(7-77)

LICENSEE EVENT REPORT

CONTROL BLOCK: [| | | | |] (1) (PLEASE PRINT OR TYPE ALL REQUIRED INFORMATION)

01	LICENSEE CODE: M N P I N 1 (2) LICENSE NUMBER: 0 0 - 0 0 0 0 0 - 0 0 (3) LICENSE TYPE: 4 1 1 1 1 (4) CAT: (5)
CON'T 01	REPORT SOURCE: L (6) DOCKET NUMBER: 0 5 0 0 0 2 8 2 (7) EVENT DATE: 0 4 2 3 8 2 (8) REPORT DATE: 0 5 0 7 8 2 (9)

EVENT DESCRIPTION AND PROBABLE CONSEQUENCES (10)

02	Measured reactor coolant boron concentration is higher than the originally
03	predicted value by about 120 ppm at a cycle burnup of about 6200 MWD/MTU.
04	Not repetitive. Tech Spec 4.9 applies. No effect on public health and safety.
05	See attached details.
06	
07	
08	

	SYSTEM CODE	CAUSE CODE	CAUSE SUBCODE	COMPONENT CODE	COMP. SUBCODE	VALVE SUBCODE
09	R C (11)	X (12)	Z (13)	Z Z Z Z Z Z (14)	Z (15)	Z (16)

(17) LER/RO REPORT NUMBER	EVENT YEAR		SEQUENTIAL REPORT NO.		OCCURRENCE CODE	REPORT TYPE		REVISION NO.
	8 2	—	0 0 6	/	0 1	T	—	0

ACTION TAKEN	FUTURE ACTION	EFFECT ON PLANT	SHUTDOWN METHOD	HOURS (22)	ATTACHMENT SUBMITTED	NPRD-4 FORM SUB.	PRIME COMP. SUPPLIER	COMPONENT MANUFACTURER
X (18)	X (19)	Z (20)	Z (21)	0 0 0 0	Y (23)	N (24)	Z (25)	Z 9 9 9 (26)

CAUSE DESCRIPTION AND CORRECTIVE ACTIONS (27)

10	Apparent miscalculation of the predicted worth and/or depletion rate of
11	gadolinium in the fresh fuel assemblies. See attached details.
12	
13	
14	

	FACILITY STATUS	% POWER	OTHER STATUS (30)	METHOD OF DISCOVERY	DISCOVERY DESCRIPTION (32)
15	E (28)	1 0 0 (29)	NA	B (31)	Surveillance Test

	ACTIVITY RELEASED	CONTENT OF RELEASE	AMOUNT OF ACTIVITY (35)	LOCATION OF RELEASE (36)
16	Z (33)	Z (34)	NA	NA

PERSONNEL EXPOSURES

	NUMBER	TYPE	DESCRIPTION (39)
17	0 0 0 (37)	Z (38)	NA

PERSONNEL INJURIES

	NUMBER	DESCRIPTION (41)
18	0 0 0 (40)	NA

LOSS OF OR DAMAGE TO FACILITY (43)

	TYPE	DESCRIPTION
19	Z (42)	NA

8205140500 820507
PDR ADOCK 05000282
S PDR

	ISSUE	DESCRIPTION	NRC USE ONLY
20	N		

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GPO 917-926

NORTHERN STATES POWER COMPANY
PRAIRIE ISLAND NUCLEAR GENERATING PLANT

Docket No. 50-282
50-306

LER 82-006/0IT-0

Event Description

On April 23, 1982 surveillance test SP 1104, Reactivity Anomalies, was performed. This surveillance compares the measured RCS full power equilibrium boron concentration as a function of burnup to the normalized predicted boron concentration. The comparison resulted in a deviation between predicted and measured RCS boron concentration which, within the limits of measurement error, reached the equivalent of 1% Δk/k. The disagreement on April 23 was 114ppm at a burnup of 6221 MWD/MTU or the equivalence of 0.98% Δk/k or 3ppm from the limit. The disagreement has been determined to be a modelling concern and not a deviation in core performance.

Cause Description and Corrective Actions

Three apparent causes were considered. These are: 1. a miscalculation of burnup; 2. a miscalculation of the predicted gadolinium worth and/or depletion rate, and; 3. RCS soluble boron with a reduced B-10 abundance. Further investigation has eliminated possibilities 1 and 3 as major contributors to the disagreement. Additional independent analysis by both NSP* and the fuel vendor definitely indicate that the disagreement is related to the analytical description of the 4 w/o gadolinia assemblies.

The predicted RCS boron concentration as a function of burnup was supplied by Exxon in their Unit 1-Cycle 7 Startup and Operations Report. NSP also calculates the predicted boron concentration vs burnup; however, the Exxon curve is used for the comparisons in SP 1104. (Note: By comparison to NSP's original normalized predictions the deviation is less than half.) The predicted Exxon curve was normalized to measured data at about 10% of cycle burnup as per T.S. 4.9. This normalization point was at 1339 MWD/MTU and a measured RCS boron concentration of 896ppm. The predicted boron concentration at this time is 914ppm for a correction of -18ppm. Subsequent comparison of normalized predicted vs measured boron concentration (Figure 1) has shown a gradual increase in the deviation between measured and predicted up to a burnup of approximately 6000 MWD/MTU where the disagreement stopped diverging and leveled off at about 1% Δk/k. The most recent measurements (up to May 5, 1982) indicate the disagreement has started to converge and is presently at 0.9% Δk/k corresponding to a burnup of approximately 6630 MWD/MTU.

Burnup is calculated using the FOLLOW code where the hourly power history, as recorded by the Nuclear Instrumentation System (NIS), and core MTU are used as input. The FOLLOW output burnup calculation is checked by comparing the unit capacity factor based on monthly burnup to the monthly electrical capacity factor. The NIS is calibrated daily using a secondary system calorimetric. All primary, secondary and electrical plant parameters show the NIS is indicating the correct power level. Based on this evidence a miscalculation of burnup has been dismissed as a cause of the boron disagreement.

* See NSP Topicals (NSPNAD-8101P and NSPNAD-8102P) submitted 2/12/82 for review.

The RCS boron concentration is measured approximately daily by titration of a sample of the RCS coolant. The measurement uncertainty is < 1% of the measured value. Only full power equilibrium xenon data points are used in the comparisons. Soluble boron with a reduced B-10 abundance was considered as a contributor to the disagreement but was dismissed because: 1. Chemistry data on lithium (a by-product of B-10, neutron reactions) removal from the RCS could account for less than 30% of the disagreement (using very conservative calculations) and 2. The Unit 2 comparison of measured and predicted RCS boron concentration agree very well (Unit 1 and 2 share boron reprocessing equipment and much intermixing of boric acid supplies exists). Concentrated samples of the Unit 1 coolant have been prepared and sent offsite for an isotopic analysis of boron. Results of this analysis are not yet available.

Analytical analysis of the disagreement by Exxon and NSP has shown that the deviation can be partially in Exxon's case or more closelyin NSP's analysis, accounted for by adjustments in the modeling of the 4 w/o gadolinia assemblies.

Both analyses indicate the disagreement should start to converge at about 6200 MWD/MTU and disappear by the end of the cycle.

Power distribution measurement using the incore instrumentation system results in good agreement with predictions with margin to Tech Spec limits. No axial shifts in the power distribution have been noted. The RCS equilibrium coolant activity has remained stable since the first month of the cycle.

Surveillance frequency of the predicted and measured boron concentration measurements and power distribution measurements has been increased until the disagreement starts to converge. Analyses by Exxon and NSP have resulted in improvements in gadolinia modeling. Continuing analysis is being performed to monitor the disagreement. Reviews of the disagreement indicate no safety related problems and demonstrate adequate shutdown margin.

FIGURE 1

PRAIRIE ISLAND UNIT 1 CYCLE 7

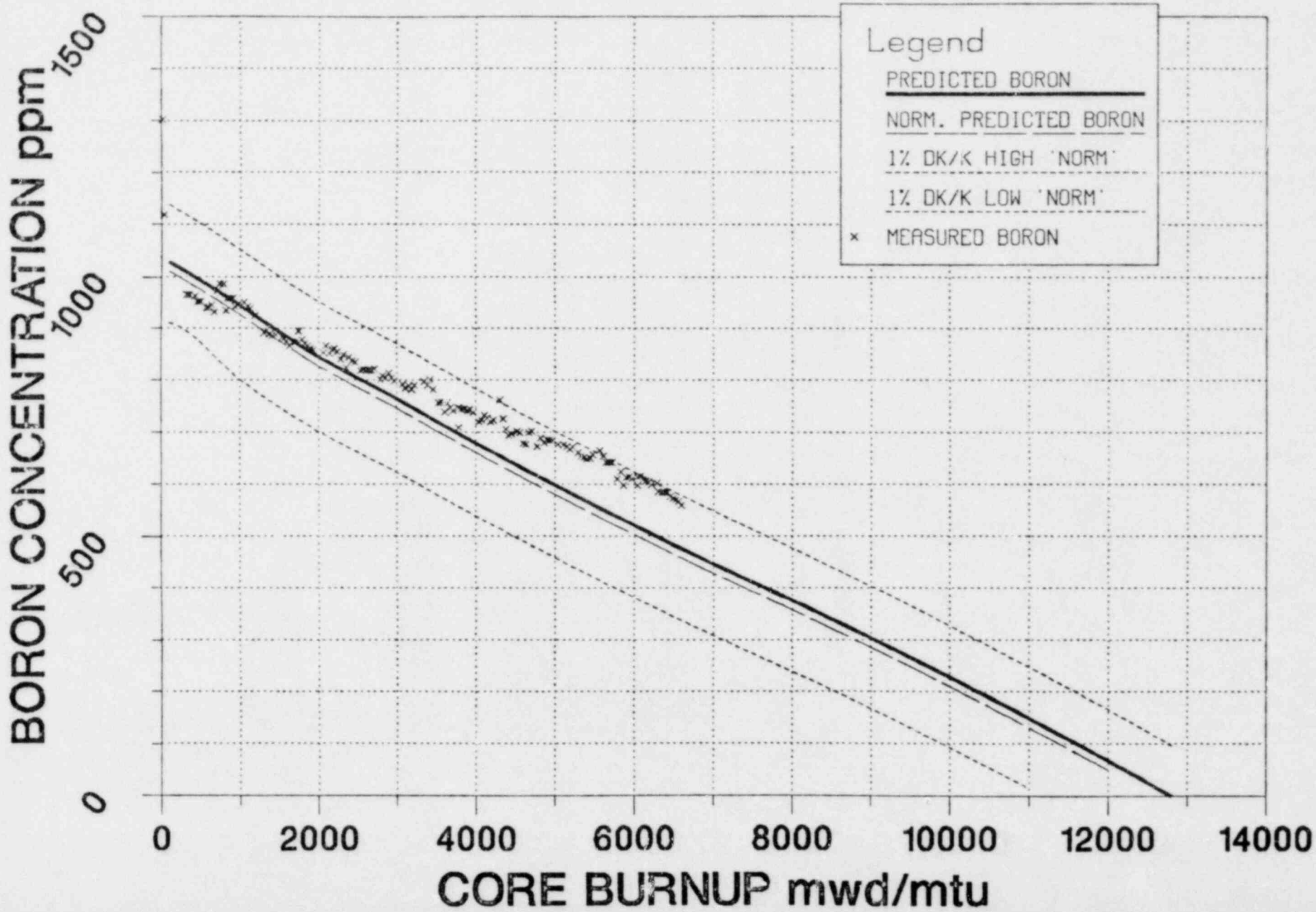
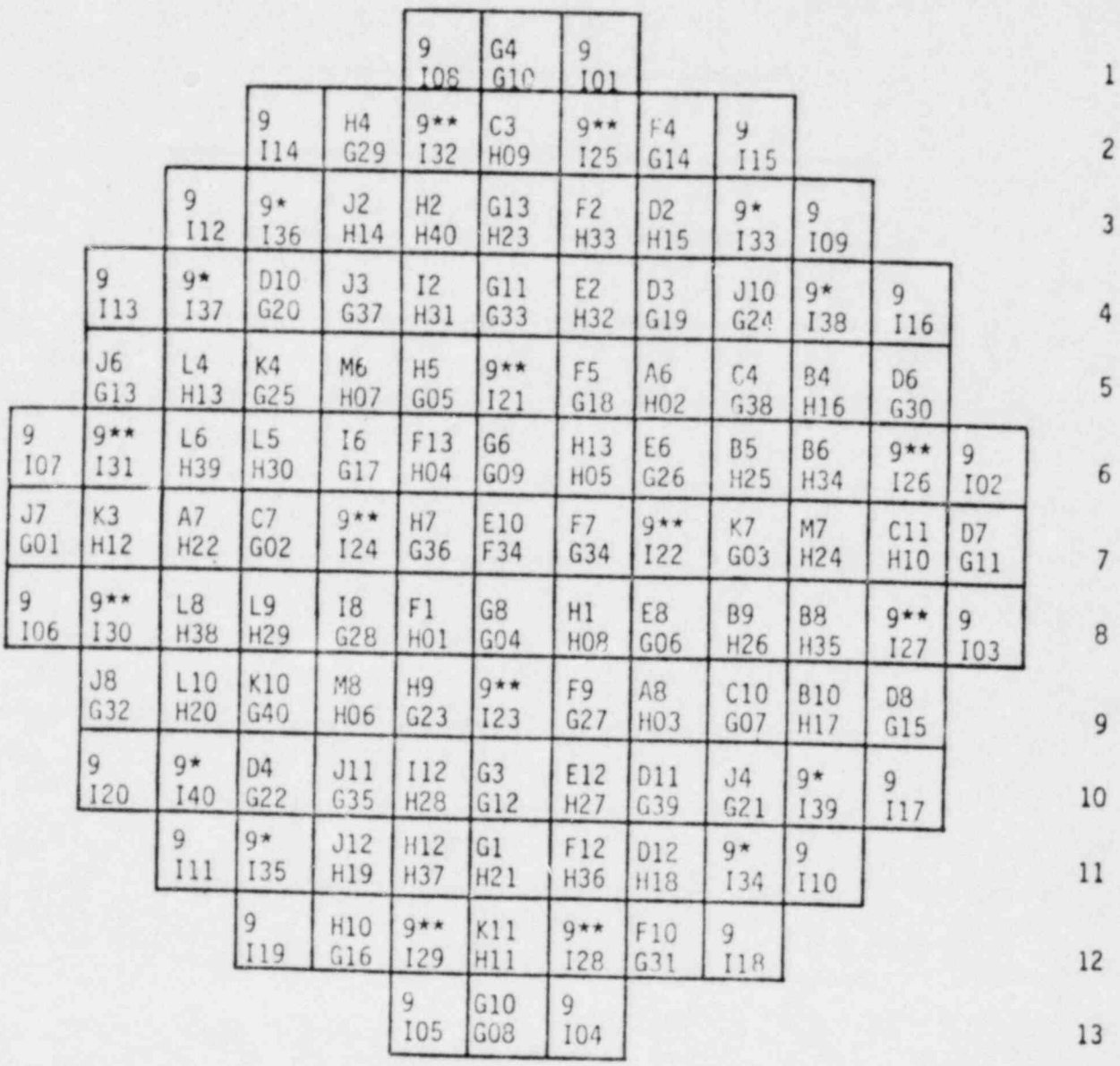


Figure 2



* 8 pins of 4 w/o gadolinia per assembly
** 12 pins of 4 w/o gadolinia per assembly

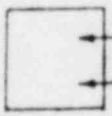


Figure 4.1 Prairie Island Unit 1, Cycle 7
Loading Pattern Startup and Operations

TABLE 1 Prairie Island Unit 1 Cycle 7 Fuel Assembly Design Parameters

	Batch					
	5	7	8	9	9*	9**
Enrichment, wt % U-235	3.30	3.40	3.47	3.56	3.52	3.50
TOPROD Fuel Assemblies						
Central 11 Feet, wt % U-235	----	----	----	3.82	3.82	3.82
UO_2-Gd_2O_3, wt % U-235	----	----	----	----	2.90	2.90
Upper ard Lower 6 inches, wt % U-235	----	----	----	.71	.71	.71
Number of Assemblies	1	40	40	20	8	12
Pellet Density, % TD	94.5	94.0	94.0	94.0	94.0	94.0
Pellet to Clad Diametrical Gap, mil	7.5	7.5	7.5	7.5	7.5	7.5
Fuel Stack Height, inches	144.0	144.0	144.0	144.0	144.0	144.0
Batch Average Burnup at BOC7, MWD/MT	27,434	24,680	7,604	0	0	0

* Fuel with 8 pins of 4 w/o gadolinia per assembly

** Fuel with 12 pins of 4 w/o gadolinia per assembly