

Byron June 2000 Examination

Proposed Operating Test

Byron June 2000 Examination

NRC-Developed Admin JPMs

As-Submitted to Licensee

Facility: BYRON

Task No: _____

Task Title: SDM CALCULATIONJob Performance Measure No: A. 1.1K/A Reference: 1A4.11 3.5/4.1

Examinee: _____

NRC Examiner: _____

Date: _____

Method of testing:

Simulated Performance _____X_____

Actual Performance _____

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: You are an extra person on shift
 Unit 1 is shutdown, in mode 3
 RCS AVG TEMP 540F, core avg burnup 397.4 EFPH
 RCS Boron Conc 1046 ppm
 All controls rods are operable,

Task Standard: SDM CALCULATION

Required Materials: COLR

1BOSR 1.1.1-1
1BGP 100-7T1
BCB-1
1BOSR NR-1

General References: COLR

1BOSR 1.1.1-1
1BGP 100-7T1
BCB-1
1BOSR NR

Initiating Cue: UNIT 1 SRO DIRECTS YOU TO PERFORM A SDM SURVEILLANCE IAW
1BOSR 1.1.1-1.

Time Critical Task: NO

Validation Time:

PERFORMANCE INFORMATION

START TIME: _____

(Denote critical steps with a **BOLD ***)

Performance step: 1

ENTER 1BOSR 1.1.1-1Standard: LOCATE AND OPEN 1BOSR 1.1.1-1Comment: _____

Performance step: 2

*** ENTER PRESENT CONDITIONS FROM TURNOVER AND COLR ***NOTE: SEE ATTACHED SDM SHEET FOR CORRECT ANSWERSStandard: ***PRESENT CONDITIONS ENTERED ***CUE: CORE AVERAGE BURNUP 397.4, DATA WILL BE GIVEN FROM 1BGP 100-7T1Comment: _____

Performance step: 3

POST RX TRIP ASSESSMENTStandard: POST RX TRIP ASSESSMENT ENTEREDCUE: THIS SURVEILLANCE INSTRUCTION IS NOT THE FIRST SDM PERFORMANCE IN
MODE 3Comment: _____

Performance step: 4

BOUNDING ASSUMPTIONS

Standard: BOUNDING ASSUMPTIONS ENTERED

CUE: LIMITS TEMP 520 TO 557F, TIME IS 10 HOURS

NOTE: SEE ATTACHED SDM CALCULATIONS FOR FURTHER DATA AND ANSWERS

Comment: -----

Performance step: 5

* ENTER MINIMUM BORON CONCENTRATION *

Standard: * MINIMUM BORON CONCENTRATION ENTERED *

Comment: -----

Performance step: 6

* ENTER REACTIVITY WORTH OF BORON *

Standard: * REACTIVITY WORTH OF BORON ENTERED *

Comment: -----

Performance step: 7

ENTER REACTIVITY WORTH OF UNTRIPPABLE RODS

Standard: REACTIVITY WORTH OF UNTRIPPABLE RODS ENTERED

Comment: -----

Performance step: 8

*** ENTER REACTIVITY CHANGE DUE TO XENON ***

Standard: *** REACTIVITY CHANGE DUE TO XENON ENTERED ***

CUE: WHEN ASKED XENON EQUIVALENT POWER IS 99.9%

Comment: -----

Performance step: 9

ENTER REACTIVITY WORTH OF SAMARIUM

Standard: REACTIVITY CHANGE DUE TO SAMARIUM ENTERED

Comment: -----

Performance step: 10

*** ENTER CORRECTIONS FOR BORON EFFECTS ON XENON AND SAMARIUM ***

Standard: ***CORRECTIONS FOR BORON EFFECTS ON XENON AND SAMARIUM ENTERED***

Comment: -----

Performance step: 11

*** ENTER TOTAL SDM ***

Standard: *** TOTAL SDM ENTERED ***

Comment: -----

TERMINATING CUE: SRO I HAVE COMPLETED 1BOSR 1.1.1-1

TIME STOP _____

CONTINUOUS USE

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Revision 3

UNIT ONE SHUTDOWN MARGIN SURVEILLANCE

A. STATEMENT OF APPLICABILITY:

1. This procedure applies to the verification of Shutdown Margin in Mode 2 with $K_{eff} < 1.0$ and Modes 3, 4, and 5.
 - a. Daily when the Present RCS Boron Concentration is greater than the Minimum Required Boron Concentration.
 - b. Shiftly when the Present RCS Boron Concentration is less than or equal to the Minimum Required Boron Concentration.
 - c. More frequently, as appropriate, when the bounding assumptions are due to expire or be exceeded.
2. The procedure applies to the verification of shutdown margin during the following infrequent conditions:
 - a. Within one hour after detection of one or more inoperable shutdown or control rod(s) in Modes 1 and 2. (LCO 3.1.4)
 - b. Within one hour after detection of one shutdown or control rod not within alignment limits and at least once per 12 hours thereafter while the rod is not within alignment limits. (LCO 3.1.4)
 - c. Within one hour after detection of more than one shutdown or control rod not within alignment limits. (LCO 3.1.4)
 - d. Within one hour after detection of one or more shutdown banks not within the insertion limits specified in the COLR in Mode 1 and 2 with any control bank not fully inserted. (LCO 3.1.5)
 - e. Within one hour after detection of one or more control banks not within the insertion, sequence or overlap limits specified in the COLR in Modes 1 and 2 with $k_{eff} \geq 1.0$. (LCO 3.1.6)
 - f. Within one hour after detection of two trains of the Boron Dilution Protection System being inoperable in Modes 3, 4, and 5. (LCO 3.3.9)

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B. REFERENCES:

1. Tech Spec Surveillance Requirements:
 - a. LCO 3.1.1
 - b. LCO 3.1.4
 - c. LCO 3.1.5
 - d. LCO 3.1.6
 - e. LCO 3.1.8
 - f. LCO 3.3.9
 - g. SR 3.1.1.1
 - h. SR 3.1.8.4
2. TRM:
 - a. LCO 3.1.h
3. UFSAR:
 - a. Section 4.3.1.5, Shutdown Margin.
 - b. Section 15.1, Increase in Heat Removal by the Secondary System.
 - c. Section 15.4, Reactivity and Power Distribution Anomalies.
4. Station Procedures:
 - a. BCB-1, Byron Curve Book - Unit One.
 - b. 1BGP 100-7T1, Reference Reactivity Data Worksheet.
 - c. 1BOSR NR-1, Unit One Power History Hourly Surveillance.
 - d. 1BOL 1.1, Shutdown Margin (SDM).

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B.4. continued

- e. 1BOL 1.h, Shutdown Margin (SDM) - Mode 1 and Mode 2 with $K_{eff} \geq 1.0$.
- 5. Byron On Site Review 92-089, Review of ENC-QE-40.1 for BDPS Operability.
- 6. Core Operating Limits Report (COLR).
- 7. Station Commitments:
 - a. 454-402-90-01702-01
 - b. 454-251-88-15100
- 8. NDIT No. NFM9800254, Byron and Braidwood Shutdown Margin within four (4) hours after Reactor Trip (or Shutdown).

C. PREREQUISITES:

- 1. Receive permission from the Shift Manager or designated SRO licensed assistant prior to performing the surveillance by having the Data Package Cover Sheet signed and dated.
- 2. Reference Reactivity Data (RRD) Worksheet, 1BGP 100-7T1, is available. If the unit is in Mode 1 or 2, the RRD shall be completed assuming the reactor trips from its present condition.

D. PRECAUTIONS:

- 1. None.

E. LIMITATIONS AND ACTIONS:

- 1. As stated in Technical Specification LCO 3.1.1 and TRM LCO 3.1.h.
- 2. In the event the Acceptance Criteria is not met during the performance of this surveillance, IMMEDIATELY NOTIFY the Shift Manager or designated SRO licensed assistant to initiate LCOAR procedure 1BOL 1.1, Shutdown Margin (SDM), or 1BOL 1.h, Shutdown Margin (SDM) - Mode 1 and Mode 2 with $K_{eff} \geq 1.0$, as applicable.

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E. continued

3. The RCS Average Temperature shall be determined using the following:
 - a. If in Mode 1 or 2, use 557°F.
 - b. If any RCP's are running:
 - 1). At $\geq 530^{\circ}\text{F}$, loop average temperature on unisolated loops with RCP(s) running.
 - 2). At $< 530^{\circ}\text{F}$, WR T_{hot} and T_{cold} temperature on unisolated loops with RCP(s) running.
 - c. If on Natural Circulation:
 - 1). WR T_{hot} and T_{cold} temperature on unisolated loops.
 - d. If RH is providing Shutdown Cooling, and if no RCP's are running:
 - 1). RH pump discharge temperature (to represent hot leg) and RH HX return temperature (to represent cold leg) of the RH train providing shutdown cooling for core average temperature.
4. If RH is providing Shutdown Cooling, and if no RCP's are running, temporarily stabilize RCS temperature during heatup or cooldown to obtain a more accurate core average temperature.

F. MAIN BODY:

0. Method of Calculation

This procedure calculates the available shutdown margin by comparing the existing or anticipated core conditions to a reference condition based on BCB-1, Table 1-1. This table lists the boron concentration required to provide the shutdown margin specified in the COLR at various core burnups and RCS temperatures. The table was derived by using the following assumptions:

- a. No Xenon.

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F.0. continued

- b. Equilibrium Samarium (i.e. Time = 0).
- c. All rods at bottom with the exception of the highest worth rod, which is assumed to be stuck out.
- d. Boron concentrations listed in BCB-1, Table 1-1, include 100 ppm factor of safety.

Deviations from each of the base assumptions and from the reference boron value given in the table are calculated in the procedure, and the sum of these effects is added to the required SDM to arrive at the actual shutdown margin available.

Note that in the event that a control rod is known to be untrippable, this is adjusted for in addition to the rod assumed to be stuck in the table.

NOTE

Use Reference Reactivity Data (RRD) Worksheet, 1BGP 100-7T1, for reactivity information prior to the shutdown.

1. PRESENT CONDITIONS

- a. RECORD Time and Date.

____/____
Time Date

- b. RECORD the Core Average Burnup in EFPH (RRD, step F.2.b).

____ EFPH

*

NOTE

The minimum temperature that can be used when performing a shutdown margin calculation is 60°F. Notify the Shift Manager and a Qualified Nuclear Engineer if the RCS temperature is less than 60°F.

*, 7.a

- c. RECORD the RCS Average Temperature (if in Mode 1 or 2, use 557°F).

____ °F

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F.1. continued

NOTE

If a trend of the RCS Boron Concentration indicates an unexpected decrease, then determine the cause of the trend and either increase the RCS boron or request additional boron samples.

If boration/dilution processes have occurred since the most recent sample, consider requesting a new boron concentration sample to determine present boron concentration.

- d. **RECORD** the Present RCS Boron Concentration (from most recent sample of the RCS or RH Train if it is providing shutdown cooling). Include the sample time and date.

____/____ ____ ppm
Time Date

NOTE

A control rod is considered to be inoperable for purposes of Shutdown Margin determination if it is untrippable or fails to fully insert upon a reactor trip.

- e. **RECORD** the Total Number of Inoperable Control Rods. _____

NOTE

If one or more control rod(s) is (are) inoperable or not within alignment limits, then perform this surveillance within one hour and at least once per 12 hours thereafter.

If the inoperable control rod(s) is (are) untrippable, then this surveillance must be performed in its entirety.

- f. **RECORD** the required SDM from the COLR.

(-) _____ pcm

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F. continued

NOTE

$1\% \Delta k/k = 1000 \text{ pcm} = 0.01 \Delta k/k$

2. POST REACTOR TRIP ASSESSMENT

NOTE

If this surveillance is being performed immediately after entry into Mode 3 via the opening of the reactor trip breakers AND there are no inoperable control rods AND all control rods are within their applicable alignment limits (alignment, insertion, sequence, and overlap), then this step (F.2) can be used to verify adequate SDM for the first 4 hours after the reactor shutdown. This assumes that Core Average Temperature remains at nominal 557°F and no dilution has occurred. Should a dilution or a cooldown be desired to be performed, the balance of this procedure, (F.3 to the end), shall be performed prior to initiating those actions.

- a. Is this the first performance of this surveillance following Mode 3 entry via opening of the reactor trip breakers?

Yes -----> Continue with step F.2.b.
☒ No -----> Go to Step F.3.

- b. Are all control rods operable? (LCO 3.1.4)

Yes -----> Continue with step F.2.c.
No -----> Go to Step F.3.

- c. Were all control rods within their alignment (LCO 3.1.4), insertion (LCOs 3.1.5 and 3.1.6), sequence (LCO 3.1.6), and overlap (LCO 3.1.6) limits?

Yes -----> Continue with step F.2.d.
No -----> Go to Step F.3.

- d. Has the Core Average Temperature remained at nominal 557°F?

Yes -----> Continue with step F.2.e.
No -----> Go to Step F.3.

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F.2. continued

- e. Has the RCS boron concentration NOT been diluted since the reactor trip breakers were opened?

Yes -----> Continue with step F.2.f.

No -----> Go to Step F.3.

- f. **RECORD** the time and date at which the reactor trip breakers were opened.

_____/_____
Time Date

- g. Add 4 hours to the time and date recorded in step F.2.f.

_____/_____
Time Date

- ¢ h. Shutdown Margin is acceptable until the time recorded in step F.2.g as long as the conditions listed in step F.2 are maintained. The performance of this step satisfies the performance of verification of adequate Shutdown Margin pursuant to LCO 3.3.9, Required Action D.2. The balance of this procedure shall be performed prior to the time and date recorded in step F.2.g or prior to initiating a plant cooldown or RCS dilution.

NSO Date SRO Date ¢

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F. continued

3. BOUNDING ASSUMPTIONS

NOTE

The Shutdown Margin verification is inherently dependent on the assumptions made for Core Average Temperature and time after shutdown. These bounding assumptions provide validity for the verification only as long as they are satisfied. For this reason, this procedure shall be reperformed if these bounding assumptions are either due to expire or are to be exceeded.

These assumptions should be made broad so as to bound the normal time period for performance (Step A.1) so that this procedure need not be repeated unnecessarily. (i.e. if a temperature range is chosen too narrow, another performance of this procedure would be required prior to cooling down below the bottom of the temperature range.) These assumptions, however, should also be specific enough to allow operational flexibility with regards to plant cooldowns. (i.e. if a timeframe of 4 to 10 hours after a reactor trip were chosen to take credit for Xenon buildup, another SDM would be required to be performed by 10 hours after the trip.) A Qualified Nuclear Engineer may be requested to provide guidance of making these assumptions.

The actual conditions recorded in step F.1 shall lie within the bounding values recorded in step F.3.

- a. **DETERMINE** and **RECORD** the bounding Core Average Temperature for this verification.

_____ °F to _____ °F

- b. **RECORD** the most Limiting Core Average Temperature within the above temperature range. This is the temperature from BCB-1, Table 1-1, with the largest minimum required boron concentration at the current core burnup.

_____ °F

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F.3. continued

- c. **DETERMINE** the bounding Time and Date for this verification.

____/____ to ____/____

NOTE

When obtaining values from the Byron Curve Book, either interpolation may be performed between the various parameters or a bounding value may be obtained. Each individual step will include guidance on what constitutes a bounding value.

4. **MINIMUM REQUIRED BORON CONCENTRATION**

NOTE

The minimum required boron concentration may be obtained from either BCB-1, Table 1-1, directly from a QNE, or from a QNE signed document written for this specific application. For the latter case, the minimum required boron concentration may be determined from a curve or table as a function of time, RCS temperature, or both. Independent verification is required for determining the minimum required boron concentration from the QNE supplied document to ensure the value is bounded by the assumptions recorded in step F.3.

- a. **OBTAIN** the Minimum Required Boron Concentration from either BCB-1, Table 1-1 (bounding value would be the largest number), a QNE, or a QNE supplied document, as appropriate.

- o BCB-1, Table 1-1, at the following _____ ppm
statepoints (record value used from
Table):
 - Burnup (F.1.b) _____ EFPH
 - Core Average Temperature (F.3.b) _____ °F
- o _____ _____ ppm
Qualified Nuclear Engineer
- o QNE supplied document _____ ppm

_____ NSO	_____ Date	_____ NSO or SRO	_____ Date
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F.4. continued

- b. Is the Present RCS Boron Concentration (F.1.d) $\geq$ Minimum Required Boron Concentration (F.4.a)?
- Yes -----> Continue with step F.4.c.
No -----> Go to Step F.5.
- c. Are all control rods operable? (LCO 3.1.4)
- Yes -----> Continue with step F.4.d.
No -----> Go to Step F.5.
- ¢ d. The SDM requirement is satisfied and this surveillance may be performed on a daily basis, provided the bounding assumption is step F.3 remain satisfied. Mark the remainder of this procedure N/A.

_____ NSO	_____ Date	_____ SRO	_____ Date ¢
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5. REACTIVITY WORTH OF BORON

- a. **CALCULATE** the reactivity difference between the current boron concentration and the concentration specified in Table 1-1.

- 1). **RECORD** the Integral Boron Worth from BCB-1, Table 1-5 at the limiting core average temperature (F.3.b) for the time period specified in F.3.c and current boron concentration (F.1.d). (A bounding value would be the least negative number.)

_____ Core Tavg (F.3.b)	°F	_____ C _b from (F.1.d) or bounding C _B used in Table 1-5	ppm	(-) _____	pcm
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F.5.a. continued

- 2). **RECORD** the Integral Boron Worth from BCB-1, Table 1-5 at the limiting core average temperature (F.3.b) and minimum required boron concentration from Table 1-1 (F.4.a). (A bounding value would be the most negative number.)

_____ °F	_____ ppm	_____ (-) pcm
Core Tavg (F.3.b)	C _b from (F.4.a) or bounding C _B used in Table 1-5	

- 3). **SUBTRACT** the result of step F.5.a.2) from step F.5.a.1).

_____ (+) pcm

- b. **CALCULATE** the net worth of boron by **ADDING** the result of step F.5.a.3) to the required SDM (F.1.f).

_____ (+) pcm	+	_____ (-) pcm	=	_____ pcm
(F.5.a.3))		(F.1.f)		

6. REACTIVITY WORTH OF UNTRIPPABLE RODS

- a. **RECORD** the Total Number of Untrippable Control Rods from step F.1.e.

_____ Total Rods

- b. **CORRECT** for untrippable control rods by **MULTIPLYING** the Total Number of Stuck Rods (F.6.a) by the Predicted Worth of the Most Reactive Rod from BCB-1, Table 1-6.

_____ Total Rods	x	_____ pcm/rod	=	_____ (+) pcm
(F.6.a)		Predicted Worth		

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F. continued

7. REACTIVITY CHANGE DUE TO XENON

- a. RECORD the Xenon Equivalent Power from RRD, step F.2.d.

_____ % Xe Pwr

- b. RECORD the Shutdown Time and Date from RRD, step F.2.a.

S/D Time _____ S/D Date _____

- c. DETERMINE the Xenon Worth using the Xe Equivalent Power (F.7.a) and "Time After Shutdown". From BCB-1, Figure 8C, select the time within the "bounding time" from step F.3.c that corresponds to the least negative (most positive) amount of reactivity. RECORD the respective Xe Worth and RECORD the associated "Time after Shutdown". Choosing the least negative (most positive) Xe Worth over the shift will yield a bounding SDM calculation.

Number of Hours Shutdown _____ hrs $\frac{(-)}{\text{Xe Worth}}$ pcm

8. REACTIVITY WORTH OF SAMARIUM

NOTE

For accumulated burnup less than 600 EFPH, make no adjustments for Samarium. Mark steps F.8.a and F.8.b N/A.

- a. RECORD the Samarium equivalent power from the RRD step F.2.c.

_____ % Sm Pwr

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F.8. continued

- b. **CALCULATE** the worth of Samarium from BCB-1, Table 1-4 by determining the Sm at the equivalent power from step 1 above, with the number of hours shutdown based on the present time and **SUBTRACTING** the Sm worth at time of shutdown (t=0). (A bounding value would be 0 pcm for Sm Worth. If zero is entered, mark other blanks N/A.)

$$\begin{array}{rcl} \text{_____ pcm} & - & \text{_____} \\ \text{Sm Worth at} & & \text{Sm Worth at} \\ \text{present time} & & \text{S/D (time = 0)} \\ \text{for \% Sm Pwr} & & \text{for \% Sm Pwr} \\ & & \text{(F.8.a)} \end{array} = \frac{(-)}{\text{Sm Worth}} \text{ pcm}$$

9. CORRECTION FOR BORON EFFECTS ON XENON AND SAMARIUM WORTHS

- a. From step F.5.a.1) **RECORD** the integral worth of boron.

$$\text{_____} \frac{(-)}{\text{_____}} \text{ pcm}$$

- b. From BCB-1, Figure 8b **DETERMINE** the correction factor at the integral boron worth recorded in F.9.a.

- c. **ADD** the Xenon worth from Step F.7.c and the Samarium worth from step F.8.b.

$$\begin{array}{rcl} \frac{(-)}{\text{(F.7.c)}} \text{ pcm} & + & \frac{(-)}{\text{(F.8.b)}} \text{ pcm} \\ & = & \frac{(-)}{\text{_____}} \text{ pcm} \end{array}$$

- d. **MULTIPLY** the sum of the fission product poison worths (step F.9.c) by the correction factor (F.9.b). This is the net value of fission product adjusted for competition effects of boron.

$$\begin{array}{rcl} \frac{(-)}{\text{(F.9.c)}} \text{ pcm} & \times & \frac{(-)}{\text{(F.9.b)}} \text{ pcm} \\ & = & \frac{(-)}{\text{_____}} \text{ pcm} \end{array}$$

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F. continued

10. TOTAL SHUTDOWN MARGIN

a. **CALCULATE** the Total Shutdown Margin, in "pcm", by adding:

BORON WORTH (step F.5.b)	_____	pcm
+ UNTRIPPABLE CONTROL ROD WORTH (Step F.6.b)		
	(+) _____	pcm
+ FISSION PRODUCT WORTH (step F.9.d)		
	(-) _____	pcm
= TOTAL SHUTDOWN MARGIN	_____	pcm

b. **RECORD** the present Operating Mode (1-5). Mode _____

NOTE

For Modes 1-5, the Total Shutdown Margin (F.8.a) must be equal to or more Negative than the Shutdown Margin specified in the COLR (F.1.f).

¢ c. **ANSWER** whether the Acceptance Criteria is satisfied or not and **INITIAL**. (YES or NO)

_____ ¢

NSO

Date

SRO

Date

If the Acceptance Criteria is not satisfied, **IMMEDIATELY** notify the Shift Manager and **INITIATE** LCOAR 1BOL 1.1, Shutdown Margin (SDM), or 1BOL 1.h, Shutdown Margin (SDM) - Mode 1 and Mode 2 with $K_{eff} \geq 1.0$.

If the Acceptance Criteria is satisfied, this surveillance should be performed each shift provided the bounding assumptions in step F.3 remain satisfied.

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G. ACCEPTANCE CRITERIA:

1. For Modes 1-5, SDM shall be within the limits of the COLR (SR 3.1.1.1). This is verified by one of the following methods:
 - a. For the first 4 hours following a reactor trip by having the following conditions met (F.2.h):
 - 1). All RCCAs operable.
 - 2). All RCCAs within alignment, insertion, sequence, and overlap limits prior to trip.
 - 3). RCS T_{ave} at nominal 557°F.
 - 4). No RCS dilutions since reactor trip.

OR

- b. At any time when the Present RCS Boron Concentration is greater than or equal to the Minimum Required Boron Concentration with no untrippable control rods (F.4.d).

OR

- c. At any time when the Total Shutdown Margin (F.10.a) is equal to or more negative than the SDM specified in the COLR (F.1.f).

(Final)

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UNIT ONE SHUTDOWN MARGIN SURVEILLANCE

A. STATEMENT OF APPLICABILITY:

1. This procedure applies to the verification of Shutdown Margin in Mode 2 with $K_{eff} < 1.0$ and Modes 3, 4, and 5.
 - a. Daily when the Present RCS Boron Concentration is greater than the Minimum Required Boron Concentration.
 - b. Shiftly when the Present RCS Boron Concentration is less than or equal to the Minimum Required Boron Concentration.
 - c. More frequently, as appropriate, when the bounding assumptions are due to expire or be exceeded.
2. The procedure applies to the verification of shutdown margin during the following infrequent conditions:
 - a. Within one hour after detection of one or more inoperable shutdown or control rod(s) in Modes 1 and 2. (LCO 3.1.4)
 - b. Within one hour after detection of one shutdown or control rod not within alignment limits and at least once per 12 hours thereafter while the rod is not within alignment limits. (LCO 3.1.4)
 - c. Within one hour after detection of more than one shutdown or control rod not within alignment limits. (LCO 3.1.4)
 - d. Within one hour after detection of one or more shutdown banks not within the insertion limits specified in the COLR in Mode 1 and 2 with any control bank not fully inserted. (LCO 3.1.5)
 - e. Within one hour after detection of one or more control banks not within the insertion, sequence or overlap limits specified in the COLR in Modes 1 and 2 with $k_{eff} \geq 1.0$. (LCO 3.1.6)
 - f. Within one hour after detection of two trains of the Boron Dilution Protection System being inoperable in Modes 3, 4, and 5. (LCO 3.3.9)

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B. REFERENCES:

1. Tech Spec Surveillance Requirements:
 - a. LCO 3.1.1
 - b. LCO 3.1.4
 - c. LCO 3.1.5
 - d. LCO 3.1.6
 - e. LCO 3.1.8
 - f. LCO 3.3.9
 - g. SR 3.1.1.1
 - h. SR 3.1.8.4
2. TRM:
 - a. LCO 3.1.h
3. UFSAR:
 - a. Section 4.3.1.5, Shutdown Margin.
 - b. Section 15.1, Increase in Heat Removal by the Secondary System.
 - c. Section 15.4, Reactivity and Power Distribution Anomalies.
4. Station Procedures:
 - a. BCB-1, Byron Curve Book - Unit One.
 - b. 1BGP 100-7T1, Reference Reactivity Data Worksheet.
 - c. 1BOSR NR-1, Unit One Power History Hourly Surveillance.
 - d. 1BOL 1.1, Shutdown Margin (SDM).

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B.4. continued

- e. 1BOL 1.h, Shutdown Margin (SDM) - Mode 1 and Mode 2 with $K_{eff} \geq 1.0$.
- 5. Byron On Site Review 92-089, Review of ENC-QE-40.1 for BDPS Operability.
- 6. Core Operating Limits Report (COLR).
- 7. Station Commitments:
 - a. 454-402-90-01702-01
 - b. 454-251-88-15100
- 8. NDIT No. NFM9800254, Byron and Braidwood Shutdown Margin within four (4) hours after Reactor Trip (or Shutdown).

C. PREREQUISITES:

- 1. Receive permission from the Shift Manager or designated SRO licensed assistant prior to performing the surveillance by having the Data Package Cover Sheet signed and dated.
- 2. Reference Reactivity Data (RRD) Worksheet, 1BGP 100-7T1, is available. If the unit is in Mode 1 or 2, the RRD shall be completed assuming the reactor trips from its present condition.

D. PRECAUTIONS:

- 1. None.

E. LIMITATIONS AND ACTIONS:

- 1. As stated in Technical Specification LCO 3.1.1 and TRM LCO 3.1.h.
- 2. In the event the Acceptance Criteria is not met during the performance of this surveillance, IMMEDIATELY NOTIFY the Shift Manager or designated SRO licensed assistant to initiate LCOAR procedure 1BOL 1.1, Shutdown Margin (SDM), or 1BOL 1.h, Shutdown Margin (SDM) - Mode 1 and Mode 2 with $K_{eff} \geq 1.0$, as applicable.

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E. continued

3. The RCS Average Temperature shall be determined using the following:
 - a. If in Mode 1 or 2, use 557°F.
 - b. If any RCP's are running:
 - 1). At $\geq 530^{\circ}\text{F}$, loop average temperature on unisolated loops with RCP(s) running.
 - 2). At $< 530^{\circ}\text{F}$, WR T_{hot} and T_{cold} temperature on unisolated loops with RCP(s) running.
 - c. If on Natural Circulation:
 - 1). WR T_{hot} and T_{cold} temperature on unisolated loops.
 - d. If RH is providing Shutdown Cooling, and if no RCP's are running:
 - 1). RH pump discharge temperature (to represent hot leg) and RH HX return temperature (to represent cold leg) of the RH train providing shutdown cooling for core average temperature.
4. If RH is providing Shutdown Cooling, and if no RCP's are running, temporarily stabilize RCS temperature during heatup or cooldown to obtain a more accurate core average temperature.

F. MAIN BODY:

0. Method of Calculation

This procedure calculates the available shutdown margin by comparing the existing or anticipated core conditions to a reference condition based on BCB-1, Table 1-1. This table lists the boron concentration required to provide the shutdown margin specified in the COLR at various core burnups and RCS temperatures. The table was derived by using the following assumptions:

- a. No Xenon.

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F.0. continued

- b. Equilibrium Samarium (i.e. Time = 0).
- c. All rods at bottom with the exception of the highest worth rod, which is assumed to be stuck out.
- d. Boron concentrations listed in BCB-1, Table 1-1, include 100 ppm factor of safety.

Deviations from each of the base assumptions and from the reference boron value given in the table are calculated in the procedure, and the sum of these effects is added to the required SDM to arrive at the actual shutdown margin available.

Note that in the event that a control rod is known to be untrippable, this is adjusted for in addition to the rod assumed to be stuck in the table.

NOTE

Use Reference Reactivity Data (RRD) Worksheet, 1BGP 100-7T1, for reactivity information prior to the shutdown.

1. PRESENT CONDITIONS

- a. RECORD Time and Date.

Done + Time

_____/_____
Time Date

- b. RECORD the Core Average Burnup in EFPH (RRD, step F.2.b).

397.4 EFPH

*

NOTE

The minimum temperature that can be used when performing a shutdown margin calculation is 60°F. Notify the Shift Manager and a Qualified Nuclear Engineer if the RCS temperature is less than 60°F.

*, 7.a

- c. RECORD the RCS Average Temperature (if in Mode 1 or 2, use 557°F).

540 °F

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F.1. continued

NOTE

If a trend of the RCS Boron Concentration indicates an unexpected decrease, then determine the cause of the trend and either increase the RCS boron or request additional boron samples.

If boration/dilution processes have occurred since the most recent sample, consider requesting a new boron concentration sample to determine present boron concentration.

- d. **RECORD** the Present RCS Boron Concentration (from most recent sample of the RCS or RH Train if it is providing shutdown cooling). Include the sample time and date.

____/____ 1046 ppm
Time Date

NOTE

A control rod is considered to be inoperable for purposes of Shutdown Margin determination if it is untrippable or fails to fully insert upon a reactor trip.

- e. **RECORD** the Total Number of Inoperable Control Rods. 0

NOTE

If one or more control rod(s) is (are) inoperable or not within alignment limits, then perform this surveillance within one hour and at least once per 12 hours thereafter.

If the inoperable control rod(s) is (are) untrippable, then this surveillance must be performed in its entirety.

- f. **RECORD** the required SDM from the COLR.

(-) 1300 pcm

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F. continued

NOTE

$1\% \Delta k/k = 1000 \text{ pcm} = 0.01 \Delta k/k$

2. POST REACTOR TRIP ASSESSMENT

NOTE

If this surveillance is being performed immediately after entry into Mode 3 via the opening of the reactor trip breakers AND there are no inoperable control rods AND all control rods are within their applicable alignment limits (alignment, insertion, sequence, and overlap), then this step (F.2) can be used to verify adequate SDM for the first 4 hours after the reactor shutdown. This assumes that Core Average Temperature remains at nominal 557°F and no dilution has occurred. Should a dilution or a cooldown be desired to be performed, the balance of this procedure, (F.3 to the end), shall be performed prior to initiating those actions.

- a. Is this the first performance of this surveillance following Mode 3 entry via opening of the reactor trip breakers?

Yes -----> Continue with step F.2.b.

No -----> Go to Step F.3.

- b. Are all control rods operable? (LCO 3.1.4)

Yes -----> Continue with step F.2.c.

No -----> Go to Step F.3.

- c. Were all control rods within their alignment (LCO 3.1.4), insertion (LCOs 3.1.5 and 3.1.6), sequence (LCO 3.1.6), and overlap (LCO 3.1.6) limits?

Yes -----> Continue with step F.2.d.

No -----> Go to Step F.3.

- d. Has the Core Average Temperature remained at nominal 557°F?

Yes -----> Continue with step F.2.e.

No -----> Go to Step F.3.

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F.2. continued

- e. Has the RCS boron concentration NOT been diluted since the reactor trip breakers were opened?

Yes -----> Continue with step F.2.f.

No -----> Go to Step F.3.

- f. **RECORD** the time and date at which the reactor trip breakers were opened.

_____/_____
Time Date

- g. Add 4 hours to the time and date recorded in step F.2.f.

_____/_____
Time Date

- h. Shutdown Margin is acceptable until the time recorded in step F.2.g as long as the conditions listed in step F.2 are maintained. The performance of this step satisfies the performance of verification of adequate Shutdown Margin pursuant to LCO 3.3.9, Required Action D.2. The balance of this procedure shall be performed prior to the time and date recorded in step F.2.g or prior to initiating a plant cooldown or RCS dilution.

NSO Date SRO Date

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F. continued

3. BOUNDING ASSUMPTIONS

NOTE

The Shutdown Margin verification is inherently dependent on the assumptions made for Core Average Temperature and time after shutdown. These bounding assumptions provide validity for the verification only as long as they are satisfied. For this reason, this procedure shall be reperformed if these bounding assumptions are either due to expire or are to be exceeded.

These assumptions should be made broad so as to bound the normal time period for performance (Step A.1) so that this procedure need not be repeated unnecessarily. (i.e. if a temperature range is chosen too narrow, another performance of this procedure would be required prior to cooling down below the bottom of the temperature range.) These assumptions, however, should also be specific enough to allow operational flexibility with regards to plant cooldowns. (i.e. if a timeframe of 4 to 10 hours after a reactor trip were chosen to take credit for Xenon buildup, another SDM would be required to be performed by 10 hours after the trip.) A Qualified Nuclear Engineer may be requested to provide guidance of making these assumptions.

The actual conditions recorded in step F.1 shall lie within the bounding values recorded in step F.3.

- a. **DETERMINE** and **RECORD** the bounding Core Average Temperature for this verification.

520 °F to 557 °F

- b. **RECORD** the most Limiting Core Average Temperature within the above temperature range. This is the temperature from BCB-1, Table 1-1, with the largest minimum required boron concentration at the current core burnup.

520 °F

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F.3. continued

- c. **DETERMINE** the bounding Time and Date for this verification.
TIME 10 HOURS TOM
____/____ to ____/____

NOTE

When obtaining values from the Byron Curve Book; either interpolation may be performed between the various parameters or a bounding value may be obtained. Each individual step will include guidance on what constitutes a bounding value.

4. MINIMUM REQUIRED BORON CONCENTRATION

NOTE

The minimum required boron concentration may be obtained from either BCB-1, Table 1-1, directly from a QNE, or from a QNE signed document written for this specific application. For the latter case, the minimum required boron concentration may be determined from a curve or table as a function of time, RCS temperature, or both. Independent verification is required for determining the minimum required boron concentration from the QNE supplied document to ensure the value is bounded by the assumptions recorded in step F.3.

- a. **OBTAIN** the Minimum Required Boron Concentration from either BCB-1, Table 1-1 (bounding value would be the largest number), a QNE, or a QNE supplied document, as appropriate.

- o BCB-1, Table 1-1, at the following statepoints (record value used from Table): 1181 ppm
 - Burnup (F.1.b) 0 EFPH
 - Core Average Temperature (F.3.b) 520 °F
- o N/A N/A ppm
Qualified Nuclear Engineer
- o QNE supplied document N/A ppm

NSO

Date

NSO or SRO

Date

Bounding Value
Interpolated
Any result is
A different
Value

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F.4. continued

- b. Is the Present RCS Boron Concentration (F.1.d) $\geq$ Minimum Required Boron Concentration (F.4.a)?

Yes -----> Continue with step F.4.c.

No -----> Go to Step F.5.

- c. Are all control rods operable? (LCO 3.1.4)

Yes -----> Continue with step F.4.d.

No -----> Go to Step F.5.

- d. The SDM requirement is satisfied and this surveillance may be performed on a daily basis, provided the bounding assumption is step F.3 remain satisfied. Mark the remainder of this procedure N/A.

NSO

Date

SRO

Date

5. REACTIVITY WORTH OF BORON

- a. **CALCULATE** the reactivity difference between the current boron concentration and the concentration specified in Table 1-1.

- 1). **RECORD** the Integral Boron Worth from BCB-1, Table 1-5 at the limiting core average temperature (F.3.b) for the time period specified in F.3.c and current boron concentration (F.1.d). (A bounding value would be the least negative number.)

520 °F
Core Tavg (F.3.b)

975 ppm
C_b from (F.1.d)
or bounding C_B
used in Table
1-5

(-) 9180 pcm

Interpolation
may result in
different
value

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F.5.a. continued

- 2). **RECORD** the Integral Boron Worth from BCB-1, Table 1-5 at the limiting core average temperature (F.3.b) and minimum required boron concentration from Table 1-1 (F.4.a). (A bounding value would be the most negative number.)

520 °F 1200 ppm (-) 11079 pcm
Core Tavg (F.3.b) C_b from (F.4.a)
or bounding C_B
used in Table
1-5

*interpolated
may yield
different
value*

- 3). **SUBTRACT** the result of step F.5.a.2) from step F.5.a.1).

(+) 1899 pcm

- b. **CALCULATE** the net worth of boron by **ADDING** the result of step F.5.a.3) to the required SDM (F.1.f).

(+) 1899 pcm + (-) 1300 pcm = 599 pcm
(F.5.a.3)) (F.1.f)

6. REACTIVITY WORTH OF UNTRIPPABLE RODS

- a. **RECORD** the Total Number of Untrippable Control Rods from step F.1.e.

0 Total Rods

- b. **CORRECT** for untrippable control rods by **MULTIPLYING** the Total Number of Stuck Rods (F.6.a) by the Predicted Worth of the Most Reactive Rod from BCB-1, Table 1-6.

0 Total Rods x 0 pcm/rod = (+) 0 pcm
(F.6.a) Predicted Worth

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F. continued

7. REACTIVITY CHANGE DUE TO XENON

- a. **RECORD** the Xenon Equivalent Power from RRD, step F.2.d.

99.9 % Xe Pwr

- b. **RECORD** the Shutdown Time and Date from RRD, step F.2.a.

S/D Time 0808 S/D Date _____

- c. **DETERMINE** the Xenon Worth using the Xe Equivalent Power (F.7.a) and "Time After Shutdown". From BCB-1, Figure 8C, select the time within the "bounding time" from step F.3.c that corresponds to the least negative (most positive) amount of reactivity. **RECORD** the respective Xe Worth and **RECORD** the associated "Time after Shutdown". Choosing the least negative (most positive) Xe Worth over the shift will yield a bounding SDM calculation.

Number of Hours Shutdown 1.1 hrs (-) 3000 pcm
Xe Worth

8. REACTIVITY WORTH OF SAMARIUM

NOTE

For accumulated burnup less than 600 EFPH, make no adjustments for Samarium. Mark steps F.8.a and F.8.b N/A.

- a. **RECORD** the Samarium equivalent power from the RRD step F.2.c.

N/A % Sm Pwr

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F.8. continued

- b. **CALCULATE** the worth of Samarium from BCB-1, Table 1-4 by determining the Sm at the equivalent power from step 1 above, with the number of hours shutdown based on the present time and **SUBTRACTING** the Sm worth at time of shutdown (t=0). (A bounding value would be 0 pcm for Sm Worth. If zero is entered, mark other blanks N/A.)

$$\begin{array}{rcl} \frac{\text{N/A}}{\text{Sm Worth at}} \text{ pcm} - \frac{\text{N/A}}{\text{Sm Worth at}} & = & \frac{(-) \text{N/A}}{\text{Sm Worth}} \text{ pcm} \\ \text{present time} & & \text{S/D (time = 0)} \\ \text{for \% Sm Pwr} & & \text{for \% Sm Pwr} \\ & & \text{(F.8.a)} \end{array}$$

9. CORRECTION FOR BORON EFFECTS ON XENON AND SAMARIUM WORTHS

- a. From step F.5.a.1) **RECORD** the integral worth of boron.

$$\frac{(-) 9180}{\text{pcm}}$$

- b. From BCB-1, Figure 8b **DETERMINE** the correction factor at the integral boron worth recorded in F.9.a.

$$\frac{.886}{\text{pcm}}$$

- c. **ADD** the Xenon worth from Step F.7.c and the Samarium worth from step F.8.b.

$$\frac{(-) 3000}{\text{(F.7.c)}} \text{ pcm} + \frac{(-) 0}{\text{(F.8.b)}} \text{ pcm} = \frac{(-) 3000}{\text{pcm}}$$

- d. **MULTIPLY** the sum of the fission product poison worths (step F.9.c) by the correction factor (F.9.b). This is the net value of fission product adjusted for competition effects of boron.

$$\frac{(-) 3000}{\text{(F.9.c)}} \text{ pcm} \times \frac{.886}{\text{(F.9.b)}} \text{ pcm} = \frac{(-) 2658}{\text{pcm}}$$

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F. continued

10. TOTAL SHUTDOWN MARGIN

a. **CALCULATE** the Total Shutdown Margin, in "pcm", by adding:

BORON WORTH (step F.5.b) 599 pcm

+ UNTRIPPABLE CONTROL ROD WORTH (Step F.6.b)
(+) 0 pcm

+ FISSION PRODUCT WORTH (step F.9.d)
(-) 2658 pcm

= TOTAL SHUTDOWN MARGIN 2059 pcm

b. **RECORD** the present Operating Mode (1-5). Mode 3

NOTE

For Modes 1-5, the Total Shutdown Margin (F.8.a) must be equal to or more Negative than the Shutdown Margin specified in the COLR (F.1.f).

c. **ANSWER** whether the Acceptance Criteria is satisfied or not and **INITIAL**. (YES or NO)

YES

NSO

Date

SRO

Date

If the Acceptance Criteria is not satisfied, **IMMEDIATELY** notify the Shift Manager and **INITIATE** LCOAR 1BOL 1.1, Shutdown Margin (SDM), or 1BOL 1.h, Shutdown Margin (SDM) - Mode 1 and Mode 2 with $K_{eff} \geq 1.0$.

If the Acceptance Criteria is satisfied, this surveillance should be performed each shift provided the bounding assumptions in step F.3 remain satisfied.

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G. ACCEPTANCE CRITERIA:

1. For Modes 1-5, SDM shall be within the limits of the COLR (SR 3.1.1.1). This is verified by one of the following methods:
 - a. For the first 4 hours following a reactor trip by having the following conditions met (F.2.h):
 - 1). All RCCAs operable.
 - 2). All RCCAs within alignment, insertion, sequence, and overlap limits prior to trip.
 - 3). RCS T_{ave} at nominal 557°F.
 - 4). No RCS dilutions since reactor trip.

OR

- b. At any time when the Present RCS Boron Concentration is greater than or equal to the Minimum Required Boron Concentration with no untrippable control rods (F.4.d).

OR

- c. At any time when the Total Shutdown Margin (F.10.a) is equal to or more negative than the SDM specified in the COLR (F.1.f).

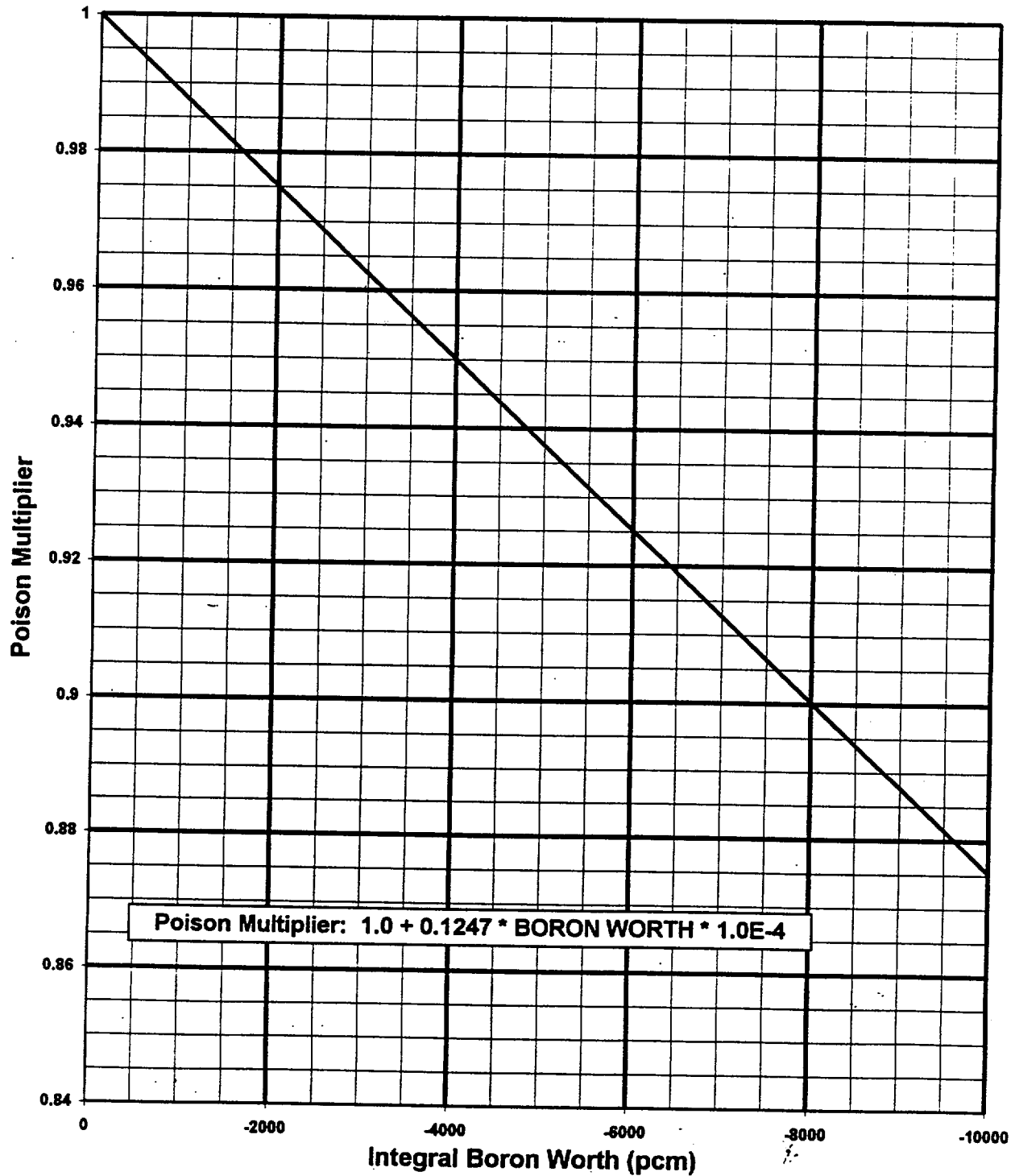
(Final)

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BYRON UNIT 1 CYCLE 10

Poison Correction Factor for RCS Boron



(Final)

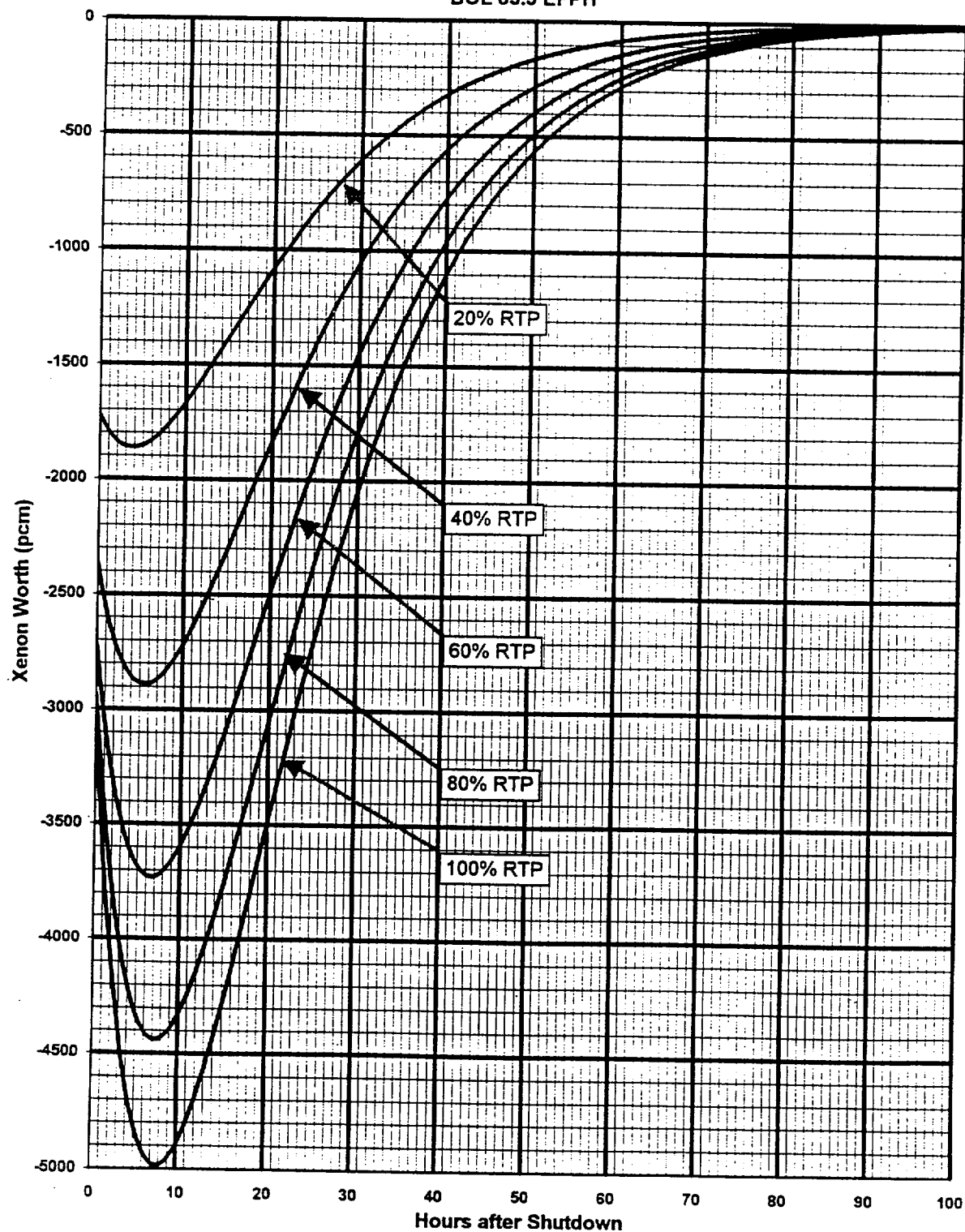
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BYRON UNIT 1 CYCLE 10

Xenon Worth vs Time After Shutdown

BOL 85.3 EFPH

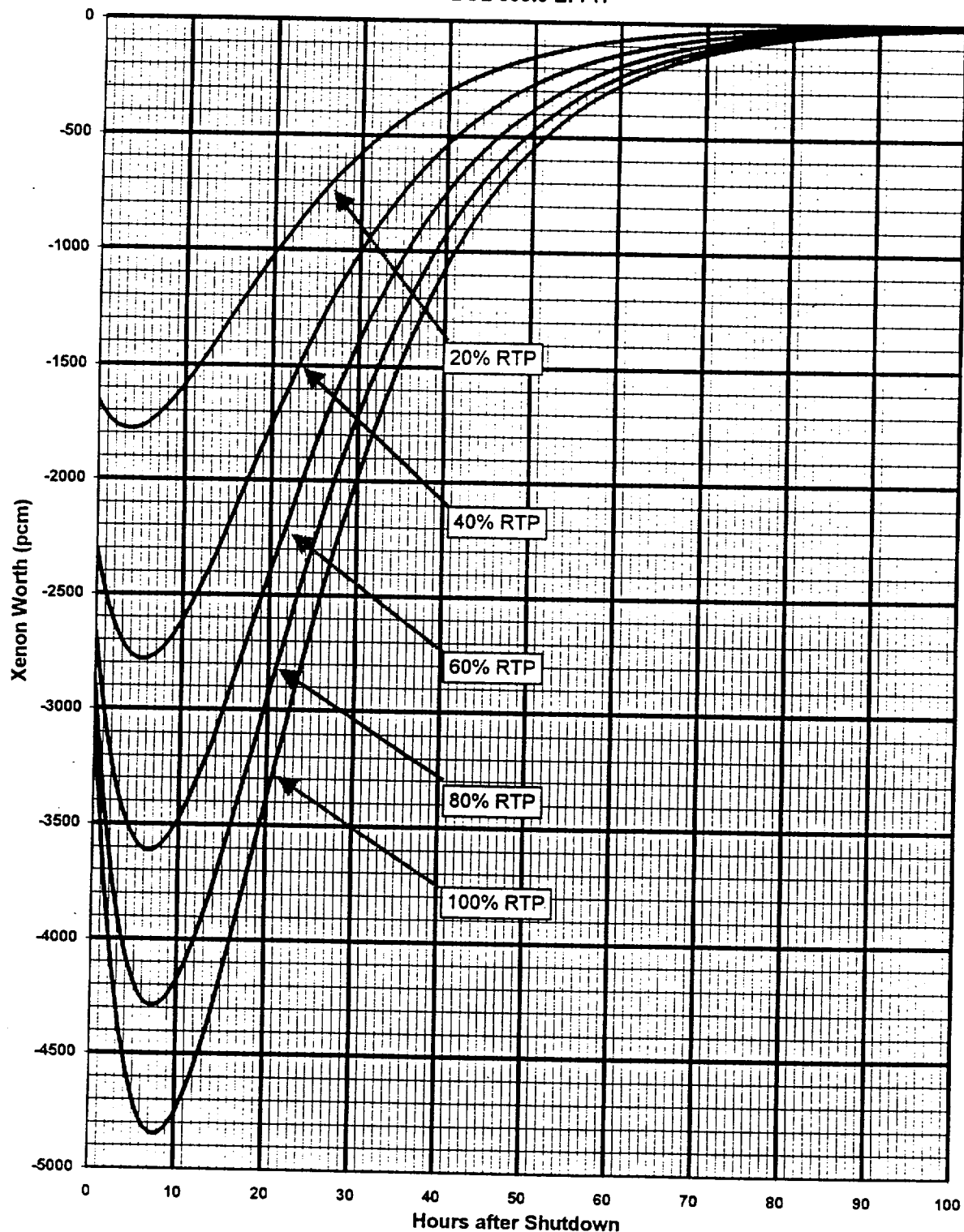


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BYRON UNIT 1 CYCLE 10

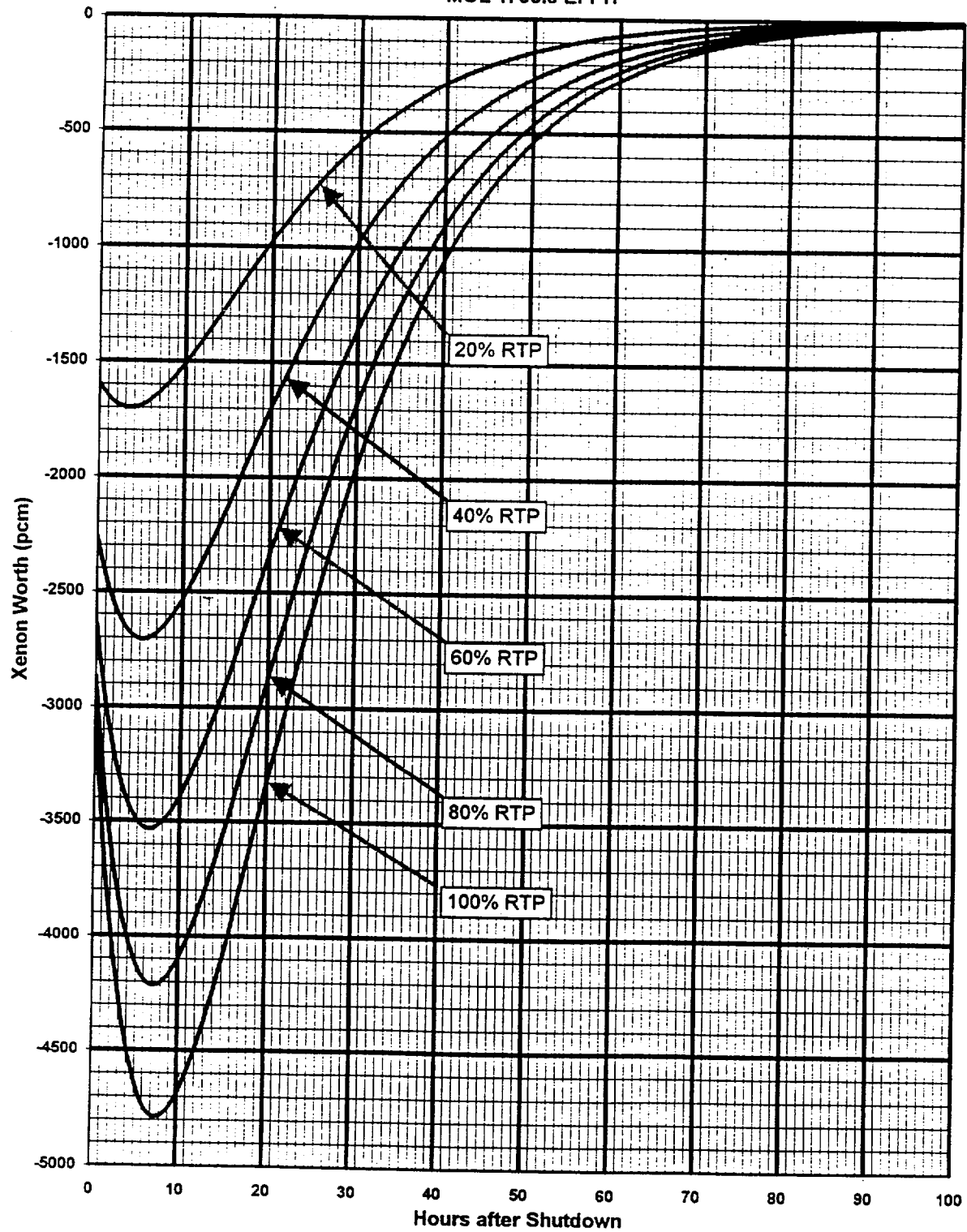
Xenon Worth vs Time After Shutdown
BOL 568.6 EFPH



BYRON UNIT 1 CYCLE 10

Xenon Worth vs Time After Shutdown

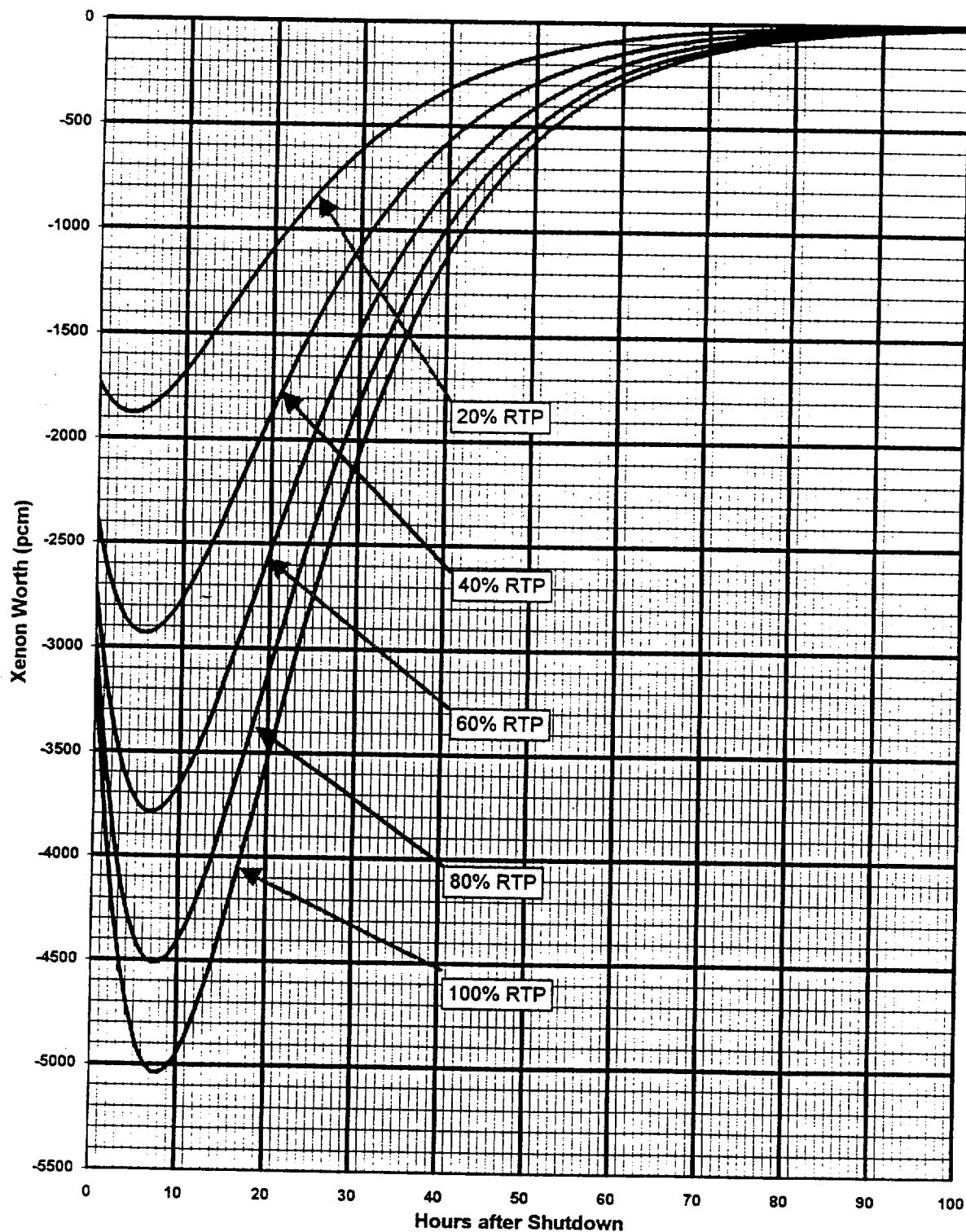
MOL 1705.8 EFPH



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BYRON UNIT 1 CYCLE 10
Xenon Worth vs Time After Shutdown
MOL 5686.1 EFPH



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BYRON UNIT 1 CYCLE 10

Xenon Worth vs Time After Shutdown

EOL 11514.4 EFPH

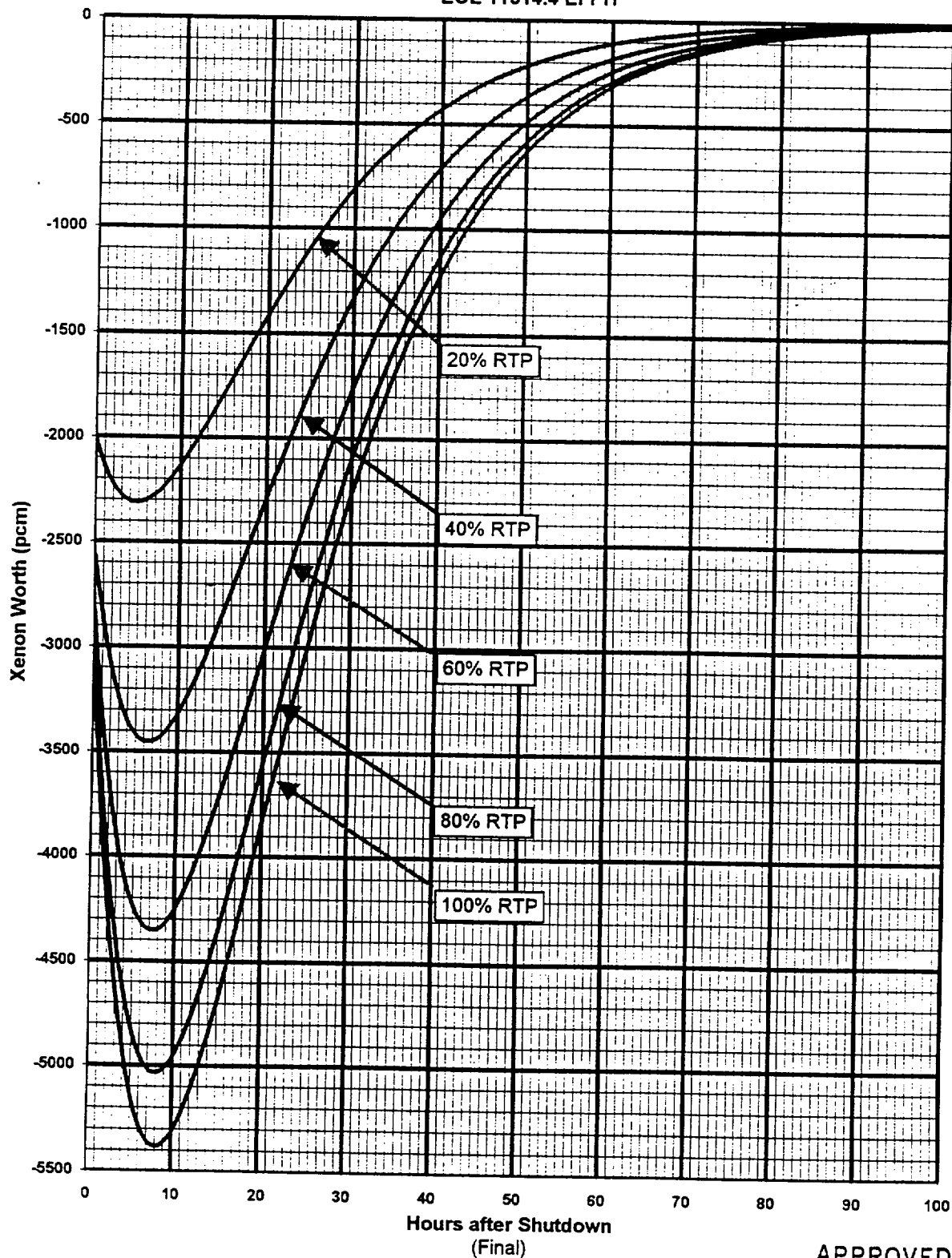


Table 1-1
Byron Unit 1 Cycle 10
Minimum Required Boron Concentration (ppm) for Shutdown Margin
As a Function of Temperature and Burnup
SDM = 1.3%

Burnup (EFPH)	Temperature (F)												
	60	80	100	120	140	160	180	200	220	240	260	280	300
0	1363	1341	1322	1306	1293	1283	1275	1270	1266	1263	1261	1260	1259
500	1346	1324	1306	1291	1279	1270	1263	1258	1255	1253	1252	1252	1252
1000	1329	1308	1291	1277	1266	1257	1251	1247	1244	1243	1243	1243	1243
1500	1312	1292	1276	1263	1252	1245	1239	1235	1233	1233	1233	1234	1235
2000	1295	1276	1261	1248	1239	1231	1227	1224	1222	1222	1223	1224	1225
2500	1279	1260	1245	1233	1224	1218	1213	1211	1210	1210	1211	1213	1214
3000	1261	1243	1229	1218	1209	1203	1199	1197	1197	1197	1199	1200	1202
3500	1243	1226	1212	1201	1193	1188	1184	1182	1182	1183	1185	1187	1189
4000	1224	1207	1194	1183	1176	1171	1167	1166	1166	1167	1169	1171	1173
4500	1204	1187	1174	1164	1157	1152	1149	1148	1148	1149	1151	1153	1155
5000	1181	1165	1153	1143	1136	1131	1128	1127	1127	1128	1130	1133	1135
5500	1157	1142	1129	1119	1113	1108	1105	1104	1104	1105	1107	1109	1112
6000	1131	1116	1103	1094	1087	1082	1079	1078	1079	1080	1081	1083	1085
6500	1102	1087	1075	1065	1058	1054	1051	1050	1050	1051	1052	1054	1056
7000	1071	1055	1043	1034	1027	1022	1019	1018	1017	1018	1019	1021	1022
7500	1036	1021	1008	999	992	987	984	982	981	982	983	984	985
8000	998	983	970	960	953	948	944	942	942	942	942	943	943
8500	957	941	928	918	910	905	901	899	897	897	897	897	897
9000	911	895	882	871	863	858	853	851	849	848	847	847	846
9500	861	845	831	821	812	806	801	798	795	794	792	791	790
10000	807	790	776	765	756	749	744	740	737	734	732	731	728
10500	748	730	716	704	695	687	681	676	673	670	667	664	661
11000	684	666	651	638	628	620	613	608	603	599	596	592	588
11514	612	593	578	564	553	544	537	531	525	520	516	511	506

Note: Boron concentrations include a 100 ppm factor of safety.

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Table 1-1 (Continued)
Byron Unit 1 Cycle 10
Minimum Required Boron Concentration (ppm) for Shutdown Margin
As a Function of Temperature and Burnup
SDM = 1.3%

Burnup (EFPH)	Temperature (F)													
	300	320	340	360	380	400	420	440	460	480	500	520	540	557
0	1259	1259	1258	1256	1254	1250	1244	1237	1227	1215	1200	1181	1159	1137
500	1252	1251	1251	1250	1248	1245	1239	1232	1223	1211	1196	1178	1156	1134
1000	1243	1244	1244	1243	1242	1239	1234	1227	1218	1206	1192	1173	1152	1130
1500	1235	1236	1236	1236	1234	1232	1227	1221	1212	1200	1186	1168	1146	1124
2000	1225	1226	1227	1227	1226	1224	1220	1213	1204	1193	1178	1160	1139	1117
2500	1214	1216	1217	1217	1217	1214	1210	1204	1195	1184	1169	1151	1130	1108
3000	1202	1204	1206	1206	1205	1203	1199	1193	1184	1173	1158	1140	1118	1096
3500	1189	1191	1192	1193	1192	1190	1186	1179	1171	1159	1144	1126	1104	1082
4000	1173	1175	1177	1177	1176	1174	1170	1164	1155	1143	1128	1109	1087	1065
4500	1155	1157	1159	1159	1158	1156	1152	1145	1136	1124	1109	1090	1067	1044
5000	1135	1137	1138	1138	1137	1135	1130	1123	1114	1102	1086	1067	1043	1020
5500	1112	1113	1115	1115	1113	1111	1106	1098	1089	1076	1060	1040	1016	993
6000	1085	1087	1088	1088	1086	1083	1077	1070	1060	1046	1030	1009	985	961
6500	1056	1057	1057	1057	1055	1051	1045	1037	1027	1013	995	974	949	925
7000	1022	1023	1023	1022	1020	1016	1009	1001	989	975	957	935	909	884
7500	985	985	985	983	980	976	969	959	947	932	913	891	864	838
8000	943	943	942	940	936	931	923	913	901	885	865	842	814	787
8500	897	896	895	892	888	882	873	862	849	832	811	787	759	731
9000	846	845	842	839	834	827	818	806	791	774	752	727	697	669
9500	790	788	785	780	775	767	757	744	728	709	687	661	630	601
10000	728	725	721	716	709	701	690	676	659	639	616	588	557	526
10500	661	657	652	646	638	629	617	602	584	563	538	509	476	445
11000	588	583	577	570	561	550	537	521	502	480	454	424	389	357
11514	506	500	493	485	475	463	448	431	411	387	360	328	292	258

Note: Boron concentrations include a 100 ppm factor of safety.

(Final)

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Table 1-5

Byron Unit 1 Cycle 10

BOL ARI Integral Boron Worth (pcm) as a Function of
Boron Concentration and Temperature
BU = 85.3 EFPH, NoXe, No Samarium

Boron Concentration (ppm)	Core Average Temperature (F)												
	60	80	100	120	140	160	180	200	220	240	260	280	300
75	-1102	-1097	-1092	-1086	-1079	-1071	-1062	-1052	-1041	-1029	-1016	-1002	-987
150	-2171	-2162	-2152	-2140	-2126	-2110	-2093	-2074	-2053	-2030	-2005	-1978	-1950
225	-3224	-3211	-3196	-3178	-3157	-3133	-3108	-3079	-3048	-3014	-2978	-2939	-2897
300	-4262	-4244	-4223	-4199	-4171	-4140	-4106	-4068	-4027	-3982	-3934	-3883	-3828
375	-5284	-5261	-5235	-5204	-5170	-5131	-5088	-5041	-4990	-4935	-4875	-4812	-4744
450	-6291	-6264	-6231	-6194	-6152	-6106	-6054	-5998	-5937	-5871	-5801	-5725	-5645
525	-7284	-7251	-7213	-7169	-7120	-7065	-7005	-6940	-6869	-6792	-6711	-6623	-6531
600	-8262	-8224	-8179	-8129	-8072	-8010	-7941	-7866	-7785	-7699	-7606	-7507	-7402
675	-9226	-9182	-9131	-9074	-9010	-8939	-8862	-8778	-8687	-8590	-8486	-8376	-8258
750	-10176	-10126	-10069	-10004	-9933	-9854	-9768	-9675	-9574	-9467	-9352	-9230	-9101
825	-11113	-11056	-10992	-10921	-10841	-10754	-10660	-10557	-10447	-10329	-10204	-10071	-9930
900	-12036	-11973	-11902	-11823	-11736	-11641	-11537	-11426	-11306	-11178	-11042	-10898	-10745
975	-12946	-12877	-12799	-12712	-12617	-12514	-12401	-12281	-12151	-12013	-11867	-11711	-11548
1050	-13843	-13767	-13682	-13588	-13485	-13373	-13252	-13122	-12983	-12835	-12678	-12512	-12337
1125	-14728	-14646	-14553	-14451	-14339	-14219	-14089	-13950	-13801	-13643	-13476	-13300	-13114
1200	-15601	-15511	-15411	-15301	-15181	-15052	-14913	-14765	-14607	-14439	-14262	-14075	-13878
1275	-16462	-16364	-16256	-16138	-16010	-15873	-15725	-15567	-15400	-15222	-15035	-14838	-14631
1350	-17312	-17206	-17090	-16964	-16827	-16681	-16524	-16358	-16181	-15993	-15796	-15589	-15371
1425	-18160	-18036	-17912	-17777	-17632	-17477	-17312	-17136	-16949	-16753	-16545	-16328	-16100
1500	-18977	-18855	-18722	-18579	-18426	-18262	-18087	-17902	-17706	-17500	-17283	-17056	-16818
1575	-19793	-19663	-19522	-19370	-19208	-19035	-18851	-18657	-18452	-18236	-18010	-17773	-17526
1650	-20599	-20460	-20310	-20150	-19979	-19797	-19604	-19400	-19186	-18961	-18726	-18479	-18221
1725	-21395	-21247	-21088	-20919	-20738	-20547	-20346	-20133	-19909	-19675	-19430	-19174	-18907
1800	-22180	-22023	-21856	-21677	-21488	-21288	-21077	-20855	-20622	-20379	-20124	-19859	-19583
1875	-22956	-22790	-22613	-22426	-22227	-22018	-21797	-21566	-21325	-21072	-20809	-20534	-20249
1950	-23723	-23548	-23361	-23164	-22956	-22738	-22508	-22268	-22017	-21755	-21483	-21200	-20906
2025	-24481	-24296	-24100	-23893	-23676	-23448	-23209	-22960	-22700	-22429	-22148	-21856	-21553
2100	-25230	-25035	-24829	-24613	-24386	-24148	-23900	-23642	-23373	-23094	-22803	-22503	-22192
2175	-25971	-25765	-25550	-25323	-25087	-24840	-24583	-24315	-24037	-23749	-23450	-23141	-22822
2250	-26703	-26487	-26261	-26025	-25779	-25522	-25256	-24979	-24692	-24395	-24088	-23771	-23443
2325	-27428	-27201	-26965	-26719	-26463	-26196	-25920	-25636	-25339	-25033	-24717	-24392	-24056
2400	-28145	-27907	-27660	-27404	-27138	-26862	-26577	-26282	-25977	-25663	-25339	-25005	-24662
2475	-28854	-28606	-28348	-28081	-27805	-27520	-27225	-26921	-26607	-26284	-25952	-25611	-25260
2500	-29089	-28837	-28576	-28305	-28026	-27737	-27439	-27132	-26815	-26490	-26155	-25811	-25458

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Table 1-5 (Cont.)

Byron Unit 1 Cycle 10

BOL ARI Integral Boron Worth (pcm) as a Function of
Boron Concentration and Temperature
BU = 86.3 EFPH, NoXe, No Samarium

Boron Concentration (ppm)	Core Average Temperature (F)													
	300	320	340	360	380	400	420	440	460	480	500	520	540	557
75	-987	-971	-954	-937	-918	-898	-877	-856	-833	-809	-785	-759	-733	-709
160	-1950	-1920	-1888	-1854	-1819	-1781	-1742	-1701	-1658	-1613	-1567	-1519	-1469	-1425
225	-2897	-2853	-2808	-2767	-2705	-2650	-2593	-2533	-2470	-2405	-2337	-2267	-2194	-2130
300	-3828	-3770	-3709	-3644	-3576	-3504	-3429	-3351	-3269	-3184	-3096	-3004	-2909	-2825
375	-4744	-4673	-4597	-4517	-4433	-4345	-4253	-4156	-4056	-3951	-3843	-3730	-3613	-3511
450	-5645	-5560	-5470	-5376	-5276	-5172	-5063	-4949	-4830	-4707	-4578	-4445	-4308	-4187
525	-6531	-6432	-6329	-6220	-6105	-5985	-5860	-5729	-5592	-5451	-5303	-5151	-4992	-4854
600	-7402	-7290	-7173	-7050	-6921	-6785	-6644	-6496	-6343	-6183	-6017	-5846	-5668	-5512
675	-8258	-8135	-8004	-7867	-7723	-7573	-7416	-7252	-7082	-6905	-6721	-6531	-6334	-6161
750	-9101	-8965	-8821	-8671	-8513	-8348	-8176	-7996	-7810	-7616	-7415	-7207	-6991	-6803
825	-9930	-9781	-9625	-9461	-9290	-9111	-8924	-8729	-8527	-8317	-8099	-7873	-7640	-7436
900	-10745	-10585	-10416	-10239	-10054	-9861	-9660	-9451	-9233	-9007	-8773	-8531	-8281	-8062
975	-11548	-11375	-11195	-11005	-10807	-10600	-10385	-10161	-9929	-9688	-9438	-9180	-8914	-8680
1050	-12337	-12163	-11960	-11759	-11548	-11328	-11099	-10862	-10615	-10359	-10095	-9821	-9538	-9291
1125	-13114	-12919	-12714	-12500	-12277	-12045	-11803	-11552	-11291	-11021	-10742	-10454	-10156	-9895
1200	-13878	-13672	-13456	-13230	-12995	-12750	-12496	-12232	-11958	-11674	-11381	-11079	-10766	-10493
1275	-14631	-14413	-14186	-13949	-13702	-13446	-13179	-12902	-12615	-12319	-12012	-11696	-11370	-11085
1350	-15371	-15143	-14905	-14657	-14399	-14130	-13852	-13563	-13264	-12955	-12636	-12306	-11967	-11670
1425	-16100	-15862	-15613	-15354	-15085	-14805	-14515	-14215	-13904	-13583	-13251	-12910	-12557	-12250
1500	-16818	-16570	-16311	-16041	-15761	-15471	-15170	-14858	-14536	-14203	-13860	-13506	-13142	-12824
1575	-17525	-17267	-16998	-16718	-16428	-16127	-15815	-15493	-15160	-14816	-14462	-14097	-13721	-13393
1650	-18221	-17953	-17674	-17385	-17084	-16773	-16452	-16119	-15775	-15421	-15056	-14681	-14294	-13957
1725	-18907	-18630	-18341	-18042	-17732	-17411	-17080	-16737	-16384	-16020	-15645	-15259	-14863	-14517
1800	-19583	-19296	-18999	-18690	-18371	-18041	-17700	-17348	-16985	-16612	-16227	-15832	-15426	-15073
1875	-20249	-19953	-19647	-19329	-19001	-18662	-18312	-17951	-17580	-17197	-16804	-16400	-15985	-15624
1950	-20906	-20601	-20286	-19960	-19623	-19275	-18916	-18547	-18167	-17776	-17375	-16963	-16540	-16172
2025	-21553	-21240	-20916	-20581	-20236	-19880	-19514	-19136	-18749	-18350	-17941	-17521	-17090	-16716
2100	-22192	-21870	-21538	-21196	-20842	-20478	-20104	-19719	-19324	-18918	-18502	-18075	-17637	-17257
2175	-22822	-22492	-22152	-21801	-21440	-21069	-20688	-20296	-19893	-19481	-19058	-18624	-18181	-17795
2250	-23443	-23105	-22758	-22400	-22032	-21653	-21265	-20866	-20458	-20039	-19610	-19170	-18721	-18331
2325	-24056	-23711	-23356	-22991	-22616	-22231	-21836	-21431	-21016	-20592	-20157	-19713	-19259	-18865
2400	-24662	-24309	-23947	-23576	-23193	-22802	-22401	-21990	-21570	-21141	-20701	-20252	-19793	-19396
2475	-25260	-24900	-24531	-24152	-23764	-23367	-22961	-22545	-22120	-21685	-21241	-20788	-20326	-19926
2500	-25458	-25096	-24724	-24343	-23953	-23554	-23146	-22728	-22302	-21866	-21421	-20967	-20503	-20102

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Table 1-5 (Cont.)

Byron Unit 1 Cycle 10

MOL ARI Integral Boron Worth (pcm) as a Function of
Boron Concentration and Temperature
BU = 1705.8 EFPD, NoXe, No Samarium

Boron Concentration (ppm)	Core Average Temperature (F)												
	60	80	100	120	140	160	180	200	220	240	260	280	300
76	-1073	-1069	-1064	-1058	-1052	-1044	-1035	-1025	-1016	-1003	-990	-976	-962
160	-2116	-2108	-2098	-2086	-2072	-2057	-2040	-2021	-2000	-1977	-1953	-1927	-1899
226	-3144	-3132	-3116	-3098	-3078	-3055	-3029	-3001	-2970	-2937	-2901	-2862	-2821
300	-4158	-4141	-4120	-4096	-4069	-4038	-4004	-3966	-3925	-3881	-3834	-3783	-3729
375	-5158	-5136	-5109	-5079	-5044	-5006	-4963	-4917	-4866	-4811	-4753	-4690	-4623
450	-6145	-6117	-6085	-6048	-6006	-5960	-5909	-5853	-5792	-5727	-5657	-5583	-5504
525	-7117	-7084	-7048	-7002	-6953	-6899	-6840	-6775	-6704	-6629	-6548	-6462	-6370
600	-8076	-8038	-7993	-7943	-7887	-7825	-7757	-7682	-7603	-7517	-7425	-7327	-7223
675	-9022	-8978	-8927	-8870	-8807	-8738	-8660	-8577	-8487	-8391	-8288	-8179	-8063
750	-9955	-9905	-9848	-9784	-9713	-9635	-9549	-9457	-9358	-9252	-9138	-9018	-8891
825	-10876	-10819	-10756	-10686	-10606	-10520	-10426	-10325	-10216	-10100	-9976	-9844	-9706
900	-11784	-11721	-11651	-11573	-11486	-11392	-11290	-11179	-11061	-10934	-10800	-10658	-10507
975	-12680	-12611	-12534	-12448	-12354	-12251	-12140	-12021	-11893	-11757	-11612	-11459	-11298
1050	-13564	-13488	-13404	-13311	-13209	-13098	-12979	-12850	-12713	-12567	-12412	-12248	-12076
1125	-14436	-14354	-14262	-14162	-14052	-13933	-13806	-13667	-13521	-13365	-13200	-13026	-12843
1200	-15297	-15208	-15109	-15001	-14883	-14756	-14619	-14472	-14317	-14151	-13976	-13792	-13598
1275	-16147	-16051	-15945	-15828	-15702	-15567	-15421	-15266	-15101	-14926	-14741	-14547	-14342
1350	-16987	-16883	-16769	-16645	-16510	-16366	-16212	-16048	-15873	-15689	-15495	-15290	-15076
1425	-17815	-17704	-17582	-17450	-17307	-17155	-16992	-16818	-16635	-16441	-16237	-16023	-15799
1500	-18633	-18514	-18384	-18244	-18093	-17932	-17760	-17578	-17386	-17183	-16969	-16745	-16511
1575	-19441	-19314	-19176	-19028	-18868	-18699	-18518	-18327	-18126	-17914	-17691	-17457	-17213
1650	-20240	-20104	-19958	-19801	-19633	-19455	-19266	-19066	-18855	-18634	-18402	-18159	-17906
1725	-21028	-20884	-20730	-20564	-20388	-20201	-20003	-19794	-19575	-19345	-19103	-18852	-18589
1800	-21807	-21655	-21492	-21318	-21133	-20937	-20730	-20513	-20284	-20045	-19795	-19534	-19262
1875	-22578	-22416	-22244	-22062	-21868	-21663	-21448	-21221	-20984	-20736	-20477	-20208	-19927
1950	-23339	-23169	-22988	-22796	-22594	-22380	-22156	-21921	-21675	-21418	-21150	-20872	-20583
2025	-24092	-23912	-23722	-23522	-23310	-23088	-22855	-22611	-22356	-22091	-21814	-21528	-21230
2100	-24836	-24647	-24448	-24238	-24018	-23786	-23545	-23292	-23029	-22755	-22470	-22175	-21868
2175	-25572	-25374	-25166	-24946	-24717	-24477	-24226	-23964	-23692	-23410	-23117	-22813	-22499
2250	-26300	-26093	-25875	-25646	-25407	-25158	-24898	-24628	-24348	-24057	-23756	-23444	-23122
2325	-27021	-26804	-26576	-26338	-26090	-25831	-25563	-25284	-24995	-24696	-24387	-24067	-23737
2400	-27735	-27507	-27269	-27022	-26764	-26497	-26219	-25932	-25635	-25327	-25010	-24682	-24345
2475	-28441	-28203	-27956	-27698	-27431	-27155	-26868	-26572	-26266	-25951	-25626	-25291	-24946
2500	-28675	-28434	-28183	-27922	-27652	-27372	-27083	-26784	-26475	-26157	-25829	-25492	-25145

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Table 1-5 (Cont.)

Byron Unit 1 Cycle 10

MOL ARI Integral Boron Worth (pcm) as a Function of
Boron Concentration and Temperature
BU = 1705.8 EFPH, NoXe, No Samarium

Boron Concentration (ppm)	Core Average Temperature (F)													
	300	320	340	360	380	400	420	440	460	480	500	520	540	557
75	-962	-946	-929	-912	-893	-873	-853	-831	-808	-785	-760	-734	-708	-684
150	-1899	-1869	-1837	-1804	-1769	-1732	-1693	-1652	-1610	-1566	-1520	-1472	-1422	-1379
225	-2821	-2778	-2731	-2682	-2631	-2577	-2520	-2461	-2400	-2335	-2268	-2199	-2127	-2064
300	-3729	-3672	-3611	-3547	-3480	-3410	-3336	-3258	-3178	-3094	-3007	-2916	-2822	-2740
375	-4623	-4553	-4478	-4399	-4316	-4229	-4139	-4044	-3945	-3842	-3735	-3624	-3509	-3408
450	-5504	-5420	-5331	-5238	-5140	-5037	-4929	-4817	-4701	-4579	-4453	-4322	-4186	-4067
525	-6370	-6273	-6171	-6063	-5950	-5832	-5709	-5580	-5445	-5306	-5161	-5011	-4855	-4719
600	-7223	-7114	-6998	-6877	-6749	-6616	-6476	-6331	-6180	-6023	-5860	-5691	-5516	-5362
675	-8063	-7941	-7813	-7677	-7536	-7388	-7233	-7072	-6904	-6730	-6549	-6362	-6168	-5999
750	-8891	-8756	-8616	-8468	-8311	-8148	-7978	-7802	-7618	-7427	-7230	-7025	-6813	-6627
825	-9705	-9559	-9405	-9243	-9074	-8897	-8713	-8521	-8322	-8115	-7901	-7679	-7460	-7249
900	-10507	-10349	-10183	-10008	-9826	-9636	-9438	-9231	-9017	-8795	-8564	-8326	-8080	-7864
975	-11298	-11128	-10949	-10763	-10567	-10364	-10152	-9931	-9702	-9465	-9219	-8965	-8702	-8472
1050	-12078	-11895	-11705	-11506	-11298	-11081	-10856	-10622	-10378	-10127	-9866	-9596	-9318	-9075
1125	-12843	-12650	-12449	-12238	-12018	-11789	-11550	-11303	-11046	-10780	-10505	-10221	-9927	-9671
1200	-13598	-13395	-13182	-12959	-12727	-12486	-12235	-11975	-11705	-11425	-11137	-10838	-10530	-10261
1275	-14342	-14128	-13904	-13671	-13427	-13174	-12911	-12638	-12355	-12063	-11761	-11449	-11127	-10846
1350	-15076	-14851	-14617	-14372	-14117	-13852	-13578	-13293	-12998	-12693	-12378	-12053	-11718	-11425
1425	-15799	-15564	-15319	-15063	-14798	-14522	-14236	-13939	-13633	-13316	-12989	-12651	-12303	-12000
1500	-16511	-16266	-16011	-15745	-15469	-15182	-14886	-14578	-14260	-13931	-13593	-13243	-12883	-12569
1575	-17213	-16959	-16694	-16418	-16131	-15834	-15527	-15209	-14880	-14540	-14190	-13830	-13458	-13134
1650	-17906	-17642	-17367	-17081	-16785	-16478	-16160	-15832	-15492	-15143	-14782	-14411	-14029	-13695
1725	-18589	-18315	-18031	-17736	-17430	-17113	-16786	-16448	-16098	-15739	-15368	-14986	-14594	-14252
1800	-19262	-18980	-18688	-18382	-18067	-17741	-17404	-17056	-16698	-16329	-15948	-15557	-15155	-14805
1875	-19927	-19635	-19333	-19020	-18696	-18361	-18016	-17659	-17291	-16913	-16524	-16123	-15712	-15355
1950	-20583	-20283	-19972	-19650	-19317	-18974	-18619	-18254	-17878	-17491	-17094	-16685	-16266	-15901
2025	-21230	-20921	-20602	-20272	-19931	-19579	-19217	-18843	-18459	-18065	-17669	-17243	-16816	-16444
2100	-21868	-21552	-21224	-20886	-20537	-20178	-19808	-19427	-19035	-18633	-18220	-17796	-17362	-16985
2175	-22499	-22174	-21839	-21493	-21137	-20770	-20392	-20004	-19606	-19196	-18777	-18346	-17905	-17522
2250	-23122	-22790	-22447	-22093	-21730	-21356	-20971	-20576	-20171	-19755	-19329	-18893	-18446	-18058
2325	-23737	-23397	-23047	-22687	-22316	-21935	-21544	-21143	-20732	-20310	-19878	-19436	-18984	-18592
2400	-24345	-23998	-23641	-23273	-22896	-22509	-22112	-21705	-21288	-20861	-20424	-19977	-19520	-19124
2475	-24946	-24592	-24228	-23854	-23470	-23077	-22674	-22262	-21840	-21408	-20966	-20514	-20053	-19654
2550	-25545	-25188	-24822	-24446	-24060	-23665	-23261	-22846	-22423	-21989	-21546	-20693	-20231	-19830

Table 1-5 (Cont.)

Byron Unit 1 Cycle 10

MOL ARI Integral Boron Worth (pcm) as a Function of
Boron Concentration and Temperature
BU = 6686.1 EFPH, NoXe, No Samarium

Boron Concentration (ppm)	Core Average Temperature (F)												
	60	80	100	120	140	160	180	200	220	240	260	280	300
75	-1089	-1083	-1077	-1069	-1061	-1052	-1043	-1032	-1021	-1008	-995	-981	-967
150	-2144	-2135	-2124	-2111	-2097	-2081	-2063	-2044	-2023	-2000	-1975	-1949	-1921
225	-3186	-3173	-3158	-3140	-3119	-3096	-3070	-3042	-3011	-2978	-2942	-2903	-2862
300	-4217	-4199	-4179	-4155	-4128	-4097	-4063	-4026	-3986	-3941	-3894	-3843	-3789
375	-5235	-5213	-5187	-5157	-5123	-5085	-5043	-4996	-4946	-4891	-4833	-4770	-4703
450	-6241	-6216	-6183	-6147	-6105	-6060	-6009	-5953	-5893	-5828	-5758	-5683	-5604
525	-7236	-7204	-7166	-7123	-7075	-7021	-6961	-6897	-6827	-6751	-6670	-6583	-6492
600	-8219	-8181	-8137	-8087	-8031	-7969	-7901	-7827	-7747	-7661	-7569	-7470	-7366
675	-9190	-9146	-9096	-9038	-8974	-8904	-8827	-8744	-8654	-8557	-8454	-8344	-8228
750	-10150	-10099	-10042	-9977	-9905	-9827	-9741	-9648	-9548	-9441	-9326	-9205	-9077
825	-11099	-11041	-10976	-10904	-10824	-10736	-10641	-10539	-10429	-10311	-10186	-10053	-9913
900	-12038	-11971	-11899	-11818	-11730	-11633	-11529	-11417	-11297	-11169	-11033	-10889	-10737
975	-12962	-12890	-12809	-12721	-12623	-12518	-12404	-12282	-12152	-12013	-11867	-11712	-11548
1050	-13878	-13797	-13708	-13611	-13505	-13390	-13267	-13135	-12995	-12846	-12688	-12522	-12348
1125	-14782	-14694	-14596	-14490	-14374	-14250	-14117	-13976	-13825	-13666	-13498	-13321	-13135
1200	-15676	-15579	-15472	-15357	-15232	-15098	-14956	-14804	-14643	-14473	-14295	-14107	-13910
1275	-16560	-16453	-16337	-16212	-16078	-15935	-15782	-15620	-15449	-15269	-15079	-14881	-14673
1350	-17433	-17317	-17191	-17056	-16912	-16759	-16596	-16424	-16243	-16052	-15852	-15643	-15425
1425	-18296	-18170	-18034	-17889	-17735	-17572	-17399	-17216	-17025	-16824	-16613	-16394	-16165
1500	-19148	-19012	-18866	-18711	-18546	-18373	-18189	-17997	-17795	-17583	-17363	-17133	-16893
1575	-19991	-19844	-19687	-19522	-19347	-19162	-18969	-18765	-18553	-18331	-18100	-17860	-17610
1650	-20824	-20666	-20498	-20322	-20136	-19941	-19736	-19523	-19300	-19068	-18827	-18576	-18316
1725	-21647	-21477	-21298	-21111	-20914	-20708	-20493	-20269	-20035	-19793	-19541	-19281	-19011
1800	-22460	-22279	-22088	-21889	-21681	-21464	-21238	-21003	-20759	-20507	-20245	-19975	-19695
1875	-23264	-23070	-22868	-22657	-22438	-22209	-21972	-21727	-21472	-21209	-20938	-20657	-20368
1950	-24068	-23852	-23638	-23416	-23184	-22944	-22696	-22439	-22174	-21901	-21619	-21329	-21031
2025	-24844	-24625	-24397	-24162	-23919	-23668	-23408	-23141	-22865	-22582	-22290	-21990	-21682
2100	-25620	-25387	-25147	-24900	-24644	-24381	-24110	-23832	-23548	-23252	-22950	-22641	-22324
2175	-26387	-26141	-25887	-25627	-25359	-25084	-24802	-24512	-24216	-23911	-23600	-23281	-22955
2250	-27145	-26885	-26618	-26344	-26064	-25777	-25483	-25182	-24874	-24560	-24239	-23911	-23576
2325	-27895	-27620	-27339	-27052	-26759	-26459	-26153	-25841	-25523	-25198	-24867	-24530	-24187
2400	-28635	-28346	-28051	-27750	-27444	-27132	-26814	-26490	-26161	-25826	-25486	-25140	-24788
2475	-29368	-29063	-28754	-28439	-28119	-27794	-27464	-27129	-26789	-26444	-26094	-25739	-25379
2550	-29610	-29300	-28986	-28666	-28342	-28013	-27679	-27340	-26997	-26648	-26295	-25937	-25574

Table 1-5 (Cont.)

Byron Unit 1 Cycle 10

MOL ARI Integral Boron Worth (pcm) as a Function of
Boron Concentration and Temperature
BU = 5686.1 EFPH, NoXe, No Samarium

Boron Concentration (ppm)	Core Average Temperature (F)													
	300	320	340	360	380	400	420	440	460	480	500	520	540	557
75	-967	-961	-935	-918	-900	-881	-861	-841	-819	-797	-774	-751	-726	-705
150	-1921	-1892	-1860	-1827	-1792	-1756	-1717	-1678	-1636	-1592	-1547	-1501	-1452	-1409
225	-2862	-2818	-2772	-2724	-2672	-2618	-2562	-2503	-2442	-2378	-2311	-2242	-2170	-2107
300	-3789	-3732	-3671	-3607	-3540	-3469	-3395	-3318	-3237	-3153	-3065	-2975	-2880	-2798
375	-4703	-4632	-4558	-4478	-4396	-4308	-4217	-4121	-4022	-3918	-3811	-3699	-3583	-3481
450	-5604	-5520	-5431	-5337	-5239	-5136	-5027	-4914	-4797	-4674	-4547	-4415	-4278	-4158
525	-6492	-6394	-6292	-6183	-6070	-5951	-5826	-5696	-5561	-5420	-5274	-5123	-4966	-4828
600	-7366	-7256	-7140	-7017	-6889	-6755	-6616	-6468	-6316	-6157	-5993	-5823	-5646	-5491
675	-8228	-8105	-7976	-7839	-7697	-7548	-7392	-7230	-7061	-6885	-6703	-6514	-6319	-6148
750	-9077	-8941	-8799	-8649	-8493	-8329	-8158	-7981	-7796	-7604	-7405	-7199	-6986	-6799
825	-9913	-9765	-9610	-9447	-9277	-9100	-8914	-8721	-8521	-8313	-8098	-7875	-7645	-7443
900	-10737	-10577	-10409	-10234	-10050	-9859	-9660	-9452	-9237	-9014	-8783	-8544	-8297	-8081
975	-11548	-11377	-11197	-11009	-10812	-10608	-10395	-10173	-9944	-9706	-9460	-9206	-8943	-8713
1050	-12348	-12164	-11972	-11772	-11563	-11345	-11119	-10885	-10641	-10389	-10129	-9860	-9582	-9340
1125	-13135	-12940	-12736	-12524	-12303	-12073	-11834	-11586	-11330	-11064	-10790	-10507	-10215	-9960
1200	-13910	-13704	-13489	-13265	-13032	-12790	-12539	-12278	-12009	-11731	-11444	-11147	-10842	-10576
1275	-14673	-14456	-14230	-13995	-13750	-13496	-13233	-12961	-12680	-12389	-12090	-11781	-11462	-11185
1350	-15425	-15197	-14960	-14713	-14458	-14193	-13918	-13635	-13342	-13039	-12728	-12407	-12077	-11789
1425	-16165	-15926	-15678	-15421	-15155	-14879	-14594	-14299	-13995	-13682	-13359	-13027	-12686	-12388
1500	-16893	-16644	-16386	-16118	-15841	-15555	-15259	-14954	-14640	-14316	-13983	-13641	-13289	-12982
1575	-17610	-17351	-17083	-16805	-16518	-16222	-15916	-15601	-15277	-14943	-14600	-14248	-13886	-13571
1650	-18316	-18047	-17769	-17481	-17185	-16879	-16563	-16239	-15905	-15562	-15210	-14848	-14478	-14155
1725	-19011	-18732	-18444	-18147	-17841	-17526	-17202	-16868	-16526	-16174	-15813	-15443	-15064	-14735
1800	-19695	-19407	-19109	-18803	-18488	-18164	-17831	-17489	-17138	-16778	-16410	-16032	-15645	-15310
1875	-20368	-20070	-19764	-19449	-19125	-18792	-18451	-18101	-17743	-17376	-16999	-16615	-16222	-15850
1950	-21031	-20724	-20408	-20085	-19752	-19412	-19063	-18706	-18340	-17966	-17583	-17192	-16793	-16447
2025	-21682	-21367	-21043	-20711	-20370	-20022	-19666	-19302	-18929	-18549	-18160	-17764	-17359	-17009
2100	-22324	-21999	-21667	-21327	-20979	-20624	-20261	-19890	-19511	-19125	-18731	-18330	-17921	-17567
2175	-22955	-22622	-22281	-21934	-21579	-21216	-20847	-20470	-20086	-19695	-19296	-18891	-18478	-18121
2250	-23576	-23234	-22886	-22531	-22169	-21801	-21425	-21043	-20654	-20258	-19856	-19446	-19030	-18671
2325	-24187	-23837	-23481	-23119	-22751	-22376	-21995	-21608	-21215	-20815	-20409	-19997	-19578	-19218
2400	-24788	-24430	-24067	-23698	-23323	-22943	-22557	-22166	-21768	-21365	-20957	-20542	-20122	-19761
2475	-25379	-25014	-24643	-24268	-23888	-23502	-23112	-22716	-22315	-21910	-21499	-21083	-20662	-20300
2500	-25574	-25206	-24833	-24456	-24074	-23687	-23295	-22898	-22496	-22090	-21678	-21262	-20841	-20480

APPROVED

Table 1-5 (Cont.)

Byron Unit 1 Cycle 10

EOL ARI Integral Boron Worth (pcm) as a Function of
Boron Concentration and Temperature
BU = 11514.4, EFPH, NoXe, No Samarium

Boron Concentration (ppm)	Core Average Temperature (F)												
	60	80	100	120	140	160	180	200	220	240	260	280	300
75	-1204	-1193	-1182	-1170	-1157	-1144	-1131	-1116	-1102	-1086	-1070	-1054	-1037
150	-2366	-2349	-2331	-2311	-2290	-2268	-2244	-2219	-2192	-2164	-2135	-2104	-2072
225	-3514	-3490	-3465	-3437	-3407	-3375	-3340	-3304	-3265	-3225	-3182	-3137	-3090
300	-4648	-4617	-4583	-4547	-4507	-4465	-4420	-4372	-4322	-4268	-4212	-4153	-4091
375	-5768	-5729	-5687	-5641	-5592	-5539	-5483	-5424	-5361	-5295	-5226	-5152	-5076
450	-6874	-6826	-6775	-6720	-6661	-6598	-6530	-6459	-6384	-6305	-6222	-6135	-6044
525	-7966	-7910	-7849	-7784	-7714	-7640	-7561	-7478	-7391	-7299	-7203	-7102	-6997
600	-9045	-8979	-8908	-8832	-8751	-8666	-8576	-8481	-8381	-8276	-8166	-8052	-7933
675	-10110	-10034	-9952	-9865	-9774	-9676	-9574	-9467	-9354	-9237	-9114	-8986	-8853
750	-11162	-11075	-10982	-10884	-10780	-10671	-10557	-10437	-10312	-10181	-10045	-9904	-9757
825	-12201	-12102	-11998	-11888	-11772	-11651	-11524	-11392	-11254	-11110	-10961	-10806	-10645
900	-13227	-13116	-12999	-12877	-12749	-12615	-12475	-12330	-12179	-12023	-11860	-11692	-11518
975	-14240	-14116	-13987	-13852	-13711	-13564	-13411	-13253	-13089	-12919	-12744	-12563	-12376
1050	-15240	-15103	-14960	-14812	-14658	-14498	-14332	-14161	-13983	-13801	-13612	-13418	-13218
1125	-16228	-16077	-15920	-15758	-15590	-15417	-15237	-15053	-14862	-14666	-14465	-14257	-14045
1200	-17203	-17037	-16866	-16690	-16508	-16321	-16128	-15929	-15726	-15517	-15302	-15082	-14856
1275	-18166	-17985	-17799	-17608	-17411	-17210	-17003	-16791	-16574	-16352	-16124	-15891	-15653
1350	-19116	-18920	-18718	-18512	-18301	-18085	-17864	-17638	-17407	-17172	-16931	-16686	-16435
1425	-20055	-19842	-19624	-19402	-19176	-18945	-18710	-18470	-18226	-17976	-17723	-17465	-17203
1500	-20981	-20761	-20537	-20309	-20077	-19841	-19591	-19337	-19079	-18817	-18550	-18278	-17995
1575	-21896	-21668	-21437	-21199	-20957	-20711	-20461	-20207	-19949	-19687	-19420	-19148	-18864
1650	-22798	-22563	-22324	-21983	-21738	-21489	-21236	-20979	-20717	-20450	-20178	-19901	-19618
1725	-23690	-23445	-23199	-22858	-22613	-22365	-22113	-21857	-21597	-21332	-21062	-20787	-20507
1800	-24570	-24316	-23961	-23654	-23345	-23035	-22724	-22411	-22097	-21781	-21463	-21144	-20824
1875	-25438	-25114	-24790	-24465	-24139	-23812	-23486	-23157	-22828	-22499	-22168	-21837	-21506
1950	-26296	-25951	-25607	-25263	-24919	-24575	-24232	-23888	-23546	-23202	-22859	-22517	-22174
2025	-27142	-26776	-26412	-26048	-25686	-25325	-24965	-24606	-24249	-23892	-23537	-23182	-22829
2100	-27977	-27590	-27205	-26821	-26441	-26062	-25685	-25311	-24938	-24568	-24200	-23834	-23470
2175	-28802	-28392	-27985	-27582	-27182	-26785	-26392	-26001	-25614	-25230	-24850	-24472	-24098
2250	-29616	-29183	-28755	-28331	-27911	-27496	-27085	-26679	-26277	-25879	-25486	-25097	-24713
2325	-30419	-29963	-29512	-29067	-28627	-28193	-27765	-27343	-26926	-26514	-26109	-25709	-25314
2400	-31212	-30732	-30268	-29791	-29331	-28878	-28432	-27993	-27561	-27136	-26718	-26307	-25903
2475	-31995	-31490	-30992	-30504	-30023	-29551	-29087	-28631	-28184	-27745	-27315	-26892	-26478
2500	-32254	-31740	-31235	-30738	-30251	-29772	-29302	-28841	-28389	-27945	-27511	-27085	-26668

Table 1-5 (Cont.)

Byron Unit 1 Cycle 10

EOL ARI Integral Boron Worth (pcm) as a Function of
Boron Concentration and Temperature
BU = 11614.4 EFP, NoXe, No Samarium

Boron Concentration (ppm)	Core Average Temperature (F)													
	300	320	340	360	380	400	420	440	460	480	500	520	540	557
75	-1037	-1019	-1001	-982	-963	-943	-923	-902	-881	-859	-836	-813	-789	-768
150	-2072	-2038	-2003	-1967	-1929	-1890	-1850	-1808	-1765	-1720	-1674	-1627	-1578	-1536
225	-3090	-3041	-2989	-2936	-2880	-2822	-2762	-2700	-2636	-2570	-2501	-2431	-2358	-2294
300	-4091	-4026	-3959	-3889	-3816	-3739	-3661	-3579	-3495	-3407	-3317	-3225	-3129	-3045
375	-5076	-4996	-4913	-4826	-4736	-4642	-4545	-4446	-4341	-4233	-4123	-4008	-3891	-3788
450	-6044	-5950	-5851	-5748	-5641	-5530	-5416	-5297	-5174	-5048	-4917	-4783	-4644	-4523
525	-6997	-6887	-6773	-6655	-6532	-6404	-6273	-6136	-5996	-5851	-5701	-5547	-5389	-5251
600	-7933	-7809	-7680	-7546	-7407	-7264	-7116	-6963	-6805	-6642	-6475	-6302	-6125	-5971
675	-8853	-8714	-8571	-8422	-8269	-8110	-7946	-7776	-7602	-7422	-7238	-7048	-6853	-6683
750	-9757	-9605	-9447	-9284	-9116	-8941	-8762	-8577	-8387	-8192	-7991	-7784	-7573	-7388
825	-10645	-10479	-10308	-10131	-9948	-9759	-9565	-9366	-9161	-8950	-8734	-8512	-8284	-8086
900	-11518	-11339	-11154	-10963	-10766	-10564	-10356	-10142	-9923	-9697	-9467	-9230	-8988	-8777
975	-12378	-12183	-11984	-11780	-11570	-11355	-11133	-10906	-10673	-10434	-10190	-9939	-9683	-9461
1050	-13218	-13012	-12801	-12583	-12361	-12132	-11898	-11658	-11412	-11160	-10903	-10640	-10372	-10139
1125	-14046	-13826	-13602	-13372	-13137	-12896	-12650	-12397	-12140	-11876	-11607	-11332	-11052	-10809
1200	-14856	-14625	-14389	-14147	-13900	-13647	-13389	-13125	-12856	-12582	-12302	-12016	-11725	-11474
1275	-15653	-15410	-15162	-14908	-14649	-14385	-14116	-13841	-13562	-13277	-12987	-12692	-12391	-12132
1350	-16435	-16180	-15920	-15655	-15385	-15110	-14831	-14546	-14257	-13962	-13663	-13359	-13050	-12783
1425	-17203	-16936	-16664	-16388	-16108	-15823	-15533	-15239	-14941	-14638	-14330	-14018	-13701	-13429
1500	-17955	-17677	-17394	-17108	-16817	-16522	-16224	-15921	-15614	-15303	-14988	-14669	-14346	-14068
1575	-18694	-18404	-18111	-17814	-17514	-17210	-16902	-16592	-16277	-15959	-15638	-15313	-14984	-14702
1650	-19418	-19117	-18813	-18507	-18197	-17885	-17569	-17251	-16930	-16606	-16279	-15948	-15616	-15330
1725	-20128	-19816	-19503	-19187	-18868	-18548	-18225	-17900	-17572	-17243	-16911	-16577	-16240	-15953
1800	-20824	-20502	-20178	-19853	-19527	-19198	-18869	-18538	-18205	-17871	-17535	-17198	-16859	-16570
1875	-21506	-21174	-20841	-20507	-20172	-19837	-19501	-19165	-18827	-18489	-18151	-17811	-17471	-17181
1950	-22174	-21832	-21490	-21148	-20806	-20464	-20123	-19781	-19440	-19099	-18758	-18418	-18077	-17788
2025	-22829	-22477	-22126	-21776	-21427	-21080	-20733	-20388	-20043	-19700	-19358	-19017	-18678	-18390
2100	-23470	-23108	-22749	-22392	-22036	-21683	-21332	-20984	-20637	-20293	-19950	-19610	-19272	-18986
2175	-24098	-23727	-23369	-22995	-22634	-22276	-21921	-21569	-21221	-20876	-20534	-20196	-19861	-19578
2250	-24713	-24333	-23967	-23586	-23219	-22857	-22499	-22145	-21796	-21451	-21111	-20775	-20444	-20165
2325	-25314	-24925	-24542	-24165	-23793	-23427	-23066	-22711	-22362	-22018	-21680	-21348	-21021	-20748
2400	-25903	-25505	-25115	-24732	-24355	-23986	-23623	-23268	-22919	-22577	-22242	-21915	-21594	-21326
2475	-26478	-26073	-25676	-25287	-24906	-24534	-24170	-23814	-23467	-23128	-22797	-22475	-22161	-21901
2500	-26668	-26259	-25860	-25469	-25087	-24714	-24350	-23994	-23648	-23310	-22981	-22660	-22349	-22091

(Final)

APPROVED

APR 15 1999

Table 1-6

Byron Unit 1 Cycle 10

Summary of Control Rod Worths (pcm)

HZP NoXe

Burnup		Control Banks	Shutdown Banks	Control and Shutdown Banks
BOL	0 EFPD	2739.0	3624.0	6363.0
MOL	1707.7 EFPD	2828.3	3679.7	6508.0
MOL	5692.2 EFPD	3019.2	3133.7	6152.9
LFPC	11526.7 EFPD	3314.9	3195.7	6510.6

HFP EqXe

Burnup		Control Banks	Shutdown Banks	Control and Shutdown Banks
BOL	85.4 EFPD	3065.4	4034.9	7100.3
MOL	1707.7 EFPD	3124.0	4084.5	7208.5
MOL	5692.2 EFPD	3380.4	4141.2	7521.6
LFPC	11526.7 EFPD	3837.9	4760.7	8598.6

Most Reactive Stuck Rod Worth To Use in the Event of
An Untrippable RCCA(s) with RCCAs Withdrawn

Rod Worth (pcm) = 2000 pcm / Untrippable RCCA

Highest (ARI-1) Stuck Rod Worths for Cycle 10

Burnup		Rod Location	Temperature	Rod Worth (pcm)
BOL	0 EFPD	K-6	200 F	869.6
MOL	1707.7 EFPD	K-6	200 F	839.7
MOL	5692.2 EFPD	K-6	350 F	1029.1
LFPC	11526.7 EFPD	K-6	200 F	1290.6

The EFPD to MWD/MTU conversion factor is 1.75679 MWD/MTU.

(Final)

- 1 -

APPROVED

JUL 09 1999

Facility: BYRON

Task No: _____

Task Title: SHIFT TURNOVERJob Performance Measure No: A.1.2K/A Reference: 2.1.3 3.0/3.4

Examinee: _____

NRC Examiner: _____

Date: _____

Method of testing:

Simulated Performance _____X_____

Actual Performance _____

Classroom _____

Simulator _____x_____

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 You are the relieving Unit SRO/RO
 You stood watch yesterday
 Unit 1 is in mode 1
 All controls are in automatic

Task Standard: PERFORM A SHIFT TURNOVER

Required Materials: BAP 300-1T9
 OP-AA-101-401

General References: BAP 300-1T9
 OP-AA-101-401

Initiating Cue: PERFORM A COMPLETE SHIFT TURNOVER OF YOUR APPROPRIATE WATCH STATION, INCLUDING LOG REVIEW . THE BOARD WALK DOWN THAT YOU PERFORM WILL BE ONLY ON PANELS 1PM05J, 6J. YOU WILL BE GIVEN 15 MINUTES FOR THE WALK DOWN. WHEN YOU ARE FINISHED WE WILL DISCUSS ANY DISCREPANCIES OR PROBLEMS NOTED.

Time Critical Task: NO

Validation Time:

PERFORMANCE INFORMATION

START TIME: _____

(Denote critical steps with a **BOLD ***)

Performance step: 1

ENTER BAP 300-1T9Standard: LOCATE AND OPEN BAP 300-1T9CUE: HAND BAP 300-1T9 TURNOVER SHEET TO APPLICANTComment: _____

Performance step: 2

REVIEW THE APPLICABLE UNIT LOGS SINCE THE LAST WATCH STOOD (YESTERDAY)Standard: UNIT LOGS REVIEWEDNOTE: THE CREW LOGS MUST BE REVIEWED ALONG WITH ANY REVIEWS REQUIRED
BY ATTACHED TURNOVER SHEETComment: _____

Performance step: 3

*** TOUR THE MAIN CONTROL ROOM/ WALK DOWN THE BOARDS ***

Standard: *** CONTROL ROOM BOARDS WALKED DOWN AND 5 ERRORS FOUND
RO'S WILL ADVISE OF TECH SPECS, SRO'S WILL EVALUATE TECH SPECS ***

ANSWER: THE FOLLOWING 5 ITEMS ARE WRONG

ACCUMULATOR #1 PRESSURE 500 PSIG

1 HOUR T.S. 3.5.1 RESTORE ACCUMULATOR PRESSURE $\geq$ 602 PSIG

ANNUNCIATOR SYSTEM IS BROKEN, LIGHTS AND HORN

EVALUATE POTENTIAL EP MS6 MATRIX

ALARM PRINTER STILL OPERATES

CONTROL RODS 18 STEPS OUT OF ALIGNMENT FOR A1

1 HOUR T.S. 3.1.4 SDM VERIFY, $>$ 12 STEPS OUT

RHR CROSS CONNECT VALVE IS SHUT

T.S. 3.0.3 7 HOURS MODE 3

RWST LEVEL 70%

1 HOUR T.S. 3.5.4 VERIFY WATER SOURCE, RWST $\geq$ 89%.

NOTE: THE SAFETY SIGNIFICANCE AND TECH SPEC ISSUE OF THE PROBLEMS MUST BE DISCUSSED BY RO'S AND ANALYZED BY SRO'S TO RECEIVE FULL CREDIT FOR EACH FAULT THAT IS IDENTIFIED. 4 OUT OF 5 FAULTS MUST BE FOUND TO PASS

Comment: -----

Performance step: 4

COMPLETE TURNOVER

Standard: **REFUSE TO TAKE THE TURNOVER UNTIL ITEMS ARE FIXED OR
ADDRESSED**

Comment: -----

TERMINATING CUE: TO RELIEF I REFUSE TO TAKE THE WATCH UNTIL THE ITEMS ARE
FIXED

TIME STOP _____

Facility: BYRON

Task No: _____

Task Title: TAGOUTJob Performance Measure No: A.2K/A Reference: 2.2.13 3.6/3.8

Examinee: _____

NRC Examiner: _____

Date: _____

Method of testing:

Simulated Performance _____X_____

Actual Performance _____

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: You are an extra SRO/RO on shift
 Unit 1 is in mode 1
 All controls are in automatic
 Maintenance will be performed on the 1B CS pump

Task Standard: REVIEW AND APPROVE A TAGOUT

Required Materials: BAP 300-1T9
 OP-AA-101-401

General References: BAP 300-1T9
 OP-AA-101-401

Initiating Cue: THE SM DIRECTS YOU TO REVIEW AND APPROVE A PREVIOUSLY
 GENERATED OOS ON THE UNIT 1 1B CONTAINMENT SPRAY PUMP FOR
 UPCOMING MAINTENANCE ON THE NEXT SHIFT

Critical Task: NO**Validation Time:**

PERFORMANCE INFORMATION

START TIME: _____

(Denote critical steps with a **BOLD ***)

Performance step: 1

ENTER BAP 330-1Standard: LOCATE AND OPEN BAP 330-1Comment: -----

Performance step: 2

REVIEW THE APPLICABLE PORTION OF BAP 330-1Standard: BAP 330-1 REVIEWEDComment: -----

Performance step: 3

*** REVIEW THE CLEARANCE ***

Standard: *** CLEARANCE REVIEWED AND 5 ERRORS FOUND ***

ANSWER: FOLLOWING 5 ITEMS ARE WRONG

1HS-CS002 IS LOCATED IN 1PM06J AND NOT BUS 142
1CS01PB FU TAG MISSING 1AP06E-H-FU-14
1AP06E-H LISTED AS CS PP 1A BRKR
1CS001B CS PP RWST SUCT VALVE LEFT OPEN
1CS016B 1B CS PP HDR DRN VLV LISTED HANG 001

NOTE: 4 OUT OF THE 5 FAULTS MUST BE FOUND TO PASS

Comment: -----

Performance step: 4

CORRECT CLEARANCE

Standard: **5 ERRORS CORRECTED ON CLEARANCE**

Comment: -----

TERMINATING CUE: SM I HAVE REVIEWED THE CLEARANCE AND FOUND 5 ERRORS
AND THE CORRECTIONS HAVE BEEN MADE

TIME STOP_____



BYRON STATION MASTER
FIRST HANG

CHECKLIST: 001
EXCEPTIONAL

990015055

UNIT 01

PAGE: 1

MASTER KEY

EPN: 1CS01PB ALT EPN: NAME: ASSY - 1B CS PP
ASMBLY/EQUIP: PMPA 01PB WORK DESC: 1B CS TRAIN-WINDOW WORK (MM,FH,OA)

MC LOC: 01 A 22
PREPARED BY: B E BUZA
1ST APPR: B E BUZA
2ND APPR:

SPECIAL INST: SEE SPECIAL INSTRUCTIONS PAGE

TECH SPEC : ITS 3.6.6
ITS 3.6.7

APPLIC MODE : 1 2 3 4
REQUIRED MODE: 1 2 3 4 5 6

AUTH BY:

HANG SEQ	HANG POS	HANG BY	HANG IV	ISOLATION POINT LOCATION & DESCRIPTION	LIFT SEQ	LIFT POS	LIFT BY	LIFT IV
HANG 001 006 INFO-I INFO 12 COM 4			N/A	1CS016B 1B CS PP SUCT HDR DRN VLV +1 OPEN TO DRAIN, THEN RECLOSE	343	-W	14	RXB1
HANG 001	OOS-S PTL			1HS-CS002 1CS01PB C/S CONTAINMENT SPRAY PP 1B MCB C/S BUS 142 → 12 CORRECT 1PM 06J	451	-L	15	AB1 MCR
HANG 001	OOS-S AUT/CL (SEE NOTES)			1HS-CS008 1CS001B C/S CS PP 1B SUCT VLV MCB C/S 1PM06J CLOSING 1CS001B WITH 1B RH SUCTION ALIGNED TO THE RCS M	451	-L	15	AB1 MCR
HANG 001	OOS-S AUT/CL			1HS-CS010 1CS009B C/S CS PP 1B RECIRC SUMP SUCT VLV MCB C/S 1PM06J	451	-L	15	AB1 MCR
HANG 002	OOS-R OFF			1A P06E-H-FU-14 1CS01PB FU 426 -N 10 CONTAINMENT SPRAY PP 1B CIP FU BUS 142 CUB 08 FU-14				12 CORRECT MISSING

COMPLETED BY:

DATE:

TIME:

HANG SEQ	HANG POS	HANG BY	HANG IV	ISOLATION POINT LOCATION & DESCRIPTION				LIFT SEQ	LIFT POS	LIFT BY	LIFT IV
HANG 003	OOS-R R/O			1AP06E-H CONTAINMENT SPRAY PP 1A BRKR BUS 142	1CS01PB BKR CUB 08	426	-L	06			
ECODE: 0000216060											
HANG 004	OOS-R OFF			1AP24E-B2-10 CS PP 1B MOTOR HEATER BRKR MCC 132X3	1CS01PB MTR HTR CUB B2-10	383	-P	16			
ECODE: 0000213594											
HANG 004	OOS-R OFF			1AP28E-A3 CS PP 1B SUCT VLV BRKR MCC 132X4	1CS001B BKR CUB A3	426	-S	13	RXB1		
ECODE: 0000213866											
HANG 004	OOS-R OFF			1AP23E-G1 CS PP 1B RECIRC SUMP SUCT VLV BRKR MCC 132X1	1CS009B BKR CUB G1	364	-N	17	AB1		
ECODE: 0000213574											
HANG 005	OOS-R CLOSED			1CS046B 1B CS EDUC INLET ISOL VLV +7		343	-W	14	RXB1		
ECODE: 0000226392											
HANG 005	OOS-R CLOSED			1CS004B 1B CS PP 1CS01PB DSCH ISOL VLV +1		343	-W	14	RXB1		
ECODE: 0000225997											
HANG 005	OOS-R CLOSED			1CS035B 1B CS PP DSCH TO EDUC ISOL VLV +1		434	-W	14	RXB1		
ECODE: 0000226335											
HANG 005	OOS-R OPEN			1CS001B ASSY - MOV 1B CS PP RWST SUCT VLV +03 (EOP VLV), CONTROLLED AT - 1PM06J		364	-W	14	RXB1		
ECODE: 0000225954											

HANG SEQ	HANG POS	HANG BY	HANG IV	ISOLATION POINT LOCATION & DESCRIPTION				LIFT SEQ	LIFT POS	LIFT BY	LIFT IV
HANG 005	OOS-R CLOSED			1CS009B ASSY - MOV 1B CS PP CNMT RECIRC SUMP SUCT VLV +01 (EOP VLV), CONTROLLED AT - 1PM06J	343	-W	14	RXB1			
ECODE: 0000225966											
HANG 006	INFO-I INFO			1CS012B 1B CS EDUC DSCH HDR DRN VLV +1 OPEN TO DRAIN, THEN RECLOSE	343	-W	14	RXB1			
ECODE: 0000226088											
HANG 006	INFO-I INFO			1CS043B 1B CS EDUC INLET HDR DRN CONN ISOL VLV +4 OPEN TO DRAIN, THEN RECLOSE	343	-W	14	RXB1			
ECODE: 0000226380											
HANG 007	NO-CARD N/A			1CS01PB-M 1B CS PP MTR +05	343	-W	13	RXB1			
ECODE: 0000226691											
HANG 007	NO-CARD N/A			1CS003B 1B CS PP 1CS01PB DSCH NOZL CHK VLV +1	343	-W	14	RXB1			
ECODE: 0000225993											
HANG 007	NO-CARD N/A			1CS011B 1B CS EDUC 1CS01SB OUTLET CHK VLV	343	-W	14	RXB1			
ECODE: 0000226078											
HANG 007	NO-CARD N/A			1CS020B 1B CS EDUC 1CS01SB INLET CHK VLV +7	343	-W	14	RXB1			
ECODE: 0000226157											
***** END OF ISOLATION POINTS *****											

Facility: BYRON

Task No: _____

Task Title: CNMT ENTRYJob Performance Measure No: A. 3K/A Reference: 2.3.2, 2.3.4, 2.3.10 2.5/2.5/2.9

Examinee: _____

NRC Examiner: _____

Date: _____

Method of testing:Simulated Performance X

Actual Performance _____

Classroom _____

Simulator _____

Plant X

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: You are an extra RO on shift
Unit 1 is in mode 1, RX power stable at 100% for last 6 hours
All controls are in automatic

Task Standard: CNMT ENTRY

Required Materials: BAP 1450-T2
1BVSR 6.2.1-2
RP-AA-460
BAP 1450-8
BAP 1450-1
BAP 1450-1T1
1BOSR Z.5.b.1-1

General References: BAP 1450-T2
1BVSR 6.2.1-2
RP-AA-460
BAP 1450-8
BAP 1450-1
BAP 1450-1T1
1BOSR Z.5.b.1-1

Initiating Cue: UNIT 1 SRO DIRECTS YOU TO MAKE A CONTAINMENT ENTRY AT POWER, THROUGH THE NORMAL AIR LOCK ON UNIT 1. THE ENTRY IS BEING PERFORMED TO INVESTIGATE A POTENTIAL LEAK WITH THE INCORE PROBES. THE ENTRY WILL LAST 15 MINUTES. YOU WILL BE GOING IN WITH A RAD TECH.

Time Critical Task: NO

Validation Time:

PERFORMANCE INFORMATION

START TIME: _____

(Denote critical steps with a **BOLD ***)

Performance step: 1

ENTER BAP 1450-1Standard: LOCATE AND OPEN BAP 1450-1Comment: _____

Performance step: 2

*** START BAP 1450-T2 ***Standard: *** PERFORM BAP 1450-T2 UP TO STEP 10 ***CUE: THE APPLICANT WILL THEN HAND THE PROCEDURE TO YOU. STEP 10- 19 WILL
BE COMPLETED BY YOU AND DISCUSSED WITH APPLICANT. YOU WILL HAND
THE APPLICANT 1BOSR Z.5.b.1-1 TO PERFORM CNMT LOOSE DEBRIS
INSPECTION DURING THE DISCUSSION.NOTE: COMPLETED INFORMATION COPY ATTACHED FOR DISCUSSION WITH CRITICAL
STEPS CIRCLEDComment: _____

Performance step: 3

RETURN TO BAP 1450-1

Standard: COMPLETE BAP 1450-1

CUE: WHEN ASKED ALL AIR SAMPLES HAVE BEEN TAKEN CURRENT SURVEY MAPS SHOW THE DATA, CONTAINMENT TEMPERATURE IS 90F, RADCON HAS ESTABLISHED CONTAINMENT STATUS

NOTE: THE APPLICANT MUST USE CURRENT SURVEY MAPS FOR JOB DESCRIPTION ROUTE AND INFORMATION. THE CURRENT RWP FOR CONTAINMENT WILL BE USED FOR DOSIMETRY AND CLOTHING REQUIREMENTS

Comment: -----

Performance step: 4

***(SIMULATE) THE APPLICANT ENTERS AND EXITS CONTAINMENT ALSO PERFORMS 1BOSR Z.5.b.1-1 ***

Standard: ***(SIMULATE) CONTAINMENT EXITED AND 1BOSR Z.5.b.1-1 COMPLETED ***

CUE: WHEN ASKED NO LOOSE DEBRIS WAS FOUND DOORS TO MISSILE BARRIER ARE CLOSED AND LOCKED

NOTE: DISCUSS CONTAINMENT ENTRY AND EXIT

Comment: -----

Performance step: 5

*** COMPLETE BAP 1450-T2 ***

Standard: *** BAP 1450-T2 COMPLETED AND TURNED IN TO SM UP TO STEP 21 ***

CUE: STEP 21 AND 22 COMPLETED DISCUSS WITH APPLICANT

NOTE: COMPLETED INFORMATION COPY ATTACHED FOR DISCUSSION

Comment: -----

TERMINATING CUE: SM I HAVE COMPLETED MY CONTAINMENT ENTRY AND FOUND NO PROBLEMS WITH THE INCORE PROBES

TIME STOP _____

Facility: BYRON

Task No: _____

Task Title: GASEOUS RELEASEJob Performance Measure No: A.3K/A Reference: 2.3.6 3.1

Examinee: _____

NRC Examiner: _____

Date: _____

Method of testing:

Simulated Performance _____X_____

Actual Performance _____

Classroom _____

Simulator _____X_____

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: You are the Unit SRO
 Unit 1 is in mode 1
 All controls are in automatic, 1PB111 IS OOS

Task Standard: AUTHORIZE A GASEOUS EFFLUENT RELEASE

Required Materials: BCP 400-TCNMT/ROUTINE
 CNMT NOBLE GAS ACTIVITY - RADIOCHEMISTRY ANALYSIS
 CNMT TRITIUM ACTIVITY - RADIOCHEMISTRY ANALYSIS

General References:
BCP 400 - TCNMT/ROUTINE

Initiating Cue: THE SM DIRECTS YOU THE UNIT SUPERVISOR TO AUTHORIZE A
 GASEOUS EFFLUENT RELEASE FROM UNIT 1 CONTAINMENT

Time Critical Task: NO

Validation Time:

PERFORMANCE INFORMATION

START TIME: _____

(Denote critical steps with a **BOLD ***)

Performance step: 1

ENTER BCP 400-TCNMTStandard: LOCATE AND OPEN BCP 400-TCNMT, OBTAIN RELEASE NUMBER
EXPIRATION TIME/DATECUE: WHEN ASKED RELEASE NUMBER IS 00094, EXPIRATION TIME 0900 NEXT DAYComment: _____

Performance step: 2

OBTAIN RADIOCHEMISTRY ANALYSES FOR CNMT NOBLE GAS AND TRITIUM ACTIVITYStandard: OBTAIN ANALYSES SHEETSCUE: WHEN ASKED GIVE THE CNMT NOBLE GAS AND TRITIUM ACTIVITY
SHEETS FROM RADIOCHEMISTRYComment: _____

_____NOTE: REFER TO ATTACHED RELEASE FORMS FOR FURTHER ANSWERS

Performance step: 3

*** DETERMINE RELEASE RATES ***Standard: *** RELEASE RATES WRITTEN IN ***Comment: _____

Performance step: 4

*** DETERMINE MONITOR SETPOINTS AND RELEASE SUMMARY INFORMATION ***

Standard: *** MONITOR SETPOINTS AND RELEASE SUMMARY INFORMATION WRITTEN IN***

CUE: WHEN ASKED 1PB101 IS READING 2.88 X 10-6
WHEN ASKED SIGN FOR RP SUPERVISION

NOTE: INITIAL CONDITIONS 1PB111 WAS OOS

Comment: -----

Performance step: 5

*** MONITOR CHECKS ***

Standard: *** MONITOR CHECKS COMPLETE ***

CUE: WHEN ASKED CHANNEL CHECK ON 1 RE-PR001 COMPLETE
1PR01J SOURCE/CHANNEL CHECK COMPLETE

Comment: -----

Performance step: 6

*** RECORD 1PB101 DATA ***

Standard: *** 1PB101 AS FOUND HIGH SETPOINT AND LOW SETPOINT DATA RECORDED ***

ACTUAL DATA HIGH _____ LOW _____

CUE: AFTER APPLICANT HAS FOUND DATA FOR 1PB101 ON GRID 2 HAVE THEM
RECORD THE FOLLOWING AS THE DATA HIGH IS 4.83 E-4 UCI/CC AND
LOW IS 2.42 E-4 UCI/CC

NOTE: MAKE APPLICANT SHOW THAT THE SETPOINT CAN BE FOUND ON GRID 2

Comment: -----

Performance step: 7

*** VERIFY FAN RUNNING ***

Standard: * OB AUX BLDG EXHAUST FAN IS RUNNING *

CUE: WHEN ASKED OB AUX BLDG EXHAUST FAN IS RUNNING

Comment: -----

Performance step: 8

* AUTHORIZE RELEASE *

Standard: * RELEASE AUTHORIZED *

CUE: WHEN ASKED 1BOSR 11.B.5-1 WAS COMPLETED AND REVIEWED

Comment: -----

TERMINATING CUE: SM I HAVE APPROVED THE GAS RELEASE

TIME STOP _____

Facility: BYRON

Task No: _____

Task Title: COMMUNICATION OF NARS FORM Job Performance Measure No: A.4K/A Reference: 2.4.43 2.8

Examinee: _____

NRC Examiner: _____

Date: _____

Method of testing:

Simulated Performance _____

Actual Performance X

Classroom _____

Simulator X

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: You are an extra RO. There has been an General Emergency event classification. The Unit SRO has directed you to make all appropriate communications/transmittals of the NARS form.

Task Standard: Emergency Communications

Required Materials: BZP 200-A1, BZP 200-1, BZP 300-A2, BZP 310-2T1, BZP 310-2

General References:

BZP 200-A1

BZP 300-A2

BZP 310-2T1

BZP 310-2

Initiating Cue: SHIFT MANAGER/EMERGENCY DIRECTOR DIRECTS YOU TO PERFORM THE COMMUNICATION/TRANSMITTAL OF THE NARS FORM AND PROVIDE THE REQUIRED INFORMATION. YOU ARE TO PERFORM STEP 3 o-r AND STEP 4a-g OF BZP 310-2, ALSO FILL OUT THE APPLICABLE SECTIONS OF BZP 310-2T1.

Time Critical Task: 15 minutes to complete

Validation Time:

PERFORMANCE INFORMATION

START TIME: _____

(Denote critical steps with a **BOLD ***)

Performance step: 1

ENTER BZP 310-2Standard: LOCATE AND OPEN BZP 310-2CUE: GIVE APPLICANT PARTIALLY COMPLETED BZP 310-2T1 FORMComment: -----

Performance step: 2

*** CONTACT THE AGENCIES IAW STEP 4 a ***Standard: *** THE FOLLOWING AGENCIES WERE CONTACTED IN ORDER IEMA, IDNS,
THEN ELECTRIC OPERATIONS USING OUTSIDE TELEPHONE NUMBERS ***NOTE: THE APPLICANT WILL DIAL CODE 37 FOR CALL SINCE GENERAL EMERGENCYCUE: WHEN APPLICANT DIALS THE NARS PHONE IS INOPERABLE
WHEN ASKED ANSWER CALL AS IEMA, IDNS, AND ELECTRIC OPERATIONSNOTE: OUTSIDE PHONE NUMBERS ARE LISTED ON BOTTOM OF BZP 310-2T1 FORMComment: -----

Performance step: 3

*** MESSAGE COMMUNICATED AND TRANSMITTED IAW STEP 4 b-g ***

Standard: *** THE NARS FORM DATA IS COMMUNICATED AND TRANSMITTED TO AGENCIES ***

CUE: WHEN ASKED ANSWER THE ROLL CALL AS THE AGENCIES
GIVE NAME AS JOHN SMITH FOR IEMA PERSON RECEIVING DATA

NOTE: CRITICAL INFORMATION ROLL CALLS, EVENT CLASSIFICATION, PARS

NOTE: JOHN SMITH WILL BE PLACED IN BLOCK 13 OF BZP 310-2T1

NOTE: 15 MINUTE TIME LIMIT FOR COMPLETION

Comment: -----

Performance step: 4

*** COMPLETE APPLICABLE PORTIONS OF BZP 310-2T1 IAW STEP 3 o-r AND GIVE TO SUPPORT STAFF***

Standard: *** STEP 3 o-r COMPLETED , BZP 310-2T1 COMPLETED AND GIVEN TO SUPPORT STAFF ***

CUE: WHEN ASKED TAKE THE COMPLETED BZP 310-2T1 FORM AS SUPPORT STAFF

NOTE: COMPLETED BZP 310-2T1 FORM WILL BE ATTACHED

Comment: -----

TERMINATING CUE: SED I HAVE COMPLETED THE TRANSMISSION OF THE NARS FORM

TIME STOP _____

Facility: BYRON

Task No: _____

Task Title: NARS FORM (CLASSIFY EVENT)Job Performance Measure No: A.4K/A Reference: 2.4.41 4.1

Examinee: _____

NRC Examiner: _____

Date: _____

Method of testing:

Simulated Performance _____

Actual Performance XClassroom 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: You are the Unit 1 SRO. Testing had been performed on a set of containment inboard and outboard isolation valves and LCO 3.6.3 was entered. A Steam Generator tube rupture occurred on 1A S/G and containment was evacuated. The Unit is cooling down IAW 1BEP-3. The chemistry results showed a 0.8% clad failure. The wind is blowing at 10 miles/hr from 222 degrees.

Task Standard: CLASSIFY EVENT AND MAKE PARS IF NECESSARY**Required Materials: BZP 200-A1, BZP 200-1, BZP 300-A2, BZP 310-2T1****General References:**

BZP 200-A1

BZP 200-1

BZP 300-A2

BZP 310-2T1

Initiating Cue: CLASSIFY THE EVENT BASED ON THE INITIAL CONDITIONS AND FILL OUT ALL ASSOCIATED PAPERWORK. (15 MINUTE TIME LIMIT AFTER CLASSIFICATION)**Time Critical Task: NO****Validation Time:**

PERFORMANCE INFORMATION

START TIME: _____

(Denote critical steps with a **BOLD ***)

Performance step: 1

ENTER 1BZP 200-A1Standard: LOCATE AND OPEN 1BZP 200-A1Comment: -----

Performance step: 2

CLASSIFY EVENTStandard: EVENT IS A GENERAL EMERGENCY BASED ON LOSS OF 3 BARRIERS

NOTE: COMPLETED CHART FOR CLASSIFICATION ATTACHED

Comment: -----

Performance step: 3

ENTER 1BZP 300-A2Standard: LOCATE AND OPEN 1BZP 300-A2Comment: -----

Performance step: 4

*** MAKE PARS ***

Standard: *** PARS C, H, F, & G MADE ***

NOTE: COMPLETED FLOW CHART OF PARS ATTACHED

Comment: -----

Performance step: 5

*** FILL OUT BZP 310-2T1 ***

Standard: *** BZP 310-2T1 FILLED IN WITH ABOVE DATA ***

NOTE: COMPLETED BZP 310-2T1 ATTACHED

Comment: -----

TERMINATING CUE: THE EVENT CLASSIFICATION AND PARS ARE MADE WITH
BZP 310-2T1 FILLED OUT

TIME STOP _____