DSB

DAIRYLAND POWER COOPERATIVE • P.O. BOX 817 • 2615 EAST AV SOUTH • LA CROSSE WISCONSIN 54601
(608) 788-4000

September 12, 1980

In reply, please refer to LAC-7135

DOCKET NO. 50-409

Mr. James G. Keppler
Regional Director
U. S. Nuclear Regulatory Commission
Directorate of Regulatory Operations
Region III
799 Roosevelt Road
Glen Ellyn, Illinois 60137

SUBJECT: DAIRYLAND POWER COOPERATIVE
LA CROSSE BOILING WATER REACTOR (LACBWR)
PROVISIONAL OPERATING LICENSE NO. DPR-45
REPORTABLE OCCURRENCES NOS. 80-06 AND 80-07

Reference: (1) LACBWR Technical Specifications, Section 3.9.2.b.(2).
(2) LACBWR Technical Specifications, LCO 4.2.2.22.a.3.
(3) LACBWR Technical Specifications, Section 4.2.2.22.f.

Dear Mr. Keppler:

In accordance with Reference (1), this is to notify you of conditions leading to operation in a degraded mode permitted by a limiting condition for operation.

Reference (2) established the limitations for the gross alpha activity of the reactor coolant system.

Reference (3) established sampling analysis and reporting requirements in the event the gross alpha activity of the reactor coolant system exceeded specified limits.

Analyses of reactor coolant system samples taken at the inlet to the primary purification system cation exchanger at 2145 hours on August 14, 1980, while the plant was in a cold shutdown condition, indicated that the coolant gross alpha activity exceeded the limiting condition for operation ($\leq 9.0 \times 10^{-7}$ µCi/gram). This limit is temporarily in force during Cycle 6 core configuration with reactor operation extended beyond 15,000 Mwd/Mtu lead assembly average exposure. The normal Technical Specification alpha activity limit is

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5.0×10^{-6} μCi/gm. The as-found gross alpha activity value was 1.63×10^{-5} μCi/gm. The action statement of Reference 3 was immediately implemented. See Attachment 1 for a discussion of the significance and cause of the high alpha activity in the coolant. Attachment 1 also includes the results of the sampling required by Reference 3.

After the two consecutive samples on August 16 met the alpha activity limitation of Reference 2, the additional sampling was terminated. The primary system was then heated, utilizing decay heat, to approximately 220°F. in order to perform a hydrostatic test on the reactor vessel. For the performance of the hydrostatic test, the Forced Circulation and Primary Purification Systems were shut down for approximately 8 hours and 7 hours, respectively. At 2025, approximately 4 hours after the Forced Circulation Pumps were restarted, a primary coolant sample was taken. The alpha activity was 1.08×10^{-6} μCi/gm, again in excess of the Technical Specification limitation of 0.9×10^{-6} μCi/gm. The action statement of Reference 3 was again implemented. See Attachment 1 for the significance and cause of this alpha activity reading and the results of the increased sampling. The additional information required for the occasions when the samples exceeded the limit is contained in Attachment 2.

Authorization for this report to be submitted beyond the 30-day reporting period was granted to L. Goodman by K. Ridgway on September 12, 1980.

Licensee Event Reports (Ref. Appendix A, Regulatory Guide 1.16, Revision 4) are enclosed.

If there are any questions concerning this report, please contact us.

Very truly yours,

DAIRYLAND POWER COOPERATIVE

Frank Linder, General Manager

FL:LSG:af
Enclosure

cc: Director, Office of Inspection and Enforcement (30)
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Director, Office of Management Information and (3)
Program Control
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

NRC Resident Inspectors

ATTACHMENT 1
REPORTABLE OCCURRENCES NOS. 80-6 & 80-7

SUBJECT: HIGH ALPHA ACTIVITY IN PRIMARY COOLANT ABOVE CYCLE 6 TECHNICAL SPECIFICATION LIMITS OF 0.9 E-06 μCURIES/ML ON AUGUST 14, 1980, AND ON AUGUST 16, 1980

On 8/14/80, the Operations Department prepared to heat up the reactor using fuel decay heat to perform a reactor hydrostatic pressure-leak test after a maintenance outage of 7-day duration. The reactor's two forced circulation pumps were started at 1930 and at 1937 respectively.

At approximately 2145, the H.P. Technician took a primary purification inlet (primary coolant) water sample for routine Operating Condition 4 analysis. This sample was counted for gross β/γ μCi/ml, alpha μCi/ml, Ge(Li)-MCA isotopic analysis and radio-iodine analyses. The gross β/γ μCi/ml revealed 6.3 E-02 μCi/ml in the primary coolant water (e.g. primary purification inlet or PPI). The proportional counter alpha count revealed an alpha activity of 1.63 E-5 μCi/ml. This alpha count was substantially higher than the Cycle 6 Technical Specification limit of 0.9 E-06 (9.0 E-07) μCi/ml alpha for primary coolant. This limit of 9 E-07 μCi/ml alpha is the current limit at which reactor operations may recommence after Operation Condition 4 as addressed in the Technical Specification. This limit is supposed to provide one parameter for an early indication of fuel cladding perforation or degradation.

As per Technical Specification requirements, we continued to sample primary coolant activities for alpha μCi/ml, gross β/γ activity and iodine activity on a 4-hour basis until we reached an alpha activity of less than 9.0 E-07 μCi/ml in two consecutive samples. (Table 2, Figure 2)

The reactor was then hydrostatically tested. After the hydrostatic test was completed, another primary coolant sample was taken on August 16, 1980, at 2025. The alpha activity in this sample was 1.08 E-06 μCi/ml (Table 2, Figure 2). The gross β/γ of this sample was 1.6 E-02 μCi/ml which was essentially the same activity of previous samples taken on August 15 and 16 prior to the reactor hydro (Table 1, Figure 1). Subsequent water samples were taken and analyzed every 4 hours until August 17 at 0636 when the alpha activity was approximately 5.4 E-07 μCi/ml (Table 2, Figure 2).

The primary coolant gross β/γ activity ranged from 6.3 E-02 μCi/ml on August 14th at 2195 to 1.3 E-02 μCi/ml on August 17th at 0636 (Table 1, Figure 1). These activities were expected and within normal ranges for shutdown condition.

The primary coolant iodine activities ranged from 1.09 E-04 µCi/ml for I-131, < 3.47 E-03 µCi/ml for I-133 and < 8.34 E-03 µCi/ml for I-135 on August 14, 1980 at 2145 to 5.29 E-05 µCi/ml for I-131, < 8.27 E-05 µCi/ml for I-133, < 1.29 E-04 µCi/ml on August 17, 1980, at 0636. These activities were expected and within normal ranges for a shutdown condition.

Primary coolant water samples were analyzed for alpha on August 19, and 21. The reactor was at 29% power on August 19, and at 50% power on August 21. The alpha activities had decreased to 1.15 E-07 and 2.12 E-07 µCi/ml respectively. The gross β/γ and iodine activities had increased to levels approximately the same as they had been prior to reactor shutdown on August 8, 1980 (Figures 1, 2, 3, and 4).

We analyzed data isotopically by Ge(Li) for activities of various pertinent radionuclides (other than iodines and noble gases) which could provide an early indication of a change in fuel cladding integrity. These pertinent "early indicators" include Np-239, Y-91 + Y-92, and Ru-103 + Ru(Rh)-106. (Refer to Tables 3 and 4 and Figure 3). These elements are highly insoluble in water, normally remain within UO_2 ceramic fuel-pellet complex, and have melting points higher than that of normal primary coolant temperatures (e.g. $350^{\circ}C$ - $360^{\circ}C$). A substantial perforation of fuel cladding would release these elements to the coolant environment, thus substantially increasing their specific activity in the primary coolant.

Since the gross β/γ activities and the iodine activities were within normal levels, and since the alpha activities decreased after the reactor was started up, the high alpha activities on August 14 and August 16 do not provide indication of recent degradation of fuel cladding. The Np, Y, and Ru isotopic data increased in an expected manner after reactor startup; and, therefore, reinforce the other data indicating that no significant increase in fuel cladding degradation had occurred.

Prior to shutdown on August 8, 1980, with the reactor at 85% power, the average off-gas release rate was 65.84 µCi/sec after the augmented off-gas system.

After reactor startup on August 22, 1980, with the reactor at 50% power, the average off-gas release rate was 52.1 µCi/sec after the augmented off-gas system. This release rate can be power corrected to approximately 88.57 µCi/sec. On August 8, 1980, the average off-gas release rate at the air ejector was 265 µCi/sec. On August 22, 1980, the average off-gas at the air ejector was 165 µCi/sec, or power corrected to approximately 280.5 µCi/sec. These off-gas activities do not indicate that increased fuel cladding degradation had occurred.

During the shutdown, the 1A recirculation loop was drained so that the forced circulation pump seal could be repaired. After repairs, the loop was refilled with water. The mechanical action of refilling the loop is believed to have contributed to the release of alpha emitting materials.

It is also believed that when the primary system recirculation flow was re-established by starting the recirculation pumps on August 14 and again on August 16, alpha emitting material deposited at various points in the primary system may have been resuspended in the primary coolant and contributed to the transient high alpha activities observed.

TABLE 1

Gross βγ Analyses of Primary Purification Inlet Water from 21 July to 22 August 1980

Date	Time of Analysis	Gross βγ Analyses (μCi/ml H_2O)	Reactor Power Level (%)
7-12	0048	1.44	85.0
7-13	0031	1.36	85.0
7-14	0033	1.36	85.0
7-15	0040	1.49	85.0
7-16	0055	1.35	85.0
7-17	0023	1.38	85.0
7-18	0130	1.33	85.0
7-19	0225	1.31	85.0
7-20	0200	1.07	45.0
7-20	2130	1.42	59.0
7-21	0225	1.61	67.0
7-22	0304	1.58	85.0
7-23	0049	1.74	85.0
7-24	0149	1.56	85.0
7-25	0053	1.71	85.0
7-26	0037	1.62	85.0
7-27	0207	1.67	85.0
7-28	0120	1.29	85.0
7-29	0150	2.02	85.0
7-30	0125	1.69	85.0
7-31	0117	1.56	85.0
8-1	0125	1.38	85.0
8-2	0215	1.52	85.0
8-3	0140	1.52	85.0
8-4	0217	1.41	85.0
8-5	0212	1.59	85.0
8-6	0142	2.02	85.0
8-7	0104	1.45	85.0
8-8	0112	1.35	85.0
8-8	1307	6.96E-01	0.0
8-9	0039	5.8E-01	0.0
1-10	0045	1.2E-01	0.0
8-11	0903	2.9E-02	0.0
8-14	0059	1.2E-02	0.0
8-14	2195	6.3E-02	0.0
8-15	0115	4.5E-02	0.0
8-15	0508	5.6E-02	0.0

TABLE 1 - (Cont'd)

Date	Time of Analysis	Gross $\beta\gamma$ Analyses ($\mu Ci/ml\ H_2O$)	Reactor Power Level (%)
8-15	0807	2.6E-02	0.0
8-15	1140	1.6E-02	0.0
8-15	1517	1.9E-02	0.0
8-15	1851	1.2E-02	0.0
8-15	2250	1.6E-02	0.0
8-16	0238	1.5E-02	0.0
8-16	0635	1.5E-02	0.0
8-16	2025	1.6E-02	0.0
8-16	2245	1.4E-02	0.0
8-17	0237	1.1E-02	0.0
8-17	0636	1.3E-02	0.0
8-18	0046	4.0E-02	< 1.0
8-19	0130	5.9E-01	29.0
8-20	0123	9.5E-01	40.0
8-21	0053	1.21	50.0
8-22	0100	1.11	51.0

FIGURE 1: Reactor Power Level and Primary Reactor Coolant Gross β-γ Activity (μCi/ml).

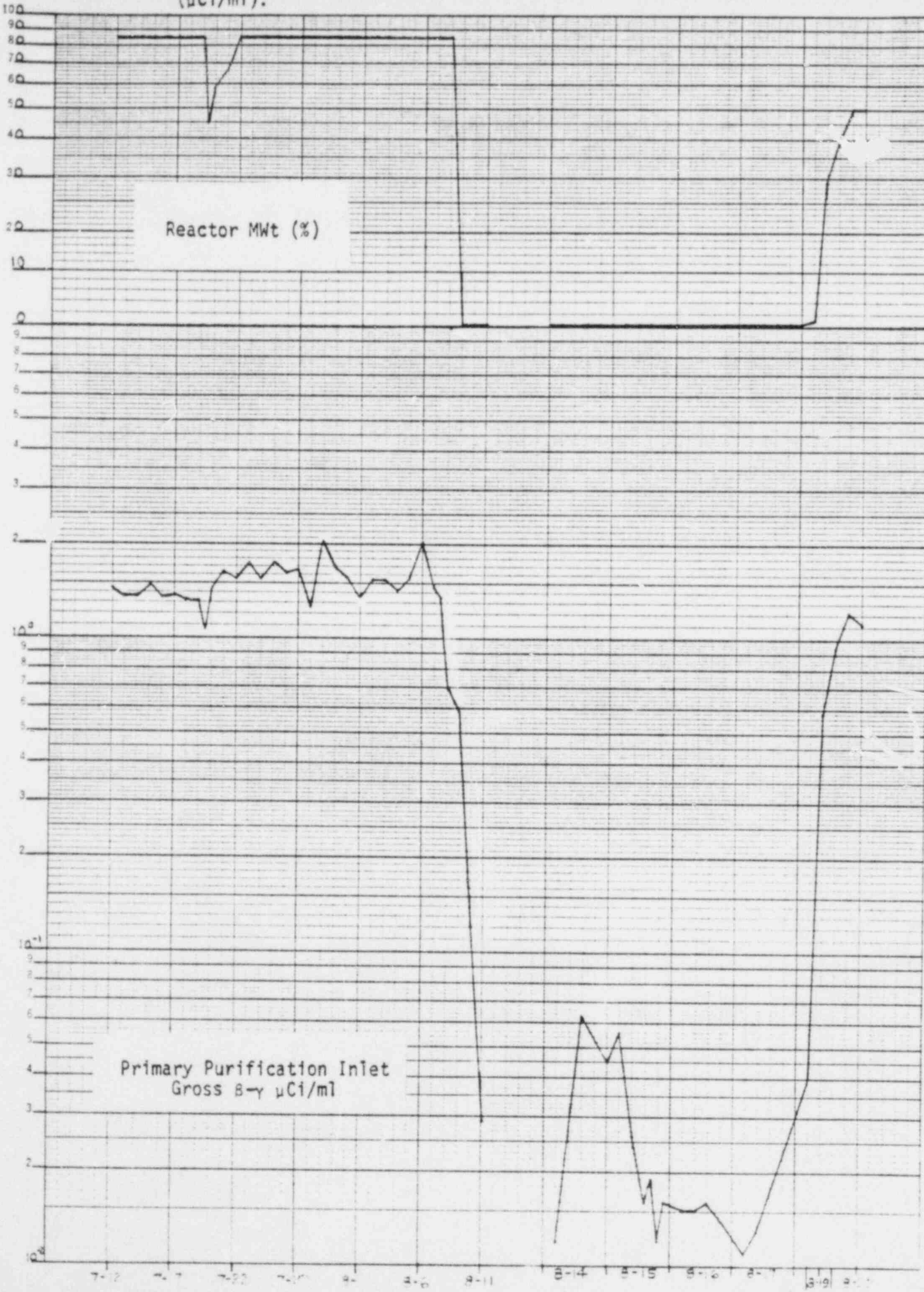


TABLE 2

Proportional Counter Alpha Activity
Analyses of Primary Purification Inlet and Outlet Water
from 14 July to 22 August 1980

Date	Time of Analysis	PPI Alpha Activity (µCi/ml H_2O)	PPO Alpha Activity (µCi/ml H_2O)
7-14	0033	5.43E-08	<2.33E-08
7-17	0023	<2.14E-08	<2.14E-08
7-21	0225	3.82E-08	<2.29E-08
7-24	0149	8.74E-08	<2.38E-08
7-28	0120	6.28E-08	<2.35E-08
7-31	0117	3.11E-08	<2.33E-08
8-4	0217	1.85E-08	<1.11E-08
8-7	0104	6.1E-07	4.18E-08
8-9	0039	6.03E-07	
8-14	2145	1.63E-05	
8-15	0115	6.22E-06	
8-15	0508	7.97E-06	
8-15	0807	(5.53E-06) (6.28E-06)*	<2.25E-08
8-15	1140	(2.11E-06) (2.26E-06)	3.75E-08
8-15	1517	(2.57E-06) (2.38E-06)	
8-15	1851	(1.50E-06) (1.70E-06)	<2.25E-08
8-15	2250	(1.13E-06) (1.10E-06)	
8-16	0238	(6.68E-07) (8.69E-07)	3.22E-08
8-16	0635	(7.40E-07) (8.20E-07)	
8-16	2025	1.08E-06	
8-16	2245	(9.40E-07) (9.64E-07)	
8-17	0237	(4.11E-07) (4.11E-07)	
8-17	0636	(5.37E-07) (5.45E-07)	
8-18	0046	6.99E-07	5.44E-08
8-19	0133	1.15E-07	
8-21	0033	2.12E-07	<2.5E-08

*Two aliquots of the same sample were analyzed to determine if α activity was due to a hot sub-microscopic particle. Results indicate that the α activity was evenly distributed in sample bottle.

FIGURE 2: Primary Coolant Alpha Activity (µCi/ml) from Primary Purification Inlet. (Dotted Line is Primary Purification Outlet α Activity (µCi/ml).

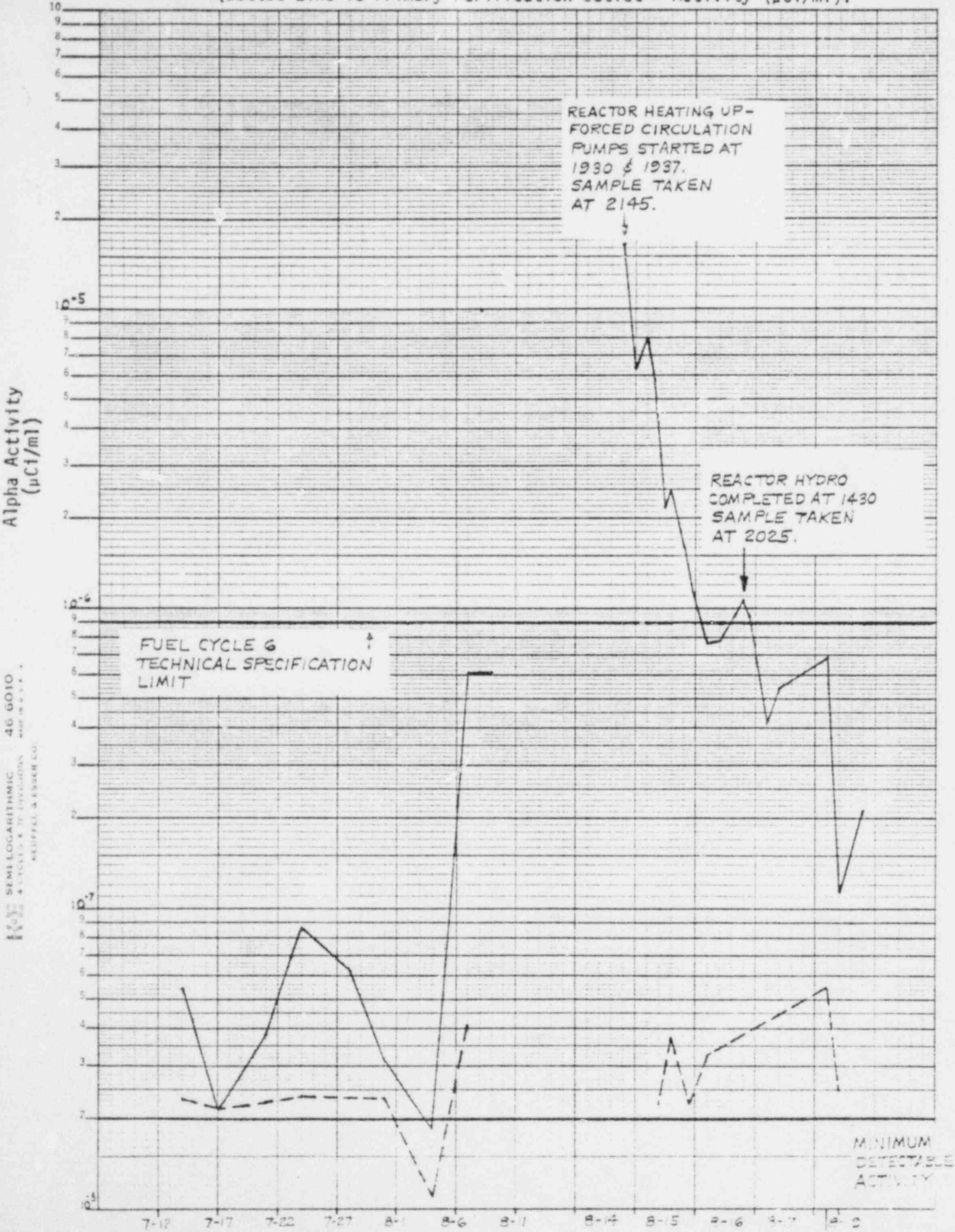


TABLE 3

Yttrium, Ruthenium, Ruthenium-Rhodium and Neptunium Activity ($\mu Ci/ml$) in Primary Purification Inlet Water as Determined by Ge(Li)-MCA

Date	Np-239 $t_{1/2}$ = 2.34d.	Y-91 $t_{1/2}$ = 58.8d.	Y-92 $t_{1/2}$ = 3.53h.	Ru-103 $t_{1/2}$ = 39.5d.	Ru(Rh)-106 $t_{1/2}$ = 368 d.
			µCi/ml		
7-17	-	-	-	-	7.09E-02
7-22	-	-	-	-	8.24E-02
7-24	-	-	-	-	5.52E-02
7-31	1.20E-01	-	-	-	1.42E-02
8-8	-	-	-	5.54E-05	-
8-14	4.72E-04	-	-	1.12E-03	-
8-15	1.29E-03	-	-	2.08E-04	5.90E-04
8-15	8.67E-04	-	-	1.39E-04	6.08E-04
8-15	1.51E-04	-	-	8.12E-05	5.88E-04
8-15	2.52E-05	-	-	7.58E-04	4.83E-04
8-15	9.72E-05	-	-	1.21E-04	6.00E-04
8-16	-	-	-	8.69E-05	7.78E-04
8-16	-	-	-	6.20E-05	-
8-16	1.02E-04	-	-	5.15E-05	6.70E-04
8-16	6.19E-05	-	-	5.41E-05	6.06E-04
8-17	-	-	-	-	3.67E-04
8-17	-	-	-	-	4.78E-04
8-18	1.00E-03	-	5.13E-04	5.66E-05	4.93E-04
8-19	1.24E-03	-	1.90E-02	-	6.85E-03

FIGURE 3: Yttrium, Ruthenium, Ruthenium (Rhodium) and Neptunium Activity (μCi/ml) in Primary Reactor Coolant

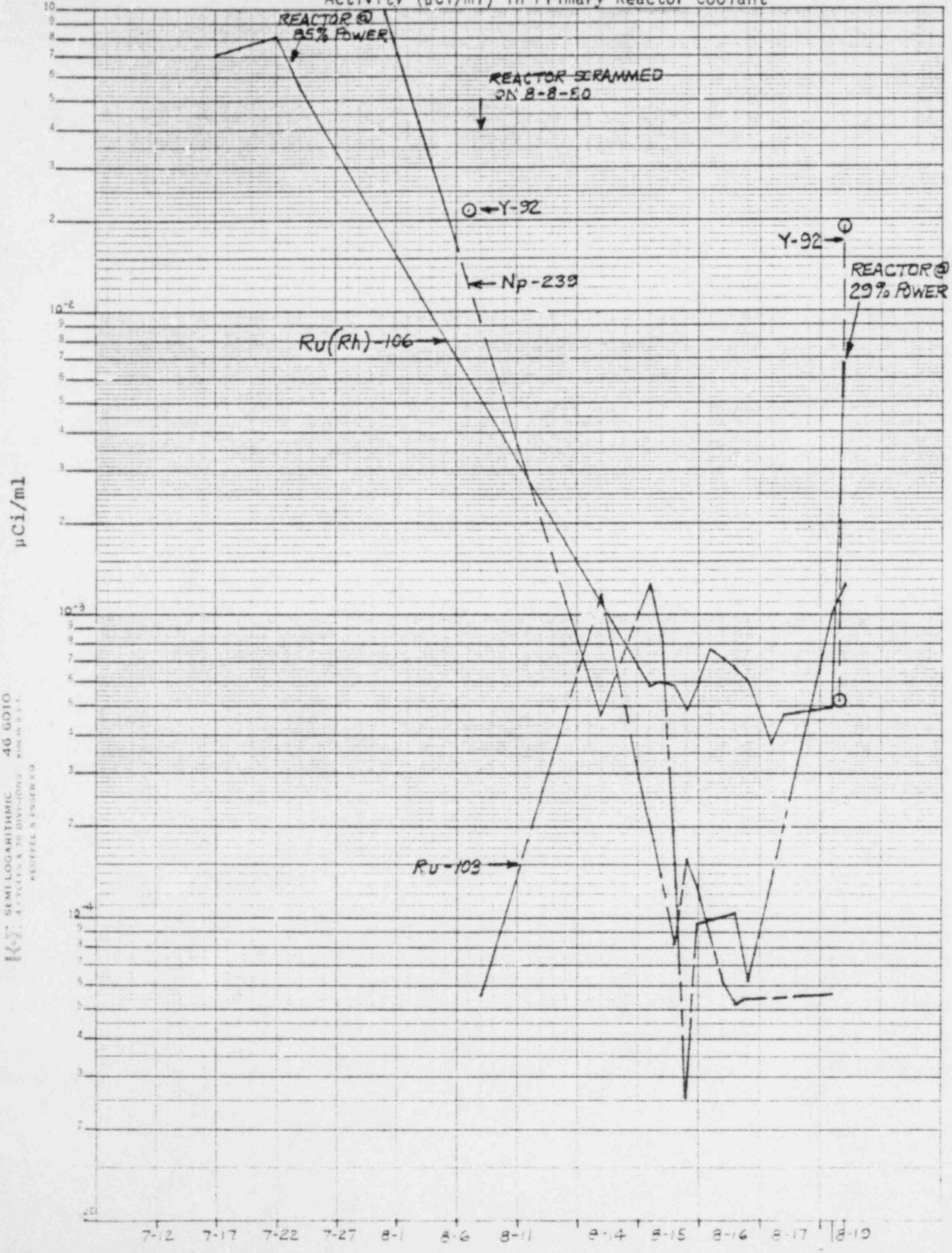


TABLE 4

Expected Fission Product Quantities from 1 Kg of Completely Fissioned U-235 (After 150 Days Irradiation and 30 Days Cooling). Ref. Nuclear Reactor Metallurgy, Argonne National Labs, 1958

Fission Products (Elements)	Grams	Curies
Nb	5	220,000
I	6	11,000
Rb	14	--
Te	14	1,200
Tc	26	170
Ba(La)	39	66,000
Sr	39	110,000
Ru, Rh, Pd	74	235,000 [1]
Mo	84	190
Cs	108	2,900
Zr	114	119,000
Kr+Xe	128	6,300
Y + rare earths	308	675,000 [2]
TOTAL	959 [3]	1,446,760

1) Ruthenium Series is 7.72% of fission products by weight and 16.24% of fission product activity.

2) Yttrium and rare earth series is 32.12% of fission products by weight and 46.66% of fission product activity.

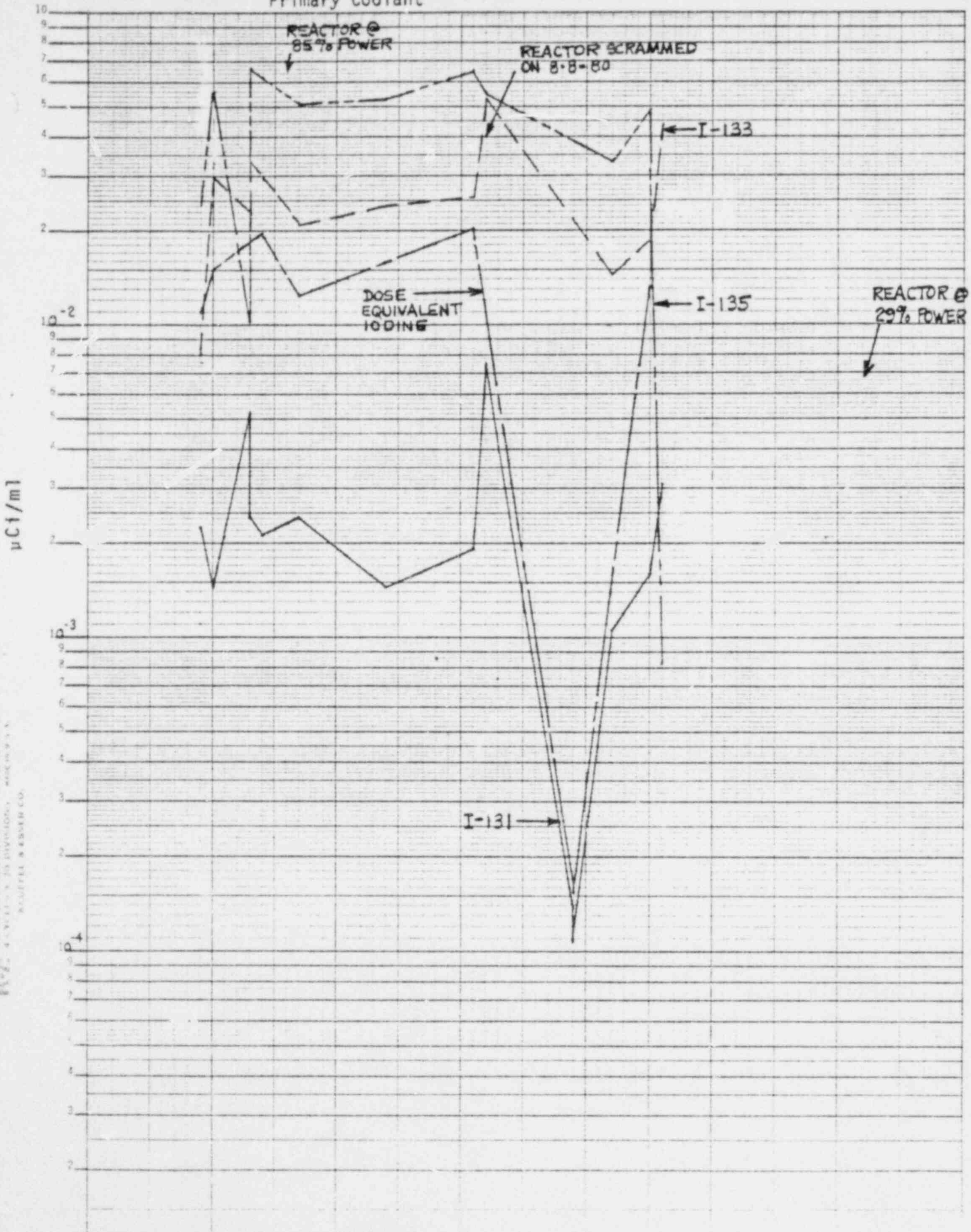
3) 41 Grams of the original 1 Kg of U-235 is fission neutron loss.

TABLE 5

Iodine-131, 133, 135 and Dose Equivalent Iodine in Primary Purification Inlet Water

Date of Sample Analysis		I-131 µCi/ml	I-133 µCi/ml	I-135 µCi/ml	Dose Equivalent Iodine
7-16		2.24E-03	8.01E-03	2.43E-02	1.10E-02
7-17		1.45E-03	2.98E-02	5.60E-02	1.50E-02
7-20	(0200)	5.19E-03	2.29E-02	1.05E-02	
7-20	(2130)	2.42E-03	3.31E-02	6.67E-02	
7-21		2.12E-03	2.95E-02	6.20E-02	1.96E-02
7-24		2.40E-03	2.09E-02	5.039E-02	1.25E-02
7-31		1.44E-03	2.40E-02	5.30E-02	
8-7		1.92E-03	2.56E-02	6.44E-02	2.01E-02
8-8		7.41E-03	5.35E-02	5.56E-02	
8-14	(2145)	[illegible].09E-04	<3.47E-03	<8.34E-03	
8-15	(0115)	<2.30E-04	<2.98E-04	<4.33E-04	
8-15	(0508)	<4.33E-04	<6.53E-04	<1.31E-03	
8-15	(0807)	8.22E-05	<4.24E-05	<6.96E-05	
8-15	(1140)	<9.69E-05	<1.33E-04	<2.40E-04	
8-15	(1517)	7.38E-05	<4.15E-05	<6.59E-05	
8-15	(1851)	7.89E-05	<3.44E-05	<5.13E-05	
8-15	(2250)	5.59E-05	<3.17E-05	<5.14E-05	
8-16	(0238)	4.22E-05	<9.04E-05	<1.59E-04	
8-16	(0635)	9.25E-05	<9.23E-05	<1.58E-04	
8-16	(2025)	4.36E-05	1.07E-05	<4.53E-04	
8-16	(2245)	3.30E-05	<2.74E-05	<4.18E-05	
8-17	(0237)	1.65E-05	<5.98E-05	<9.07E-05	
8-17	(0637)	5.29E-05	<8.27E-05	<1.29E-04	
8-18	(2306)	1.04E-03	1.44E-02	3.31E-02	
8-21		1.60E-03	1.85E-02	4.88E-02	1.31E-02
8-22		3.09E-03	4.34E-02	<8.35E-03	

FIGURE 4: Iodine-131, 133, 135 and Dose Equivalent Iodine in Primary Coolant



ATTACHMENT 2

ADDITIONAL INFORMATION

1) Reactor Power Level for 48 Hours Prior to the Samples Exceeding the Limit

   Reactor shut down for this entire time period.

2) Fuel Burnup by Core Region

   See attached Figure 5.

3) Cleanup Flow History Starting 48 Hours Prior to the Samples Exceeding the Limit

8/12/80 @ 2100-2400:	40 gpm
8/13/80 @ 0100-2400:	40 gpm
8/14/80 @ 0100-0700:	40 gpm
8/14/80 @ 0800-0900:	39.5 gpm
8/14/80 @ 1000-1500:	40 gpm
8/14/80 @ 1600:	System Shut Down
8/14/80 @ 1700-2000:	39 gpm
8/14/80 @ 2100-2400:	40 gpm
8/15/80 @ 0100:	40 gpm
8/15/80 @ 0200-1100:	41 gpm
8/15/80 @ 1200-1300:	40 gpm
8/15/80 @ 1400-1800:	40.5 gpm
8/15/80 @ 1900:	41 gpm
8/15/80 @ 2000-2300:	40 gpm
8/15/80 @ 2400:	40.5 gpm
8/16/80 @ 0100-0800:	40 gpm
8/16/80 @ 0900-1500:	System Shut Down
8/16/80 @ 1600-1700:	38.5 gpm
8/16/80 @ 1800-2025:	39 gpm

4) Off-Gas Level Starting 48 Hours Prior to the Samples Exceeding the Limit

   No Off-Gas flow.

5) Gross Alpha Activity Level Starting With the Last Sample Taken Prior to the First Sample in Which Limit was Exceeded

   See Attachment 1

Fuel Exposure Estimation (GWD/MTU).
An Indication of Exposure on August 14, 1980.
The Average Exposure: 10.486 GWD/MTU.

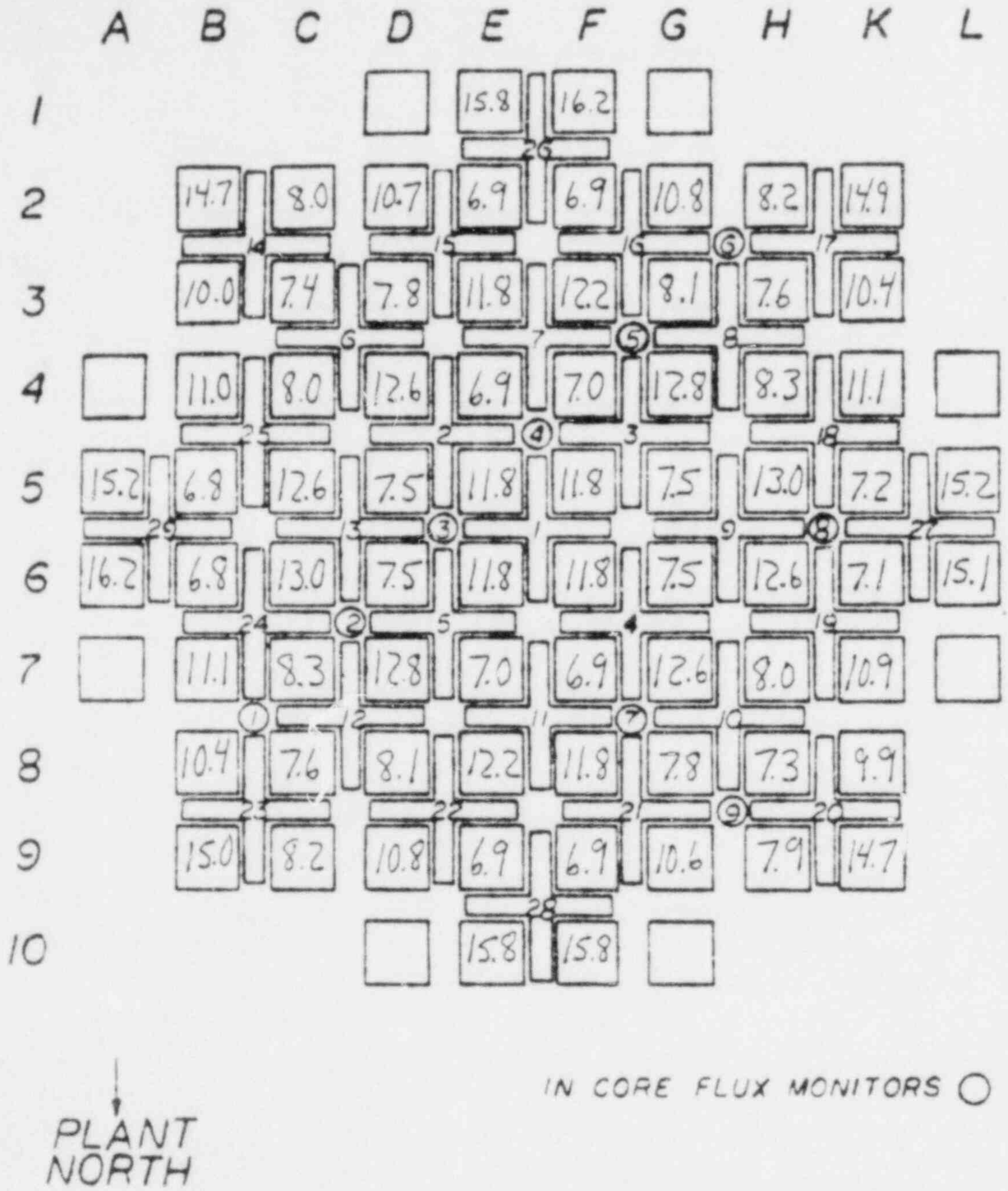


FIGURE 5