.

KEY – DO NOT GIVE TO EXAMINEE

AUTHORIZATION FOR EMERGENCY EXPOSURE

Name: Joe Radworker Date / Time: Today Current Time

Employee ID Number: 123456 Current Annual Exposure: 24 mRem

Reason For Request:

Rescue of injured worker

REQUESTING AUTHORIZATION TO EXCEED:

❑ 5 Rem TEDE (Authorized to receive greater than 5 Rem TEDE but less than 10 Rem TEDE)

❑ 10 Rem TEDE (Authorized to receive greater than 10 Rem TEDE but less than 25 Rem TEDE)

☒ 25 Rem TEDE (Authorized to receive greater than 25 Rem TEDE)

Joe Radworker Today/Now
* Emergency Worker Signature Date / Time

*Emergency Worker Exposure Limits and Associated Risks (EP-AA-113 Attachment 1) have been reviewed and the potential health affects are understood.

Rad. Protection Management (Review) Date / Time

Examinee Today/Now
Station Emergency Director (Authorization) Date / Time

The Shift Manager (Shift Emergency Director) may approve prior to transferring Command and Control to the Station Emergency Director.

KEY – DO NOT GIVE TO EXAMINEE

PERSONNEL PROTECTIVE ACTIONS

1. PURPOSE

1.1. This procedure provides the necessary guidance used in determining onsite personnel protective actions during an event.

Assembly, Accountability and Evacuation	**REFER** to Section 4.1
Habitability	**REFER** to Section 4.2
Emergency Exposure Limits	**REFER** to Section 4.3
KI Assessment	**REFER** to Section 4.4

2. TERMS AND DEFINITIONS

2.1. Accountability - Accountability is the process of verifying the location of personnel who are inside the Protected Area. That is, any personnel within the Protected Area who have not carded into the card reader will be identified as missing (unaccounted for). Accountability is required to be completed within 30 minutes of its initiation (the names of any missing persons identified by security and the number of missing provided to the Station Emergency Director).

Accountability must be conducted at a Site Area or General Emergency, if not previously initiated. Accountability may be conducted at the Alert level following TSC activation, at the discretion of the Station Emergency Director.

2.2. Assembly - Assembly occurs at a Site Area Emergency (or at the discretion of the Station Emergency Director). On-duty and ERO personnel assemble in the emergency response facilities. All other non-essential personnel, contractors and visitors report to their designated Assembly Area. The Assembly Area is used to coordinate the need for any immediate additional resources and to establish an ERO shift relief roster and schedule.

2.3. Evacuation - A site evacuation is required at the Site Area Emergency classification level immediately following completion of Accountability actions. Site evacuation may be called for at any lower classification; however, conditions that require a site evacuation are inherently defined as Site Area Emergency events and should be classified as such.

Evacuation can involve the movement of large numbers of personnel outside of the Protected Area by keying out of the turnstiles. Evacuation may warrant station egress control by Security. Security will provide specific instructions to personnel leaving the Protected Area. Evacuees may be directed to a Relocation Center (offsite assembly areas) for monitoring and decontamination, or sent home. Other situations that involve the evacuation of personnel from occupied localized onsite areas are controlled on a case-by-case basis.

2.4. OCA – Owner Controlled Area. Company owned property on which a nuclear station is located and may include Exelon Nuclear leased-lands adjacent to that nuclear station.

2.5. Protected Area – Area controlled by Security and surrounded by a double fence. Access is normally gained through the Main Access Facility (or Gatehouse).

2.6. Release - A '*Release in Progress*' is defined as ANY radioactive release that is a result of, or associated with, the emergency event.

2.7. Thyroid Blocking Agent - an agent which when properly administered to an individual will result in sufficient accumulation of stable iodine in the thyroid to prevent significant uptake of radioiodine. Potassium Iodide (KI) is such an agent.

3. RESPONSIBILITIES

3.1. The Shift Manager (Shift Emergency Director) will perform the responsibilities of the Station Emergency Director until relieved.

3.2. The Station Emergency Director is responsible for the following protective actions:

- Authorization of emergency exposure greater than 5 Rem (per EPA-400 lower limits).
- Authorization for issuance of KI to Exelon Nuclear emergency workers and/or onsite personnel.
- Direction of Assembly, Accountability and Evacuation of personnel.

3.3. The respective Radiation Protection Manager (TSC or EOF) is responsible for approval of emergency exposures below 5 Rem (EPA-400 lower limits) for Exelon personnel associated with response actions under their facility's direction.

3.4. The Security Shift Supervisor (or Security Coordinator when the TSC is activated) is responsible for performing Accountability, controlling site access, and coordinating Site and OCA Evacuations.

3.5. The Security Coordinator in the TSC is responsible for coordinating activities between the TSC and the Security force.

3.6. The Maintenance Manager is responsible for coordinating Search and Rescue Teams and Assembly Area rosters.

4. MAIN BODY

NOTE: Protective Actions for the onsite workers shall be based on preventing or minimizing radiological exposures to the emergency workers onsite.

4.1. Assembly, Accountability and Evacuation

4.1.1. Protective Measure Guidelines

1. **Accountability** is required to be conducted at a Site Area or General Emergency, if not previously initiated and maintained. Accountability may be conducted at the Alert level at the discretion of the Station Emergency Director, or Shift Manager (Shift Emergency Director) prior to TSC activation.

   A. Accountability and evacuation of non-essential site personnel should also be considered when a security-related Unusual Event or Alert has been declared.

   B. Accountability shall be initiated expeditiously, but only after evaluating the need for offsite assembly and appropriate evacuation route based on radiological release and meteorological conditions.

   C. Once initiated, accountability is required to be completed (i.e., the names of any missing persons identified by security and the number of missing provided to the Station Emergency Director) within 30 minutes of initial PA announcement for site evacuation.

2. A **Site Evacuation** may be delayed if the health and safety of the plant personnel may be in jeopardy, such as severe weather or due to a security-related Unusual Event or Alert.

3. **Non-essential personnel evacuating the site**, contractors and visitors, shall report to a Remote (Off-Site) Assembly Area, if designated, for radiological monitoring and decontamination as warranted.

4. **Protected Area access** is halted during personnel accountability, except for the following:
   - ERO responders requiring access to staff the Operations Support Center (OSC) and/or Technical Support Center (TSC).
   - Direct approval from the TSC Security Coordinator or Shift Manager for others.

5. **Accountability**, once achieved, will be maintained by restricting Protected Area access and controlling/tracking the movement of on-shift personnel or ERO personnel on site in or out of their respective emergency response facility.

4.1.2. Determination of Actions

NOTE: Site Evacuation of non-essential personnel shall be conducted immediately after a Site Area or General Emergency has been declared. An exception may be made for events that could require the pre-planned evacuation to be rerouted or delayed such as:

- Severe weather, radiological or other hazardous conditions threaten safe movement of personnel.
- A security threat is occurring which could have an adverse impact on security response or personnel while leaving the site.

1. **IF** a Site Area Emergency has been declared **THEN** immediately perform protective measure steps per the appropriate Checklist:

   A. Mid-Atlantic Stations shall use EP-AA-113-F-04, Mid Atlantic Site Assembly, Accountability and Evacuation Checklist.

   B. Mid-West Stations shall use EP-AA-113-F-07, Mid West Site Assembly, Accountability and Evacuation Checklist.

NOTE: Site Assembly and/or Site Evacuation of non-essential personnel should be considered when a security related Unusual Event or Alert has been declared.

2. **IF** a Site Area Emergency has not been declared, **THEN** evaluate the need for and ability to conduct a Site Assembly and/or Site Evacuation.

   A. **CONDUCT** a Site Assembly whenever it has been determined that:

      1. Excess dose or other dangers exist to the onsite personnel.

      2. Positive control of location and movement of all onsite personnel is necessary for support of response efforts.

   B. **CONDUCT** a Site Evacuation whenever it has been determined that:

      1. Hazardous conditions exist that necessitate the removal of all non-essential personnel from the site.

      2. Positive control of location and movement of essential personnel is necessary for support of response efforts.

4.2. Habitability

4.2.1. **DETERMINE** if radiological controls are required to protect onsite personnel. The need for radioactive controls shall be based on monitored radioactive releases, exposure levels, and plant status information. Standard Radiation Protection policies and procedures shall form the basis of the decision-making for the administration of radiological controls.

NOTE: The decision to utilize radiological controls that differ from standard Radiation Protection practices shall be documented in position logs.

4.2.2. Radiological controls for continuously occupied areas for emergency workers are to be evaluated using EP-AA-113-F-01, On-Site Habitability Checklist.

4.2.3. Onsite radiological controls shall be used to the extent practical based on the emergency condition. They include but are not limited to the following:

1. Radiological Access Control for Rad/High Rad Areas - Access Control is used to limit the personnel who may be exposed to the radiological condition.

2. Use of Radiological Protective Clothing - Protective clothing shall be used to limit the spread of radiological contamination and to protect the emergency worker from becoming radiologically contaminated.

3. Use of Radiological Respiratory Protective Equipment - Respiratory protective equipment shall be used to limit the inhalation and ingestion of radioactive materials during the course of the emergency event. The need for respirators shall be based on air samples, plant monitoring systems, and plant conditions.

4. Use of Contamination Control Techniques - Contamination control techniques such as Step-off Pads, Posting, Contamination surveys, and whole body frisking shall be used to the extent practical based on the emergency condition.

4.3. Emergency Exposure Limits

NOTE: This section implements the requirements of RP-AA-203 and should **not** be revised without first reviewing the requirements of the current revision of the procedure.

Emergency Exposure Determination	**REFER** to Section 4.3.1
Briefing Personnel (greater than 5 Rem TEDE)	**REFER** to Section 4.3.2
Authorization (greater than 5 Rem TEDE)	**REFER** to Section 4.3.3
Tracking and Recording of Exposures	**REFER** to Section 4.3.4

4.3.1. Emergency Exposure Determination

NOTE: In certain onsite emergency situations, extremely high dose rates may be encountered (more than 500 Rem/hr). Before a rescue team is committed to life-saving emergency dose limits, weigh the probability of success against the probable cost of the commitment. Specifically there must be reasonable assurance that the victim is in the area and that they are alive or likely to survive.

1. **ASSURE** that the emergency exposure is for a bona fide emergency involving risk of life or limb, or the destruction of valuable property.

   A. **PLAN** emergency operations prior to entry.

   B. **WEAR** respiratory protection and protective clothing to reduce contamination where possible.

2. **DETERMINE** if emergency exposure limits in excess of 5 Rem TEDE (EPA-400 lower limits) are required for Exelon emergency workers.

3. **If** emergency exposure is less than 5 Rem TEDE (EPA-400 lower limits), **then OBTAIN** approval as appropriate:

   - TSC Radiation Protection Manager for onsite Exelon personnel
   - EOF Radiation Protection Manager for Exelon field team personnel

4.3.2. Briefing Personnel (greater than 5 Rem TEDE)

1. For exposures at or above 5 Rem TEDE (EPA-400 lower limits), **COMPLETE** an Authorization for Emergency Exposure (EP-AA-113-F-02).

2. **INFORM** emergency personnel (volunteers) before the fact of possible health effects at the anticipated exposure level using Attachment 1, Emergency Worker Exposure Limits and Associated Risks.

3. **OBTAIN** emergency worker's acknowledge that they have volunteered and understand the associated risks. Acknowledgement should be in writing on Authorization for Emergency Exposure Form if possible **OR** verbally for teams in the field,

4. **FORWARD** to the completed form to the Station Emergency Director for approval.

4.3.3. Authorization greater than 5 Rem TEDE (EPA-400 lower limits):

CAUTION

Emergency exposure limits greater than 5 Rem TEDE may be applicable for stopping a release, life saving actions, and protection of major equipment and large populations. Emergency exposure greater than 5 Rem TEDE should be voluntary.

All emergency exposures in excess of 25 Rem TEDE **shall** be voluntary and **shall** be limited to once in a lifetime. Persons who may receive exposures greater than 25 Rem TEDE **shall be fully aware of the risks involved**.

1. **OBTAIN** and **DOCUMENT** Station Emergency Director approval, by signature, for the use of the emergency dose limits above 5 Rem TEDE (EPA-400 lower limits) on the Authorization for Emergency Exposure form.

NOTE: The decision to authorize personnel exposure per EPA-400 limits is the responsibility of the Station Emergency Director and may **not** be delegated.

2. **NOTIFY** Occupational Health (Medical) Services Department promptly if any EPA-400 dose limit is exceeded.

4.3.4. Tracking and Recording

1. **ESTIMATE** and **RECORD** personnel dose equivalents resulting from any emergency situation.

2. **REPORT** final emergency exposures greater than 5 Rem TEDE (EPA-400 lower limits) to the NRC.

4.4. KI Assessment

Determination	**REFER** to Section 4.4.1
Authorization and Issuing KI	**REFER** to Section 4.4.2
Briefing Personnel	**REFER** to Section 4.4.3

4.4.1. Determination

1. **ASSESS** the potential of high thyroid exposure to emergency workers in, or projected to be sent into, areas where the possibility exists of exposure to radioactive iodine as follows:

   A. For Field Monitoring Teams or other Exelon emergency workers working offsite, determine if **EITHER** of the following conditions exist:

      Condition 1

      - There is an Offsite Release in Progress.

        And

      - There has been a loss or potential loss of the Fuel Clad Barrier.

      OR

Condition 2

- Dose Assessments project iodine thyroid exposure for emergency workers will be ≥ 50 Rem Committed Dose Equivalent (CDE).

B. For OSC Emergency Teams and other onsite workers, determine if **EITHER** of the following conditions exist:

Condition 1

- Workers will be entering an unknown radiological atmosphere that is suspected to have a high iodine concentration. Loss of the Fuel Clad barrier is a good indication of possible high iodine concentrations.

OR

Condition 2

- The calculated iodine thyroid exposure (actual or projected) for emergency workers, base on station Radiation Protection procedures or use of the dose assessment program, will be ≥ 50 Rem Committed Dose Equivalent (CDE).

2. **If** the condition A and/or B listed above are met **then**, **RECOMMEND** the issuance of one (1) 130 mg KI tablet to each emergency worker affected per day for 10 consecutive days

4.4.2. Authorization

NOTE: The Radiation Protection Manager and OSC Director should avoid the use of individuals known to have possible adverse reactions to KI for tasks where exposure to iodine may occur. A list of individuals who indicated possible allergies is available.

1. **DOCUMENT** the decision to issue KI using Thyroid Blocking Agent Authorization Form (EP-AA-113-F-03).
   - The Station Emergency Director must authorize issuance of KI to Exelon emergency workers.

2. **NOTIFY** Occupational Health (Medical) Services Department promptly if KI is to be issued to Exelon Nuclear personnel or contractors.

4.4.3. Briefing Personnel and Issuing KI

NOTE: The effectiveness of potassium iodide as a thyroid blocking agent decreases as a function of time. The effectiveness of potassium iodide is as follows:

- 90% effective if taken immediately prior to or concurrent with exposure to radioactive iodine.
- 50% effective if taken within 3 to 4 hours following exposure.
- Ineffective if taken more than 12 hours following exposure.

NOTE: The FDA KI Package insert provided with the KI product identifies the side effects and risks involved with KI usage. It is general use guidance intended for members of the public. It states approval from state and public health authorities is needed prior to use, this applies to members of the public. Exelon has the authority and responsibility to direct use of KI by Exelon Emergency Workers.

NOTE: Persons with a known allergy to iodine should not be considered for work requiring the use of potassium iodide blocking agents.

CAUTION

KI dosage in excess of that recommended by this procedure could lead to possible effects including: rash, swelling of salivary glands, soreness in the teeth and gums, upset stomach and diarrhea.

1. **REVIEW** Thyroid Blocking Agent Authorization Form (EP-AA-113-F-03) to ensure all individuals being issued KI are listed and form is complete.

2. **READ**, or instruct the Emergency Worker(s) to read, “Information on use of Thyroid Blocking Agent” on authorization form or the FDA KI package insert prior to taking or administering KI.

NOTE: Potassium Iodide (KI) has a limited effective shelf life, which may be extended by the manufacturer. Potassium iodide must be stored in sealed containers that are protected from light and are in areas that meet all manufacturers' limitations on temperature variances.

3. **VERIFY** the expiration date of the KI to ensure it is within its acceptable shelf life period prior to being used.

4. **ISSUE** of one (1) 130 mg KI tablet to each emergency worker affected per day for 10 consecutive days.

4.5. The following forms will be used by various members of the ERO to perform their duties related to personnel protective actions outlined in this procedure:

- EP-AA-113-F-01, On-Site Habitability Checklist
- EP-AA-113-F-02, Authorization of Emergency Exposure
- EP-AA-113-F-03, Thyroid Blocking Agent Authorization Form
- EP-AA-113-F-04, MA Emergency Director – Site Assembly, Accountability and Evacuation Checklist
- EP-AA-113-F-05, Vehicle and Evacuee Control Group Leader Checklist
- EP-AA-113-F-06, Vehicle and Evacuee Control Group Member Checklist
- EP-AA-113-F-07, MW Emergency Director – Site Assembly, Accountability and Evacuation Checklist
- EP-AA-113-F-08, PBAPS Assembly, Accountability and Evacuation Guidelines
- EP-AA-113-F-09, LGS Assembly, Accountability and Evacuation Guidelines
- EP-AA-113-F-10, TMI Assembly, Accountability and Evacuation Guidelines
- EP-AA-113-F-11, Remote Assembly Area Muster List
- EP-AA-113-F-12, Vehicle Survey and Decontamination Report
- EP-AA-113-F-13, Facility Accountability List (Within Protected Area)
- EP-AA-113-F-14, Rock River Division Headquarters Vehicle Traffic Flowpath
- EP-AA-113-F-15, Rock River Division Headquarters Frisking Area and Personnel Flowpath
- EP-AA-113-F-17, Braidwood Assembly, Accountability and Evacuation Guidelines

- EP-AA-113-F-18, Byron Assembly, Accountability and Evacuation Guidelines
- EP-AA-113-F-19, Dresden Assembly, Accountability and Evacuation Guidelines
- EP-AA-113-F-20, LaSalle Assembly, Accountability and Evacuation Guidelines
- EP-AA-113-F-21, Quad Cities Assembly, Accountability and Evacuation Guidelines
- EP-AA-113-F-22, Clinton Assembly, Accountability and Evacuation Guidelines
- EP-AA-113-F-23, Assembly Area Roster
- EP-AA-113-F-24, Relocation Center Operations Checklist
- EP-AA-113-F-25, Relocation Center Accountability Log
- EP-AA-113-F-26, Relocation Center Monitoring Log
- EP-AA-113-F-27, Midwest ERO Off-Site Staging Area Checklist
- EP-AA-113-F-28, MA ERO Off-Site Staging Area Checklist
- EP-AA-113-F-29, Oyster Creek Assembly, Accountability and Evacuation Guidelines

5. DOCUMENTATION

5.1. The following forms, when completed during a declared event document implementation of this procedure:

- EP-AA-113-F-01, On-Site Habitability Checklist
- EP-AA-113-F-02, Authorization of Emergency Exposure
- EP-AA-113-F-03, Thyroid Blocking Agent Authorization Form
- EP-AA-113-F-04, MA Emergency Director – Site Assembly, Accountability and Evacuation Checklist
- EP-AA-113-F-05, Vehicle and Evacuee Control Group Leader Checklist
- EP-AA-113-F-06, Vehicle and Evacuee Control Group Member Checklist
- EP-AA-113-F-07, MW Emergency Director – Site Assembly, Accountability and Evacuation Checklist
- EP-AA-113-F-08, PBAPS Assembly, Accountability and Evacuation Guidelines

- EP-AA-113-F-09, LGS Assembly, Accountability and Evacuation Guidelines
- EP-AA-113-F-10, TMI Assembly, Accountability and Evacuation Guidelines
- EP-AA-113-F-11, Remote Assembly Area Muster List
- EP-AA-113-F-12, Vehicle Survey and Decontamination Report
- EP-AA-113-F-13, Facility Accountability List (Within Protected Area)
- EP-AA-113-F-14, Rock River Division Headquarters Vehicle Traffic Flowpath
- EP-AA-113-F-15, Rock River Division Headquarters Frisking Area and Personnel Flowpath
- EP-AA-113-F-16, River Bend Middle School Vehicle Traffic and Relocation Center Layout
- EP-AA-113-F-17, Braidwood Assembly, Accountability and Evacuation Guidelines
- EP-AA-113-F-18, Byron Assembly, Accountability and Evacuation Guidelines
- EP-AA-113-F-19, Dresden Assembly, Accountability and Evacuation Guidelines
- EP-AA-113-F-20, LaSalle Assembly, Accountability and Evacuation Guidelines
- EP-AA-113-F-21, Quad Cities Assembly, Accountability and Evacuation Guidelines
- EP-AA-113-F-22, Clinton Assembly, Accountability and Evacuation Guidelines
- EP-AA-113-F-23, Assembly Area Roster
- EP-AA-113-F-24, Relocation Center Operations Checklist
- EP-AA-113-F-25, Relocation Center Accountability Log
- EP-AA-113-F-26, Relocation Center Monitoring Log
- EP-AA-113-F-27, Midwest ERO Off-Site Staging Area Checklist
- EP-AA-113-F-28, MA ERO Off-Site Staging Area Checklist
- EP-AA-113-F-29, Oyster Creek Assembly, Accountability and Evacuation Guidelines

5.2. The Standard Records Retention ID for the above documents per the Standards Records Retention Schedule is 5B.100.

6. REFERENCES

6.1. Development References

6.1.1. Nuclear Operations Directive NOD-RP.14, "ALARA, Exposure Management, Work Controls and Radiological Monitoring," current revision.

6.1.2. EPA 400-R-92-001, "Manual of Protective Action Guides and Protective Actions for Nuclear Incidents," October 1991.

6.1.3. "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion, "Federal Guidance Report No. 11, Office of Radiation Programs, U.S. EPA, EPA-520/1-88-020, September 1988.

6.1.4. "Potassium Iodide as a Thyroid Blocking Agent in Radiation Emergency: Final Recommendations on use," Federal Register, Vol. 47, No. 125, June 29, 1982.

6.1.5. "Protection of Thyroid Gland in the Event of Releases of Radioiodine," NCRP Report No. 55, 1977.

6.1.6. Commonwealth Edison Quality Verification Audit Finding, Audit No. CE-92-04, CAR# CE-92-029 (Nov. 18, 1992)

6.1.7. Commonwealth Edison Medical Dept. Procedure and Practice Guideline, "Exposure Evaluation: Ionizing Radiation" (10/5/93).

6.1.8. RP-AA-203, “Exposure Control and Authorization

6.2. User References

None

7. ATTACHMENTS

7.1. Attachment 1 - Emergency Worker Exposure Limits and Associated Risks

ATTACHMENT 1

EMERGENCY WORKER EXPOSURE LIMITS AND ASSOCIATED RISKS

Page 1 of 1

EMERGENCY WORKER EXPOSURE LIMITS

The dose-limiting recommendations for emergency situations are as follows:

Dose Limit (Rem TEDE)*	Activity	Condition
5	All	Personnel should be kept within normal 10CFR20 limits during emergencies, except as authorized for activities as indicated below
10	Protecting Valuable Property	When a lower dose is not practical
25	Life Saving or Protection of Large Populations	When a lower dose is not practical
>25	Life Saving or Protection of Large Population	Only on a voluntary basis to persons fully aware of the risks involved

* Dose Equivalent Limit (TEDE in Rem). Workers performing services during emergencies should limit dose to the lens of the eye (LDE) to three times each listed value and doses to any other organ (including skin and body extremities) to ten times each listed value.

EMERGENCY EXPOSURE RISKS

Health effects associated with whole body absorbed doses received within a few hours[a]

Dose in rad (≈ Rem DDE)	Percent of population affected by prodromal[b] effects (e.g. reddening of skin, loss of appetite, nausea, fatigue, diarrhea)	Dose in rad (≈ Rem DDE)	Early fatalities[c] (percent affected)
50 rad	2 %	140 rad	5 %
100 rad	15 %	200 rad	15 %
150 rad	50 %	300 rad	50 %
200 rad	85 %	400 rad	85 %
250 rad	98 %	460 rad	95 %

Approximate cancer risk to average individuals from 25 Rem TEDE received promptly

Age at exposure (years)	Risk of premature death (deaths per 1000 persons exposed)	Average years of life lost if premature death occurs (years)
20 to 30	9.1	24
30 to 40	7.2	19
40 to 50	5.3	15
50 to 60	3.5	11

[a] Risks will be lower for extended exposure periods.

[b] Forewarning symptoms of more serious health effects associated with large doses of radiation.

[c] Supportive medical treatment may increase the dose at which these frequencies occur by approximately 50 percent.

Exelon Nuclear

AUTHORIZATION FOR EMERGENCY EXPOSURE

Name: _____ Date / Time: ____/____/____ ____:____

Employee ID Number: _____ Current Annual Exposure: _____ mRem

Reason For Request:

_____

_____

_____

REQUESTING AUTHORIZATION TO EXCEED:

- ❑ 5 Rem TEDE (Authorized to receive greater than 5 Rem TEDE but less than 10 Rem TEDE)
- ❑ 10 Rem TEDE (Authorized to receive greater than 10 Rem TEDE but less than 25 Rem TEDE)
- ❑ 25 Rem TEDE (Authorized to receive greater than 25 Rem TEDE)

_____ _____

* Emergency Worker Signature Date / Time

* Emergency Worker Exposure Limits and Associated Risks (EP-AA-113 Attachment 1) have been reviewed and the potential health affects are understood.

_____ _____

Rad. Protection Management (Review) Date / Time

_____ _____

Station Emergency Director (Authorization) Date / Time

\# The Shift Manager (Shift Emergency Director) may approve prior to transferring Command and Control to the Station Emergency Director.