Appendix C	Job Performance Measure Worksheet	Form ES-C-1

Facility: Shearon Harris Task No.: 301005H401

Task Title: Determine Rod Misalignment Using Thermocouples JPM No.: 2009a NRC JPM RO A1-1

K/A Reference: G2.17 4.4 / 4.7

Examinee: _____ NRC Examiner: _____

Facility Evaluator: _____ Date: _____

Method of testing:

Simulated Performance: _____ Actual Performance: X

Classroom X Simulator _____ Plant _____

READ TO THE EXAMINEE

I will explain the initial conditions, which steps to simulate or discuss, and provide initiating cues. When you complete the task successfully, the objective for this Job Performance Measure will be satisfied.

Initial Conditions: The plant was at 90 percent power, with a load decrease in progress, when the USCO noticed that the DRPI indication for rod H02 was reading 24 steps higher than the group demand. The load decrease has been stopped and AOP-001 entered.

Initiating Cue: The USCO has directed you to calculate the temperature difference between thermocouple(s) adjacent to the misaligned rod and the average of symmetric thermocouple(s), using Attachment 2 of AOP-001 and the provided T/C Core Maps.

Task Standard: All calculations within ± 2° of actual.

Required Materials: Calculator

General References: AOP-001, Attachment 1 and Attachment 2, Rev. 32 and Tech Specs

Handouts: JPM Cue Sheets Pages 10-11
AOP-001, Attachments 1 and 2, (Rev. 32)

Time Critical Task: No

Validation Time: 12 minutes

Start Time: _____.

Performance Step: 1 OBTAIN PROCEDURE (provided with handout)

Standard: Obtains AOP-001 and refers to Attachments 1 and 2.

Comment:

✓ **Performance Step: 2** DETERMINE THERMOCOUPLE LOCATION(S) ADJACENT TO THE MISALIGNED ROD USING THE CORE GRID MAP (SHEET 1), AND CIRCLE LOCATION(S) IN TABLE ABOVE. THESE THERMOCOUPLES(S) ARE AFFECTED.

Standard: Using the core grid map (Attachment 2, page 1 of 2), Determines affected thermocouples to be G02, J02, and H03.

Circles G02, J02, and H03 on the table

(Attachment 2, page 2 of 2).

Comment:

✓ **Performance Step: 3** RECORD VALUES FOR ALL OPERABLE AFFECTED AND SYMMETRIC THERMOCOUPLES USING THE RVLIS CONSOLE OR ERFIS. SYMMETRIC THERMOCOUPLES ARE THOSE IN THE SAME ROW.

Standard: Locates RVLIS Console and accesses T/C CORE MAP for Train A and Train B. **(Printout of RVLIS core map provided in handout)**

Records value for Affected TC G02 (652°F) and Symmetric TC P07 (636°F).

Records value for Affected TC J02 (628°F) and Symmetric TC P07 (636°F).

Records value for Affected TC H03 (636°F) and Symmetric TCs C08 (636°F), H13 (640°F), and N08 (644°F).

Comment:

✓ **Performance Step: 4** DETERMINE THE AVERAGE OF SYMMETRIC THERMO-COUPLES, FOR EACH AFFECTED THERMOCOUPLE.

Standard: Determines (636°F) for G02's Symmetric TC

Determines (640°F ± **2°F**) for H03's Symmetric TC

Determines (636°F) for J02's Symmetric TC

Comment:

EXAMINERS NOTE: **If the candidate includes the adjacent TCs with the Symmetric TC numbers the averages will be wrong and the end result will be that a wrong final difference will be given:**

Determines (~~644°F~~ (632°F)) for G02's Symmetric TCs ✓ 3/25/09

Determines (640°F) for H03's Symmetric TCs.

Determines (~~632°F~~ (644°F)) for J02's Symmetric TCs. ✓ 3/25/09

✓ **Performance Step: 5** CALCULATE THE DIFFERENCE BETWEEN EACH AFFECTED THERMOCOUPLE AND THE AVERAGE OF ITS SYMMETRIC THERMOCOUPLES.

16°F for TC G02
4°F for TC H03
8°F for TC J02

Standard: Calculates difference of ~~4°F~~ 7 3/25/09 (± 2°F between all affected TCs and their symmetric TCs.)

Reports that temperature difference is ~~within~~ greater than 10°F. 7 3/25/09

Evaluator Cue: **USCO acknowledges report.**

END OF JPM

Comment:

Stop Time: _____

Terminating Cue: Difference between each affected thermocouple and it's symmetric thermocouples has been calculated.

EXAMINERS NOTE: **If the candidate included the adjacent TCs with the Symmetric TC numbers the averages would have been wrong and the calculated difference would be 12°F.**

The report would be that the temperature difference is greater than 10°F. This report would provide the USCO with inaccurate information.

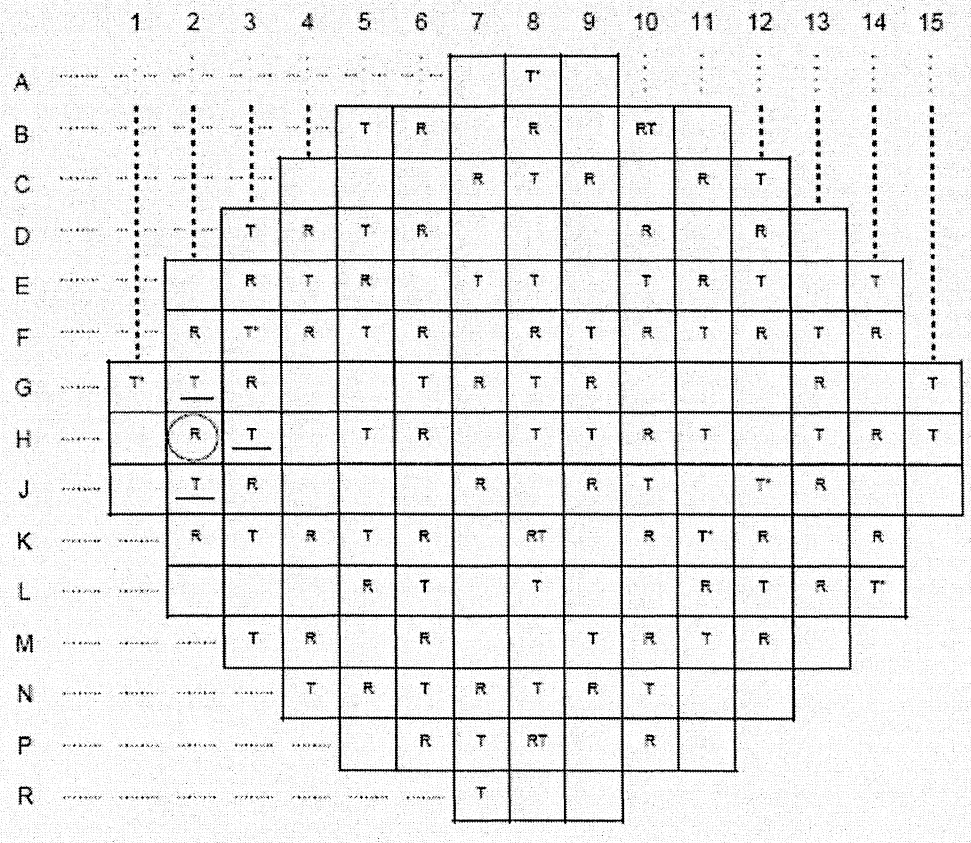
7 3/25/09

KEY

MALFUNCTION OF ROD CONTROL AND INDICATION SYSTEM

Attachment 2 - Adjacent and Symmetric Thermocouple Locations
Sheet 1 of 3

THERMOCOUPLE LOCATIONS



R - Control Rod

T - Thermocouple

T* - Thermocouples abandoned by EC 47997

KEY

MALFUNCTION OF ROD CONTROL AND INDICATION SYSTEM

Attachment 2 - Adjacent and Symmetric Thermocouple Locations
Sheet 2 of 3

NOTE

- B10, E07, H08, K08, and P08 have no symmetric locations.
- Symmetric thermocouples are those in the same row.

SYMMETRIC LOCATIONS

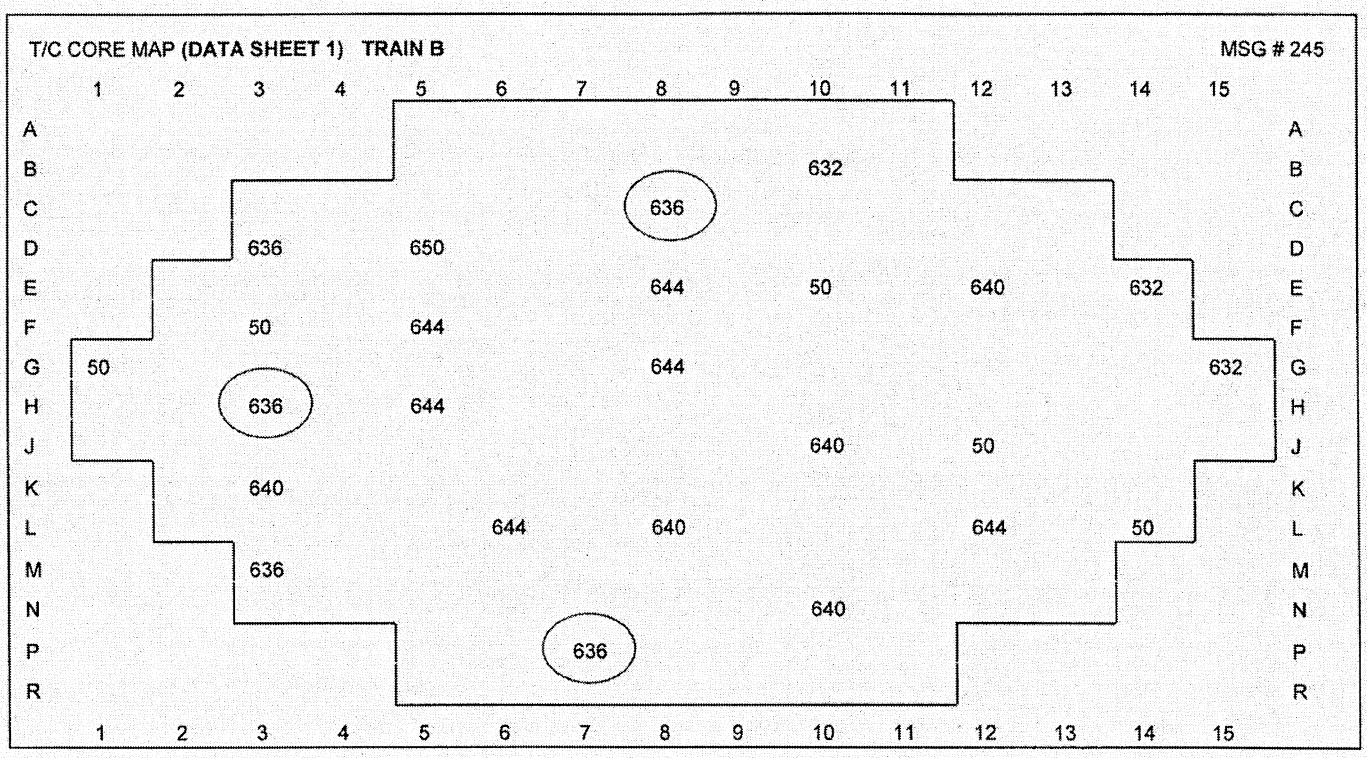
GRID	I		II		III		IV	
TRAIN	A	B	A	B	A	B	A	B
	A08*				H15			
		G01*		G15			R07	
	B05			E14		L14*		
		C08	H13				N08	(H03)
		D03	C12				N04	M03
	E04	D05		E12	M11	L12		
			H11	E08		L08		H05
		F05	F11	E10	K11*		K05	L06
		F03*	F13			N10	N06	K03
	G06		F09			J10		
		G08			H09			
	(G02)						(J02)	P07
					M09	J12*		

SYMMETRIC LOCATIONS

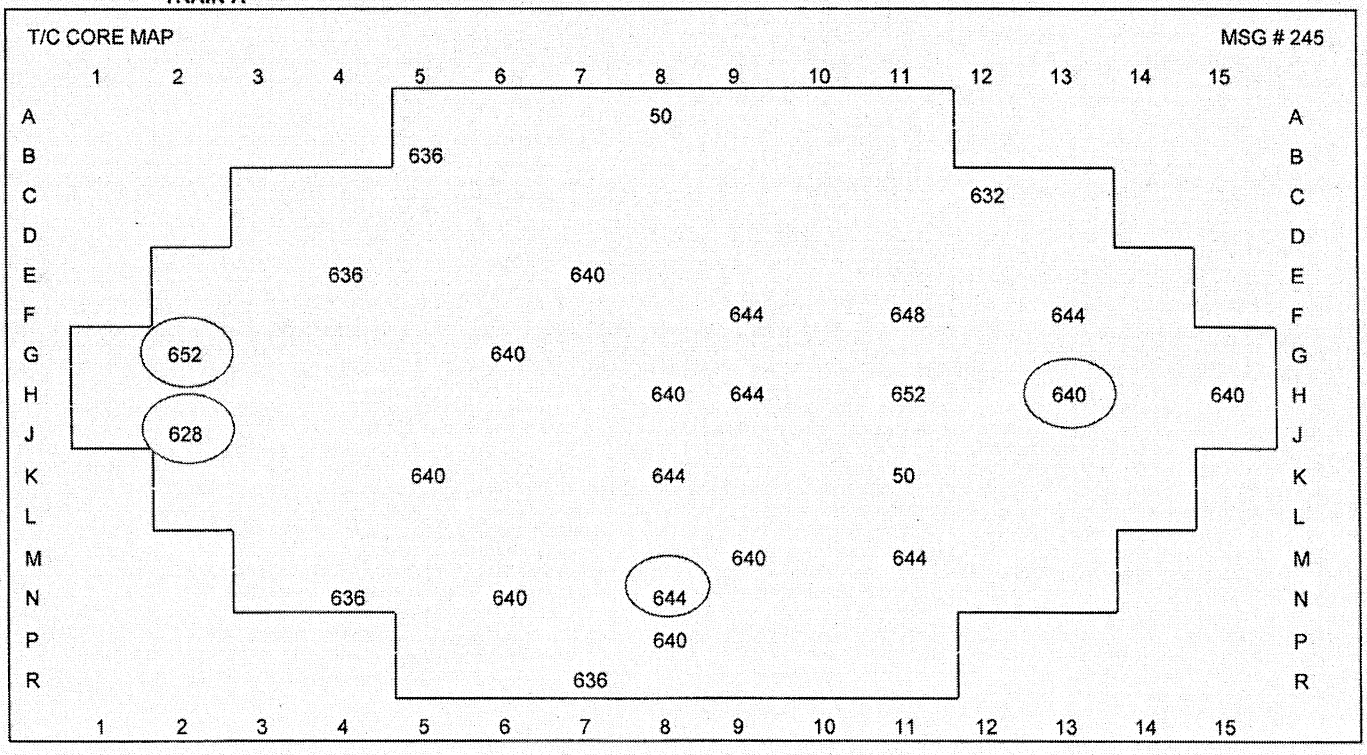
* Thermocouples abandoned by EC 47997

1. **DETERMINE** thermocouple location(s) adjacent to the misaligned rod using core grid map (Sheet 1), **AND CIRCLE** location(s) in Table above.

KEY


T/C CORE MAP (DATA SHEET 1) TRAIN B
MSG # 245
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
A B C D E F G H J K L M N P R
636
632
636
650
644 50 640 632
50 644
50 644 632
636 644
640 50
640
644 640 644 50
636
640
636

TRAIN A


T/C CORE MAP
MSG # 245
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
A B C D E F G H J K L M N P R
50
636
632
636 640
644 648 644
652 640
640 644 652 640 640
628
640 644 50
640 644
636 640 644
640
636

KEY

MALFUNCTION OF ROD CONTROL AND INDICATION SYSTEM

Attachment 2 - Adjacent and Symmetric Thermocouple Locations
Sheet 3 of 3

2. **RECORD** the following in the table below:
   - Adjacent TC number
   - Adjacent TC value using the RVLIS Console, ERFIS, or OSI-PI
   - Symmetric TC numbers (not including adjacent TCs)
   - Symmetric TC values for all OPERABLE TCs using the RVLIS Console, ERFIS, or OSI-PI
3. **DETERMINE** the average of symmetric thermocouples, for each adjacent thermocouple.

Adjacent TC		Symmetric TC		Symmetric TC
Number	Value	Number	Value	Average
G02	652	J02 P07	N/A 636	636
H03	636	C08 H13 N08	636 640 644	640
J02	628	G02 P07	N/A 636	636

4. **COMPARE** each adjacent thermocouple value listed to its symmetric thermocouple average for indication of a misaligned rod. (**REFER TO** Attachment 1.)

--END OF ATTACHMENT 2--

VERIFICATION OF COMPLETION

Job Performance Measure No.: 2009a NRC JPM RO/SRO A1-1

DETERMINE ROD MISALIGNMENT USING THERMOCOUPLES

Examinee's Name:

Date Performed:

Facility Evaluator:

Number of Attempts:

Time to Complete:

Question Documentation:

Question:

Response:

Result: SAT _____ UNSAT _____

Examiner's Signature: _____ Date: _____

Initial Conditions: The plant was at 90 percent power, with a load decrease in progress, when the USCO noticed that the DRPI indication for rod H02 was reading 24 steps higher than the group demand. The load decrease has been stopped and AOP-001 entered.

Initiating Cue: The USCO has directed you to calculate the temperature difference between thermocouple(s) adjacent to the misaligned rod and the average of symmetric thermocouple(s), using Attachment 2 of AOP-001 and the provided T/C Core Maps.

T/C CORE MAP (**DATA SHEET 1**) **TRAIN B** MSG # 245

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
A																A
B										632						B
C								636								C
D			636		650											D
E								644		50		640		632		E
F			50		644											F
G	50							644							632	G
H			636		644											H
J										640		50				J
K			640													K
L						644		640				644		50		L
M			636													M
N										640						N
P							636									P
R																R
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	

TRAIN A

T/C CORE MAP MSG # 245

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
A								50								A
B					636											B
C												632				C
D																D
E				636			640									E
F									644		648		644			F
G		652				640										G
H								640	644		652		640		640	H
J		628														J
K					640			644			50					K
L																L
M									640		644					M
N				636		640		644								N
P								640								P
R							636									R
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	

REFERENCE

ADMIN JPM
RO A1-1

Attachment 1 – Indications of Misaligned Rod

Sheet 1 of 1

The table below indicates the variation in plant parameters which may be indicative of rod misalignment. This variation refers to relative changes in indication from a reference condition at which the suspect rod's position was known to be properly aligned. The reference case may be taken from prior operating records, or it may be updated each time the proper rod positioning is verified by in-core measurements. In general, greater misalignment will cause larger variations. Variations in NI channel indication are also affected by the core location of the suspect rod. For example, a misaligned rod that is closest to the N-44 detector should indicate that N-44 flux parameters are abnormal when compared with flux parameters of the other Power Range NI channels. If the parameters below exhibit no abnormal variations with an individual DRPI differing from its group step counter demand position by more than 12 steps, it is probably a rod position indication problem.

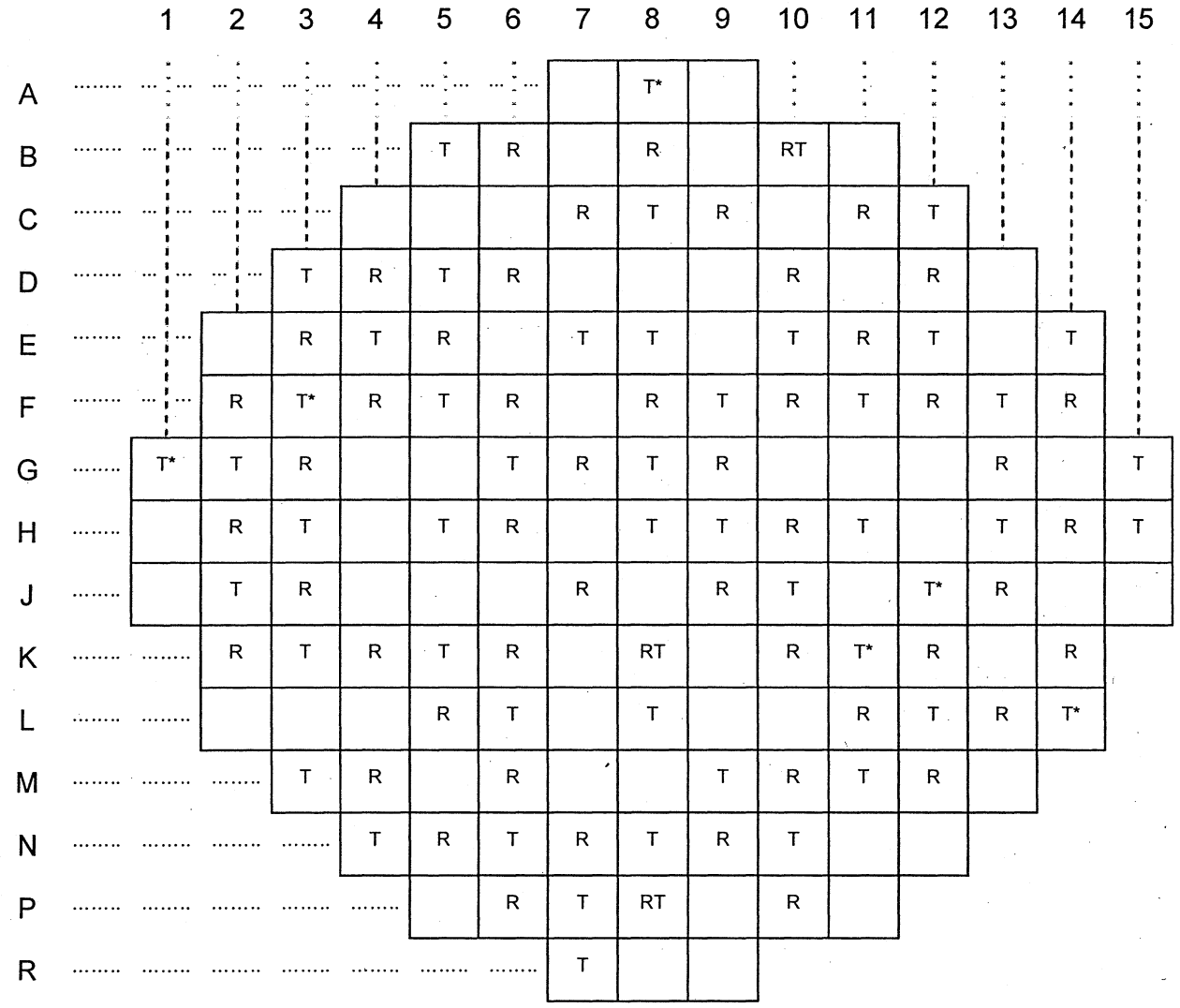
PLANT PARAMETER	VALUE INDICATIVE OF ROD MISALIGNMENT
Quadrant Power Tilt Ratio (QPTR)	Greater than 1.02
Power Range Instrumentation	Greater than 2% difference between any two channels (**REFER TO** Attachment 4)
Delta Flux Indicators	Greater than 2% difference between any two channels (**REFER TO** Attachment 4)
Core Outlet Thermocouples	Greater than 10°F difference between thermocouples adjacent to the misaligned rod and the average of symmetric thermocouples (**PERFORM** Attachment 2)
Axial Flux Traces (in-core movable detector)	**CONSULT** Reactor Engineering **AND EVALUATE** using in-core movable detectors per EST-922, Control Rod Position Determination Via Incore Instrumentation

--END OF ATTACHMENT 1--

Attachment 2 - Adjacent and Symmetric Thermocouple Locations

Sheet 1 of 3

THERMOCOUPLE LOCATIONS



R - Control Rod

T - Thermocouple

T* - Thermocouples abandoned by EC 47997

Attachment 2 - Adjacent and Symmetric Thermocouple Locations

Sheet 2 of 3

NOTE

- B10, E07, H08, K08, and P08 have no symmetric locations.
- Symmetric thermocouples are those in the same row.

SYMMETRIC LOCATIONS

GRID		I		II		III		IV	
TRAIN		A	B	A	B	A	B	A	B
		A08*				H15			
			G01*		G15			R07	
S	L	B05			E14		L14*		
Y	O		C08	H13				N08	H03
M	C		D03	C12				N04	M03
M	A	E04	D05		E12	M11	L12		
E	T			H11	E08		L08		H05
T	I		F05	F11	E10	K11*		K05	L06
R	O		F03*	F13			N10	N06	K03
I	N	G06		F09			J10		
C	S		G08			H09			
		G02						J02	P07
						M09	J12*		

* Thermocouples abandoned by EC 47997

1. **DETERMINE** thermocouple location(s) adjacent to the misaligned rod using core grid map (Sheet 1), **AND CIRCLE** location(s) in Table above.

Attachment 2 - Adjacent and Symmetric Thermocouple Locations
Sheet 3 of 3

2. **RECORD** the following in the table below:
   - Adjacent TC number
   - Adjacent TC value using the RVLIS Console, ERFIS, or OSI-PI
   - Symmetric TC numbers (not including adjacent TCs)
   - Symmetric TC values for all OPERABLE TCs using the RVLIS Console, ERFIS, or OSI-PI

3. **DETERMINE** the average of symmetric thermocouples, for each adjacent thermocouple.

Adjacent TC		Symmetric TC		Symmetric TC Average
Number	Value	Number	Value	
_____	_____			_____
_____	_____			_____
_____	_____			_____
_____	_____			_____

4. **COMPARE** each adjacent thermocouple value listed to its symmetric thermocouple average for indication of a misaligned rod. (**REFER TO** Attachment 1.)

--END OF ATTACHMENT 2--

Appendix C	Job Performance Measure Worksheet	Form ES-C-1

Facility: Shearon Harris Task No.: 301005H401

Task Title: Determine Rod Misalignment Using Thermocouples JPM No.: 2009a NRC JPM SRO A1-1

K/A Reference: G2.17 4.4 / 4.7

Examinee: _____ NRC Examiner: _____

Facility Evaluator: _____ Date: _____

Method of testing:

Simulated Performance: _____ Actual Performance: X

Classroom X Simulator _____ Plant _____

READ TO THE EXAMINEE

I will explain the initial conditions, which steps to simulate or discuss, and provide initiating cues. When you complete the task successfully, the objective for this Job Performance Measure will be satisfied.

Initial Conditions: The plant was at 90 percent power, with a load decrease in progress, when the USCO noticed that the DRPI indication for rod H02 was reading 24 steps higher than the group demand. The load decrease has been stopped and AOP-001 entered.

Initiating Cue: The USCO has directed you to calculate the temperature difference between thermocouple(s) adjacent to the misaligned rod and the average of symmetric thermocouple(s), using Attachment 2 of AOP-001 and the provided T/C Core Maps.

Task Standard: All calculations within ± 2° of actual.

Required Materials: Calculator

General References: AOP-001, Attachment 1 and Attachment 2, Rev. 32 and **Tech Specs**

Handouts: JPM Cue Sheets Pages 10-11
AOP-001, Attachments 1 and 2, (Rev. 32)

Time Critical Task: No

Validation Time: 16 minutes

Start Time: _____.

Performance Step: 1 OBTAIN PROCEDURE (provided with handout)

Standard: Obtains AOP-001 and refers to Attachments 1 and 2.

Comment:

✓ **Performance Step: 2** DETERMINE THERMOCOUPLE LOCATION(S) ADJACENT TO THE MISALIGNED ROD USING THE CORE GRID MAP (SHEET 1), AND CIRCLE LOCATION(S) IN TABLE ABOVE. THESE THERMOCOUPLES(S) ARE AFFECTED.

Standard: Using the core grid map (Attachment 2, page 1 of 2), Determines affected thermocouples to be G02, J02, and H03.

Circles G02, J02, and H03 on the table

(Attachment 2, page 2 of 2).

Comment:

✓ **Performance Step: 3** RECORD VALUES FOR ALL OPERABLE AFFECTED AND SYMMETRIC THERMOCOUPLES USING THE RVLIS CONSOLE OR ERFIS. SYMMETRIC THERMOCOUPLES ARE THOSE IN THE SAME ROW.

Standard: Locates RVLIS Console and accesses T/C CORE MAP for Train A and Train B. **(Printout of RVLIS core map provided in handout page 11)**

Records value for Affected TC G02 (652°F) and Symmetric TC P07 (636°F).

Records value for Affected TC J02 (628°F) and Symmetric TC P07 (636°F).

Records value for Affected TC H03 (636°F) and Symmetric TCs C08 (636°F), H13 (640°F), and N08 (644°F).

Comment:

✓ **Performance Step: 4** DETERMINE THE AVERAGE OF SYMMETRIC THERMOCOUPLES, FOR EACH AFFECTED THERMOCOUPLE.

Standard: Determines (636°F) for G02's Symmetric TC.
Determines (636°F) for J02's Symmetric TC.
Determines (640°F ± **2°F**) for H03's Symmetric TCs.

Comment:

EXAMINERS NOTE: **If the candidate includes the adjacent TCs with the Symmetric TC numbers the averages will be wrong ~~and the end result will be that the wrong Tech Spec will be given. The information below is what the candidate will calculate IF the adjacent TCs were inappropriately used:~~** ~~7~~ 3/25/09
~~(632°F)~~ 7 3/25/09
Determines ~~(644°F)~~ for G02's Symmetric TCs.
Determines (640°F) for H03's Symmetric TCs.
Determines ~~(632°F)~~ for J02's Symmetric TCs.
~~(644°F)~~ 7 3/25/09

✓ **Performance Step: 5** CALCULATE THE DIFFERENCE BETWEEN EACH AFFECTED THERMOCOUPLE AND THE AVERAGE OF ITS SYMMETRIC THERMOCOUPLES.

Standard: Calculates difference of ~~**4°F**~~ 16°F for TC G02, 4°F for TC H03, 7 3/25/09 8°F for TC J02
(± 2°F between all affected TCs and their symmetric TCs.)
Reports that temperature difference is ~~within~~ 7 3/25/09 greater than 10°F.

Evaluator Cue: **USCO acknowledges calculations and report.**

(IF calculation difference is 4°F then)

Cue: Evaluate Tech Specs for compliance. When evaluating Tech Spec compliance, assume that the other parameters listed on Attachment 1 of AOP-001 agree with your determination of thermocouples.

(IF calculation difference is >10°F then)

Cue: Evaluate Tech Specs for compliance. When evaluating Tech Spec compliance, assume that rod H02 is untrippable.

Comment:

EXAMINERS NOTE:	**If the candidate included the adjacent TCs with the Symmetric TC numbers the averages would have been wrong and the calculated difference would be 12°F.** **The report would be that the temperature difference is greater than 10°F. This report would provide the USCO with inaccurate information.**

7 3/25/09

✓ **Performance Step: 6** OBTAIN AND EVALUATE TECH SPECS

Standard: Obtains Tech Specs and refers to LCO ~~3.1.3.2~~ 3.1.3.1 7 3/25/09

Determines that ACTION a. is applicable. (See Attached)

(IF candidate incorrectly calculated the temperature difference the Tech Spec reported will be ~~3.1.3.1~~ 3.1.3.2 ACTION a) 7 3/25/09

Evaluator Cue:	**USCO acknowledges Tech Spec call.** **END OF JPM**

Comment:

Stop Time: _____

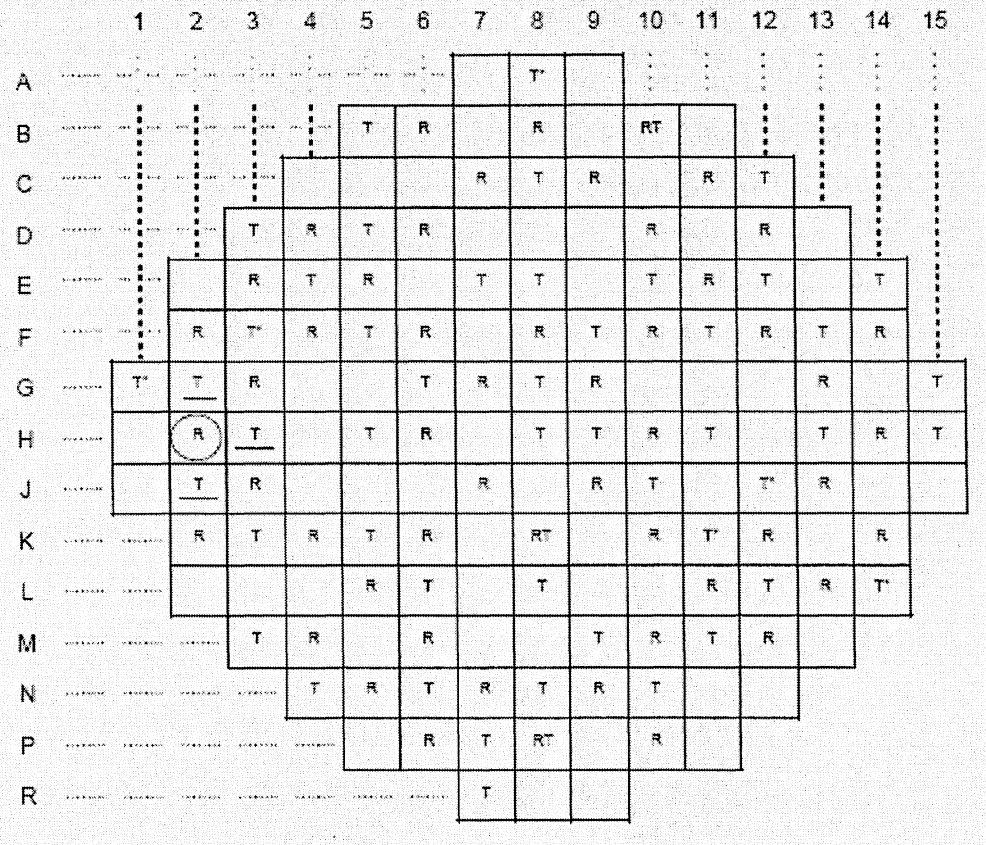
Terminating Cue: Difference between each affected thermocouple and it's symmetric thermocouples has been calculated.

KEY

MALFUNCTION OF ROD CONTROL AND INDICATION SYSTEM

Attachment 2 - Adjacent and Symmetric Thermocouple Locations
Sheet 1 of 3

THERMOCOUPLE LOCATIONS



R - Control Rod

T - Thermocouple

T* - Thermocouples abandoned by EC 47997

KEY

MALFUNCTION OF ROD CONTROL AND INDICATION SYSTEM

Attachment 2 - Adjacent and Symmetric Thermocouple Locations
Sheet 2 of 3

NOTE

- B10, E07, H08, K08, and P08 have no symmetric locations.
- Symmetric thermocouples are those in the same row.

SYMMETRIC LOCATIONS

GRID	I		II		III		IV	
TRAIN	A	B	A	B	A	B	A	B
	A08*				H15			
		G01*		G15			R07	
SYMMETRIC LOCATIONS	B05			E14		L14*		
		C06	H13				N06	(H03)
		D03	C12				N04	M03
	E04	D05		E12	M11	L12		
			H11	E08		L08		H05
		F05	F11	E10	K11*		K05	L06
		F03*	F13			N10	N06	K03
	G06		F09			J10		
		G08			H09			
	(G02)						(J02)	P07
					M09	J12*		

* Thermocouples abandoned by EC 47997

1. **DETERMINE** thermocouple location(s) adjacent to the misaligned rod using core grid map (Sheet 1), **AND CIRCLE** location(s) in Table above.

KEY

MALFUNCTION OF ROD CONTROL AND INDICATION SYSTEM

Attachment 2 - Adjacent and Symmetric Thermocouple Locations
Sheet 3 of 3

2. **RECORD** the following in the table below:
   - Adjacent TC number
   - Adjacent TC value using the RVLIS Console, ERFIS, or OSI-PI
   - Symmetric TC numbers (not including adjacent TCs)
   - Symmetric TC values for all OPERABLE TCs using the RVLIS Console, ERFIS, or OSI-PI

3. **DETERMINE** the average of symmetric thermocouples, for each adjacent thermocouple.

Adjacent TC		Symmetric TC		Symmetric TC
Number	Value	Number	Value	Average
G02	652	J02 P07	N/A 636	636
H03	636	C08 H13 N08	636 640 644	640
J02	628	G02 P07	N/A 636	636

4. **COMPARE** each adjacent thermocouple value listed to its symmetric thermocouple average for indication of a misaligned rod. (**REFER TO** Attachment 1.)

--END OF ATTACHMENT 2--

KEY

SEE ATTACHED

✓ 3/25/09

REACTIVITY CONTROL SYSTEMS

POSITION INDICATION SYSTEMS - OPERATING

LIMITING CONDITION FOR OPERATION

3.1.3.2 The Digital Rod Position Indication System and the Demand Position Indication System shall be OPERABLE and capable of determining the shutdown and control rod positions within ± 12 steps.

APPLICABILITY: MODES 1 and 2.

ACTION:

a. With a maximum of one digital rod position indicator per bank inoperable either:

1. Determine the position of the nonindicating rod(s) indirectly by the movable incore detectors at least once per 8 hours and immediately after any motion of the nonindicating rod which exceeds 24 steps in one direction since the last determination of the rod's position, or

2. Reduce THERMAL POWER to less than 50% of RATED THERMAL POWER within 8 hours.

b. With a maximum of one demand position indicator per bank inoperable either:

1. Verify that all digital rod position indicators for the affected bank are OPERABLE and that the most withdrawn rod and the least withdrawn rod of the bank are within a maximum of 12 steps of each other at least once per 8 hours, or

2. Reduce THERMAL POWER to less than 50% of RATED THERMAL POWER within 8 hours.

SURVEILLANCE REQUIREMENTS

4.1.3.2 Each digital rod position indicator shall be determined to be OPERABLE by verifying that the Demand Position Indication System and the Digital Rod Position Indication System agree within 12 steps at least once per 12 hours except during time intervals when the rod position deviation monitor is inoperable, then compare the Demand Position Indication System and the Digital Rod Position Indication System at least once per 4 hours.

SHEARON HARRIS - UNIT 1 3/4 1-17

VERIFICATION OF COMPLETION

Job Performance Measure No.: 2009a NRC JPM SRO A1-1

DETERMINE ROD MISALIGNMENT USING THERMOCOUPLES

Examinee's Name:

Date Performed:

Facility Evaluator:

Number of Attempts:

Time to Complete:

Question Documentation:

Question:

Response:

Result: SAT _____ UNSAT _____

Examiner's Signature: _____ Date: _____

Initial Conditions: The plant was at 90 percent power, with a load decrease in progress, when the USCO noticed that the DRPI indication for rod H02 was reading 24 steps higher than the group demand. The load decrease has been stopped and AOP-001 entered.

Initiating Cue: The USCO has directed you to calculate the temperature difference between thermocouple(s) adjacent to the misaligned rod and the average of symmetric thermocouple(s), using Attachment 2 of AOP-001 and the provided T/C Core Maps.

T/C CORE MAP (DATA SHEET 1) TRAIN B

MSG # 245

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A															
B										632					
C								636							
D			636		650										
E								644		50		640		632	
F			50		644										
G	50							644							632
H			636		644										
J										640		50			
K			640												
L						644		640				644		50	
M			636												
N										640					
P							636								
R															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

TRAIN A

T/C CORE MAP

MSG # 245

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A								50							
B					636										
C												632			
D															
E				636			640								
F									644		648		644		
G		652				640									
H								640	644		652		640		640
J		628													
K					640			644			50				
L															
M									640		644				
N				636		640		644							
P								640							
R							636								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

3/4.1.3 MOVABLE CONTROL ASSEMBLIES

GROUP HEIGHT

LIMITING CONDITION FOR OPERATION

3.1.3.1 All shutdown and control rods shall be OPERABLE and positioned within ± 12 steps (indicated position) of their group step counter demand position.

APPLICABILITY: MODES 1* and 2*.

ACTION:

a. With one or more rods inoperable due to being immovable as a result of excessive friction or mechanical interference or known to be untrippable, determine that the SHUTDOWN MARGIN requirement of Specification 3.1.1.1 is satisfied within 1 hour and be in HOT STANDBY within 6 hours.

b. With more than one rod misaligned from the group step counter demand position by more than ± 12 steps (indicated position), be in HOT STANDBY within 6 hours.

c. With more than one rod inoperable, due to a rod control urgent failure alarm or obvious electrical problem in the rod control system existing for greater than 36 hours, be in HOT STANDBY within the following 6 hours.

d. With one rod trippable but inoperable due to causes other than addressed by ACTION a., above, or misaligned from its group step counter demand height by more than ± 12 steps (indicated position), POWER OPERATION may continue provided that within 1 hour:

1. The rod is restored to OPERABLE status within the above alignment requirements, or

2. The rod is declared inoperable and the remainder of the rods in the group with the inoperable rod are aligned to within ± 12 steps of the inoperable rod while maintaining the rod sequence and insertion limits of Specification 3.1.3.6. The THERMAL POWER level shall be restricted pursuant to Specification 3.1.3.6 during subsequent operation, or

3. The rod is declared inoperable and the SHUTDOWN MARGIN requirement of Specification 3.1.1.1 is satisfied. POWER OPERATION may then continue provided that:

a) A reevaluation of each accident analysis of Table 3.1-1 is performed within 5 days; this reevaluation shall confirm that the previously analyzed results of these accidents

*See Special Test Exceptions Specifications 3.10.2 and 3.10.3.

LIMITING CONDITION FOR OPERATION

ACTION (Continued):

remain valid for the duration of operation under these conditions:

b) The SHUTDOWN MARGIN requirement of Specification 3.1.1.1 is determined at least once per 12 hours;

c) A power distribution map is obtained from the movable incore detectors and $F_Q(Z)$ and $F_{\Delta H}^N$ are verified to be within their limits within 72 hours; and

d) The THERMAL POWER level is reduced to less than or equal to 75% of RATED THERMAL POWER within the next hour and within the following 4 hours the High Neutron Flux Trip Setpoint is reduced to less than or equal to 85% of RATED THERMAL POWER.

SURVEILLANCE REQUIREMENTS

4.1.3.1.1 The position of each rod shall be determined to be within the group demand limit by verifying the individual rod positions at least once per 12 hours except during time intervals when the rod position deviation monitor is inoperable, then verify the group positions at least once per 4 hours.

4.1.3.1.2 Each rod not fully inserted in the core shall be determined to be OPERABLE by movement of at least 10 steps in any one direction at least once per 92 days.

REFERENCE

ADMIN JPM

SRO A1-1

Attachment 1 – Indications of Misaligned Rod

Sheet 1 of 1

The table below indicates the variation in plant parameters which may be indicative of rod misalignment. This variation refers to relative changes in indication from a reference condition at which the suspect rod's position was known to be properly aligned. The reference case may be taken from prior operating records, or it may be updated each time the proper rod positioning is verified by in-core measurements. In general, greater misalignment will cause larger variations. Variations in NI channel indication are also affected by the core location of the suspect rod. For example, a misaligned rod that is closest to the N-44 detector should indicate that N-44 flux parameters are abnormal when compared with flux parameters of the other Power Range NI channels. If the parameters below exhibit no abnormal variations with an individual DRPI differing from its group step counter demand position by more than 12 steps, it is probably a rod position indication problem.

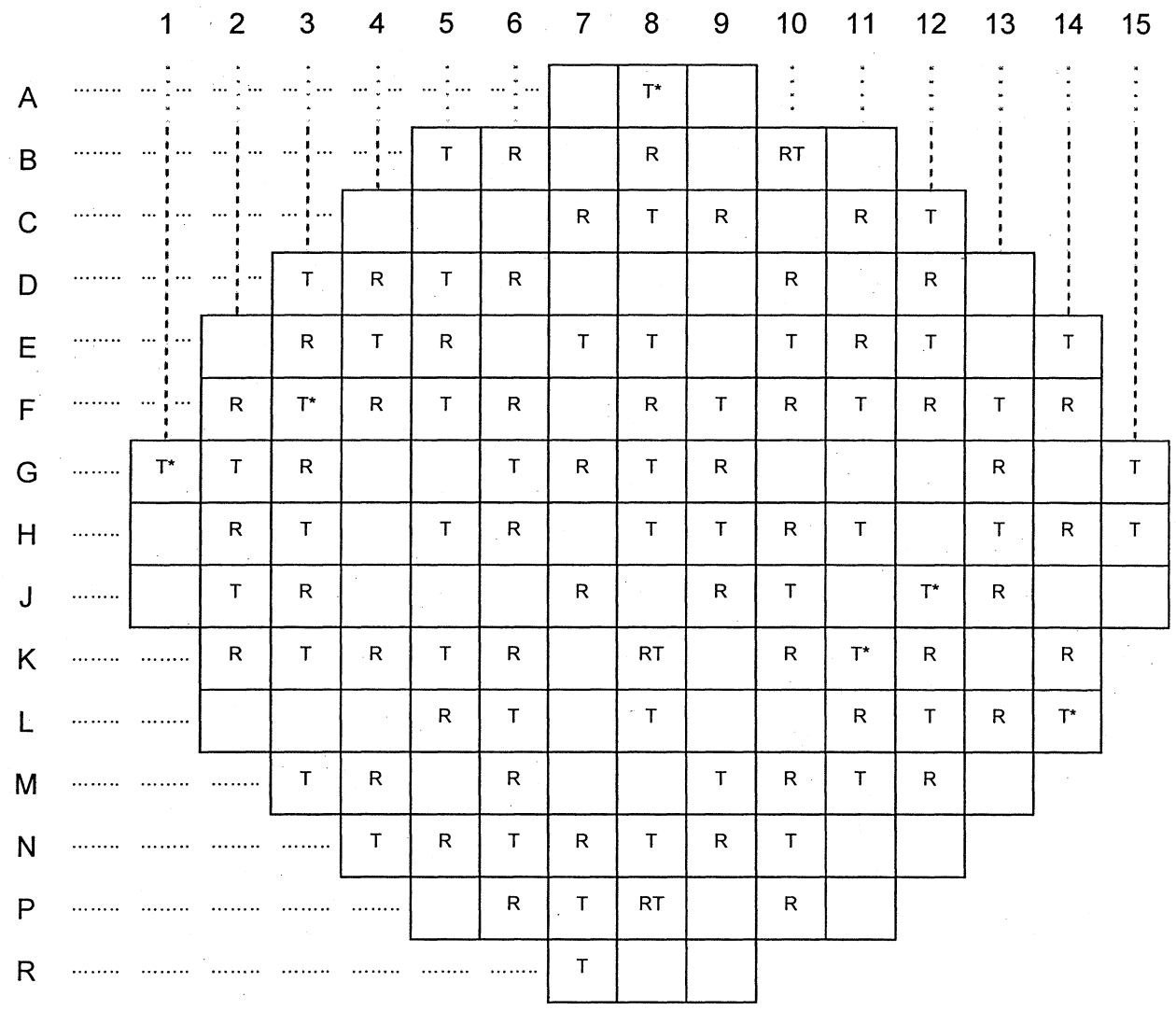
PLANT PARAMETER	VALUE INDICATIVE OF ROD MISALIGNMENT
Quadrant Power Tilt Ratio (QPTR)	Greater than 1.02
Power Range Instrumentation	Greater than 2% difference between any two channels (**REFER TO** Attachment 4)
Delta Flux Indicators	Greater than 2% difference between any two channels (**REFER TO** Attachment 4)
Core Outlet Thermocouples	Greater than 10°F difference between thermocouples adjacent to the misaligned rod and the average of symmetric thermocouples (**PERFORM** Attachment 2)
Axial Flux Traces (in-core movable detector)	**CONSULT** Reactor Engineering **AND EVALUATE** using in-core movable detectors per EST-922, Control Rod Position Determination Via Incore Instrumentation

--END OF ATTACHMENT 1--

Attachment 2 - Adjacent and Symmetric Thermocouple Locations

Sheet 1 of 3

THERMOCOUPLE LOCATIONS



R - Control Rod

T - Thermocouple

T* - Thermocouples abandoned by EC 47997

Attachment 2 - Adjacent and Symmetric Thermocouple Locations

Sheet 2 of 3

NOTE

- B10, E07, H08, K08, and P08 have no symmetric locations.
- Symmetric thermocouples are those in the same row.

SYMMETRIC LOCATIONS

GRID	I		II		III		IV	
TRAIN	A	B	A	B	A	B	A	B
	A08*				H15			
		G01*		G15			R07	
S L	B05			E14		L14*		
Y O		C08	H13				N08	H03
M C		D03	C12				N04	M03
M A	E04	D05		E12	M11	L12		
E T			H11	E08		L08		H05
T I		F05	F11	E10	K11*		K05	L06
R O		F03*	F13			N10	N06	K03
I N	G06		F09			J10		
C S		G08			H09			
	G02						J02	P07
					M09	J12*		

* Thermocouples abandoned by EC 47997

1. **DETERMINE** thermocouple location(s) adjacent to the misaligned rod using core grid map (Sheet 1), **AND CIRCLE** location(s) in Table above.

Attachment 2 - Adjacent and Symmetric Thermocouple Locations
Sheet 3 of 3

2. **RECORD** the following in the table below:
   - Adjacent TC number
   - Adjacent TC value using the RVLIS Console, ERFIS, or OSI-PI
   - Symmetric TC numbers (not including adjacent TCs)
   - Symmetric TC values for all OPERABLE TCs using the RVLIS Console, ERFIS, or OSI-PI

3. **DETERMINE** the average of symmetric thermocouples, for each adjacent thermocouple.

Adjacent TC		Symmetric TC		Symmetric TC Average
Number	Value	Number	Value	
_____	_____			_____
_____	_____			_____
_____	_____			_____
_____	_____			_____

4. **COMPARE** each adjacent thermocouple value listed to its symmetric thermocouple average for indication of a misaligned rod. (**REFER TO** Attachment 1.)

--END OF ATTACHMENT 2--

Appendix C	Job Performance Measure Worksheet	Form ES-C-1

Facility: Shearon Harris Task No.: 001004H101

Task Title: Perform A Manual Shutdown Margin Calculation JPM No.: 2009a NRC JPM RO A1-2

K/A Reference: 2.1.25 3.1 / 2.8

Ability to obtain and interpret station reference materials such as graphs, monographs, and tables which contain performance data

Examinee: _____ NRC Examiner: _____

Facility Evaluator: _____ Date: _____

Method of testing:

Simulated Performance: _____ Actual Performance: X

Classroom X Simulator _____ Plant _____

READ TO THE EXAMINEE

I will explain the initial conditions, which steps to simulate or discuss, and provide initiating cues. When you complete the task successfully, the objective for this Job Performance Measure will be satisfied.

Initial Conditions: The plant has been operating at 75% power for 6 weeks
Core burnup is 350 EFPD
RCS boron concentration is 300 ppm
NO rods are believed to be immovable / untrippable
POWERTRAX is **NOT** available

Initiating Cue: The USCO has directed you to complete OST-1036, Shutdown Margin Calculation Modes 1-5, Section 7.3, "Manual SDM Calculation (Modes 1 and 2)" for current plant conditions.

NOTE: For this JPM assume independent verification has been performed.

Task Standard: OST-1036, Attachment 3, Manual SDM Calculation (Modes 1 and 2), completed with SDM of ~~3818 ± 75 pcm~~ **(tolerance based on total of curves used and their division readability)** 7 3/25/09 3840 pcm ± 75 pcm

Required Materials: **OST-1036, Shutdown Margin Calculation Modes 1-5 Rev. 39**
Curve Book ~~(Cycle 15)~~ 7 3/25/09 (Cycle 13)

General References: OST-1036, Shutdown Margin Calculation Modes 1-5 Rev. 39
Curve Book ~~(Cycle 15)~~ 7 3/25/09 (Cycle 13)

Handouts: OST-1036, Shutdown Margin Calculation Modes 1-5 Rev. 39

Time Critical Task: No

Validation Time: 20 minutes

Start Time: _____.

Performance Step: 1 OBTAIN PROCEDURE (OST-1036 will be provided to allow candidates to write on, Curve Book will be included as a reference in the Book Cart)

Standard: OST-1036, Section 7.3, Attachment 3, and Curve Book

Comment:

Performance Step: 2 Enters Reactor Power Level

Standard: Refers to given conditions and enters 75%

Comment:

✓ **Performance Step: 3** **Determine Rod Insertion Limit for power level**

F-13-1 + 3/25/09

Standard: **Refers to Curve ~~E-15-1~~ and determines TS limit for RIL to be 140 ± 2 steps (tolerance based on curve division readability)**

Comment:

Performance Step: 4 Enters core Burn Up

Standard: Refers to given conditions and enters 350 EFPD

Comment:

Performance Step: 5 Enters RCS Boron Concentration

Standard: Refers to initial conditions and enters 300 ppm

Comment:

NOTE: ***ATT 3, STEP 5 NOT PERFORMED SINCE VALUE IS INCLUDED AS PART OF ATTACHMENT.***

✓ **Performance Step: 6** **Determines Power Defect for current power level**

Standard: C-13-3 T 3/25/09
Refers to Curve ~~C-15-3~~ and determines power defect to be ~~2265~~ 2340 T 3/25/09 ± 50 pcm (tolerance based on curve division readability)

Comment:

✓ **Performance Step: 7** **Determines Rod Worth for RIL position determined above**

Standard: A-13-11 T 3/25/09
Refers to Curve ~~A-15-11~~ and determines rod worth to be 630 + 25 pcm (tolerance based on curve division readability)

Comment:

Performance Step: 8 Enters worth of any additional immovable or untrippable rods

Standard: Refers to given conditions and enters 0

Comment:

✓ **Performance Step: 9** **Determines Total Shutdown Margin**

3840 ± 3/25/09

Standard: **Determines Total Shutdown Margin to be ~~3915~~ ± 75 pcm (tolerance based on total of all curves used and their division readability)**

Comment:

Performance Step: 10 Signs off Section 7.3 steps

Standard: Signs off steps as complete

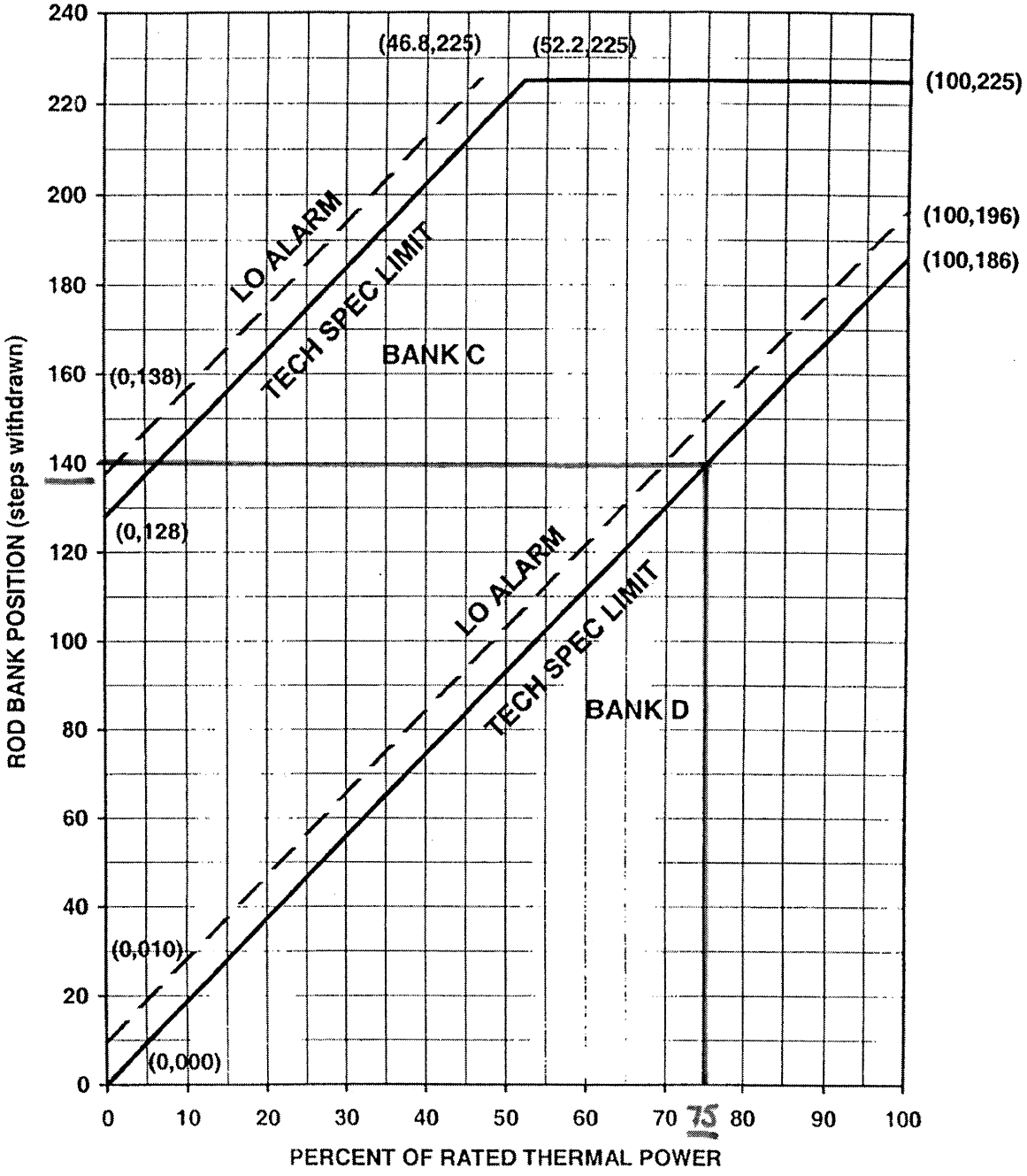
Comment:

Evaluator Note: **When the candidate returns the completed OST-1036, Attachment 3, Manual SDM Calculation this JPM is complete.**

Stop Time: _____

Terminating Cue: **Competition of OST-1036, Attachment 3, Manual SDM Calculation.**

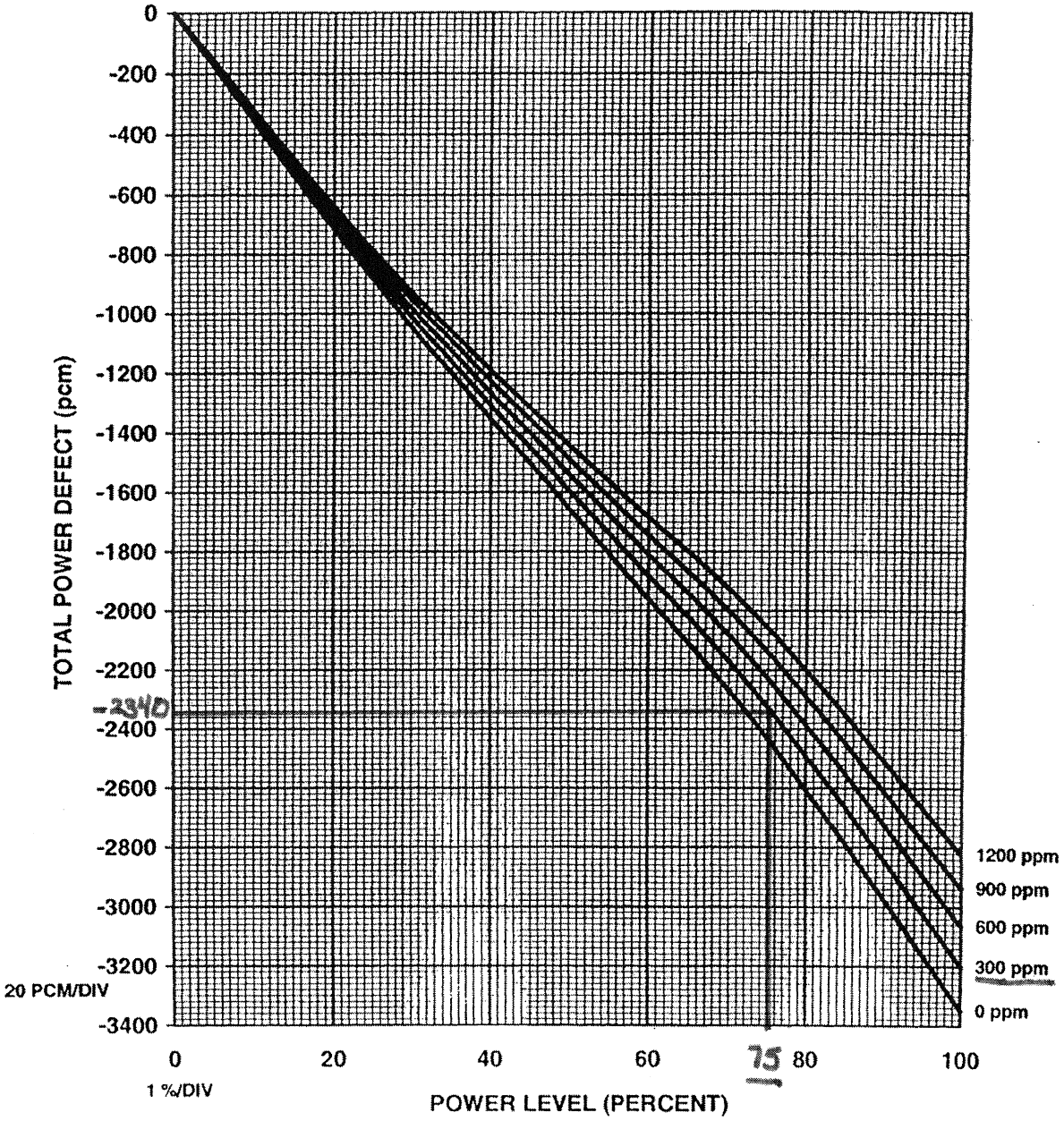
HARRIS UNIT 1 CYCLE 13
ROD INSERTION LIMITS



CURVE NO.	F-13-1	REV NO.	0
ORIGINATOR	Charles Gibbs	DATE	10/14/04 10/19/04
SUPERVISOR		DATE	10/23/04
SUPERINTENDENT - SHIFT OPERATIONS	CR Smith	DATE	10/24/04

HARRIS UNIT 1 CYCLE 13
POWER DEFECT vs. POWER LEVEL
for VARIOUS BORON CONCENTRATIONS

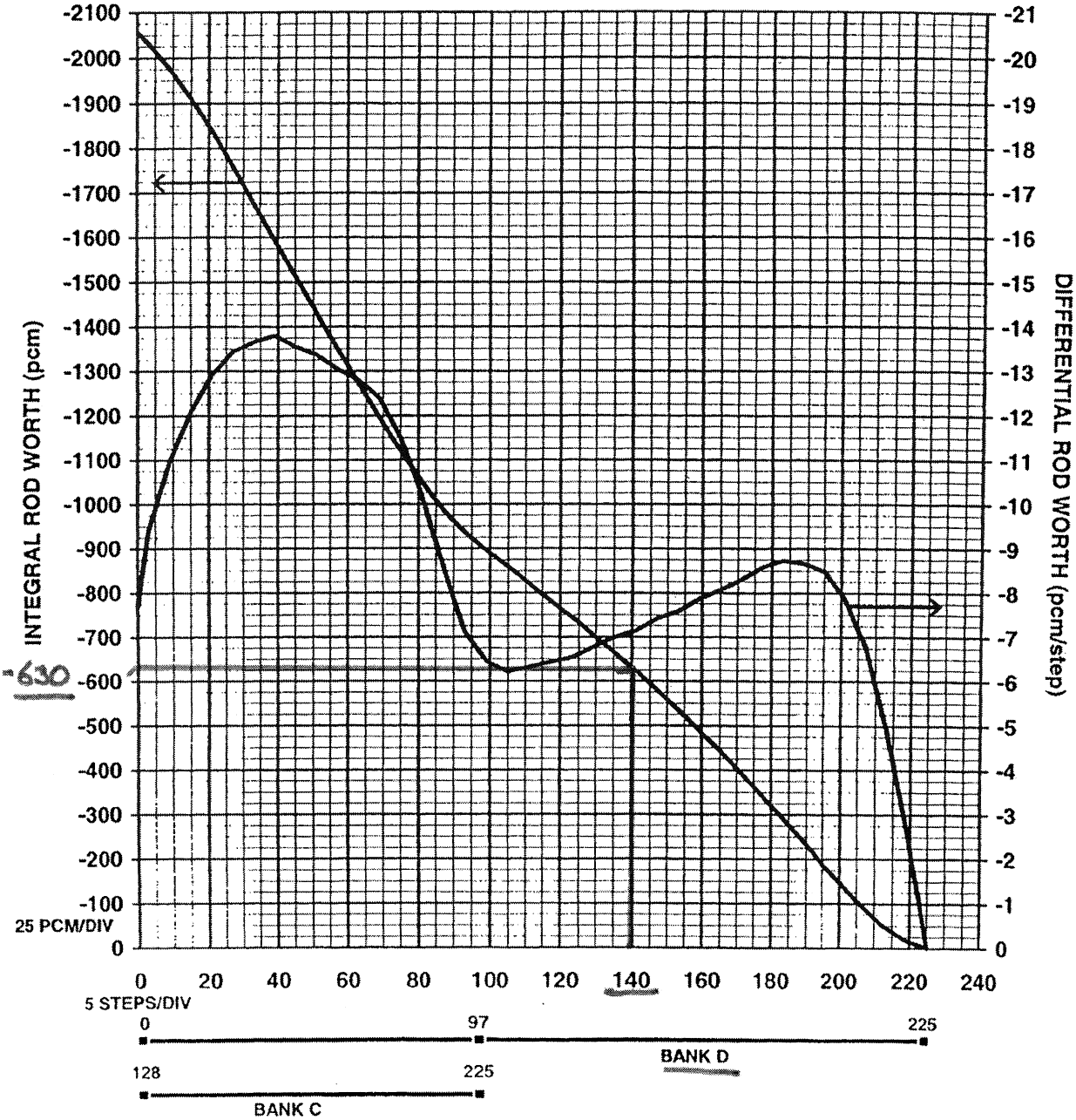
EOL (333 < EFPD ≤ 517)



CURVE NO.	C-13-3	REV NO.	0
ORIGINATOR	Charles L. Higgins	DATE	10/14/04 10/19/04
SUPERVISOR		DATE	10/23/04
SUPERINTENDENT - SHIFT OPERATIONS	C R Smith	DATE	10/24/04

HARRIS UNIT 1 CYCLE 13
DIFFERENTIAL AND INTEGRAL
ROD WORTH CONTROL BANKS D and C
MOVING WITH 97 STEP OVERLAP

EOL (333 < EFPD ≤ 517), HFP, EQUILIBRIUM XENON



CURVE NO.	A-13-11	REV NO.	0
ORIGINATOR	Charles K Gifford	DATE	10/14/04 10/12/04
SUPERVISOR	A. Nicholas Allen	DATE	10/23/04
SUPERINTENDENT - SHIFT OPERATIONS	C R Smith	DATE	10/24/04

KEY

Manual SDM Calculation (Modes 1 and 2)

1. Reactor power level. 75 %

2. Rod insertion limit for the above power level 140 steps on bank D

3. Burn up (POWERTRAX/MCR Status Board). 350 EFPD

4. Present RCS Boron Concentration 300 ppm

NOTE: Use absolute values of numbers obtained from curves.

5. Total worth of all control and shutdown banks, minus the worth of the most reactive rod for Fuel Cycle 15.

6810 pcm
(a)

6. Cycle 15 Power defect for the power level recorded in Step 1. (Refer to Curves C-X-1 to C-X-3).

Curve used C-13-3 2340 pcm ± 50
(b)

NOTE: HFP curves are used for power levels of 10% or greater.

7. Inserted control rod worth at the rod insertion limit recorded in Step 2. (Refer to Curves A-X-6 to A-X-11)

Curve used A-13-11 630 pcm ± 25
(c)

8. Worth of any additional immovable or untrippable rods (for each stuck rod, use the most reactive single rod worth (1326 pcm) or obtain individual withdrawn rod worth from the reactor engineer).

0 pcm
(d)

9. Determine the Total Shutdown Margin using the following formula:

Total SDM C_B = (e) $\frac{6810}{(a)} - \frac{2340}{(b)} - \frac{630}{(c)} - \frac{0}{(d)}$

3840 pcm ± 75
(e)

VERIFICATION OF COMPLETION

Job Performance Measure No.: 2009a NRC JPM RO A1-2

Examinee's Name:

Date Performed:

Facility Evaluator:

Number of Attempts:

Time to Complete:

Question Documentation:

Question:

Response:

Result: SAT _____ UNSAT _____

Examiner's Signature: _____ Date: _____

Initial Conditions:

- The plant has been operating at 75% power for 6 weeks
- Core burnup is 350 EFPD
- RCS boron concentration is 300 ppm
- **NO** rods are believed to be immovable / untrippable
- POWERTRAX is **NOT** available

Initiating Cue:

The USCO has directed you to complete OST-1036, Shutdown Margin Calculation Modes 1-5, Section 7.3, "Manual SDM Calculation (Modes 1 and 2)" for current plant conditions.

NOTE: For this JPM assume independent verification has been performed.

REFERENCE

ADMIN IPM

RO A1-2

HARRIS NUCLEAR PLANT

PLANT OPERATING MANUAL

VOLUME 3

PART 9

PROCEDURE TYPE: OPERATIONS SURVEILLANCE TEST

NUMBER: **OST-1036**

TITLE: # SHUTDOWN MARGIN CALCULATION MODES 1 - 5

NOTE: This procedure has been screened per PLP-100 Criteria and determined to be CASE III. No additional management involvement is required.

1.0 PURPOSE

NOTE: If the requirement to perform a SDM Calculation is time critical, the Manual Calculation has been evaluated to be the preferred method.

1. Provide methods to ensure that RCS boron concentration has a shutdown margin greater than 1770 pcm in Modes 1 and 2, through the use of calculations.

2. Provide methods to ensure that RCS has an adequate shutdown margin by verifying the RCS boron concentration is greater than the minimum required boron concentration in Modes 3 through 5.

3. This procedure satisfies the requirements of Technical Specification Surveillance Requirements 4.1.1.1.1.a, 4.1.1.2.a and 4.1.1.2.b.

NOTE: The boron concentration to satisfy FSAR Section 6.3.2.8 takes credit for all control rods being inserted into the core and does NOT satisfy Technical Specification SDM requirements.

4. This procedure calculates the RCS boron concentration required by FSAR Section 6.3.2.8 to block SI actuation signals.

2.0 REFERENCES

2.1. Plant Operating Manual Procedures

1. AP-039

2. AOP-002

3. PLP-106

2.0 References (Cont.)

2.2. Technical Specifications

1. 3.1.1.1
2. 3.1.1.2
3. 4.1.1.1.1.a
4. 4.1.1.2.a
5. 4.1.1.2.b

2.3. Final Safety Analysis Report

1. 15.4.6.2
2. 6.3.2.8

2.4. Other

1. Plant Curve Book
2. "HNP Cycle 15 PDD Setup" Calculation HNP-F/NFSA-0160.
3. EMF-1715(P) Powertrax Users Guide
4. ESR 98-00388
5. EC 64030

3.0 PREREQUISITES

1. The performance of this OST has been coordinated with other plant evolutions such that the minimum equipment operating requirements of Tech Specs are met. _____

2. **OBTAIN** any tools and equipment required per Section 5.0. _____

3. **OBTAIN** Unit SCO permission to perform this OST.

_____ _____
Signature Date

4.0 PRECAUTIONS AND LIMITATIONS

1. If either of the following conditions exist, initiate emergency boration per AOP-002 and continue until the required shutdown margin is achieved:

   - In Modes 1 and 2, shutdown margin is less than 1770 pcm,

     OR

   - In Modes 3 - 5 shutdown margin is less than required by PLP-106, Technical Specification Equipment List Program and Core Operating Program.

2. Projected conditions should be for the minimum shutdown margin expected in the next 24 hours unless a manual Xenon free calculation is performed. (This precaution is N/A if performing Section 7.4)

3. If POWERTRAX is being used it should have been updated with recent power history (less than 72 hours during steady state operation).

4. The POWERTRAX program cannot be run out long enough to calculate a totally Xenon-free value for SDM for any given time. To obtain Xenon Free data, either use the SOR Minimum Boron which is shown on any SDM printout, or perform a manual SDM calculation per Section 7.2.

5. Rod worth provided in this procedure for control banks, shutdown banks, and most reactive rod are the most conservative values for Cycle 15 only. Subsequent fuel cycles will require a change to this procedure.

6. Samarium is considered in the assumptions used to develop the curve inputs and as a fixed input to the POWERTRAX transient calculations.

4.0 PRECAUTIONS AND LIMITATIONS (Cont.)

7. The required minimum boron concentration usually varies with xenon decay. It is necessary to select a time and temperature based calculation that corresponds to planned plant evolution, and repeat this calculation as necessary if the plan changes.

8. Powertrax is an ICON based computer program. After a calculation is completed, positioning the mouse on a specific node located on the graph and clicking the center mouse button will display the parameters for that specific node. If the mouse is a two button unit the equivalent function is obtained by depressing both buttons at the same time. This function can be used as many times as desired and allow a printout of the specific time/data points needed.

9. The Powertrax Shutdown Boron Concentration Module printout will show the Xenon free boron as SOR Minimum Boron. The minimum shutdown boron for the projected time will be listed in the table specific to the temperature under the "ppm B" column.

10. The requirement to be borated to cold shutdown conditions prior to blocking SI is based on a commitment contained in FSAR Section 6.3.2.8. This requirement ensures that if a steam line break occurs after SI has been blocked, the resultant cooldown will not result in return to criticality. The required value is not the Tech Spec shutdown margin; therefore, it is acceptable to credit the worth of all control rods inserted.

11. To ensure the requirements of FSAR Section 6.3.2.8 are met, prior to blocking SI, the RCS must be borated to cold shutdown.

5.0 TOOLS AND EQUIPMENT

1. EMF-1715(P) Powertrax Users Guide

2. Operations Curve Book

3. Technical Specifications

4. PLP-106 Shutdown Margin Curve

6.0 ACCEPTANCE CRITERIA

This procedure will be completed satisfactorily if any one of the following criteria is met:

- **IF** performed for Modes 3, 4, or 5, **AND** the RCS has been borated to the required Refueling Boron Concentration (COLR value),

OR

- **IF** performed for Modes 3, 4, or 5, Section 7.1 is completed satisfactorily as indicated by the current RCS boron being greater than the minimum RCS boron listed on the POWERTRAX printout for the desired condition,

OR

- **IF** performed for Modes 3, 4 or 5, Section 7.2 is completed satisfactorily as indicated by the current RCS boron being greater than the calculated required shutdown boron concentration.

OR

- **IF** performed for Modes 1 or 2, Section 7.3 is completed satisfactorily as indicated by the shutdown margin recorded in Item 9 of Attachment 3 being greater than or equal to 1770 pcm.

7.0 PROCEDURE

CAUTION

Do not use Section 7.1 before initial criticality on any new fuel cycle.

1. **IF** this procedure is being performed to verify Shutdown Boron Concentration in Modes 3, 4, or 5 with **two or more stuck rods**, **THEN PERFORM** the following substeps:

   a. The required Shutdown Boron Concentration is equal to 2172 ppm with no further calculation required. _____

   b. **COMPLETE** Attachment 6, Certifications and Reviews. _____

   c. **INFORM** the Unit SCO that this test has been completed. _____

2. **IF** this procedure is being performed to verify adequate Shutdown Boron Concentration in Modes 3, 4, or 5, **AND** the RCS is borated to the required Refueling Boron Concentration of 2172 ppm, **THEN PERFORM** the following substeps:

   a. **COMPLETE** Section 7.5, Test Completion _____

   b. **COMPLETE** Attachment 6, Certifications and Reviews. _____

   c. **INFORM** the Unit SCO that this test has been completed. _____

7.1. Shutdown Boron Concentration Prediction Using POWERTRAX (Modes 3 - 5)

NOTE: The review of the Control Operator's Log will ensure adequate sampling of a constant xenon condition to provide an accurate Shutdown Margin.

1. **IF** performing this procedure while in Modes 1 or 2 for projected Mode 3-5 conditions, **THEN PERFORM** the following: (Otherwise this step N/A)

   a. **REVIEW** the Control Operator's Log to ensure steady state conditions (less than 10% power manipulations) within the previous 72 hours. _____

b. **IF** steady state conditions have not existed for the past 72 hours, **THEN PERFORM** one of the following: (N/A if not performed)

(1) **CONTACT** Reactor Engineering **AND** have additional MICROBURN-P triggers processed, if required. _____

OR

(2) **DISCONTINUE** this procedure section and **PERFORM** Section 7.2. _____

c. **N/A** Steps 7.1.2, 7.1.3, 7.1.11, 7.1.14 and 7.1.15.d. _____

d. **CONTINUE** with Step 7.1.4. _____

2. **IF** performing this procedure while in Modes 3-5, **THEN PERFORM** the following:

a. **CHECK** that a MICROBURN-P file trigger has been processed at or subsequent to the reactor trip or shutdown. _____

b. **IF** a MICROBURN-P file trigger has not been processed, **THEN PERFORM** one of the following: (This Step N/A if a file has been processed, N/A substep not performed)

(1) **CONTACT** Reactor Engineering and have additional MICROBURN-P triggers processed. _____

OR

(2) **DISCONTINUE** this procedure section and **PERFORM** Section 7.2. _____

3. **RECORD** the following parameters:

a. RCS Sample Time and Date: _____ _____

b. RCS Boron Concentration: _____ ppn

c. Projected SDM Time and Date _____ _____

d. Projected SDM Temperature _____ °F

_____

NOTE: Powertrax is a case sensitive application. The commands listed in "apostrophes" should be typed as listed in the procedure.

4. To use the STA LAN computer **PERFORM** the following steps:

   a. **GO** to START/STA Icons. _____

   b. **DOUBLE CLICK** on **PowerTrax at HNP** icon. _____

   c. **SIGN ON** User ID as "sta". _____

   d. **TAB** to Password. _____

   e. **USE** "hnp_sta" as a password. _____

   f. **DEPRESS** ENTER. _____

NOTE: Due to conflicts between the operating systems(Unix vs. Windows), Step 7.1.4.g may have to be performed twice.

   g. **WHEN** the HNP Unix window opens, **PERFORM** the following:

      (1) **ENTER** "hnpptx". _____

      (2) **DEPRESS** ENTER. _____

5. From the PowerTrax Main Menu **SELECT**:

Shutdown Boron Concentration Prediction

   _____

6. Once the POWERTRAX Shutdown Boron Concentration Module screen appears, **PERFORM** the following:

   a. **ACTIVATE** the "File" pull down menu. _____

   b. **SELECT** "Open". _____

   c. **SELECT** "MB-P File". _____

NOTE: "Directories" will be listed in the following format: "/ptrax/hnp/CY11/MBP/d.YYMMDD.HHmmss". Example would be /ptrax/hnp/CY11/MBP/d.021201.090037 = 12/01/02 @ 0900.37

NOTE: In the case of a Reactor Trip or Emergency Shutdown, a new file will most likely be generated by Reactor Engineering.

7. **WHILE** viewing the File Selection Menu screen, **PERFORM** the following:

   a. **PERFORM** one of the following: (N/A substep not performed)

      (1) **IF** in Modes 1 or 2, in the Directories sub-screen, **THEN SELECT** a directory created within the previous 72 hrs (preferably the most recent directory). _____

      OR

      (2) **IF** in Modes 3-5, **THEN SELECT** a directory created at or subsequent to the reactor trip or shutdown (preferably the most recent). _____

   b. **SELECT** "Filter". _____

   c. In the Files sub-screen, **SELECT** the file labeled as "dat.YYMMDD.HHmmss". _____

   d. **RECORD** the file name(date and time) selected in the previous step. _____

      File _____

   e. **SELECT** "OK". _____

8. On the POWERTRAX Shutdown Boron Concentration Module Screen, **INPUT** the following POWERTRAX data fields:

   a. Calc Directory (suggest YYMMDD_XXX, where XXX is the users initials) _____

NOTE: The preset defaults for the Number of Calculations and Delta Time will result in a 24 hour projection. These defaults will normally be used, however, they may be modified if a different projection time is desired.

NOTE: If this procedure is being performed in Modes 1 or 2 for projected shutdown conditions, the time between the last MICROBURN-P file and projected SDM should be 24 hrs in Step 7.1.8.b.

   b. **DETERMINE** the time between the last MICROBURN-P file (Step 7.1.7.d) and the projected SDM.

      _____ Hrs _____

   c. **DIVIDE** the number of hours (Step 7.1.8.b) by 2 and round up to the nearest whole number.

      _____ result (number of calculations) _____

   d. **ENTER** the resultant from Step 7.1.8.c into the number of calculations field (Default is 12). _____

   e. **VERIFY** (2) is entered in the Delta Time field. _____

   f. **RECORD** the value displayed for Burnup.

      Burnup- _____ EFPD _____

9. **ACTIVATE** the "File" pull down menu and **PERFORM** the following:

   a. **SELECT** "Run". _____

   b. At the "Job Execution Dialog" box, **SELECT** "Run". _____

NOTE: POWERTRAX will take several minutes to complete the necessary calculations.

10. **AFTER** the calculation is complete, **PERFORM** the following:

    a. **ACTIVATE** the "Output" pull down menu. _____

    b. **SELECT** "Output". _____

NOTE: Section 7.0 provides guidance if more than one rod is known to be immovable or untrippable.

11. **IF** any rod is known to be immovable or untrippable **AND** is not completely inserted in the core, **THEN PERFORM** the following: (otherwise, mark the Step "N/A" and proceed to the next Step)

    a. For any stuck rod, **USE** the value of the most reactive single rod worth (-1326 pcm) **OR OBTAIN** the individual withdrawn rod worth for each rod from Reactor Engineering. In the upper right hand portion of the screen, **INPUT** the reactivity value of the known stuck rod(s). _____

12. **ACTIVATE** the "RCS Temperatures" pull down menu, and **PERFORM** the following:

    a. **SELECT** "Select Temperatures". _____

NOTE: **IF** performing in Modes 1 or 2 for projected conditions in Modes 3-5, **THEN** the following temperatures are normally entered:

557, 550, 500, 450, 400, 350, 300, 250, 200, and 70°F

    b. **INPUT** the desired corresponding temperature values. _____

    c. **SELECT** "OK". _____

13. **ACTIVATE** the "File" pull down menu, and perform the following:

    a. **SELECT** "Print". _____

    b. **SELECT** "Report". _____

    c. **SELECT** "No Format". _____

    d. **SELECT** "OK". _____

NOTE: The POWERTRAX output indicates the postulated shutdown occurring at the 1st data point. Successive datapoints correspond to the **elapsed time** following the shutdown.

NOTE: The data for the time and date of the MICROBURN-P file is on line "1" of the printout. The data for projected time and date are on the last line.

14. **PERFORM** the following to verify the present RCS boron concentration is greater than the minimum boron concentration required for the projected conditions:

    a. **VERIFY** the projected time and date on the printout are within two hours of that in Step 7.1.3.c. _____

    b. **VERIFY** the present boron concentration is greater than that required:

        (1) **RECORD** present boron _____ppm (Step 7.1.3.b) _____

        (2) **RECORD** required boron _____ ppm (Printout) _____

15. From the POWERTRAX printout, **PERFORM** Independent verification of the following:

    a. Date and Time for the first data point is at or subsequent to the time of the reactor trip or shutdown. (N/A if no trip or shutdown occurred) _____

    b. Date and time(1 second later) for the first data point corresponds to the file name recorded in Step 7.1.7.d. _____

    c. **IF** there is a stuck rod, **THEN** the pcm value listed on the printout is -1326 pcm, otherwise the value is zero. _____

    d. The Acceptance Criteria listed in Step 7.1.14 is met. _____

16. **UPDATE** the MCR Status Board with the EFPD value recorded in Step 7.1.8.f. _____

17. **IF** performing in Modes 1 or 2 for projected Modes 3-5 conditions, **THEN UPDATE** the Xenon Free boron concentration for the temperatures specified on the status board. (N/A if performed in Modes 3-5) _____

18. To exit the PowerTrax application, **PERFORM** the following:

    a. **ACTIVATE** the "File" pull down menu. _____

    b. **SELECT** "Close". _____

    c. **ACTIVATE** the "File" pull down menu. _____

    d. **SELECT** "Exit". _____

    e. **ACTIVATE** "Exit" pull down menu. _____

    f. **SELECT** "Exit". _____

    g. **DEPRESS** Enter at the prompt. _____

    h. **TYPE** "exit". _____

    i. **DEPRESS** Enter. _____

7.2. Manual SDM Calculation (Modes 3 - 5)

1. **RECORD** the following information:

		Value
EFPD	Core burn up from MCR Status board.	
SDM Temp	Temperature for which this SDM calculation is taking credit.	
C_{RCS}	Latest available RCS boron sample.	
NOTE: Following core reload, the RWST ATOM percent value should be used until a measurement is obtained for the current Cycle.		
A_{RCS}	RCS B-10 ATOM percent from MCR status board. **OR** RWST B-10 Atom percent, **IF** following Core Reload	

2. **CHECK** rod status as follows:

   a. **IF** all rods are inserted, **RECORD** C_{RODS} = 0 in Step 7.2.3.a and N/A Step 7.2.2.b.

   b. **IF** all rods are not inserted, **COMPLETE** Attachment 1.

NOTE: Curve A-X-22 contains Notes to ensure SDM requirements are met for plant conditions.

3. **DETERMINE** Xenon free SDM boron concentration, C_{SDM}, as follows:

   a. **RECORD** the following information:

		Value
C_{RODS}	Boron addition to compensate for stuck rods from Attachment 1 or Step 7.2.2.a.	
C_{CURVE}	Uncorrected required SDM boron concentration from curve A-X-22 (Use action level line on curve.)	

b. **DETERMINE** required Xenon free SDM uncorrected boron concentration C_{REQ}:

$C_{REQ} = C_{RODS} + C_{CURVE}$

C_{REQ} = _____

_____

c. **DETERMINE** Xenon free SDM corrected boron concentration, C_{SDM}:

$C_{SDM} = \frac{19.9}{A_{RCS}} * (C_{REQ})$

A_{RCS} - RCS B-10 ATOM percent from Step 7.2.1.

C_{SDM} = _____

C_{REQ} - Xe free SDM uncorrected boron concentration from Step 7.2.3.b

_____

4. **DETERMINE** whether SDM requirements can be met by Xenon free SDM calculation:

a. **COMPARE** RCS boron concentration, C_{RCS}, and Xenon free SDM corrected boron concentration, C_{SDM}:

C_{RCS} _____ RCS boron sample from Step 7.2.1.

C_{SDM} _____ Xenon free SDM corrected boron concentration from Step 7.2.3.c.

_____

b. **IF** C_{RCS} is greater than C_{SDM},
THEN SDM requirements are met and this OST is satisfactory for the temperature recorded in Step 7.2.1 upon performance of the following: _____

(1) **PERFORM** an independent verification of this Section and applicable attachments. _____

(2) **MARK** remaining Steps in this Section N/A and **COMPLETE** Section 7.5 Test Completion. _____

c. **IF** C_{RCS} is less than or equal to C_{SDM},
THEN CONTINUE with Step 7.2.5 to take credit for Xenon effects. _____

5. **PERFORM** Attachment 2 to calculate SDM boron requirements to account for Xenon effects. _____

6. **DETERMINE** SDM boron concentration corrected for boron-10 and Xenon effects, $C_{SDM, XE}$:

C_{XE} = _____ Boron equivalent to compensate for Xenon from Attachment 2.

$C_{SDM, XE} = C_{SDM} - C_{XE}$ C_{SDM} - Xenon free SDM corrected boron concentration from Step 7.2.3.c.

$C_{SDM, XE}$ = _____

_____

7. **DETERMINE** whether SDM requirements can be met by SDM boron concentration corrected for boron-10 and Xenon effects:

a. **COMPARE** RCS boron concentration, C_{RCS} , and SDM boron concentration corrected for boron-10 and Xenon effects, $C_{SDM, XE}$:

C_{RCS} _____ Latest available RCS boron sample from Step 7.2.1.

$C_{SDM, XE}$ _____ SDM boron concentration corrected for boron-10 and Xenon effects from Step 7.2.6.

_____

7.2 Manual SDM Calculation (Modes 3 - 5) (Cont.)

b. **IF** C_{RCS} is greater than $C_{SDM, XE}$,
THEN SDM requirements are met and this OST is satisfactory for the temperature recorded in Step 7.2.1 until the projected time recorded in Attachment 2 upon performance of the following:

(1) **PERFORM** an independent verification of this Section and applicable attachments. _____

(2) **COMPLETE** Section 7.5, Test Completion. _____

c. **IF** C_{RCS} is less than or equal to $C_{SDM, XE}$, **THEN** SDM requirements are <u>not</u> met and this OST is unsatisfactory. **BORATE** to establish adequate SDM. _____

7.3. Manual SDM Calculation (Modes 1 and 2)

1. **ENTER** the absolute value for each parameter on Attachment 3. _____

2. **PERFORM** the calculation listed on Attachment 3 Item 9 for the required SDM boron concentration for the projected conditions. _____

3. **PERFORM** an independent verification of Attachment 3. _____

4. **VERIFY** that total SDM recorded on Attachment 3 is 1770 pcm or greater. _____

7.4. Manual Determination For Cold Shutdown Boron Requirements to Allow Blocking Safety Injection

NOTE: The RCS temperature is assumed to be 200 °F for Cold Shutdown.

1. **IF** this section is being performed to determine the Projected Boron Required (C_{PBR}) in preparation for plant shutdown,
   THEN MARK this step N/A, Otherwise **VERIFY** the following conditions (If all conditions cannot be met, discontinue use of this section and mark all remaining Steps N/A):

   a. All reactor trip breakers are Open. _____

   b. All reactor trip bypass breakers are Open. _____

   c. All control bank and all shutdown rods are fully inserted. _____

2. **RECORD** the following information:

		Value
EFPD	Core burn up from MCR Status board.	
RCS Temp	Temperature for which this SDM calculation is taking credit.	200 °F
C_{RCS}	Latest available RCS boron sample.	
A_{RCS}	RCS B-10 ATOM percent from MCR status board.	

_____

7.4 Manual Determination For Cold Shutdown Boron Requirements to Allow Blocking Safety Injection (Cont.)

NOTE: Curve A-X-22 contains Notes to ensure SDM requirements are met for plant conditions.

3. **DETERMINE** the required Xenon free cold shutdown boron concentration, C_{CSD}, as follows:

   a. From Curve A-X-22, **DETERMINE** the required Xenon free SDM uncorrected boron concentration, C_{REQ}: _____

   C_{REQ} = _____

   b. **DETERMINE** Xenon free cold shutdown corrected boron concentration, C_{CSD}:

$$C_{CSD} = \frac{19.9}{A_{RCS}} * (C_{REQ})$$

A_{RCS} - RCS B10 ATOM percent from Step 7.4.2.

C_{REQ} - Xe free SDM uncorrected boron concentration from Step 7.4.3.a.

C_{CSD} = _____ _____

4. **DETERMINE** the absolute value of uncorrected differential boron worth, DBW_{UNC}, from curve A-X-16, A-X-17, or A-X-18.

   Curve Used _____

   DBW_{UNC} = _____

   DBW_{UNC} = Uncorrected differential boron worth. _____

5. **DETERMINE** corrected differential boron worth DBW_{CORR}:

$$DBW_{CORR} = \frac{(DBW_{UNC})(A_{RCS})}{19.9}$$

DBW_{UNC} - Uncorrected differential boron worth. Step 7.4.4.

A_{RCS} - RCS B-10 ATOM percent from Step 7.4.2.

DBW_{CORR} = _____ Corrected differential boron worth. _____

7.4 Manual Determination For Cold Shutdown Boron Requirements to Allow Blocking Safety Injection (Cont.)

NOTE: Step 7.4.6 determines the boron equivalent of the most reactive rod being inserted into the core(instead of stuck out).

6. **DETERMINE** the boron equivalent for the most reactive control rod fully inserted into the core, C_{ROD}:

$$C_{ROD} = \frac{1326}{DBW_{CORR}}$$

1326 - Additional reactivity worth of most reactive control rod fully inserted into the core.

DBW_{CORR} - Corrected differential boron worth from Step 7.4.5.

C_{ROD} = _____ Boron equivalent for most reactive control rod fully inserted.

7.4 Manual Determination For Cold Shutdown Boron Requirements to Allow Blocking Safety Injection (Cont.)

7. **DETERMINE** the projected time period after shutdown or reactor trip to be used in determining Xenon worth:

   - Time since shutdown/trip. _____ (a) hours.
   - Projected Time = Time since shutdown/trip _____ (a) hours + 12 hours.
   - Projected Time = _____ (b) hours _____

   Projected Time period = _____ (a) hours to _____ (b) hours

   _____

8. **DETERMINE** the absolute value of Xenon reactivity worth using either of the following: (Method not used is N/A)

   a. **IF** EXSPACK is NOT available,
   THEN DETERMINE the absolute value of the lowest Xenon reactivity worth during the projected time period from curves B-X-5, B-X-6 or B-X-7, ρ_{XE}:

   Curve used = _____

   ρ_{XE} = _____ Absolute value of the lowest Xenon reactivity worth during the projected time period.

   _____

   OR

   b. **IF** EXSPACK is available,
   THEN DETERMINE the absolute value of Xenon reactivity worth as follows:

   (1) **VERIFY** reactor power at steady state (less than 10 percent power change) for at least 72 hours prior to initiation of the shutdown/trip: _____

7.4 Manual Determination For Cold Shutdown Boron Requirements to Allow Blocking Safety Injection (Cont.)

(2) **OBTAIN** a power history of the shutdown from any of the following:

- Operator logs
- ERFIS plots, archives, or other

_____

(3) **RECORD** the power history in Attachment 4. _____

(4) **VERIFY** EXSPACK version PNR02020 is in use. _____

(5) **ENTER** the following data in the EXSPPACK program using the STA computer:

- EFPD from Step 7.4.2
- Type of transient: Xenon
- Power history from Attachment 4

_____

(6) **USING** the EXSPACK program, **EXECUTE** a Xenon transient calculation to determine the Xenon worth: _____

(7) **FROM** the EXSPACK printout, **DETERMINE** the minimum value for Xenon during the 12 hours following the reactor trip or shutdown.

ρ_{XE} = _____ Xenon reactivity worth.

_____

9. **DETERMINE** the boron equivalent for Xenon, C_{XE}:

$$C_{XE} = \frac{\rho_{XE}}{DBW_{CORR}}$$

ρ_{XE} - Absolute value of the lowest Xenon reactivity worth during the projected time period Step 7.4.8.a.

DBW_{CORR} - Corrected differential boron worth from Step 7.4.5.

C_{XE} = _____ Boron equivalent for Xenon worth at projected time.

_____

7.4 Manual Determination For Cold Shutdown Boron Requirements to Allow Blocking Safety Injection (Cont.)

10. **DETERMINE** if cold shutdown conditions are met with credit taken for Xenon and the most reactive rod fully inserted.

    a. **IF** it is desired to determine what the Projected Boron Required (C_{PBR}) to block Safety Injection,
    THEN PERFORM the following calculation:

    (1)

    $C_{PBR} = C_{CSD} - C_{ROD} - C_{XE}$

    $C_{PBR} =$ _____ _____ _____

    (7.4.3.b) (7.4.6) (7.4.9)

    $C_{PBR} =$ _____

    _____

    _____
    Verified

    (2) **MARK** Steps 7.4.10.b, 7.4.10.c, 7.4.10.d, and 7.4.10.e N/A. _____

    (3) **COMPLETE** Section 7.5, Test Completion _____

    b. **IF** it is desired to Calculate the equivalent RCS boron concentration C_{EQ},
    THEN PERFORM the following calculation:

    $C_{EQ} = C_{RCS} + C_{ROD} + C_{XE}$

    $C_{EQ} =$ _____ _____ _____

    (7.4.2) (7.4.6) (7.4.9)

    $C_{EQ} =$ _____

    _____

    _____
    Verified

7.4 Manual Determination For Cold Shutdown Boron Requirements to Allow Blocking Safety Injection (Cont.)

c. **COMPARE** the equivalent RCS boron concentration C_{EQ} to the required boron concentration for cold shutdown:

C_{EQ} = _____ from Step 7.4.10.b

C_{CSD} = _____ from Step 7.4.3.b

_____

NOTE: Substep d or e will be performed based on above results.

d. **IF** C_{EQ} is greater than or equal to C_{CSD},
THEN the RCS is borated to cold shutdown conditions and the automatic SI actuation signals can be blocked as follows:

(1) **PERFORM** an independent verification of this Section and applicable attachments. _____

(2) **MARK** Step 7.4.10.e as N/A. _____

(3) **COMPLETE** Section 7.5 Test Completion. _____

e. **IF** C_{EQ} is less than C_{CSD},
THEN the RCS is **NOT** borated to cold shutdown conditions and the automatic SI actuation signals can **NOT** be blocked.

(1) **PERFORM** an independent verification of this Section and applicable attachments. _____

(2) **MARK** Step 7.4.10.d as N/A. _____

(3) **COMPLETE** Section 7.5 Test Completion. _____

7.5. Test Completion

1. **IF** performed as a result of the detection of an inoperable control rod, **THEN DOCUMENT** completion of PMID RQ 22121-01. _____

2. **IF** performed for the daily Modes 3, 4, and 5 requirements, **THEN DOCUMENT** completion of PMID RQ 22122-01. _____

3. **IF** sections 7.1 or 7.2 were performed and the results were satisfactory, **THEN RECORD** the following:

   SDM Temperature _____

   Projected time after shutdown _____ Hours (N/A for Xenon Free calculations)

   _____

4. **IF** Section 7.4 was performed, **THEN RECORD** the following for the substep that was performed (N/A the substep that was not performed):

   a. Projected Boron Required (C_{PBR}), Step 7.4.10.a(1) _____ PPM

   b. **IF** the results for equivalent RCS boron concentration were satisfactory, **THEN RECORD** the following:

      Boron for cold shutdown conditions (C_{CSD}), Step 7.4.10.b _____ PPM

      Projected time after shutdown for calculation _____ Hours

   _____

5. **IF** being performed for the weekly online activity, **THEN** perform the following:

   a. **UPDATE** the Unit Status Board. _____

   b. **PLACE** a completed copy of this test in the Curve Book at the ACP. _____

6. **COMPLETE** applicable portions of Attachment 6, Certifications and Reviews, and **INFORM** the Unit SCO that this OST is completed. _____

8.0 DIAGRAMS/ATTACHMENTS

Attachment 1 - Boron Addition Calculation to Compensate for Stuck Rods

Attachment 2 - Boron Equivalent Calculation to Compensate for Xenon

Attachment 3 - Manual SDM Calculation (Modes 1 and 2)

Attachment 4 - Reactor Power History for EXSPACK Calculation of Xenon Reactivity

Attachment 5 - Determining The Date and Time of MICROBURN-P Files

Attachment 6 - Certifications and Reviews

Boron Addition Calculation to Compensate for Stuck Rods

1. **DETERMINE** and **RECORD** the number of rods not fully inserted into the core, N:

   N = ___ Number of rods not fully inserted into the core

> **NOTE:** The reactivity worth of the single most reactive rod is 1326 pcm. Either this value or the individual withdrawn rod worth for each rod, as provided by the reactor engineer, may be used.

2. **DETERMINE** reactivity worth of rods not fully inserted into the core:

   ρ_{RODS} = N * (1326 pcm)

   or

   ρ_{RODS} = Value provided by reactor engineering

   ρ_{RODS} = ____ Reactivity worth of rods not fully inserted into the core

3. **DETERMINE** the absolute value of uncorrected differential boron worth, DBW_{unc}, from curves A-X-16, A-X-17, or A-X-18.

   Curve used _____

   DBW_{UNC} = _____ DBW_{UNC} - Uncorrected differential boron worth

4. **DETERMINE** boron addition to compensate for stuck rods, C_{RODS}:

   $$C_{RODS} = \frac{\rho_{RODS}}{DBW_{UNC}}$$

   ρ_{RODS} - Reactivity worth of rods not fully inserted into the core from Attachment 1, Step 2

   DBW_{UNC} - Uncorrected differential boron worth from Attachment 1, Step 3

   C_{RODS} = _____ Boron addition to compensate for stuck rods

5. **RECORD** value of C_{RODS} in Step 7.2.3.a.

Boron Equivalent Calculation to Compensate for Xenon

NOTE: The projected time from the shutdown margin calculation that compensates for Xenon effects should be for a minimum of 24 hours from the time this calculation is completed.

1. **DETERMINE** projected time after shutdown:

   Projected Time = Time since shutdown_____Hours + 24 hours

   Projected Time =____ Hours

2. **DETERMINE** the absolute value of Xenon reactivity worth at projected time from curves B-X-5, B-X-6 or B-X-7, ρ_{XE} :

   Curve used

   ρ_{XE} = ___ Xenon reactivity worth at projected time

3. **DETERMINE** the absolute value of uncorrected differential boron worth, DBW_{UNC}, from curves A-X-16, A-X-17, or A-X-18.

   Curve used

   DBW_{UNC} = ___ DBW_{UNC} - Uncorrected differential boron worth

4. **DETERMINE** corrected differential boron worth DBW_{corr}:

   $DBW_{corr} = \frac{(DBW_{UNC})(A_{RCS})}{19.9}$

   DBW_{UNC}- Uncorrected differential boron worth from Attachment 2, Step 3

   A_{RCS} - RCS B-10 ATOM percent from Step 7.2.1

   DBW_{corr} = ___ Corrected differential boron worth

5. **DETERMINE** boron equivalent corrected for boron-10 and Xenon effects, C_{XE}:

   $C_{XE} = \frac{\rho_{XE}}{DBW_{corr}}$

   ρ_{XE} - Xenon reactivity worth at projected time from Attachment 2, Step 2

   DBW_{corr} - Corrected differential boron worth from Attachment 2, Step 4

   C_{XE} = ___ Boron equivalent to compensate for Xenon

6. **RECORD** value of C_{XE} in Step 7.2.6.

Manual SDM Calculation (Modes 1 and 2)

1. Reactor power level. _____ %

2. Rod insertion limit for the above power level
_____ steps on bank _____

3. Burn up (POWERTRAX/MCR Status Board). _____ EFPD

4. Present RCS Boron Concentration _____ ppm

NOTE: Use absolute values of numbers obtained from curves.

5. Total worth of all control and shutdown banks, minus the worth of the most reactive rod for Fuel Cycle 15.
6810 pcm
(a)

6. Cycle 15 Power defect for the power level recorded in Step 1. (Refer to Curves C-X-1 to C-X-3).
Curve used _____ _____ pcm
(b)

NOTE: HFP curves are used for power levels of 10% or greater.

7. Inserted control rod worth at the rod insertion limit recorded in Step 2. (Refer to Curves A-X-6 to A-X-11)
Curve used _____ _____ pcm
(c)

8. Worth of any additional immovable or untrippable rods (for each stuck rod, use the most reactive single rod worth (1326 pcm) or obtain individual withdrawn rod worth from the reactor engineer).
_____ pcm
(d)

9. Determine the Total Shutdown Margin using the following formula:

$$\text{Total SDM } C_{B} \text{ (e)} = \underset{\text{(a)}}{\_\_\_\_} - \underset{\text{(b)}}{\_\_\_\_} - \underset{\text{(c)}}{\_\_\_\_} - \underset{\text{(d)}}{\_\_\_\_}$$

_____ pcm
(e)

Reactor Power History for EXSPACK Calculation of Xenon Reactivity

NOTE: The initial entry must be for steady state conditions since EXSPACK assumes equilibrium Xenon for this point.

NOTE: The Xenon transient must be projected 12 hours from the time of the reactor trip or shutdown.

Date	Time	Reactor Power	Comments

Determining The Date and Time of MICROBURN-P Files

NOTE: Powertrax is a case sensitive application. The commands listed in "apostrophes" should be typed as listed in the procedure.

NOTE: All instructions assume that PowerTrax is accessed from the STA LAN computer.

1. **GO** to START/STA Icons
2. **DOUBLE CLICK** on **PowerTrax at HNP** icon.
3. **SIGN ON** User ID as "sta".
4. **TAB** to Password
5. **USE** "hnp_sta" as a password
6. **DEPRESS** ENTER.

NOTE: Due to conflicts between the operating systems(Unix vs. Windows), Step 7 may have to be performed twice.

7. **WHEN** the HNP Unix window opens, **PERFORM** the following:
   a. **ENTER** "hnpptx"
   b. **DEPRESS** ENTER.
8. From the PowerTrax Main Menu **SELECT**:

   Shutdown Boron Concentration Prediction

9. Once the Powertrax Shutdown Boron Concentration Module screen appears, **PERFORM** the following:
   a. **ACTIVATE** the "File" pull down menu
   b. **SELECT** "Open"
   c. **SELECT** "MB-P File"

NOTE: "Directories" will be listed in the following format: "/ptrax/hnp/CY11/MBP/d.YYMMDD.HHmmss". Example would be /ptrax/hnp/CY11/MBP/d.021201.090037 = 12/01/02 @ 0900.37

10. **CLICK** on the directory to highlight the file and determine the time and date at which the file was created.

Certifications and Reviews

This OST was performed as a:

Periodic Surveillance Requirement: ____
Postmaintenance Operability Test: ____
Redundant Subsystem Test: ____

Plant Conditions: _____ MODE: _____
OST Completed By: _____ Date: _____
Time: _____

OST Performed By:

Initials	Name (Print)	Initials	Name (Print)

General Comments/Recommendations/Corrective Actions/Exceptions:

Pages used: _____

OST Completed with NO EXCEPTIONS/EXCEPTIONS

Reviewed By: _____ _____
Unit SCO Date

After receiving the final review signature, this OST becomes a QA RECORD and should be submitted to Document Services.

Revision 38 Summary

(PRR-190763)

General

This revision is performed to incorporate EC 64030 (Cycle 15 Core reload design). All changes are directly related to EC 64030.

Description of Changes

Page	Section	Change Description
3	2.4.2	Changed reference to "HNP CYCLE 15 PDD Setup," Calculation HNP-F/NFSA-0160.
	2.4.5	Changed reference to EC 64030
4	4.0.5	Changed "for Cycle 14" to "for Cycle 15"
7	7.0.1.a	Changed "2181 ppm" to "2172 ppm"
	7.0.2	Changed "2181 ppm" to "2172 ppm"
12	7.1.11.a	Changed "-1028 pcm" to "-1326 pcm"
13	7.1.15.c	Changed "-1028 pcm" to "-1326 pcm"
22	7.4.6	Changed "1028" to "1326" (Two locations)
29	Attachment 1	In NOTE prior to Step 2, changed "1028 pcm" to "1326 pcm"
		In Step 2, changed "1028 pcm" to "1326 pcm"
31	Attachment 3	In Step 5, "Cycle 14" to "Cycle 15"
		In Step 5, changed "7249" to "6810"
		In Step 6, changed "Cycle 14" to "Cycle 15"
		In Step 8, changed "1028 pcm" to "1326 pcm"

Revision 39 Summary

(PRR-276071)

General

This editorial correction corrects a typo.

Description of Changes

Page	Section	Change Description
All		Updated revision level.
11	Step 7.1.8.b	Corrected typo. Changed MICROBURB to MICROBURN.

Appendix C	Job Performance Measure Worksheet	Form ES-C-1

Facility: Shearon Harris Task No.: 301013H401

Task Title: Determine Boric Acid Addition Following CR Evacuation JPM No.: 2009a NRC JPM SRO A1-2

K/A Reference: G2.1.25 3.9 / 4.2

Examinee: _____ NRC Examiner: _____

Facility Evaluator: _____ Date: _____

Method of testing:

Simulated Performance: _____ Actual Performance: X

Classroom X Simulator _____ Plant _____

READ TO THE EXAMINEE

I will explain the initial conditions, which steps to simulate or discuss, and provide initiating cues. When you complete the task successfully, the objective for this Job Performance Measure will be satisfied.

Initial Conditions: The Control Room has been evacuated and the MCB transfer to the ACP has been completed. Plant management has directed a plant cooldown to mode 5 utilizing AOP-004. BAT level is 86% with a concentration of 7300 ppm. The RCS is currently 745 ppm.

Initiating Cue: You are the "Unit" SCO. Perform a calculation of the required boric acid addition to achieve cold shutdown and BAT level change per AOP-004, Section 3.2 Step 25 to obtain an OST-1036 cold shutdown boron requirement of 1600 ppm.

Task Standard: Utilizes Curve D-2 and obtains a change of 23.5 to 29.5 percent (or a final level of 57.5 to 61.5 percent).
Actual is 26.5% change (or 59.5% final).

Required Materials: SHNPP CURVE BOOK
Calculator

General References: AOP-004 Rev. 44, Curve Book nomograph E-2 and curve D-2

Time Critical Task: No

Validation Time: 15 minutes

Start Time: _____.

Performance Step: 1	OBTAIN PROCEDURE
Standard:	Obtains AOP-004 and refers to Section 3.2 Step 25
Comment:	
Performance Step: 2	Obtain cold shutdown boron concentration using copy of latest OST-1036 in back of book.
Standard:	
Evaluator Cue:	**(If candidate asks: This information is provided in the initiating cue.)** **Required shutdown boron concentration is 1600 ppm**
Comment:	

✓ **Performance Step: 3** USING THE FORMULA ON THE BORON ADDITION NOMOGRAPH E-2 FROM THE CURVE BOOK, DETERMINE REQUIRED GALLONS OF BORIC ACID TO ACHIEVE REQUIRED RCS BORON CONCENTRATION.

Standard: Utilizes formula on Nomograph E-2 and calculates between 8975 to 9075 gallons of boric acid to be added. Actual is 9027 gallons

Boron Addition (RCS @ 350°F)

$$V_B = \frac{-M}{8.33} \ln\left(\frac{7000 - C_f}{7000 - C_i}\right)$$

$$M = 538{,}000$$

Comment:

Examiners NOTE: **The Nomograph formula found on Curve E-2 assumes that the BAT boron concentration is 7000 ppm. In this JPM the given information is that the BAT concentration is 7300 ppm. The candidate MUST use the given concentration of 7300 ppm to come to the correct boron addition.**

CORRECT CALCULATION

$$V_B = \frac{-538000}{8.33} ln\left(\frac{7300-1600}{7300-745}\right)$$

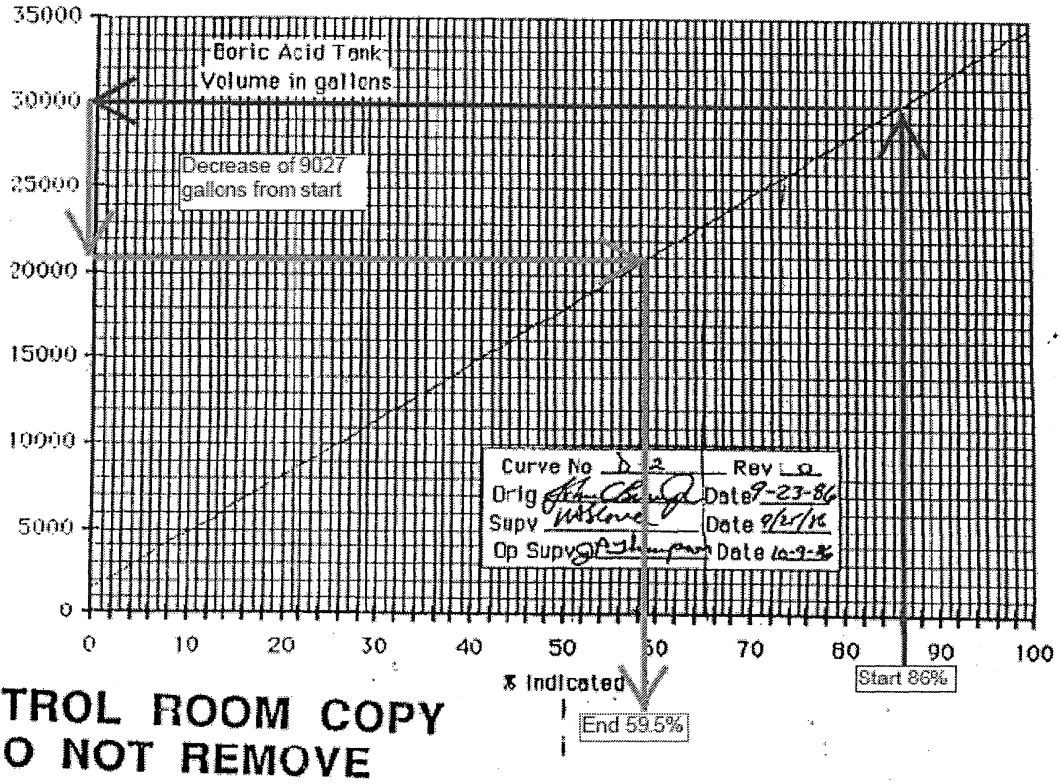
If candidate uses 7000 ppm for BAT BA concentration (from the nomograph) instead of changing to 7300 ppm the result will be 9493 gallons

INCORRECT CALCULATION

$$V_B = \frac{-538000}{8.33} ln\left(\frac{7000-1600}{7000-745}\right)$$

✓ **Performance Step: 4** USING THE BORIC ACID TANK CURVE D-2 FROM THE CURVE BOOK, DETERMINE THE CHANGE IN BORIC ACID TANK LEVEL EQUIVALENT TO THE REQUIRED GALLONS OF BORIC ACID.

Standard: Utilizes Curve D-2 and obtains a change of 23.5 to 29.5 percent (or a final level of 57.5 to 61.5 percent).
Actual is 26.5% change (or 59.5% final).



CONTROL ROOM COPY
DO NOT REMOVE

Comment:

Evaluator Note:	**When candidate completes the calculations the JPM is completed.**

Stop Time: _____

Terminating Cue: Change in BAT level calculated.

VERIFICATION OF COMPLETION

Job Performance Measure No.: 2009a NRC JPM SRO A1-2

DETERMINE BORIC ACID ADDITION FOLLOWING CR EVACUATION

Examinee's Name:

Date Performed:

Facility Evaluator:

Number of Attempts:

Time to Complete:

Question Documentation:

Question:

Response:

Result: SAT _____ UNSAT _____

Examiner's Signature: _____ Date: _____

INITIAL CONDITIONS: The Control Room has been evacuated and the MCB transfer to the ACP has been completed. Plant management has directed a plant cooldown to mode 5 utilizing AOP-004. BAT level is 86% with a concentration of 7300 ppm. The RCS is currently 745 ppm.

INITIATING CUE: You are the USCO. Perform a calculation of the required boric acid addition to achieve cold shutdown and BAT level change per AOP-004, Section 3.2 Step 25 to obtain an OST-1036 cold shutdown boron requirement of 1600 ppm.

REFERENCE

ADMIN IPM

SRO A1-2

INSTRUCTIONS	RESPONSE NOT OBTAINED

3.2 Remote Shutdown With No Fire

ACP / STA and Unit SCO

☐ **24. EVALUATE** the operational status of plant equipment
AND INITIATE repairs to equipment required to achieve cold shutdown.

NOTE

Reactor Engineering may need to be contacted to obtain the latest critical RCS boron concentration and RCS B-10 atom percent.

ACP / Unit SCO

25. REFER TO Curve Book
AND PERFORM boration of RCS to cold shutdown boron concentration:

☐ **a. OBTAIN** cold shutdown boron concentration, using copy of latest OST-1036 in back of book:

_____ ppm

☐ **b. DETERMINE** gallons of boric acid required to achieve required boron concentration, using formula on boron addition nomograph E-2:

_____ gallons

☐ **c. DETERMINE** change in Boric Acid Tank level equivalent to the required gallons of boric acid, using curve D-2:

_____ % change

(Continued on Next Page)

INSTRUCTIONS	RESPONSE NOT OBTAINED

3.2 Remote Shutdown With No Fire

25. (continued)

NOTE

- PRZ level (LI-459A2) may be raised to 90% to achieve required RCS boration.
- RCS cooldown may be necessary to shrink RCS volume and allow completion of RCS boration.
- Placing letdown in service using OP-107 may be desirable. However, some components needed for this evolution can not be controlled from the ACP, and would need to be operated locally. PNSC concurrence should be obtained prior to placing letdown in service.
- If the Boric Acid Filter is isolated, it will be necessary to locally open 1CS-565, BA Filter Bypass Vlv.

☐ **d. CHECK** BOTH Boric Acid Transfer Pumps UNAVAILABLE.

d. PERFORM the following:

☐ **(1) CONTINUE** boration using charging pump and boric acid flow.

☐ **(2) GO TO** Step 27.

26. COMMENCE boration using gravity feed from the Boric Acid Tank:

ACP / Unit SCO

☐ **a. STOP** the running CSIP.

ACP / Unit SCO

☐ **b. VERIFY** LI-161.2, Boric Acid Tank Level, ABOVE 20%.

248' RAB / RAB

☐ **c. SHUT** 1CS-292, B CSIP Supply From RWST.

(Continued on Next Page)

Appendix C	Job Performance Measure Worksheet	Form ES-C-1

Facility: Shearon Harris Task No.: 015004H201

Task Title: Perform A Quadrant Power Tilt Ratio Calculation JPM No.: 2009a NRC JPM RO A-2

K/A Reference: G2.2.12 3.7 / 4.1

Examinee: _____ NRC Examiner: _____

Facility Evaluator: _____ Date: _____

Method of testing:

Simulated Performance: _____ Actual Performance: X

Classroom X Simulator _____ Plant _____

READ TO THE EXAMINEE

I will explain the initial conditions, which steps to simulate or discuss, and provide initiating cues. When you complete the task successfully, the objective for this Job Performance Measure will be satisfied.

Initial Conditions: The plant is operating at 100 percent power. Power Range N41 is inoperable. AOP-001, Malfunction Of Rod Control And Indication System has been entered due to a misaligned control rod.

Initiating Cue: The USCO has directed you to perform a Manual QPTR utilizing OST-1039, Calculation Of Quadrant Power Tilt Ratio. All prerequisites have been satisfied.
The Power Range NIS readings are provided in the table below.

For the purposes of the examination, there will be no independent verification of your work.

Task Standard: QPTR correctly calculated per OST-1039, Rev 14.

Required Materials: Calculator

General References: OST-1039 Rev 14

Handouts:
- **Provide page 9 (copy of curve F-15-8) to the candidate with cue sheet**
- OST-1039 Revision 14

Time Critical Task: No

Validation Time: 20 minutes

Start Time: _____.

Performance Step: 1 OBTAIN PROCEDURE (Provided to candidate to allow candidate to write on the procedure. The required Curve book figure is supplied on page 9.)

Standard: Obtains OST-1039

Comment:

Performance Step: 2 PRIOR TO READING THE VALUE OF DETECTOR CURRENT, ENSURE THE METER RANGE/RATE SWITCH IS IN THE 400 μA/SLOW POSITION.

Standard: Locates Meter Range/Rate switches for NI-41, NI-42, NI-43, and NI-44 and verifies they are in the 400 μA/SLOW position. (Switches do not have to be checked all at once but should be checked before reading is taken from a drawer.)

NOTE: This step is not performed with conducting exam in a classroom setting. Readings will be provided to candidate.

Comment:

✓ **Performance Step: 3** RECORD ON ATTACHMENT 2 THE UPPER AND LOWER DETECTOR CURRENTS FROM ALL OPERABLE POWER RANGE CHANNELS AS READ AT THE NUCLEAR INSTRUMENTATION CABINET.

Standard: Locates upper and lower detector current indications and records them on Attachment 2.

NOTE: This step is not performed with conducting exam in a classroom setting. Readings will be provided to candidate.

Comment:

✓ **Performance Step: 4** RECORDS ON ATTACHMENT 2 THE 100 % POWER NORMALIZED CURRENT FOR EACH CHANNEL

Standard: References Curve F-15-8 (Revision 7) and records the 100 % values on Attachment 2.

Comment:

✓ **Performance Step: 5** DIVIDE VALUE IN COLUMN A BY THE RESPECTIVE NORMALIZED CURRENT IN COLUMN B AND RECORD THE RESULT IN COLUMN C.

Standard: Takes value of Upper Detector Currents and divides by Normalized value for each channel and records values in Column C.

Comment:

✓ **Performance Step: 6** CALCULATE THE AVERAGE VALUE FOR THE UPPER AND LOWER NORMALIZED FRACTION AND RECORD IN COLUMN D OF ATTACHMENT 2.

Standard: Adds the Upper Normalized Fractions and divides by 3 and enters in Column D. Adds the Lower Normalized Fractions and divides by 3 and enters in Column D.

Comment:

✓ **Performance Step: 7** USING THE FORMULA AND VALUES FROM ATTACHMENT 2 CALCULATE THE UPPER AND LOWER RATIOS

Standard: Divides the Maximum Upper Normalized Fraction by the Average Upper Normalized Fraction. Divides the Maximum Lower Normalized Fraction by the Average Lower Normalized Fraction. Enters the values on Attachment 2.

Comment:

✓ **Performance Step: 8** PERFORM INDEPENDENT VERIFICATION OF ALL CALCULATIONS MADE ON ATTACHMENT 2

Standard:

Evaluator Cue:	**(If Candidate asks for independent verification)** **For the purpose of this examination, there will be no independent verification of your work.**

Comment:

✓	**Performance Step: 9**	THE UPPER RATIO OR THE LOWER RATIO, WHICHEVER IS GREATER, IS THE QUADRANT POWER TILT RATIO (QPTR). RECORD QPTR AND VERIFY QPTR IS LESS THAN OR EQUAL TO 1.02
	Standard:	**Acceptable band is +/- .5% (rounded to .005) around 1.0264 (1.0214 to 1.0314).** **LOWER (Greatest) = 1.0264** **QPTR is UNSAT**
	Comment:	

Evaluator Cue:	**When the candidate completes the calculations and provides the report of the QPTR then the JPM is completed.**

Stop Time: _____

Terminating Cue:	**After the USCO has been notified of QPTR: Evaluation on this JPM is complete.**

KEY

UPPER DETECTOR	A UPPER DETECTOR CURRENT	B UPPER 100% POWER NORMALIZED CURRENT	C UPPER NORMALIZED FRACTION (NOTE 1)
N-41	INOPERABLE	INOPERABLE	INOPERABLE
N-42	193.1	192.5	1.0031
N-43	217.6	218.1	0.9977
N-44	176.4	176.1	1.0017
		SUM	3.0025/3 = 1.0008

LOWER DETECTOR	A LOWER DETECTOR CURRENT	B LOWER 100% POWER NORMALIZED CURRENT	C LOWER NORMALIZED FRACTION (NOTE 1)
N-41	INOPERABLE	INOPERABLE	INOPERABLE
N-42	229.3	223.6	1.0254
N-43	237.1	240.6	0..9854
N-44	209.9	212.8	0..9863
		SUM	2.9971/3 = 0.9990

Highest Upper (N-42) 1.0031/1.0008 = 1.0022 (0.9972 to 1.0072)
Highest Lower (N-42) 1.0254/0.9990 = 1.0264 (1.0214 to 1.0314)

VERIFICATION OF COMPLETION

Job Performance Measure No.: 2009a NRC JPM RO A2

PERFORM A QUADRANT POWER TILT RATIO CALCULATION

Examinee's Name:

Date Performed:

Facility Evaluator:

Number of Attempts:

Time to Complete:

Question Documentation:

Question:

Response:

Result: SAT _____ UNSAT _____

Examiner's Signature: _____ Date: _____

INITIAL CONDITIONS:

- The plant is operating at 100 percent power.
- Power Range N41 is inoperable.
- AOP-001, MALFUNCTION OF ROD CONTROL AND INDICATION SYSTEM has been entered due to a misaligned control rod.

INITIATING CUE:

The USCO has directed you to perform a Manual QPTR utilizing OST-1039, Calculation Of Quadrant Power Tilt Ratio. All prerequisites have been satisfied.
The Power Range NIS readings are provided in the table below.

For the purposes of the examination, there will be no independent verification of your work.

PRNIS Readings

PRNIS Channel	UPPER READING	LOWER READING
N41	INOPERABLE	INOPERABLE
N42	193.1	229.3
N43	217.6	237.1
N44	176.4	209.9

* All values were taken with the Range/Rate switch in 400 µA/Slow position.

Current and Voltage Setpoints Table

(100 % Power, 0 % Incore Axial Offset)

Channel #	Top Current (μA)	Bottom Current (μA)
N41	176.1	200.2
N42	192.5	223.6
N43	218.1	240.6
N44	176.1	212.8

Curve No.	F-15-8	Rev. No. 7
Originator		Date 9/23/2008
Supervisor		Date 9/23/08
Superintendent-Shift Operations		Date 9/23/08

REFERENCE

ADMIN JPM

RO A-2

Progress Energy

C
CONTINUOUS
USE

HARRIS NUCLEAR PLANT

PLANT OPERATING MANUAL

VOLUME 3

PART 9

PROCEDURE TYPE: OPERATIONS SURVEILLANCE TEST

NUMBER: **OST-1039**

TITLE: **CALCULATION OF QUADRANT POWER TILT RATIO, WEEKLY INTERVAL (WITH ALARM OPERABLE) 12 HOUR INTERVAL (WITH ALARM INOPERABLE) MODE 1**

NOTE: This procedure has been screened per PLP-100 Criteria and determined to be CASE III. No additional management involvement is required.

Table of Contents

1.0 PURPOSE

In MODE 1, greater than 50% Rated Thermal Power:

1. This test is performed weekly, per Tech Spec 4.2.4.1.a, if the alarm is operable.

2. This test is performed every 12 hours, per Tech Spec 4.2.4.1.b, if the alarm is inoperable.

The Power Range Detector Currents will be recorded and compared with calculated full power normalized currents to determine the upper and lower quadrant power tilt ratios. The larger of these two ratios is the quadrant power tilt ratio referenced in technical specifications.

2.0 REFERENCES

2.1. Plant Operating Manual Procedures

1. OP-105
2. EST-911
3. EST-915
4. MST-I0044
5. MST-I0045
6. MST-I0046
7. MST-I0047

2.2. Technical Specifications

1. 3.2.4
2. 3.10.2

2.3. Final Safety Analysis Report

1. 4.4

3.0 PREREQUISITES

NOTE: Precaution and Limitation 4.0.1 has guidance if performing this OST with one Power Range Channel inoperable.

1. **VERIFY** instrumentation needed for the performance of this test is free of deficiencies that affect instrument indication. _____

2. **VERIFY** the most recent Curve F-x-8 is used in the performance of this procedure. (Reference 2.1.1 and 2.1.2)

   Curve F-x-8 Revision Number _____ _____

3. **OBTAIN** Unit SCO permission to perform this OST.

_____ _____
Signature Date

4.0 PRECAUTIONS AND LIMITATIONS

1. With one power range channel inoperable, this OST shall be performed using the remaining three detectors. In addition, if Reactor Power is greater than 75%, EST-915 must also be performed per Surveillance Requirement 4.2.4.2. (Reference 2.1.3)

2. If performing this OST to support NIS calibration (MST-I0044, I0045, I0046, and I0047), then new calculated currents on Curve F-x-8 are to be used per OP-105. (Reference 2.1.1)

3. There is usually a time lapse between the generation of the new curve values and the calibration of the power range NIs. Operations should approve the new curve with the QPTR alarm operable. The installed NI currents are outdated and will not be the same as the new values on the curve. This is conservative since the QPTR alarm will actuate when actual QPTR is below the setpoint. If the QPTR alarm actuates, the new curve values should be used in the calculation. These values reflect core conditions from the most recent flux map.

5.0 TOOLS AND EQUIPMENT

1. IBM PC or compatible

6.0 ACCEPTANCE CRITERIA

1. This OST will be completed satisfactorily if the Quadrant Power Tilt Ratio when measured at greater than 50% Rated Thermal Power is less than or equal to 1.02.

7.0 PROCEDURE

1. **IF** Quadrant Power Tilt Ratio Calculation Computer Program is used, **THEN PERFORM** the following:

   a. **MARK** Step 7.0.2 N/A. _____

   b. **MARK** Section 7.2 N/A. _____

   c. **PERFORM** Section 7.1. _____

2. **IF** manual calculation of the Quadrant Power Tilt Ratio is used, **THEN PERFORM** the following:

   a. **MARK** Section 7.1 N/A. _____

   b. **PERFORM** Section 7.2. _____

7.1. Computer Quadrant Power Tilt Ratio Calculation

NOTE: The detector current meters on each power range channel drawer are designated as left-upper, right-lower.

1. Prior to reading the value of detector current, **VERIFY** the Meter Range/Rate switch is in the 400 µA/SLOW position.

   - N-41 Upper _____
   - N-41 Lower _____
   - N-42 Upper _____
   - N-42 Lower _____
   - N-43 Upper _____
   - N-43 Lower _____
   - N-44 Upper _____
   - N-44 Lower _____

2. **RECORD** on Attachment 1 the upper and lower detector currents from all operable power range channels as read at the Nuclear Instrumentation Cabinet. _____

NOTE: If the STA's computer is not available, it is possible to use the floppy disc labeled "OST-1039 QPTR calculation Program Version 1.0". This will require attaching a floppy disc drive to the computer being used. The floppy disc write protect tab should be disabled prior to inserting into the A disk drive to allow updating the 100% Power Normalized currents.

3. From the STA's computer, **ACCESS** the OST-1039 program using the menu prompts. _____

4. **VERIFY** that the program version on the computer screen is version 1.0. _____

5. **WHEN** prompted,
   THEN ENTER the data from Attachment 1. _____

6. **IF** necessary,
   THEN CORRECT the 100% Power Normalized currents by comparing them to the updated currents on Curve F-x-8. _____

7.1 Computer Quadrant Power Tilt Ratio Calculation (continued)

NOTE: The normalized fraction should approximately equal reactor power level.

NOTE: The computer program prints out to LPT1. By default, LPT1 is not normally mapped, since most programs do not need it. This can be verified, and if necessarily changed, by going to Start -> Programs -> Accessories -> Local PRT. This screen also allows enabling LPT1 if necessary.

7. **PRINT** the results from the computer program. _____

8. **SIGN** the Data Input Line. _____

9. **PERFORM** Independent Verification of data input. _____

10. **SIGN** the Data Input Verification Line. _____

11. **RECORD** QPTR from the printed results.

    QPTR = _____ _____

12. **CHECK** QPTR is less than or equal to 1.02. _____

13. **ATTACH** the printed results to this procedure. _____

7.2. Manual Quadrant Power Tilt Ratio Calculation

NOTE: The detector current meters on each power range channel drawer are designated as left-upper, right-lower.

1. Prior to reading the value of detector current, **VERIFY** the Meter Range/Rate switch is in the 400 µA/SLOW position.

   - N-41 Upper _____
   - N-41 Lower _____
   - N-42 Upper _____
   - N-42 Lower _____
   - N-43 Upper _____
   - N-43 Lower _____
   - N-44 Upper _____
   - N-44 Lower _____

2. **RECORD** on Attachment 2, in column A, the upper and lower detector currents from all operable power range channels as read on the Nuclear Instrumentation Cabinet. _____

3. **RECORD** on Attachment 2, in column B, the 100% power normalized current for each channel from Curve F-x-8) _____

NOTE: When recording all fractions and ratios, record to four decimal places, dropping the fifth and subsequent decimal places.

4. **DIVIDE** values in column A by the respective normalized current in column B recording the result in column C as the Normalized Fraction. _____

5. **CALCULATE** the average value for the upper and the lower Normalized Fractions as follows:

   a. **ADD** the Normalized Fraction in each section of column C, recording the sum in the space provided. _____

   b. **DIVIDE** the sum obtained in Step 7.2.5.a by the number of operable NI channels, recording the result in column D of Attachment 2. _____

7.2 Manual Quadrant Power Tilt Ratio Calculation (continued)

6. Using the formula and values from Attachment 2, **CALCULATE** the Upper and Lower Ratios. _____

7. **PERFORM** independent verification of all calculations made on Attachment 2. _____

> **NOTE:** The upper ratio or the lower ratio, whichever is greater, is the quadrant power tilt ratio (QPTR).

8. **RECORD** QPTR:

   QPTR = _____ _____

9. **CHECK** QPTR is less than or equal to 1.02. _____

7.3. Test Completion

1. **IF** this test was performed due to an inoperable QPTR alarm, **THEN DOCUMENT** completion of PMID 22125 RQ 01. _____

2. **COMPLETE** applicable sections of Attachment 3, Certifications and Reviews. _____

3. **INFORM** the Unit SCO this test is completed. _____

8.0 DIAGRAMS/ATTACHMENTS

Attachment 1 - Computer Data Sheet
Attachment 2 - Manual Data Sheet
Attachment 3 - Certifications and Reviews

Attachment 1 - Computer Data Sheet
Sheet 1 of 1

UPPER DETECTOR	UPPER DETECTOR CURRENT
N-41	
N-42	
N-43	
N-44	

LOWER DETECTOR	LOWER DETECTOR CURRENT
N-41	
N- 42	
N-43	
N-44	

Attachment 2 - Manual Data Sheet
Sheet 1 of 1

UPPER DETECTOR	A UPPER DETECTOR CURRENT	B UPPER 100% POWER NORMALIZED CURRENT	C UPPER NORMALIZED FRACTION (NOTE 1)	D AVERAGE UPPER NORMALIZED FRACTION
N-41				
N-42				
N-43				
N-44				
		SUM		

Upper Ratio = $\frac{\text{Maximum Upper Normalized Fraction}}{\text{Average Upper Normalized Fraction}}$ = _____ = _____

LOWER DETECTOR	A LOWER DETECTOR CURRENT	B LOWER 100% POWER NORMALIZED CURRENT	C LOWER NORMALIZED FRACTION (NOTE 1)	D AVERAGE LOWER NORMALIZED FRACTION
N-41				
N-42				
N-43				
N-44				
		SUM		

Lower Ratio = $\frac{\text{Maximum Upper Normalized Fraction}}{\text{Average Upper Normalized Fraction}}$ = _____ = _____

NOTE 1: Normalized Fraction should approximately equal reactor power level.

Attachment 3 - Certification and Reviews
Sheet 1 of 1

This OST was performed as a: Periodic Surveillance Requirement: _____

Postmaintenance Operability Test: _____

Redundant Subsystem Test: _____

Plant Conditions: _____ MODE: _____

OST Completed By: _____ Date: _____

Time: _____

OST Performed By:

Initials	Name (Print)	Initials	Name (Print)

General Comments/Recommendation/Corrective Actions/Exceptions:

Pages Used: _____

OST Completed with NO EXCEPTIONS/EXCEPTIONS:

_____ Date: _____
Unit SCO

After receiving the final review signature, this OST becomes a QA RECORD and should be submitted to Document Services.

Revision Summary

General

Converted procedure to Word XP and formatted per PRO-NGGC-0201. Incorporated all outstanding PRRs.

Description of Changes

Page	Section	Change Description
All		Updated revision level. Restored cross referencing. Corrected formatting to comply with PRO-NGGC-0202 and AP-005. Separated Steps with multiple actions into individual steps (actual steps were unaffected)
2	TOC	Added Table of Contents.
3	2.3.1	Corrected reference. 4.4.2.10 did not exist, instead referenced FSAR Chapter 4.4
7	7.1.7	Added Note on how to enable LPT1 to the default printer, if needed.

Appendix C	Job Performance Measure Worksheet	Form ES-C-1

Facility: Shearon Harris Task No.: 015004H201

Task Title: Perform A Quadrant Power Tilt Ratio Calculation JPM No.: 2009a NRC JPM SRO A-2

K/A Reference: G2.2.12 3.7 / 4.1

Examinee: _____ NRC Examiner: _____

Facility Evaluator: _____ Date: _____

Method of testing:

Simulated Performance: _____ Actual Performance: X

Classroom X Simulator _____ Plant _____

READ TO THE EXAMINEE

I will explain the initial conditions, which steps to simulate or discuss, and provide initiating cues. When you complete the task successfully, the objective for this Job Performance Measure will be satisfied.

Initial Conditions: The plant is operating at 100 percent power. Power Range N41 is inoperable. AOP-001, Malfunction Of Rod Control And Indication System has been entered due to a misaligned control rod.

Initiating Cue:

- The USCO has directed you to perform a Manual QPTR utilizing OST-1039, Calculation Of Quadrant Power Tilt Ratio.
- All prerequisites have been satisfied. The Power Range NIS readings are provided in the table below.
- **IF** calculations are outside acceptable tolerances **THEN** evaluate Tech Specs.
- **For the purposes of the examination, there will be no independent verification of your work.**

Task Standard: QPTR correctly calculated per OST-1039, Rev 14.

Required Materials: **Calculator**

General References: OST-1039 Rev 14

Handouts:

- **Provide page 10 (copy of curve F-15-8) to the candidate with cue sheet**
- OST-1039 Revision 14
- **Tech Specs**

Time Critical Task: No
Validation Time: 25 minutes

Start Time: _____.

Performance Step: 1	OBTAIN PROCEDURE (Provided to candidate to allow candidate to write on the procedure. The required Curve book figure is supplied on page 10.)
Standard:	Obtains OST-1039
Comment:	
Performance Step: 2	PRIOR TO READING THE VALUE OF DETECTOR CURRENT, ENSURE THE METER RANGE/RATE SWITCH IS IN THE 400 μA/SLOW POSITION.
Standard:	Locates Meter Range/Rate switches for NI-41, NI-42, NI-43, and NI-44 and verifies they are in the 400 μA/SLOW position. (Switches do not have to be checked all at once but should be checked before reading is taken from a drawer.)
	NOTE: This step is not performed with conducting exam in a classroom setting. Readings will be provided to candidate with cue sheet.
Comment:	

✓ **Performance Step: 3** RECORD ON ATTACHMENT 2 THE UPPER AND LOWER DETECTOR CURRENTS FROM ALL OPERABLE POWER RANGE CHANNELS AS READ AT THE NUCLEAR INSTRUMENTATION CABINET.

Standard: Locates upper and lower detector current indications and records them on Attachment 2.

NOTE: This step is not performed with conducting exam in a classroom setting. Readings will be provided to candidate.

Comment:

✓ **Performance Step: 4** RECORDS ON ATTACHMENT 2 THE 100 % POWER NORMALIZED CURRENT FOR EACH CHANNEL

Standard: References Curve F-15-8 (Revision 7) and records the 100 % values on Attachment 2.

Comment:

✓ **Performance Step: 5** DIVIDE VALUE IN COLUMN A BY THE RESPECTIVE NORMALIZED CURRENT IN COLUMN B AND RECORD THE RESULT IN COLUMN C.

Standard: Takes value of Upper Detector Currents and divides by Normalized value for each channel and records values in Column C.

Comment:

✓ **Performance Step: 6** CALCULATE THE AVERAGE VALUE FOR THE UPPER AND LOWER NORMALIZED FRACTION AND RECORD IN COLUMN D OF ATTACHMENT 2.

Standard: Adds the Upper Normalized Fractions and divides by 3 and enters in Column D. Adds the Lower Normalized Fractions and divides by 3 and enters in Column D.

Comment:

✓ **Performance Step: 7** USING THE FORMULA AND VALUES FROM ATTACHMENT 2 CALCULATE THE UPPER AND LOWER RATIOS

Standard: Divides the Maximum Upper Normalized Fraction by the Average Upper Normalized Fraction. Divides the Maximum Lower Normalized Fraction by the Average Lower Normalized Fraction. Enters the values on Attachment 2.

Comment:

✓ **Performance Step: 8** PERFORM INDEPENDENT VERIFICATION OF ALL CALCULATIONS MADE ON ATTACHMENT 2

Standard:

Evaluator Cue:	**(If Candidate asks for independent verification)** **For the purpose of this examination, there will be no independent verification of your work.**

Comment:

✓ **Performance Step: 9** THE UPPER RATIO OR THE LOWER RATIO, WHICHEVER IS GREATER, IS THE QUADRANT POWER TILT RATIO (QPTR). RECORD QPTR AND VERIFY QPTR IS LESS THAN OR EQUAL TO 1.02

Standard: **Acceptable band is +/- .5% (rounded to .005) around 1.0264 (1.0214 to 1.0314).**
LOWER (Greatest) = 1.0264
QPTR is UNSAT

Evaluator Note:	**The SRO Candidate should determine that the QPTR is UNSAT, and continue to evaluate Tech Specs for compliance.**

Comment:

Performance Step: 10 OBTAIN TECH SPECS

Standard: Obtains Tech Specs

Comment:

✓ **Performance Step: 11** Refers to Tech Spec 3.2.4

Standard: Determines that ACTION a. is to be applied

Evaluator Note:	**When candidate completes calculations and reports Tech Spec evaluation (IF QPTR is determined to be UNSAT) the JPM is complete**

Comment:

Stop Time: _____

Terminating Cue: Determines QPTR and Tech Spec action for the QPTR calculation exceeding 1.02

KEY

UPPER DETECTOR	A UPPER DETECTOR CURRENT	B UPPER 100% POWER NORMALIZED CURRENT	C UPPER NORMALIZED FRACTION (NOTE 1)
N-41	INOPERABLE	INOPERABLE	INOPERABLE
N-42	193.1	192.5	1.0031
N-43	217.6	218.1	0.9977
N-44	176.4	176.1	1.0017
		SUM	3.0025/3 = 1.0008

LOWER DETECTOR	A LOWER DETECTOR CURRENT	B LOWER 100% POWER NORMALIZED CURRENT	C LOWER NORMALIZED FRACTION (NOTE 1)
N-41	INOPERABLE	INOPERABLE	INOPERABLE
N-42	229.3	223.6	1.0254
N-43	237.1	240.6	0.9854
N-44	209.9	212.8	0.9863
		SUM	2.9971/3 = 0.9990

Highest Upper (N-42) 1.0031/1.0008 = 1.0022 (0.9972 to 1.0072)
Highest Lower (N-42) 1.0254/0.9990 = 1.0264 (1.0214 to 1.0314)

KEY

POWER DISTRIBUTION LIMITS

3/4.2.4 QUADRANT POWER TILT RATIO

LIMITING CONDITION FOR OPERATION

3.2.4 The QUADRANT POWER TILT RATIO shall not exceed 1.02.

APPLICABILITY: MODE 1, above 50% of RATED THERMAL POWER*.

ACTION:

a. With the QUADRANT POWER TILT RATIO determined to exceed 1.02 but less than or equal to 1.09:

1. Calculate the QUADRANT POWER TILT RATIO at least once per hour until either:

a) The QUADRANT POWER TILT RATIO is reduced to within its limit, or

b) THERMAL POWER is reduced to less than 50% of RATED THERMAL POWER.

2. Within 2 hours either:

a) Reduce the QUADRANT POWER TILT RATIO to within its limit, or

b) Reduce THERMAL POWER at least 3% from RATED THERMAL POWER for each 1% of indicated QUADRANT POWER TILT RATIO in excess of 1 and similarly reduce the Power Range Neutron Flux-High Trip Setpoints within the next 4 hours.

3. Verify that the QUADRANT POWER TILT RATIO is within its limit within 24 hours after exceeding the limit or reduce THERMAL POWER to less than 50% of RATED THERMAL POWER within the next 2 hours and reduce the Power Range Neutron Flux-High Trip Setpoints to less than or equal to 55% of RATED THERMAL POWER within the next 4 hours; and

4. Identify and correct the cause of the out-of-limit condition prior to increasing THERMAL POWER; subsequent POWER OPERATION above 50% of RATED THERMAL POWER may proceed provided that the QUADRANT POWER TILT RATIO is verified within its limit at least once per hour for 12 hours or until verified acceptable at 95% or greater RATED THERMAL POWER.

*See Special Test Exceptions Specification 3.10.2.

SHEARON HARRIS - UNIT 1 3/4 2-11

Job Performance Measure No.: 2009a NRC JPM SRO A-2

PERFORM A QUADRANT POWER TILT RATIO CALCULATION

Examinee's Name:

Date Performed:

Facility Evaluator:

Number of Attempts:

Time to Complete:

Question Documentation:

Question:

Response:

Result: SAT _____ UNSAT _____

Examiner's Signature: _____ Date: _____

Initial Conditions: The plant is operating at 100 percent power. Power Range N41 is inoperable. AOP-001, Malfunction Of Rod Control And Indication System has been entered due to a misaligned control rod.

Initiating Cue: The USCO has directed you to perform a Manual QPTR utilizing OST-1039, Calculation Of Quadrant Power Tilt Ratio.

All prerequisites have been satisfied. The Power Range NIS readings are provided in the table below.

IF calculations are outside acceptable tolerances **THEN** evaluate Tech Specs.

For the purposes of the examination, there will be no independent verification of your work.

PRNIS Readings

PRNIS Channel	UPPER READING	LOWER READING
N41	INOPERABLE	INOPERABLE
N42	193.1	229.3
N43	217.6	237.1
N44	176.4	209.9

* All values were taken with the Range/Rate switch in 400 µA/Slow position.

HARRIS 2009 NRC SRO JPM A-2
Curve F-15-8 HANDOUT

Current and Voltage Setpoints Table
(100 % Power, 0 % Incore Axial Offset)

Channel #	Top Current (μA)	Bottom Current (μA)
N41	176.1	200.2
N42	192.5	223.6
N43	218.1	240.6
N44	176.1	212.8

Curve No.	F-15-8	Rev. No. 7
Originator		Date 9/23/2008
Supervisor		Date 9/23/08
Superintendent-Shift Operations		Date 9/23/08

REFERENCE

ADMIN JPM

SRO A-2

Progress Energy

C
CONTINUOUS
USE

HARRIS NUCLEAR PLANT

PLANT OPERATING MANUAL

VOLUME 3

PART 9

PROCEDURE TYPE: OPERATIONS SURVEILLANCE TEST

NUMBER: **OST-1039**

TITLE: **CALCULATION OF QUADRANT POWER TILT RATIO, WEEKLY INTERVAL (WITH ALARM OPERABLE) 12 HOUR INTERVAL (WITH ALARM INOPERABLE) MODE 1**

NOTE: This procedure has been screened per PLP-100 Criteria and determined to be CASE III. No additional management involvement is required.

Table of Contents

1.0 PURPOSE

In MODE 1, greater than 50% Rated Thermal Power:

1. This test is performed weekly, per Tech Spec 4.2.4.1.a, if the alarm is operable.

2. This test is performed every 12 hours, per Tech Spec 4.2.4.1.b, if the alarm is inoperable.

The Power Range Detector Currents will be recorded and compared with calculated full power normalized currents to determine the upper and lower quadrant power tilt ratios. The larger of these two ratios is the quadrant power tilt ratio referenced in technical specifications.

2.0 REFERENCES

2.1. Plant Operating Manual Procedures

1. OP-105
2. EST-911
3. EST-915
4. MST-I0044
5. MST-I0045
6. MST-I0046
7. MST-I0047

2.2. Technical Specifications

1. 3.2.4
2. 3.10.2

2.3. Final Safety Analysis Report

1. 4.4

3.0 PREREQUISITES

NOTE: Precaution and Limitation 4.0.1 has guidance if performing this OST with one Power Range Channel inoperable.

1. **VERIFY** instrumentation needed for the performance of this test is free of deficiencies that affect instrument indication. _____

2. **VERIFY** the most recent Curve F-x-8 is used in the performance of this procedure. (Reference 2.1.1 and 2.1.2)

   Curve F-x-8 Revision Number _____ _____

3. **OBTAIN** Unit SCO permission to perform this OST.

_____ _____
Signature Date

4.0 PRECAUTIONS AND LIMITATIONS

1. With one power range channel inoperable, this OST shall be performed using the remaining three detectors. In addition, if Reactor Power is greater than 75%, EST-915 must also be performed per Surveillance Requirement 4.2.4.2. (Reference 2.1.3)

2. If performing this OST to support NIS calibration (MST-I0044, I0045, I0046, and I0047), then new calculated currents on Curve F-x-8 are to be used per OP-105. (Reference 2.1.1)

3. There is usually a time lapse between the generation of the new curve values and the calibration of the power range NIs. Operations should approve the new curve with the QPTR alarm operable. The installed NI currents are outdated and will not be the same as the new values on the curve. This is conservative since the QPTR alarm will actuate when actual QPTR is below the setpoint. If the QPTR alarm actuates, the new curve values should be used in the calculation. These values reflect core conditions from the most recent flux map.

5.0 TOOLS AND EQUIPMENT

1. IBM PC or compatible

6.0 ACCEPTANCE CRITERIA

1. This OST will be completed satisfactorily if the Quadrant Power Tilt Ratio when measured at greater than 50% Rated Thermal Power is less than or equal to 1.02.

7.0 PROCEDURE

1. **IF** Quadrant Power Tilt Ratio Calculation Computer Program is used, **THEN PERFORM** the following:

   a. **MARK** Step 7.0.2 N/A. _____

   b. **MARK** Section 7.2 N/A. _____

   c. **PERFORM** Section 7.1. _____

2. **IF** manual calculation of the Quadrant Power Tilt Ratio is used, **THEN PERFORM** the following:

   a. **MARK** Section 7.1 N/A. _____

   b. **PERFORM** Section 7.2. _____

7.1. Computer Quadrant Power Tilt Ratio Calculation

NOTE: The detector current meters on each power range channel drawer are designated as left-upper, right-lower.

1. Prior to reading the value of detector current, **VERIFY** the Meter Range/Rate switch is in the 400 µA/SLOW position.

   - N-41 Upper _____
   - N-41 Lower _____
   - N-42 Upper _____
   - N-42 Lower _____
   - N-43 Upper _____
   - N-43 Lower _____
   - N-44 Upper _____
   - N-44 Lower _____

2. **RECORD** on Attachment 1 the upper and lower detector currents from all operable power range channels as read at the Nuclear Instrumentation Cabinet. _____

NOTE: If the STA's computer is not available, it is possible to use the floppy disc labeled "OST-1039 QPTR calculation Program Version 1.0". This will require attaching a floppy disc drive to the computer being used. The floppy disc write protect tab should be disabled prior to inserting into the A disk drive to allow updating the 100% Power Normalized currents.

3. From the STA's computer, **ACCESS** the OST-1039 program using the menu prompts. _____

4. **VERIFY** that the program version on the computer screen is version 1.0. _____

5. **WHEN** prompted,
   THEN ENTER the data from Attachment 1. _____

6. **IF** necessary,
   THEN CORRECT the 100% Power Normalized currents by comparing them to the updated currents on Curve F-x-8. _____

7.1 Computer Quadrant Power Tilt Ratio Calculation (continued)

NOTE: The normalized fraction should approximately equal reactor power level.

NOTE: The computer program prints out to LPT1. By default, LPT1 is not normally mapped, since most programs do not need it. This can be verified, and if necessarily changed, by going to Start -> Programs -> Accessories -> Local PRT. This screen also allows enabling LPT1 if necessary.

7. **PRINT** the results from the computer program. _____

8. **SIGN** the Data Input Line. _____

9. **PERFORM** Independent Verification of data input. _____

10. **SIGN** the Data Input Verification Line. _____

11. **RECORD** QPTR from the printed results.

    QPTR = _____ _____

12. **CHECK** QPTR is less than or equal to 1.02. _____

13. **ATTACH** the printed results to this procedure. _____

7.2. Manual Quadrant Power Tilt Ratio Calculation

NOTE: The detector current meters on each power range channel drawer are designated as left-upper, right-lower.

1. Prior to reading the value of detector current, **VERIFY** the Meter Range/Rate switch is in the 400 µA/SLOW position.

   - N-41 Upper _____
   - N-41 Lower _____
   - N-42 Upper _____
   - N-42 Lower _____
   - N-43 Upper _____
   - N-43 Lower _____
   - N-44 Upper _____
   - N-44 Lower _____

2. **RECORD** on Attachment 2, in column A, the upper and lower detector currents from all operable power range channels as read on the Nuclear Instrumentation Cabinet. _____

3. **RECORD** on Attachment 2, in column B, the 100% power normalized current for each channel from Curve F-x-8) _____

NOTE: When recording all fractions and ratios, record to four decimal places, dropping the fifth and subsequent decimal places.

4. **DIVIDE** values in column A by the respective normalized current in column B recording the result in column C as the Normalized Fraction. _____

5. **CALCULATE** the average value for the upper and the lower Normalized Fractions as follows:

   a. **ADD** the Normalized Fraction in each section of column C, recording the sum in the space provided. _____

   b. **DIVIDE** the sum obtained in Step 7.2.5.a by the number of operable NI channels, recording the result in column D of Attachment 2. _____

7.2 Manual Quadrant Power Tilt Ratio Calculation (continued)

6. Using the formula and values from Attachment 2, **CALCULATE** the Upper and Lower Ratios. _____

7. **PERFORM** independent verification of all calculations made on Attachment 2. _____

> **NOTE:** The upper ratio or the lower ratio, whichever is greater, is the quadrant power tilt ratio (QPTR).

8. **RECORD** QPTR:

   QPTR = _____ _____

9. **CHECK** QPTR is less than or equal to 1.02. _____

7.3. Test Completion

1. **IF** this test was performed due to an inoperable QPTR alarm, **THEN DOCUMENT** completion of PMID 22125 RQ 01. _____

2. **COMPLETE** applicable sections of Attachment 3, Certifications and Reviews. _____

3. **INFORM** the Unit SCO this test is completed. _____

8.0 DIAGRAMS/ATTACHMENTS

Attachment 1 - Computer Data Sheet
Attachment 2 - Manual Data Sheet
Attachment 3 - Certifications and Reviews

Attachment 1 - Computer Data Sheet
Sheet 1 of 1

UPPER DETECTOR	UPPER DETECTOR CURRENT
N-41	
N-42	
N-43	
N-44	

LOWER DETECTOR	LOWER DETECTOR CURRENT
N-41	
N- 42	
N-43	
N-44	

Attachment 2 - Manual Data Sheet
Sheet 1 of 1

UPPER DETECTOR	A UPPER DETECTOR CURRENT	B UPPER 100% POWER NORMALIZED CURRENT	C UPPER NORMALIZED FRACTION (NOTE 1)	D AVERAGE UPPER NORMALIZED FRACTION
N-41				
N-42				
N-43				
N-44				
		SUM		

Upper Ratio = $\frac{\text{Maximum Upper Normalized Fraction}}{\text{Average Upper Normalized Fraction}}$ = _____ = _____

LOWER DETECTOR	A LOWER DETECTOR CURRENT	B LOWER 100% POWER NORMALIZED CURRENT	C LOWER NORMALIZED FRACTION (NOTE 1)	D AVERAGE LOWER NORMALIZED FRACTION
N-41				
N-42				
N-43				
N-44				
		SUM		

Lower Ratio = $\frac{\text{Maximum Upper Normalized Fraction}}{\text{Average Upper Normalized Fraction}}$ = _____ = _____

NOTE 1: Normalized Fraction should approximately equal reactor power level.

Attachment 3 - Certification and Reviews

Sheet 1 of 1

This OST was performed as a: Periodic Surveillance Requirement: _____

Postmaintenance Operability Test: _____

Redundant Subsystem Test: _____

Plant Conditions: _____ MODE: _____

OST Completed By: _____ Date: _____

Time: _____

OST Performed By:

Initials	Name (Print)	Initials	Name (Print)

General Comments/Recommendation/Corrective Actions/Exceptions:

Pages Used: _____

OST Completed with NO EXCEPTIONS/EXCEPTIONS:

_____ Date: _____

Unit SCO

After receiving the final review signature, this OST becomes a QA RECORD and should be submitted to Document Services.

Revision Summary

General

Converted procedure to Word XP and formatted per PRO-NGGC-0201. Incorporated all outstanding PRRs.

Description of Changes

Page	Section	Change Description
All		Updated revision level. Restored cross referencing. Corrected formatting to comply with PRO-NGGC-0202 and AP-005. Separated Steps with multiple actions into individual steps (actual steps were unaffected)
2	TOC	Added Table of Contents.
3	2.3.1	Corrected reference. 4.4.2.10 did not exist, instead referenced FSAR Chapter 4.4
7	7.1.7	Added Note on how to enable LPT1 to the default printer, if needed.

Appendix C	Job Performance Measure Worksheet	Form ES-C-1

Facility:	Shearon Harris	Task No.:	34502H601
Task Title:	Determine TEDE While Working in a High Airborne Area	JPM No.:	2009a NRC JPM RO/SRO A3
K/A Reference:	2.3.4 3.2 / 3.7		

Examinee: _____ NRC Examiner: _____

Facility Evaluator: _____ Date: _____

Method of testing:

Simulated Performance: _____ Actual Performance: X

Classroom X Simulator _____ Plant _____

READ TO THE EXAMINEE

I will explain the initial conditions, which steps to simulate or discuss, and provide initiating cues. When you complete the task successfully, the objective for this Job Performance Measure will be satisfied.

Initial Conditions:

- The unit is being shut down for refueling and a planned crud burst is in progress.
- The RAB AO is being directed to enter an area to align several valves. He is the only AO available to perform this task.
- This individual was employed at North Anna earlier this same year. At North Anna he received a combined 3,486 mRem TEDE during routine and emergency repair work response.
- In the same calendar year while working at HNP, he has received another 349 mRem TEDE.
- The estimated dose rate in the area is 520 mRem/hr. An airborne contamination concern also exists.
- It is estimated that it will take approximately 20 minutes to complete the alignment if he uses a respirator. If he does **NOT** wear a respirator, the alignment will take only 10 minutes, but Radiation Protection projects that your internal exposure will be 8 DAC-hrs.

Initiating Cue:

1. Determine the resultant total effective dose equivalent for both with a respirator (1.a) and without a respirator (1.b).

2. Using the lowest dose determined in number 1, determine if the individual can perform the task without exceeding Progress Energy's Annual Administrative Dose Limit.

Show your calculations on the next page

Task Standard:	Determination made that **NOT** wearing a respirator will result in a lower TEDE and that the individual can perform the task without exceeding Progress Energy's Annual Administrative Dose Limit.
Required Materials:	None
General References:	DOS-NGGC-0004, NGGM-PM-0002, Radiation Control and Protection Manual
Handouts:	JPM Cue Sheet Pages 9 and 10
Time Critical Task:	No
Validation Time:	10 minutes

Start Time: _____.

NOTE: Steps in this JPM may be performed in any order.

Performance Step: 1 Determines internal exposure while wearing a respirator

Standard: Determines internal exposure to be ZERO while wearing a respirator

Comment:

✓ **Performance Step: 2** Determines external exposure while wearing a respirator

Standard: Determines external exposure to be 173.3 mRem TEDE while wearing a respirator

(520 mRem / hr x 20 min = 173.3 mRem)

(NOTE: Could round to 173 tolerance ± 2)

Comment:

Performance Step: 3 Determines TOTAL exposure while wearing a respirator

Standard: Determines total exposure to be 173.3 mRem while wearing a respirator
(0 mRem internal + 173.3 mRem external = 173.3 mRem total)

(NOTE: Could round to 173 tolerance ± 2)

Comment:

✓ **Performance Step: 4** Determines internal exposure while NOT wearing a respirator

Standard: Determines internal exposure to be 20 mRem while not wearing a respirator

(2.5 mRem / hr x 8 DAC-hr = 20 mRem)

(NO tolerance)

Comment:

✓ **Performance Step: 5** Determines external exposure while NOT wearing a respirator

Standard: Determines external exposure to be 86.7 mRem TEDE while not wearing a respirator

(520 mRem / hr x 10 min = 86.7 mRem)

(NOTE: Could round to 87 tolerance ±2)

Comment:

Performance Step: 6 Determines TOTAL exposure while NOT wearing a respirator

Standard: Determines total exposure to be 106.7 mRem while not wearing a respirator

(20 mRem internal + 86.7 mRem external = 106.7 mRem total)

(NOTE: Could round to 107 tolerance ±2)

Comment:

Performance Step: 7 Determines individual's total exposure for the year

Standard: Determines individual's total exposure for the year to be 3835 mRem

(3485 mRem + 349 mRem = 3835 mRem)

Comment:

✓ **Performance Step: 8** Determines individual's total exposure for the year if the work is allowed without a respirator

Standard: Determines individual's total exposure for the year if the work is allowed to be 3941.7 mRem
(3835 mRem + 106.7 = 3941.7)

(NOTE: Could round to 3942 tolerance ±2)

Note: If calculated wearing a respirator the total exposure for the year will be 4008.3 mRem and work cannot be performed. The directions were to use the lowest dose and this represents UNSAT performance.

(NOTE: Could round to 4008 tolerance ±2)

Comment:

✓ **Performance Step: 8** Determines if the individual can perform the work without exceeding Progress Energy's Annual Administrative Dose Limit of 4000 mRem

Standard: Determines the individual **CAN** perform the work not wearing a respirator without exceeding Progress Energy's Annual Administrative Dose Limit of 4000 mRem
(3835 mRem + 106.7 = 3941.7)

Comment:

Stop Time: _____

Terminating Cue: **When all calculations have been completed and the determination that work can proceed, this JPM is complete.**

KEY

1.a Calculation for resultant total effective dose equivalent with a respirator.

Determines internal exposure to be ZERO while wearing a respirator

Determines external exposure to be 173.3 mRem TEDE while wearing a respirator
(520 mRem / hr x 20 min = 173.3 mRem)
(NOTE: Could round to 173 tolerance ± 2)

Determines TOTAL exposure while wearing a respirator
(0 mRem internal + 173.3 mRem external = 173.3 mRem total)
(NOTE: Could round to 173 tolerance ± 2)

Determines individual's total exposure for the year to be 3835 mRem
(3485 mRem + 349 mRem = 3835 mRem)

Determines individual's total exposure for the year if the work is allowed to be 4008.3 mRem
(3835 mRem + 173.3 = 4008.3)
(NOTE: Could round to 4008 tolerance ±2)

Note: If calculated wearing a respirator the total exposure for the year will be 4008.3 mRem and work **CANNOT** be performed. The directions were to use the lowest dose and this represents UNSAT performance.

1.b Calculation for resultant total effective dose equivalent without a respirator.

Determines internal exposure to be 20 mRem while **not** wearing a respirator
(2.5 mRem / hr x 8 DAC-hr = 20 mRem)
(NO tolerance)

Determines external exposure to be 86.7 mRem TEDE while not wearing a respirator
(520 mRem / hr x 10 min = 86.7 mRem)
(NOTE: Could round to 87 tolerance ±2)

Determines total exposure to be 106.7 mRem while not wearing a respirator
(20 mRem internal + 86.7 mRem external = 106.7 mRem total)
(NOTE: Could round to 107 tolerance ±2)

Determines individual's total exposure for the year if the work is allowed to be 3941.7 mRem
(3835 mRem + 106.7 = 3941.7)
(NOTE: Could round to 3942 tolerance ±2)

The individual **CAN** perform the task without exceeding Progress Energy's Annual Admin Dose Limit if the task is performed **WITHOUT** a respirator.

KEY

2. Using the lowest dose determined from the above calculations (1a or 1b):

CAN the individual perform the task without exceeding Progress Energy's Annual Administrative Dose Limit?

YES (without a respirator)

Job Performance Measure No.: 2009a NRC JPM RO/SRO A3
Determine TEDE While Working in a High Airborne Area

Examinee's Name:

Date Performed:

Facility Evaluator:

Number of Attempts:

Time to Complete:

Question Documentation:

Question:

Response:

Result: SAT _____ UNSAT _____

Examiner's Signature: _____ Date: _____

INITIAL CONDITIONS:

The unit is being shut down for refueling and a planned crud burst is in progress.

The RAB AO is being directed to enter an area to align several valves. He is the only AO available to perform this task.

This individual was employed at North Anna earlier this same year. At North Anna he received a combined 3,486 mRem TEDE during routine and emergency repair work response.

In the same calendar year while working at HNP, he has received another 349 mRem TEDE.

The estimated dose rate in the area is 520 mRem/hr. An airborne contamination concern also exists.

It is estimated that it will take approximately 20 minutes to complete the alignment if he uses a respirator. If he does **NOT** wear a respirator, the alignment will take only 10 minutes, but Radiation Protection projects that your internal exposure will be 8 DAC-hrs.

INITIATING CUE:

1. Determine the resultant total effective dose equivalent for both with a respirator (1.a) and without a respirator (1.b)
2. Using the lowest dose determined in number 1, determine if the individual can perform the task without exceeding Progress Energy's Annual Administrative Dose Limit.

Show your calculations on the next page

1.a Calculation for resultant total effective dose equivalent with a respirator.

1.b Calculation for resultant total effective dose equivalent without a respirator.

2. Using the lowest dose determined from the above calculations (1a or 1b):

CAN the individual perform the task without exceeding Progress Energy's Annual Administrative Dose Limit?

Appendix C	Job Performance Measure Worksheet	Form ES-C-1

Facility: Shearon Harris Task No.: 345001H602

Task Title: CLASSIFY AN EVENT JPM No.: 2009a NRC JPM SRO A4

K/A Reference: 2.4.41 2.3 / 4.1

Examinee: _____ NRC Examiner: _____

Facility Evaluator: _____ Date: _____

Method of testing:

Simulated Performance: _____ Actual Performance: X

Classroom X Simulator _____ Plant _____

READ TO THE EXAMINEE

I will explain the initial conditions, which steps to simulate or discuss, and provide initiating cues. When you complete the task successfully, the objective for this Job Performance Measure will be satisfied.

Initial Conditions: The operating crew was performing a rapid shutdown of the plant when they were forced to initiate a manual reactor trip.

Initiating Cue: Using the attached information sheet and the EAL Flow Path, classify the event. Mark the EAL Flow Path appropriately.

THIS IS A TIME CRITICAL JPM.

Task Standard: Event classified as an Site Area Emergency (2-1-3)

Required Materials: None

General References: PEP-110 EAL Flowpath (EP-EAL is an allowed reference)

Handouts: JPM Cue Sheets Pages 4 and 5
PEP-110 EAL Flowpath (EP-EAL is an allowed reference)

Time Critical Task: **Yes**

Validation Time: 15 minutes

Evaluator Note: **Start Time for this JPM begins when the individual has been briefed and accepted the task**

Start Time: _____.

Performance Step: 1 OBTAIN EAL FLOW PATH.

Standard: Obtains EAL Flow Path. (EP-EAL is an allowed reference)

Comment:

✓ **Performance Step: 2** CLASSIFY EVENT

Standard: Identifies an Site Area Emergency (2-1-3), Two Fission Product Barriers BREACHED OR JEOPARDIZED. The Fuel is BREACHED due to an increase >1.0E5 CPM in 30 minutes. CNMT is BREACHED due to primary to secondary leakage in 'A' SG >10 GPM and an 'A' SG safety valve not shut

Evaluator Cue: **END OF JPM**

Stop Time: _____.

Terminating Cue: Event classification stated to evaluator.

VERIFICATION OF COMPLETION

Job Performance Measure No.: 2009a NRC JPM RO/SRO A1-1

CLASSIFY AN EVENT

Examinee's Name:

Date Performed:

Facility Evaluator:

Number of Attempts:

Time to Complete:

Question Documentation:

Question:

Response:

Result: SAT _____ UNSAT _____

Examiner's Signature: _____ Date: _____

Initial Conditions: The operating crew was performing a rapid shutdown of the plant when they were forced to initiate a manual reactor trip.

Initiating Cue: Using the attached information sheet and the EAL Flow Path, classify the event. Mark the EAL Flow Path appropriately.

THIS IS A TIME CRITICAL JPM

CLASSIFICATION INFORMATION SHEET

The plant was operating at 100% power when the following sequence of events occurred:

At 1029, A SGTL was diagnosed on 'A' SG at 12.0 GPM

At 1038, the operating crew began a reactor shutdown per AOP-038, Rapid Downpower

At 1039, the GFFD was reading 1.5E1 CPM when the shutdown was commenced

At 1101, a manual reactor trip was initiated due to high vibration on "A" RCP

At 1103, the following indications exist immediately after the reactor trip:

- One Safety Valve on 'A' SG opened and did not reseat
- All MSIVs were manually closed
- The GFFD is reading 1.2E5 CPM

EAL Classification: _____